Park Spring Wind Farm

Environmental Statement

Volume 1

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PARSONS BRINCKERHOFF



EDF ENERGY RENEWABLES

Park Spring Wind Farm
Environmental Statement

Volume 1

Prepared for
EDF Energy Renewables Limited
Endeavour House
Victory Way
Doxford Business Park
Sunderland
SR3 3XL

Prepared by
Parsons Brinckerhoff
Amber Court
William Armstrong Drive
Newcastle upon Tyne
NE4 7YQ
0191 226 2000
www.pbworld.com

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SECTION 1

INTRODUCTION

1 INTRODUCTION

1.1 The application

1.1.1 This Environmental Statement (ES) has been prepared by Parsons Brinckerhoff on behalf of EDF Energy Renewables Limited (EDF ER) in support of a planning application under the Town and Country Planning Act 1990 for a wind farm to the east of Park Spring Road (A6195), Little Houghton, Barnsley (to be known as Park Spring Wind Farm or the Development), as shown on Figure 3.1 and Figure 3.2. This document should be read in conjunction with the associated Planning Application and supporting documents as outlined in Section 1.4.

1.1.2 The proposed site lies approximately 750 m west of Great Houghton, 1 km south of Grimethorpe, 1 km north of Little Houghton and 1.5 km north east of Darfield. Further afield, Barnsley is located approximately 6.5 km to the west.

1.1.3 The Development includes the installation of three wind turbines of approximately 6 MW installed generating capacity in total, together with associated infrastructure as described in Chapter 3. The proposed site layout is shown on Figure 3.2.

1.1.4 The site is located to the east of Park Spring Road (A6195) and comprises undulating mixed use agricultural land, small areas of woodland, and includes areas of restored open cast workings, extending over an area of 90.4 ha. The topography of the site comprises a broad mound with convex slopes ranging in height between 35 and 80 metres Above Ordnance Datum (m AOD). Access tracks, a public footpath and a bridleway cross the site.

1.2 The applicant

1.2.1 EDF ER is jointly owned by EDF Energy plc (EDF Energy) and EDF Energies Nouvelles SA (EDF EN).

1.2.2 EDF Energy is one of the UK's largest energy companies and the largest producer of low carbon electricity. EDF Energy produce around one fifth of the UK's electricity from nuclear, coal and gas power stations, combined heat and power plants, and wind farms, resulting in the employment of around 15,000 people. EDF Energy is a core part of EDF Group, which is one of Europe's largest energy companies.

1.2.3 EDF EN is a leader in the production of renewable energy globally. It has interests in renewable energy across Europe and North America with approximately 5,400 MW gross capacity in operation, a further 1,300 MW gross capacity in construction and a substantial development pipeline.

EDF ER

1.2.4 EDF ER is tasked with delivery of its shareholders' strategic objective to significantly increase owned operational renewable capacity in the UK. To achieve this objective EDF ER's operations are focussed on successful development of its portfolio and participation in selected acquisition opportunities that provide access to consented projects, a pipeline of development opportunities and development capability.

1.2.5 EDF ER is the main vehicle for developing wind farm projects within the UK on behalf of EDF Energy and EDF EN, employing at present a team of 64 dedicated staff located in a number of offices throughout the UK, including the North East of England, Scotland, Wales and London.

1.2.6 Within the team there is a wealth of experience in the wind farm sector supported by a significant track record within the wider renewables field. EDF ER uses experienced and respected renewable energy consultants to support the development process.

1.2.7 In addition, the EDF ER development team can rely on the support of the following internal resource when developing wind farms:

- Site feasibility.
- Planning.
- Environmental consents.
- Engineering construction.
- Electrical/grid connection.
- Communications.
- Legal.

1.2.8 EDF ER, with the backing of EDF Energy and EDF EN, aspires to be a long term wind farm developer and asset owner, with an existing operations team set up to manage these assets. With over 10 years experience of developing wind farms, significant knowledge and experience has been acquired.

1.2.9 EDF ER has a combined UK renewable portfolio of over 600 MW, comprising of projects that are either operational, in construction or consented plus a large portfolio of projects in development.

1.3 The ES

Structure of the ES

1.3.1 This ES describes the Development, the site and the surroundings, and provides necessary information for interested parties to assess the Development with respect to its potential effects on the environment. The EIA process predicts these potential impacts, their magnitude and significance and proposes measures by which the severity of those impacts can be reduced or the impact mitigated entirely. The data analysed, the impacts identified and assessments of significance are reported within the ES.

1.3.2 This ES is structured as follows:

ES Volume 1	(This document) - contains the written text of the EIA, including an outline of the EIA methodology, a project description including details on site selection, the planning context and the environmental assessments.
ES Volume 2	Contains the technical appendices.
ES Volume 3	Contains the figures to support the assessments as described in ES Volume 1.

The ES team

1.3.3 The environmental and technical assessments and the ES chapter production for Park Spring Wind Farm have been undertaken by specialist consultants. Table 1.1 details the contributors to the ES.

Table 1.1: ES Team

Chapter	Prepared by
Chapter 1: Introduction	Parsons Brinckerhoff
Chapter 2: EIA Methodology	Parsons Brinckerhoff
Chapter 3: The Proposal	Parsons Brinckerhoff
Chapter 4: Planning Policy Context	Parsons Brinckerhoff
Chapter 5: Noise	Parsons Brinckerhoff
Chapter 6: Landscape and Visual	Parsons Brinckerhoff
Chapter 7: Archaeology and Cultural Heritage	Parsons Brinckerhoff
Chapter 8: Hydrology, Geology, Hydrogeology	Parsons Brinckerhoff
Chapter 9: Ecology	Parsons Brinckerhoff
Chapter 10: Ornithology	Ecology Consulting Ltd
Chapter 11: Socio-Economic Impacts	Parsons Brinckerhoff
Chapter 12: Shadow Flicker	Parsons Brinckerhoff
Chapter 13: Traffic and Transportation	Parsons Brinckerhoff
Chapter 14: Technical Issues	Parsons Brinckerhoff

1.4 Additional documentation

Non-Technical Summary (NTS)

1.4.1 The NTS summarises the ES, including a description of the proposed development and the conclusion of the various technical and environmental assessments undertaken.

Planning Statement

1.4.2 The Planning Statement assesses Park Spring Wind Farm in the context of the national planning and energy policy and the local planning policy. The assessment considers the overall benefits of the proposal against the potential harm which may arise, with an overall conclusion on the acceptability of the proposal.

Design and Access Statement (DAS)

1.4.3 The DAS details the design concepts and principles and access as required under the Planning and Compulsory Purchase Act (2004). The DAS demonstrates how the proposal has been iteratively designed such that the proposed final site design is the most suitable for the site. Details are provided on the access arrangements to the Development.

Statement of Community Involvement (SCI)

1.4.4 The SCI demonstrates the consultation undertaken for the proposal, the submission of a SCI is required under the Planning and Compulsory Purchase Act (2004). The Park Spring Wind Farm SCI outlines the programme of stakeholder and community consultation undertaken throughout the project development process and details the responses received.

1.5 Contact details

1.5.1 Copies of this ES are available from the following addresses for a fee of £125 (to cover copying charges). An electronic version is available, free of charge, on CD.

Parsons Brinckerhoff
Amber Court
William Armstrong Drive
Newcastle Business Park
Newcastle upon Tyne
NE4 7YQ

Tel: 0191 226 2056 or 0800 0566650

1.5.2 A Non-Technical Summary is available, free of charge, as a separate volume upon request.

1.5.3 The ES will be available to view, by prior arrangement, with Barnsley Metropolitan Borough Council (BMBC).

Barnsley Metropolitan Borough Council
Civic Hall
Eldon Street
Barnsley
S70 2JL

Tel: 01226 770770

SECTION 2

EIA METHODOLOGY

2 EIA METHODOLOGY

2.1 Introduction

2.1.1 Environmental Impact Assessment (EIA) is a process in which potential impacts caused by a development are identified, and all significant (direct and indirect) environmental effects are then evaluated. In this ES potential impacts are identified and evaluated during different stages of the development, i.e. during construction, operation and decommissioning.

2.1.2 The legislative basis for the assessment of the environmental effects of development projects is contained within EC Directives 85/337/EEC and 97/11/EC, which are implemented in the UK through the Town and Country Planning (Environmental Impact Assessment) Regulations 2011 ("EIA Regulations").

2.1.3 Under the EIA Regulations, projects are divided into two schedules: those projects where an EIA is always required are set out in Schedule 1, whilst those projects that only require an EIA where significant environmental effects are likely to arise by virtue of factors such as its nature, size or location are set out in Schedule 2.

2.1.4 The Park Spring Wind Farm Development is a Schedule 2 development: *3(i) Installation for the harnessing of wind power for energy production (wind farms)* where *(i) The development involves the installation of more than 2 turbines; or (ii) the hub height of any other structure exceeds 15 metres.*

2.1.5 Due to the nature, scale and potential environmental impacts it is considered that the proposed Development requires a formal EIA.

2.1.6 Schedule 4 of the EIA Regulations lists the information required to be submitted within the ES, as summarised here:

- A description of the site and the development.
- Consideration of alternatives.
- Necessary data to identify and assess the main effects the development has on the environment.
- Review of significant direct and indirect effects.
- Measures to prevent, reduce or offset any significant adverse effects.
- A Non-Technical Summary.
- An indication of difficulties encountered in preparing the ES.

2.2 Scoping

2.2.1 Scoping is a process in which the context and extent of environmental assessments to be undertaken for the EIA are agreed with the local planning authority and statutory consultees.

2.2.2 A detailed Scoping Study and consultation exercise was undertaken for Park Spring Wind Farm, this identified the potential environmental issues associated with the

construction, operation and decommissioning of the Development and how these should be addressed in this ES.

Scoping Study and Consultation with Statutory Consultees

2.2.3 A Scoping Study was prepared and submitted to BMBC by Parsons Brinckerhoff in February 2011. The study described the key environmental issues that, in the opinion of Parsons Brinckerhoff, would require detailed evaluation as part of the EIA process.

2.2.4 The formal Scoping Study was issued for information and comment to all parties deemed to have a relevant interest in the development of Park Spring Wind Farm, including statutory and non-statutory consultees and local organisations. These included:

Table 2.1: Organisations consulted

Doncaster Metropolitan Borough Council	Ramblers Association
Wakefield City Council	British Horse Society
Billingley Parish Council	Robin Hood Airport Doncaster - Sheffield
Brierley Town Council	Ofcom
Great Houghton Parish Council	Airwaves Solutions Ltd
Little Houghton Parish Council	CE Electric
The Coal Authority	YEDL
Civil Aviation Authority	National Grid
Ministry of Defence	British Telecom
National Air Traffic	Yorkshire Water Services Ltd
Environment Agency	Joint Radio Company
English Heritage	Arqiva
Natural England	South Yorkshire Archaeology Service
Department for Transport	Dearne Valley Green Heart
Council for the Protection of Rural England	Sheffield Area Geological Trust
RSPB	Everything Everywhere
Mobile Broadband Network Limited	Atkins

2.2.5 In the Scoping Response issued by BMBC on the 14th September 2011 it was stated that the ES for the Development should focus on:

- Landscape and visual impacts including any cumulative effects.
- Impact on the green belt.
- Impact on residential amenity including shadow flicker.
- Highways, access and transportation.
- Noise.
- Biodiversity.
- Archaeology and cultural heritage.

- Hydrology and hydrogeology.
- Geology, past coal mining activity and site stability.
- Socio-economics including tourism, recreation, bridleways and footpaths.
- Infrastructure, telecommunications, television reception, aviation and public safety.

2.2.6 Consultation with interested parties has continued throughout the EIA process through meetings and exchanges of correspondence.

2.3 Public consultation

2.3.1 An important stage of the development process is informing local residents and the wider general public of the proposals for the Development.

2.3.2 EDF ER hosted three public exhibitions, the details of which were as follows:

Table 2.2 - Public consultation events

Location	Date and Time
Sandhill Golf Club, Little Houghton	Friday 1 March 2013, 1pm-7pm
Great Houghton Welfare Hall	Saturday 2 March 2013, 11am-3:30pm
Welfare Hall, Grimethorpe	Friday 26 April 2013, 11am -7pm

2.3.3 Further information on the public exhibitions is detailed in the Statement of Community Involvement (SCI).

2.4 EIA Process

Prediction and evaluation of impacts

2.4.1 Each chapter will follow a broadly similar approach:

- Introduction.
- Methodology.
- Baseline.
- Impact assessment.
- Mitigation.
- Residual impacts and conclusions.

2.4.2 The EIA Regulations do not provide standardised guidelines for the assessment of potential impacts (sensitivity, magnitude and significance). Therefore, the methods used to assess the impacts are specific to each discipline, and are in most cases defined by the relevant professional body or industry best practice and guidance.

2.4.3 Each chapter will include a detailed description of the impact assessment methodology, including a description of surveys undertaken and the approach used to determine significance. The criteria used to define significance will be described within this ES for each discipline.

Mitigation

2.4.4 The EIA Regulations state that the ES should include; *A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.*

2.4.5 Where significant adverse environmental impacts are identified through the assessment process, where appropriate, mitigation measures are incorporated into the design proposal.

2.4.6 Throughout the development process the site layout has been designed such to minimise environmental impacts where possible. This mitigation is embedded mitigation i.e. design changes made during the development process as a result of constraints identified.

2.4.7 Wherever possible, mitigation has been included within the Development proposal to ensure that no significant residual impacts are predicted to occur.

2.4.8 Specific mitigation measures are outlined in the ES chapters where appropriate.

Cumulative impacts

2.4.9 An assessment of cumulative impact is a key part of the EIA process and is concerned with identifying situations where a number of impacts from separate projects combine to cause a significant impact on a particular resource. The assessment of such effects should be integral to the EIA process. These effects are therefore assessed within each of the following chapters at a scale appropriate to that subject.

2.4.10 The EIA considers existing wind turbines in the area. A full list is given in Table 2.3. Projects have been considered if operational, under construction, holding planning permission or are in the planning process. Whilst there may be other wind development projects at the feasibility stage or Scoping stage, these projects have not been considered as turbine layouts and sizes are not fixed until formally submitted for planning.

2.4.11 Table2.3 gives details of the existing and proposed wind farms within 20 km of the Park Spring Wind Farm site as assessed within the Landscape and Visual Impact Assessment (Chapter 6). The locations of these cumulative wind farms/turbines are shown on Figure 6.23 and Figure 6.24, Volume 3. Details for consented and proposed turbines are based on the best available information and may be subject to change in the event that these projects proceed to the construction or operational phases.

Table 2.3: Wind farm developments within 20 km of Park Spring Wind Farm

Site	MW Capacity of Turbines (MW)	Number of Turbines	Maximum MW Capacity (MW)	Approx Distance to Site (km)
Operational				
Marr	2	4	8	9.0
Penny Hill Lane	3.3	6	19.8	20.0

Site	MW Capacity of Turbines (MW)	Number of Turbines	Maximum MW Capacity (MW)	Approx Distance to Site (km)
Under Construction				
Hampole	2	4	8	9.4
Consented				
ASDA Normanton	2	1	2	16.6
In Planning				
Mount Pleasant	0.8	2	1.6	1.5
Norton	2.5	2	5	13.0
Fieldhouses	0.8	1	0.8	16.0
Darrington Quarry	2.3	7	16	16.8
Infield Farm	0.5	1	0.5	19.9

Assumptions and limitations

2.4.12 The general assumptions and limitations identified during the EIA are set out below. Assumptions relevant to specific disciplines are discussed in the appropriate chapter.

- The EIA has been assessed using a candidate turbine (REpower MM92, 126.5 m to tip). Flexibility regarding turbine selection is required, see 3.4.2 for details.
- The EIA has been assessed based upon the site layout as proposed. The turbines would be subject to a maximum micro-siting allowance tolerance. See 3.3.4 - 3.3.6 for details.

SECTION 3

THE PROPOSAL

3 THE PROPOSAL

3.1 Site description

3.1.1 The Development site is centred on Grid Reference SE 420 070, and the site location can be seen on Figure 3.1.

3.1.2 The Development site falls within the Parish of Little Houghton, which is within the area administered by BMBC.

3.1.3 The proposed Park Spring Wind Farm will be situated approximately 750 m west of Great Houghton, 1 km south of Grimethorpe, 1 km north of Little Houghton and 1.5 km east of Darfield. Further afield, Barnsley is located 6.5 km to the west, Rotherham 13 km to the south, Doncaster 15 km to the south east and Wakefield 15 km to the north west.

3.1.4 The site is located to the east of Park Spring Road (A6195) and comprises undulating, mixed use agricultural land and small areas of woodland and includes areas of restored open cast workings, extending over an area of 90.4ha. The topography of the site comprises a broad mound with convex slopes ranging in height between 35 and 80 metres Above Ordnance Datum (m AOD). Access tracks, a public footpath and a bridleway cross the site. The medium sized, irregular shaped fields are delineated by low hedgerows with widely spaced hedgerow trees.

3.1.5 The Development will comprise three turbines and associated infrastructure, each turbine with an anticipated rated installed generating capacity of 2 MW and a total height to tip of up to 126.5 m. The wind turbines will consist of three blades connected to a hub/nacelle supported by a steel tower.

3.2 Site selection

Consideration of alternatives

3.2.1 The EIA regulations state that the ES should include an outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for the choices made, taking into account environmental effects.

3.2.2 Guidance on the consideration of alternatives is provided in the Overarching National Policy Statement for Energy (EN-1):

"From a policy perspective this NPS does not contain any general requirement to consider alternatives or to establish whether the proposed project represents the best option. However:

- *Applicants are obliged to include in their ES, as a matter of fact, information about the main alternatives they have studied. This should include an indication of the main reasons for the applicant's choice, taking into account the environmental, social and economic effects and including, where relevant, technical and commercial feasibility."*

3.2.3 The NPS also states: *"where (as in the case of renewables) legislation imposes a specific quantitative target for particular technologies …, the IPC should not reject an application for development on one site simply because fewer adverse impacts would*

result from developing similar infrastructure on another suitable site, and it should have regard as appropriate to the possibility that all suitable sites for energy infrastructure of the type proposed may be needed for future proposals."

3.2.4 EDF ER has an ongoing site finding programme to search for suitable wind farm sites. Initial site finding exercises includes the analysis of factors such as predicted wind speed, proximity to residential properties, locations of designated sites and other constraining factors such as airports.

3.2.5 Through the site finding exercise, the Development site was identified as being a potentially suitable site for the development of a wind farm. Following the completion of a series of detailed assessments by EDF ER, the site was selected for further consideration.

3.2.6 The Development site was assessed with regard to:

- Wind resource.
- Distance from housing.
- Existing land use and planning policy considerations.
- Ecological factors.
- Cultural heritage/archaeological factors.
- Landscape designations and potential visual impacts on the landscape.
- Availability of electrical network connection.
- Telecommunications links across the site.
- Aviation and air defence.
- Accessibility and rights of way.

3.2.7 This process of assessment revealed that, taking into account the factors outlined above, a sufficient area for a commercially viable wind farm could be identified.

3.3 Site design

3.3.1 The design of the Park Spring Wind Farm site has followed an iterative process responding to the information gathered throughout the design process, including responses from statutory and non-statutory consultees, and members of the public. Throughout the development of the project, EDF ER has sought to minimise the impact of the Development through embedded mitigation.

3.3.2 The layout of the wind turbines has altered throughout the development process. The final proposed layout takes into account information received from the surveys and studies undertaken as part of the EIA and, where possible, comment received from various consultees. An example of this includes; turbine locations which have been relocated from the initial site design following the on-site ecology surveys to ensure that a 50 m buffer from wind turbine blade tips to habitat features was maintained. This is embedded mitigation for bats as recommended by Natural England.

3.3.3 A number of comments from the community consultation exercise informed the decision to redesign the access route to site, including the internal access track design. Accessing the site from Park Lane, Great Houghton was presented at the initial public consultation event. As a result of the feedback received, the site

entrance for the proposed Development is from Park Spring Road (A6195), this is discussed in greater detail in Chapter 13.

Micro-siting

3.3.4 "Micro-siting" is the final iteration in the design of the Development layout and is undertaken in the final stages of development as further information becomes available. For example, the results of geotechnical investigations to be conducted at each proposed turbine location will inform micro-siting, as will the ground conditions encountered during the construction phase. Similarly there may be design features of the turbines selected for installation at the proposed site that may require minor changes to the design as outlined in this ES. As a consequence, flexibility in determining the precise turbine locations and access track alignment may be required.

3.3.5 The National Policy Statement for Renewable Energy Infrastructure (EN-3) recognises that design flexibility is required for onshore wind energy development and therefore recommends that planning authorities may consider granting planning permission with a micro-siting allowance for the required elements, with a tolerance typically of between 30 m and 50 m.

3.3.6 Any micro-siting would be limited so as to be within the scope of the environmental impact assessments undertaken for the project (and the results in this ES) and any further site specific factors which could only be determined through detailed ground investigations in the construction phase.

3.4 Project description

Wind Turbines

3.4.1 The Development will comprise three turbines, each with an anticipated rated installed generating capacity of 2 MW. Each turbine will have a total height to tip of up to 126.5 m. The rotor will consist of three blades connected to a hub supported by a steel tower.

3.4.2 The National Policy Statement for Renewable Energy Infrastructure (EN-3) is clear that it is common practice that the specific turbine model will not be known at the time of planning submission, and therefore a degree of flexibility is required. The exact model of turbine to be used at the Development site will not be known until a contractor/manufacturer has been chosen. The exact size and output of the wind turbines will depend upon the particular turbine model selected. Wind turbine selection depends on a number of factors, including equipment availability at the time of construction, and tendering. This selection is expected to follow tendering upon successful planning permission. For this reason, the EIA has been based on preliminary design information. For the purposes of this ES, turbines of the maximum size envisaged will be considered, that is three turbines up to 126.5 m to tip height.

3.4.3 Figure 3.3 provides details of a typical turbine design. Each turbine will stand up to 126.5 m to tip. The hub height is anticipated to be up to 80 m with a rotor diameter of approximately 92 m, the overall total height to tip at its highest position would be no more than 126.5 m. Each turbine will have a rotor that will consist of three blades. The rotors on all the proposed Park Spring Wind Farm turbines will rotate in the same direction.

3.4.4 The tower of each turbine would be a tubular conical steel structure manufactured in three sections. The tower would be approximately 5 m in diameter at the base.

3.4.5 The nacelle, which is located at the top of the turbine tower and attached to the rotor hub, would be constructed from steel reinforced fibre glass. The nacelle houses the main mechanical components of the wind turbine generator. These include the drive train, gearbox and generator. An anemometer and wind vane on the nacelle will send wind speed and direction information to a computer system that monitors and controls various aspects of the turbine. This will then use electric motors (the yaw mechanism) to rotate the nacelle and rotor to point the turbine blades into the wind to maximise energy capture.

3.4.6 The blades of each turbine will be constructed from glass reinforced polyester composite.

3.4.7 The turbine tower, nacelle and blades would be finished in either white or light grey with the precise colour to be agreed with the Local Planning Authority through a planning condition.

3.4.8 Intrusive ground investigations will be undertaken prior to any development works to fully characterise the underlying deposits and assess their suitability to support a range of foundations or the potential of causing chemical or physical modification. Following which, suitable turbine foundations will be designed (either gravity foundations or piled foundations) as appropriate.

Vehicular access

3.4.9 Vehicular access to the Park Spring Wind Farm site (for both construction and maintenance vehicles) will be taken from Park Spring Road (A6195). Full details of the proposed route to the site are provided in Section 13.

3.4.10 To construct and service the wind turbines approximately 1.45 km of access tracks (550 m of existing tracks and 900 m of new tracks), including a turning point adjacent to turbine T1, will be utilised/constructed or improved to link the turbines to the site entrance. The alignment of the access tracks is shown on Figure 3.2 (Proposed Site Layout) (subject to the required flexibility regarding micro-siting).

3.4.11 A cross section of a typical access track is shown in Figure 3.4. Construction tracks will be 5 m nominal width, with wider sections at corners and passing places as required. The site tracks will be constructed of crushed compacted stone, with a nominal thickness of 500 - 750 millimetres (mm).

Crane hardstanding

3.4.12 A crane pad of 45 m x 20 m, formed from compacted stone will be required adjacent to each turbine location to accommodate the cranes required for installation of the turbine components. The crane hardstandings are also used as a laydown area.

3.4.13 The crane hardstandings will be left in place following construction in order to allow for the use of similar plant should major components need replacing during the lifetime of the wind farm. The crane hardstandings are also required for decommissioning.

3.4.14 In addition to the crane hardstanding a blade laydown area of 45 m x 10 m next to each crane hardstanding is required. The blade laydown area will be managed open

areas of land adjacent to the crane hardstandings providing space to laydown and manoeuvre turbine components during the construction phase. These are generally level areas utilising existing materials on site.

Cabling

3.4.15 The individual turbines will be connected by underground cables to the onsite control building that will house switchgear and grid transformers as necessary. The power generated by the turbines will then be exported to the grid network, most likely at Houghton Main primary substation.

Control building

3.4.16 The proposed control building would be a small single-storey building measuring 10 m by 5.8 m. It is anticipated that this would have a rendered exterior and grey roof. However, the external appearance of the control building will be agreed with the local planning authority, subject to an appropriate planning condition. Indicative elevations of the proposed control building are included in Figure 3.5. External to the building would be a stone hardstanding to facilitate parking for maintenance vehicles.

3.4.17 The control building would include a control room, switchgear, junction boxes, in-door breakers, relaying equipment and steel support structures. Metering and protection equipment would be included. Switches would allow particular collector lines and turbines to be turned off or isolated. This would allow maintenance and repair of individual turbines to take place without shutting down the other turbines.

3.4.18 Also included within the control building would be welfare facilities for the maintenance staff or other occasional visitors.

3.4.19 The foundations of the control building would have an enclosed trench about 1 m deep where the underground electrical cables from the turbines enter. A buried earthing ring and earthing rods tied to the collection system and a common neutral would also be fitted.

Temporary Works

3.4.20 A secure temporary storage area/site compound of approximately 50 m by 50 m will be required during the construction period. The location of the compound is shown in Figure 3.2. The compound will be used for the following purposes:

- Parking of construction vehicles and equipment.
- Parking of staff vehicles.
- Storage of materials and small components.
- Site offices (portable buildings) and welfare facilities including portable toilets.

3.4.21 The site compound will be constructed of compacted stone. Following the construction period the construction compound area will be restored.

3.5 Electricity production

Renewable energy generation

3.5.1 As discussed in the associated Planning Statement, the UK has an obligation to generate electricity from renewable sources. Electricity produced from renewable

sources makes a vital contribution to meeting the UK renewable energy targets and also aids in increases the security of the domestic energy supply.

3.5.2 In order to quantify the amount of renewable energy generation, and the associated offset of emissions, produced by the Development, it is necessary to calculate the amount of the electricity the Development is expected to produce in a typical year. For the purpose of this assessment, the calculations have been based upon a 2 MW candidate turbine.

3.5.3 The annual electricity production of the Development is estimated from:

= Project rated capacity (kW) x Number of Hours in Year x Capacity Factor

3.5.4 A capacity factor (the equivalent percentage time each year that the wind turbine would operate at full load) of 25.9 per cent has been used to estimate the annual electricity production (based on an average 2008 - 2012 load factor for onshore wind in the UK, DUKES 2013[1]).

3.5.5 Annual electricity production at the Development is expected to be approximately equal to:

6000 (rated capacity) x 8760 (number of hours in a year) x 0.259 (capacity factor)

3.5.6 Therefore, for the Development which is expected to have an output of 6 MW, the total annual electricity production would be approximately 13,613,040 kWh (or 13,613 MWh)

3.5.7 Based on DECC's 2005 - 2011 average annual domestic consumption of 4266 kWh[2], it can be calculated that the Development will provide approximately 3191 households with renewable energy annually.

3.5.8 The population of the towns and villages within 2 km of the site boundary are summarised below:

- Great Houghton (~1,130 homes).
- Little Houghton (~50 homes).
- Billingley (~85 homes).
- Darfield (~ 4,100 homes).
- Grimethorpe (~2,100 homes).
- Other isolated residential properties in the surrounding 2 km area (~50 homes).

3.5.9 The output of the wind farm is anticipated to meet the approximate equivalent needs of the total domestic energy consumption of residential properties in Great Houghton, Little Houghton and Grimethorpe. Alternatively, the output of the wind farm could provide the equivalent of approximately 42 per cent of the total domestic energy

[1] https://www.gov.uk/government/publications/digest-of-united-kingdom-energy-statistics-dukes-2013-printed-version-excluding-cover-pages

[2] https://www.gov.uk/government/statistical-data-sets/sub-national-energy-consumption-statistics

needs of the town, villages and isolated residential properties within 2 km of the site (amounting to ~7,500 homes).

3.5.10 The Development will therefore make a material contribution to the local and national targets for renewable energy generation as detailed in the associated Planning Statement.

Carbon savings

3.5.11 Nationally and globally, a significant benefit of the use of wind power rather than fossil fuels is the reduction of emissions of environmentally harmful gases. These benefits are associated with the prevention of emissions of:

- Carbon dioxide, the main greenhouse gas.
- The acid gases.
- Local air quality pollutants.
- Sulphur dioxide.
- Oxides of nitrogen.
- Particulate matter.
- Volatile Organic Compounds (VOCs).

3.5.12 The quantity of carbon dioxide emissions that the Development could prevent being emitted from non-renewable sources has been calculated using the RenewableUK methodology[3], which uses the DECC carbon saving figure of 430 g/kWh.

3.5.13 Using the RenewableUK methodology it can be estimated that the Development could offset the emission of 5853 tonnes of carbon dioxide per year.

3.5.14 The Development will therefore make a material contribution to reducing carbon dioxide emissions in line with local and national planning policy.

3.6 Construction

Construction programme and methods

3.6.1 In the event of a successful planning permission and subsequent awarding of construction contracts, it is anticipated that construction of the Development would take approximately 6-9 months.

3.6.2 The site entrance, completed to Highways Authority requirements, will be constructed first, followed by the internal access tracks. The stone for use in the site access tracks will be imported from local quarries if possible. Recycled materials could be considered if suitable quality is available locally. It is not proposed to open up any borrow pits within the site to obtain materials, and no crushing plant will be used on the site.

3.6.3 A temporary site compound would then be constructed for the parking of construction vehicles and equipment, staff vehicles, and the storage of materials and small components.

[3] http://www.renewableuk.com/en/renewable-energy/wind-energy/uk-wind-energy-database/figures-explained.cfm

3.6.4 Once the access tracks and site compound are in place, turbine foundation construction will commence.

3.6.5 Construction of the foundations would comprise: excavation of the foundation void to a depth of approximately 2.5 m using excavators, and stockpiling the excavated materials for reuse; installation of cable ducts below foundation; rebar and bolt cage assembly; formwork installation, placement and finishing concrete; removing the forms; backfilling; compacting; and foundation site restoration. Excavation and foundation construction would be conducted in a manner that would minimise the size and duration of the excavated area. On site excavated materials will be used for backfill and reinstatement as far as is possible. The piling of foundations (where concrete or steel piles are driven in to the ground to a sufficient depth to provide a suitable foundation for the turbine) are not expected to be necessary. The final foundation design will be confirmed following pre-construction on-site geotechnical surveys.

3.6.6 Trenching and installation of underground services can then take place.

3.6.7 The delivery of the wind turbines will be dependent on the manufacturer's production schedule and may not follow directly on from the civil works. Each wind turbine should take approximately three days to assemble depending on the weather conditions.

3.6.8 Turbine erection would be performed in multiple stages including: erecting the tower (usually in three sections); erecting the nacelle; assembling and erecting the hub and blades; connecting and terminating the internal cables; and inspecting and testing the electrical system prior to operation. High lift cranes would be required for turbine erection.

3.6.9 After construction has been completed the temporary construction compound and laydown areas would be restored as close as possible to their original condition or in accordance with an approved restoration plan. Turbine foundations will be covered up to the base and reseeded where appropriate. Wherever feasible and desirable, reinstatement will be undertaken as the project progresses.

3.6.10 Construction working hours will be restricted to the following, with no working on Sundays or Bank Holidays:

Monday to Friday	7.30 am to 7pm
Saturday	8am to 1pm

3.6.11 Any deviations from these times (e.g. for the erection of the wind turbines) will be agreed in advance with the local planning authority. In the case where emergency works have had to be undertaken outwith these hours the LPA will be advised within 24 hrs of the occurrence.

Construction management

3.6.12 A construction work-force of up to 30 personnel is expected, however not all workers would be on-site at any one time. The peak workforce would be on site during the busiest construction period when multiple disciplines of contractors complete work simultaneously. Electricians, riggers, crane operators and heavy equipment operators will also be required. Suitably experienced local contractors will be encouraged to tender for the civil and electrical works.

3.6.13 The contract for supply, construction and commissioning of the wind turbines and associated infrastructure will be awarded through a competitive process to one or more contractors who may in turn appoint specialist subcontractors. The main contractors and subcontractors will be responsible for the detailed design, civil and electrical construction, manufacture, supply, delivery to site, off-loading, erection, installation and commissioning of the wind turbines and associated infrastructures. The selection of the construction contractor will include an assessment of the contractor's record in dealing with environmental issues and require provision of evidence that it has incorporated environmental requirements into its method statements.

3.6.14 The main contractor will be responsible for organising the site construction and installation works to the required safety standards and the project programme.

3.6.15 A Construction Environmental Management Plan (CEMP) will be prepared in consultation with the relevant authorities. The CEMP will identify potential impacts, such as pollution risks, associated with each activity and will include:

- Programme of works.
- Drainage Management Plan.
- Accident Management Plan.
- Site Waste Management Plan.
- Procedures for dealing with surface water.
- Procedures for dealing with pollution/contamination.
- Details of any monitoring proposals to be implemented e.g. archaeological watching brief.

3.6.16 EDF ER will ensure that, among other things, the site contractor nominates an Environmental Site Manager and Site Waste Manager to manage the Site and Waste Management Plan (SWMP) for the duration of the construction and commissioning phase.

3.6.17 EDF ER will retain the services of specialist advisors with regards to ecology and archaeology for the construction period, for example for assistance with micro-siting and an archaeological watching brief.

3.6.18 Construction activities will be undertaken in accordance with a Working Practices Procedure for the Control of Pollution (Working Practices Procedure) that will be developed by the contractor. This will be agreed with the relevant authorities prior to any works on site and can be secured by planning condition requiring the submission and approval of a Construction Method Statement.

3.6.19 The procedures aim would be to provide guidance on good working practices on site in order to minimise impacts on the soil, geology, hydrology and hydrogeology resulting from the construction of the Development. Additional procedures will be developed to cover ecology, noise, etc. The procedures will ensure compliance with: the project's planning permission; relevant mitigating measures identified by this EIA; and the EA and Construction Industry Research and Information Association's (CIRIA) guidance for the work and operations to be undertaken. The Contractor will be obliged to comply with the Working Practices Procedure as part of the contract.

3.6.20 The Contractor would also be responsible for training its personnel in spill prevention and control and, if an incident occurs, would be responsible for containment and cleanup. Spills would be addressed in accordance with the Working Practice Procedures.

3.6.21 Dust could be emitted during several activities associated with the construction works if preventative measures are not taken. Dust could arise from: earth moving operations for excavation and back filling of foundations; blow-off and spillage from vehicles; site reinstatement; and road construction. Dust emissions from the site should be similar to those normally encountered on construction sites. Construction operations will be conducted so as to minimise the generation and spread of dust in order to prevent construction work generating levels of atmospheric dust that would constitute a health hazard or nuisance to people working on the site or living nearby.

3.6.22 A temporary wheel washing facility will be provided adjacent to the site exit and will be used by all heavy commercial vehicles leaving the site, preventing the transmission of soil from the site to the public highway. Vehicles will be encouraged to reduce their speed while moving around the site during dry weather to minimise disturbance.

3.6.23 The details of a Traffic Management Plan governing vehicle movement to and from and in and out of the site would also be developed and agreed with the Highways Authority prior to the commencement of the Project. This can be secured by planning condition and is discussed further in Section 13.

3.6.24 An individual will be nominated who will be responsible for the site management and all aspects of the work. An information board will be displayed in a publicly accessible location at all times, giving the name and telephone number of the developer's site representative. Warning signs would be erected to inform and protect members of the general public of the construction works being undertaken. Inductions to site will be provided for all visitors.

3.7 Operation

3.7.1 The Development is expected to have an operational life of 25 years.

3.7.2 The operation of the proposed Development will be undertaken in accordance with an Operational Environmental Management Plan (OEMP).

3.7.3 Modern wind turbines are fully automatic, turning into the prevailing wind direction and shutting down when necessary. The minimum wind speed for the turbine to begin electricity generation is approximately 4 m/s at hub height, rising to the full rated output at 15 m/s. The design of the turbines would be such that, should average wind speeds consistently exceed 24 m/s at the hub, the turbine would automatically stop for safety reasons and in order to avoid excessive wear on the components. These very high wind speeds only occur for a very small percentage of the year. In reality, turbines are designed to withstand much higher wind speeds.

3.7.4 Therefore, the portion of the time the turbines will generate electricity will correspond to the frequency of winds between 4 and 25 m/s, and the amount of energy generated varies with the seasons, with highest sustained wind speeds generally occurring in winter when electricity demand is also highest.

3.7.5 Typically modern wind turbines operate with an availability of 95 to 99 per cent i.e. the turbines are available to operate for this percentage of the year. Forced outages can occur due to the malfunction of mechanical or electrical components, or computer

controls. These outages are generally due to the malfunction of auxiliaries and controls, rather than the malfunction of heavy rotating machinery, as the latter are routinely inspected during planned maintenance or by condition monitoring.

3.7.6 Wind farms on average operate for 70 to 80 per cent of the time, at varying levels of output resulting in a capacity factor of around 30 per cent. The capacity factor is the ratio of the actual annual output to the theoretical maximum if the turbine was generating at maximum output for the complete year.

3.7.7 Electrical power generated by the turbines would be collected at between 575 and 690 V (volts) depending on the type of turbine used. A transformer, typically located in the turbine base or nacelle, transforms the voltage to that required for connection to the local electrical distribution network.

3.7.8 As the rotor blades capture the wind energy they will face into the wind, with the tower and nacelle behind. The rotor blades would turn at about 10 to 25 rpm (Revolutions Per Minute) although the precise rpm depends on the design and varies from model to model.

3.7.9 The wind turbines will be equipped with sophisticated computer control systems that would continuously monitor variables such as: wind speed and direction; air and machine temperatures; electrical voltage and current; vibrations; blade pitch; and rotation (i.e. yaw). These variables will be monitored in order to automatically control the operation of the nacelle and subsequent power generation. This Supervisory Control and Data Acquisition (SCADA) system would rotate the nacelle into the wind and apply the brakes when necessary. This allows the Development to be unmanned. In addition, the operators would be able to monitor information remotely, including fault diagnostics, and control the turbines as necessary from a central off-site host computer or from a remote personal computer. In the event of any fault on the system the SCADA system would be able to alert operations staff. The control system would always run to ensure that the machines operate efficiently and safely.

3.7.10 Frequent and detailed turbine inspections and maintenance would be undertaken in the first year of operation. Following this, a programme of six monthly services is expected. This generally takes the wind turbine off-line for a day and consists of: inspecting and testing safety systems; inspecting wear and tear on components such as seals and bearings; lubricating the mechanical systems; performing electronic diagnostics on the control systems; verifying pre-tension of the mechanical fasteners; gearbox oil change and inspecting the overall structural components of the wind turbines. The blades would also be inspected. As far as is practical, short term routine maintenance procedures would be undertaken during periods of little or no wind to minimise the impact on electricity generation. Major maintenance/servicing are planned where practical during the summer months.

3.7.11 In the event of a fault, the modular design of modern wind turbines allows most of the parts to be rapidly replaced, especially in the electrical and control systems.

3.7.12 Electrical equipment such as breakers, relays and transformers require annual visual inspections which does not affect availability of the turbines. On a 3 yearly basis testing and calibration of this equipment would require a short break in operation.

3.7.13 A site sign would be located at the access point and would provide information about the turbines and contact telephone numbers.

3.8 Decommissioning

3.8.1 There are several aspects of the decommissioning phase of the Development that may have environmental effects. The main activities will comprise:

- Removal of tower, nacelle, blades.
- Reuse/disposal of foundation waste, tower, nacelle, blades.
- Removal of ancillary structures.

3.8.2 Decommissioning will take account of the environmental legislation and the technology available at the time. Notice will be given to the local planning authority in advance of the commencement of the decommissioning work. Any necessary licences or permits would be acquired.

3.8.3 EDF ER would also develop a Decommissioning Plan and the works would be undertaken in accordance with a Working Practices Procedure, the details of which would be agreed not less than 12 months prior to decommissioning.

3.8.4 The first step of decommissioning will be to make the Development safe for work in accordance with the normal safety procedures, such as the issue of permits to work. The Development would be de-energised in conjunction with the Distribution Network Operator. Once the Development is completely disconnected, it will be handed over to a competent Contractor (or contractors) to complete the dismantling and demolition work. The lead Contractor would produce Safety and Environmental Management Plans for the work.

3.8.5 It is anticipated that foundations would be removed to a depth of 1 m below ground and the soil surface would be restored in accordance with the provisions of the approved decommissioning plan in place at that time.

3.8.6 Disposal of all waste materials will only be via appropriate and authorised routes.

3.8.7 Once the site is decommissioned the access tracks would be removed or left in place depending on the restoration requirements and the landowner's preferences.

3.8.8 Compared to other power generation technologies, wind turbines can be easily and economically decommissioned and removed from site at the end of their economic life, and the site returned to its original condition.

SECTION 4

PLANNING POLICY CONTEXT

4 PLANNING POLICY CONTEXT

4.1 Introduction

4.1.1 This chapter provides an overview of national and local planning policy and guidance relevant to the Development or the area in which it is located. This covers Government guidance outlined within the National Planning Policy Framework (NPPF) and other relevant national planning and energy policy documents along with the local Barnsley Metropolitan Borough Council (BMBC) planning policy documentation.

4.1.2 These policies and guidance documents have informed this EIA which has in turn informed the design of the Development proposals.

4.1.3 This chapter identifies the relevant policies and their general requirements; whilst a more detailed assessment of the degree to which the Development is consistent with the requirements of these policies is contained within the Planning Statement submitted in support of this application. The Planning Statement also contains details on the relevant energy policy and the need for renewable energy development including achieving climate change targets and contributing towards the security of energy supplies.

4.2 Spatial scope of the chapter

4.2.1 The baseline review of spatial planning policy has been limited to the application site for land use designations in the Development Plan, supplemented by the study area associated with specific disciplines where relevant. An example of where this wider study area has been used is in relation to policies relating to Landscape Designations. A wider, more regional scope has been taken to identify relevant strategic policies.

4.3 National planning policy

<u>The Plan for Growth - Ministerial Statement (March 2011)</u>

4.3.1 The Plan for Growth was published as an "urgent call for action" in response to the state of Britain's economy and the requirement for improvement. The Statement considered various aspects of the economy and identified measures for improvement; including the planning system.

4.3.2 The Government reform of the planning system sought to focus on and promote sustainable economic growth and employment. In particular, it states that local authorities should support enterprise and facilitate housing, economic and other forms of sustainable development (DCLG 2011).

4.3.3 It also states that in determining planning applications, local planning authorities are obliged to have regard to all relevant considerations, ensure that they give appropriate weight to the need to support economic recovery, and that those applications which secure sustainable growth should be treated favourably.

4.3.4 The Statement identifies 10 "Planning Review Actions", including Action 8 in relation to streamlining the planning system. Included within the explanation of Action 8 is a reference to applications for renewable energy development.

4.3.5 Section 2.27 states that *"to support renewable energy while maintaining standards of protection, environmental regulators will work closely with the renewables industry to streamline administrative processes for their permissions"*.

National Planning Policy Framework (NPPF) (March 2012)

4.3.6 The national planning policy context for England is set out in the NPPF, issued by the Government in 2012.

4.3.7 The NPPF has replaced the previous Planning Policy Guidance (PPG) and Planning Policy Statements (PPS) (with the exception of PPS 10: Planning for Sustainable Waste Management) with a single document. The document sets out the Government's economic, environmental and social planning policies for England. The NPPF provides the planning policy context for this ES.

4.3.8 The NPPF continues to recognise that the planning system is plan-led and that Local Plans must aim to achieve the objective of sustainable development. Paragraph 14 states that there is a presumption in favour of sustainable development at the heart of the NPPF, which should be seen as a golden thread running though both plan-making and decision-taking. For decision-taking this means:

- *Approving development proposals that accord with the development plan without delay.*
- *Where the development plan is absent, silent or relevant polices are out of date, granting permission unless:*
  - *Any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the polices in the NPPF taken as a whole; or*
  - *Specific polices in the NPPF indicate development should be restricted.*

4.3.9 The Government is committed to ensuring that the planning system does everything it can to support long term, sustainable economic growth and has made it clear that significant weight should be placed upon the need to support economic recovery through the planning system and related consent regimes (Paragraph 19).

4.3.10 The NPPF contains 12 core planning principles, of which the following is of particular relevance to the Park Spring Wind Farm proposals:

Support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy).

4.3.11 At paragraph 97, the NPPF sets out how local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources. The NPPF lists that local planning authorities should:

- *Have a positive strategy to promote energy from renewable and low carbon sources.*

- *Design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including cumulative landscape and visual impacts.*
- *Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources.*
- *Support community-led initiative for renewable and low carbon energy, including development outside such areas being taken forward through neighbourhood planning.*
- *Identify opportunities where development can draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.*

4.3.12 The NPPF identifies 13 key policy areas that constitute the Government's view of what sustainable development in England means in practice for the planning system.

4.3.13 As well as adopting the 12 core principles, the 13 policy areas seek to aide local authorities in achieving sustainable development when writing Local Plans and when deciding on whether or not a planning application should be approved. The most relevant of these 13 policies to this wind energy development are listed below:

1. *Building a strong, competitive economy.*
3. *Supporting a prosperous rural economy.*
7. *Requiring Good Design.*
9. *Protecting Green Belt Land.*
10. *Meeting the challenge of climate change, flooding and coastal change.*
11. *Conserving and enhancing the natural environment.*
12. *Conserving and enhancing the historic environment.*

4.3.14 An assessment of the Development against the planning policy, in particular Green Belt, is included in the separate Planning Statement.

4.3.15 In addition to the 13 sustainability policy guidance areas, the NPPF also provides guidance to local authorities on how to write Local Plans and the approach they should adopt in structuring their plans. Relevant to proposed wind energy projects, it advises local authorities to set out strategic priorities in Local Plans to deliver the following:

- *The provision of infrastructure for transport, telecommunications, waste management, water supply, waste water, flood risk and coastal change management and the provision of minerals and energy (including heat).*
- *Climate change mitigation and adaptation, conservation and enhancement of the natural and historic environment, including landscape.*

4.3.16 The NPPF states that crucially, Local Plans should:

- *Plan positively for the development and infrastructure required in the area to meet the objectives, principles and policies of this Framework.*

- *Be based on co-operation with neighbouring authorities, public, voluntary, and private sector organisations; the new development should be looked on more favourably.*
- *Identify land where development would be inappropriate, for instance because of its environmental or historic significance.*

4.3.17 The NPPF states that local planning authorities should follow the approach set out in the National Policy Statement for Renewable Energy Infrastructure (EN-3) when assessing wind energy developments; with reference to the relevant sections of the Overarching National Policy Statement for Energy (EN-1). Both of these are discussed below.

National Policy Statements for Energy (NPS)

4.3.18 Designated under the Planning Act 2008 the six NPS's for energy set out national policy against which major energy proposals are assessed.

4.3.19 Whilst the NPS's were initially written specifically as guidance for major energy infrastructure developments (proposed onshore wind energy scheme of above 50 MW installed generating capacity), the NPPF states that local planning authorities should follow the approach set out in the NPS's for renewable energy projects, regardless of proposed installed generating capacity.

Overarching National Policy Statement for Energy (EN-1) (July 2011)

4.3.20 EN-1 sets out national policy for energy infrastructure. This includes the rationale for the development of new nationally significant infrastructure projects, including the role of renewable energy generation, and then goes on to set out the general policies against which energy proposals should be decided.

4.3.21 The generic impacts described in EN-1 (of relevance to renewable energy) include:

- Air quality and emissions.
- Biodiversity and geological conservation.
- Civil and military aviation and defence interests.
- Dust, odour, artificial light, smoke and insect infestation.
- Flood risk.
- Historic environment.
- Landscape and visual.
- Land use including open space, green infrastructure and green belt.
- Noise and vibration.
- Socio-economic.
- Traffic and transport.
- Waste management.
- Water quality and resources.

National Policy Statement for Renewable Energy Infrastructure (EN-3) (July 2011)

4.3.22 EN-3 is a technology-specific NPS which should be read in conjunction with EN-1. EN-3 discusses impacts and other matters which are specific to renewable energy developments. This NPS discusses factors that are likely to influence site selection, technical considerations such as access tracks, requirement for flexibility and micro-siting, and the assessment principles for onshore wind which include:

- Biodiversity and geological conservation.
- Historic environment.
- Landscape and visual.
- Noise and vibration.
- Shadow flicker.
- Traffic and transport.

Planning Practice Guidance for Renewable and Low Carbon Energy (July 2013)

4.3.23 In July 2013 the Department for Communities and Local Government (DCLG) released guidance on planning issues associated with the development of renewable energy projects. 'Planning Practice Guidance for Renewable and Low Carbon Energy' should be read in conjunction with the NPPF.

4.3.24 Following the introduction of 'Planning Practice Guidance for Renewable and Low Carbon Energy' the previous guidance 'Planning for Renewable Energy: A Companion Guide to PPS22' is cancelled.

4.4 Regional planning policy

4.4.1 The Yorkshire and Humber Plan Regional Spatial Strategy (RSS) was adopted in May 2008 and was intended to provide the regional framework for development and investment for the region up to 2026. The Strategic Environment Assessment for abolition of the RSS went out to consultation in December 2012 and concluded in March 2013. All RSS' have now been abolished however, the RSS was used to inform the Development Plan for BMBC and is therefore of relevance in the determination of planning applications within their jurisdiction.

4.4.2 The RSS contains nine key spatial priorities; of which the following is of relevance to the Park Spring proposals: avoid increasing flood risk, and manage land and river catchments for flood mitigation, renewable energy generation, biodiversity enhancement and increased tree cover.

4.4.3 The RSS has one policy specifically regarding renewable energy, Policy ENV5: Energy, which supports renewable energy development and provides targets for installed, grid-connected renewable energy capacity. The targets set for South Yorkshire are 47 MW by 2010 and 160 MW by 2021. At a more local scale, the RSS set a target for installed grid-connected renewable energy for Barnsley of 15 MW by 2010 and 34 MW by 2021. The Core Strategy, dated 2011, outlined that Barnsley at that point had 6.5 MW of installed generating capacity with a further 20.1 MW consented.

4.4.4 Other RSS policies of relevance to the Development are as follows:

- Policy YH2: Climate change and resource use.
- Policy YH8: Green infrastructure.
- Policy YH9: Green belts.
- Policy SY1: South Yorkshire sub area policy.
- Policy ENV7: Agricultural land.
- Policy E1: Creating a successful and competitive regional economy.

4.5 Local planning policy

4.5.1 At a local level, the 2004 Planning Act introduced the Local Development Framework (LDF), aimed at offering a more flexible and easily adaptable system that allowed local authorities to tailor their development policies for the benefit of communities in line with their corresponding Regional Spatial Strategy (RSS), national PPGs and PPS'.

4.5.2 RSS' have since been revoked and the NPPF replaced the PPG and PPS Guidance to become the primary source of policy guidance for local authorities and developers alike. Although PPGs and PPS' are no longer relevant, the RSS remains a material consideration in the development of the LDF and the consideration of planning applications.

4.5.3 The Development Plan for Barnsley consists of the remaining saved policies of the Unitary Development Plan (UDP), the LDF documents (including the adopted Core Strategy), and the RSS (as discussed above).

Barnsley Unitary Development Plan (adopted December 2000)

4.5.4 The saved policies of the UDP will continue to be used for determining planning applications until the LDF documents are completed.

4.5.5 The UDP makes one mention of renewable development in relation to the Western Rural Community area (where the likelihood for this type of development was anticipated). This section states that: "*The need to provide alternative 'renewable' energy sources and essential materials for the development industry has to be carefully weighed against the significant environmental consequences of such developments*".

4.5.6 Saved policies of particular relevance to the development proposals include:

- GS6 Extent of Green Belt.
- DA4 Area of Investigation for Potential Employment Development.
- DA5 Green Belt.
- DA7 Nature Conservation Sites.
- DA8 Recreational Routeways.
- DA11 Conservation Areas.

Barnsley Local Development Framework

4.5.7 The Barnsley LDF comprises a number of different documents that provide the main planning policies and proposals previously contained in the UDP. The documents are at varying stages in their production.

4.5.8 A Supplementary Planning Document providing guidance for renewable energy developments was not available at the time of writing this ES.

Barnsley LDF Core Strategy (adopted September 2011)

4.5.9 The Core Strategy forms part of the LDF, providing the spatial strategy for the development of the Barnsley area up to the year 2026. The Core Strategy should be read in conjunction with national policy documents as well as the saved policies in the UDP.

4.5.10 The Core Strategy supports the development of renewable energy developments, recognising the positive impact that such development can have on reducing the potential effects of climate change.

4.5.11 Policies of particular relevance to the development proposals include:

- CSP 1 Climate Change.
- CSP 6 Development that Produces Renewable Energy.
- CSP 21 Rural Economy.
- CSP 34 Protection of Green Belt.

4.5.12 The development site is located within the "Accessibility Improvement Zone" but there are no policies that relate to the development proposed.

Barnsley Development Plan Document (DPD) (October 2005)

4.5.13 The Barnsley DPDs provide additional information and supporting text to the policies contained within the LDF documents. Various DPD were produced in relation to the consultation on Preferred Options in 2005, of which the following are of relevance to the Development proposals:

- Background Paper 6: Natural Environment Preferred Options.
- Background Paper 7: Green Belt and Safeguarded Land Preferred Options.
- Background Paper 9: Landscape Preferred Options.
- Background Paper 12: Renewable Energy and Climate Change.

4.5.14 The purpose of Background Paper 12 is to provide relevant background information on the preparation of policy and outline how the policies can be implemented effectively. The rationale for policy is stated as being the various national and regional level documents available at the time the DPD were being written.

SECTION 5

NOISE

5 NOISE

5.1 Introduction

5.1.1 The introduction of wind turbines has the potential to cause disturbance to the surrounding area and adjacent residential properties through noise emissions. In order to protect the reasonable amenity of neighbours of the wind farm, an assessment of the proposed wind farm, including the measurement of the existing background noise levels, has been undertaken. This chapter presents the approach and findings of this assessment, including recommended planning noise limits.

5.1.2 The methodology for the noise survey, including the selection of receptors and background noise monitoring locations, was discussed and agreed during correspondence with an Environmental Health Officer (EHO) at Barnsley Metropolitan Borough Council (BMBC) prior to commencement.

5.1.3 The results of the background noise survey have been correlated against hub height wind speed, calculated from simultaneously measured wind speed at various heights, with correction for wind shear. This has been done in order to establish changes in the noise climate at the proposed site with increasing wind speed. From this data, noise limits for the scheme have been derived for the night-time and amenity hours in accordance with the methodology set out in ETSU-R-97 'The Assessment and Rating of Noise from Wind Farms'.

5.2 Legislation / Policy / Good Practice

General

5.2.1 The following Legislative framework and published guidance has been used for this assessment:

- National Policy Statement for Renewable Energy Infrastructure (EN-3).
- National Planning Policy Framework (NPPF): 2012.
- ETSU-R-97 The Assessment & Rating of Noise from Wind Farms.
- Prediction and Assessment of Wind Turbine Noise: Agreement about relevant factors for noise assessment from wind energy projects – Bowdler et al, Acoustics Bulletin, Vol 34 No 2 March/April 2009, Institute of Acoustics.
- A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, May 2013, Institute of Acoustics.
- BS5228:2009 Noise and vibration control on construction and open sites.
- BS7445: 2003 Description and measurement of environmental noise.
- ISO9613, 1996 Acoustics – Attenuation of Sound During Propagation Outdoors, Part2: General Method of Calculation.
- IEC 61400-11 Wind Turbine Generator Systems Part 11: Acoustic Noise Measurement Techniques. International Electro-technical Commission, 2002.

National Policy Statement for Renewable Energy Infrastructure (EN-3)

5.2.2 EN-3 provides guidance for noise in relation to renewable energy developments in England. This document endorses the use of ETSU-R-97 "The Assessment and Rating of Noise from Wind Farms" for assessment of noise impacts at nearby sensitive properties.

NPPF: 2012

5.2.3 The NPPF (DCLG, 2012) sets out the Government's requirements for the national planning policy and directs how it is to be implemented in order to achieve sustainable development. Sustainable development focuses on positive growth – making economic, environmental and social progress for this and future generations.

5.2.4 The NPPF states that the *'planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution and remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate'.*

5.2.5 The NPPF states that planning policies and decisions should aim to:

- *Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;*
- *Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions;*
- *Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and*
- *Identify and protect areas of tranquility which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.*

ETSU-R-97, The Assessment and Rating of Noise from Wind Farms

5.2.6 In August 1993 the Department of Trade and Industry (DTI) facilitated the establishment of a Noise Working Group (NWG) to investigate the assessment of noise from Wind Farms. The culmination of the efforts of the NWG resulted in a report in September 1996, which is referred to as ETSU-R-97.

5.2.7 The NWG recommended that the current practice of controlling wind farm noise by the application of noise limits at the nearest noise-sensitive properties is the most appropriate approach. This approach has the advantage that the limits can directly reflect the existing noise environment at the nearest properties and the impact that the wind farm may have on these levels.

5.2.8 The ETSU-R-97 report recommends the following aspects of wind farm noise be considered:

- The LA_{90} noise index should be used to describe both prevailing background noise levels and the predicted wind farm noise levels (correlated to 10 m high wind speed).
- Measurements and predictions should be undertaken using 10-minute time intervals.
- The noise limit should be set for the whole wind farm.
- The wind turbine noise limits should be limited to 5 dB(A) above the measured background for both quiet day and night time periods, except in low noise environments where a lower fixed limit may also apply.

5.2.9 In low noise environments the night time lower fixed limit $LA_{90,10min}$ of wind turbine noise should be limited to an absolute level of 43 dB, or a 45 dB fixed limit for financially involved properties. During amenity hours, it should be limited within the range of 35 – 40 dB. The actual value chosen should depend upon a number of factors:

- The number of dwellings in the neighbourhood of the wind farm.
- The effect of noise limits on the number of kWh generated.
- The duration and level of exposure.

5.2.10 The character of the noise from modern wind turbines is normally not considered to be tonal, and manufacturers will warrant a turbine selection to this effect. ETSU-R-97 does contain an extensive procedure for determining the tonal properties of a turbine should this become necessary, and a penalty would be applied to the noise output to compensate in the event of a tonality problem.

5.2.11 Background noise levels upon which relative limits are based and the noise limits themselves, are based upon typical or average levels rather than extreme values at any given wind speed.

5.2.12 The noise limits referred to in ETSU-R-97 take into account the fact that all wind turbines exhibit to some extent the character of noise described as blade swish and amplitude modulation (AM). ETSU-R-97 also recognises that through design improvements, turbine manufacturers have been able to design out the source of low frequency noise and infrasound as it is the mechanical noise that gives rise to this structure-borne noise source.

5.2.13 A 2007 report produced by Salford University 'Research into Aerodynamic Modulation of Wind Turbine Noise' concluded that AM was only apparent at four wind farm sites, and a possible factor at a further 8 of the 133 operational UK sites considered. At the four identified sites it was considered that AM may occur between 7 and 15% of the time. Following the report by Salford University the Government advised that the assessment and rating guidance in ETSU-R-97 should continue to be used. No alternations to the guidance were proposed to take account of AM.

5.3 Assessment Methodology

Construction / Decommissioning Phase

5.3.1 Construction / decommissioning activity inevitably leads to some degree of noise disturbance at locations in close proximity to the construction activities. It is however a temporary source of noise. The noise levels generated by construction activities would have the potential to impact upon nearby neighbouring dwellings. Noise levels

at any one location will vary as different combinations of plant machinery are used, and throughout the construction of the proposed plant as the construction activities and locations change. These would depend upon a number of variables.

5.3.2 In the absence of specific information regarding the proposed construction plant and activities, potential construction noise impacts have been assessed using the methodology set out in BS 5228 in conjunction with general information regarding proposed activities.

5.3.3 The significance of constructional noise impacts has been assessed based on the Category 'A' daytime threshold of 65 dB(A) from Table E.1 of BS5228-1: 2009. The significance of construction noise will relate to the degree of exceedance of this value. Exceedances will be rated as negligible (<1 dB), minor (1<3 dB), moderate (3<5 dB), major (5<10 dB) and severe (>10 dB).

Choice of Noise Monitoring Locations

5.3.4 In order to determine the locations where noise monitoring is required, all residential properties within 1km of the proposed turbine location were identified, and those where turbine noise levels were predicted to exceed 35 dB(A) were acknowledged. The noise contour plots are shown in Appendix 5.6.

5.3.5 The location of each monitoring station was discussed and agreed with BMBC, prior to survey work commencing in email and phone correspondence, and also a site visit by their external consultant.

5.3.6 Table 5.1 lists the properties chosen for noise monitoring around the Park Spring Wind Farm site.

Table 5.1: Noise monitoring locations

Ref	Address	Area	Easting	Northing
NL1	165 Middlecliff Lane, Little Houghton, Barnsley S72 0HW	Little Houghton	442251	405699
NL2	17 Pear Tree Close, Great Houghton, Barnsley S72 0BJ	Houghton Green	440617	406338
NL3	2 Woodland Terrace, Grimethorpe, Barnsley S72 7LG	New Park Spring	441906	408297
NL4	2 Crook House Court, Crook House Lane, Barnsley S71 5EG	Edderthorpe	442824	406679

Monitoring location: 165 Middlecliff Lane (NL1)



Figure 1 – NL1 Middlecliff Lane (view towards property)



Figure 2 – NL1 Middlecliff Lane (view towards garden)

5.3.7 The monitoring location at NL1 was approximately 1km to the nearest turbine.

5.3.8 Ambient noise levels at this location are influenced by road traffic noise (nearby A6195 audible), occasional aircraft noise and local events such as dog barking.

5.3.9 This location provides a relatively sheltered and screened location due to the fenced garden and surrounding houses, adequately representing the possible amenity spaces for the surrounding properties.

Monitoring location: 17 Pear Tree Close (NL2)



Figure 3 – NL1 17 Pear Tree Close (view to side of property)



Figure 4 – NL2 17 Pear Tree Close (from garden towards site)

5.3.10 The monitoring location at NL2 was approximately 850m to the nearest turbine.

5.3.11 Ambient noise levels at this location are typically quite low and influenced by distant road traffic noise (A6195 and nearby High Street audible), birdsong, occasional aircraft noise and local events such as occasional traffic on Pear Tree Close, lawn mowing etc. These effects have been minimised in the choice of monitoring location.

5.3.12 This location provides a relatively sheltered and screened location due to the fenced garden and surrounding houses, adequately representing the possible amenity spaces for the surrounding properties.

Monitoring location: 2 Woodland Terrace (NL3)



Figure 5 – NL3 2 Woodland Terrace (view towards property)



Figure 6 – NL3 2 Woodland Terrace (view away from property)

5.3.13 The monitoring location at NL3 was approximately 900m to the nearest turbine.

5.3.14 Ambient noise levels at this location are typically quite low and influenced by distant road traffic noise and local sources such as cars on local roads and dogs barking.

5.3.15 This location provides a sheltered and screened location due to the fenced garden and surrounding buildings, adequately representing the possible amenity spaces for the surrounding properties.

Monitoring location: 2 Crook House Court (NL4)



Figure 7 – NL4 2 Crook House Court (view towards property)



Figure 8 – NL4 2 Crook House Court (view towards Crook House Lane)

5.3.16 The monitoring location at NL4 was approximately 1.4km to the nearest turbine.

5.3.17 Ambient noise levels at this location are typically low and influenced by distant road traffic noise and local agricultural activities such as occasional vehicles movements.

5.3.18 This location provides a sheltered and screened location due to the distance from Crook House Lane, adequately representing the possible amenity spaces for the surrounding properties.

Measurement Procedure

5.3.19 In order to gain a robust data set, the sound level meters were set to log the parameters L_{A90}, L_{A10}, L_{Aeq}, L_{Amax} and L_{Amin} over 10 minute intervals for a period of approximately 24 days between the 19th February 2013 and 19th March 2013. Due to equipment failure at NL1 and subsequent poor weather conditions, the sound level meter remained at this location until 9th April 2013. Results were stored at synchronised 10-minute intervals between the sound level meters and the on-site anemometry data logger to allow for later correlation between noise levels and wind speeds. All simultaneous wind speed and direction measurements were taken on site at a height of 40 m and 70 m. Levels of precipitation were also measured by the on-site anemometry mast in 10-minute intervals. Periods with recorded precipitation were removed from the dataset. Where two or more 10 minute periods consecutively recorded precipitation, the subsequent two periods were also omitted.

5.3.20 The prevailing background noise levels, were recorded in terms of $L_{A90,10min}$ continuously over this period. In accordance with the ETSU-R-97 guidelines, the survey was carried out in order to identify the existing ambient noise levels during the 'quiet daytime' and night periods. 'Night' is defined in ETSU-R-97 as 11 pm to 7 am, and 'quiet daytime', which is described as amenity hours and are comprised of the following periods:

- All evenings from 6 pm to 11 pm
- Saturday afternoon from 1 pm to 6 pm,
- All day Sunday, 7 am to 6 pm.

Instrumentation

5.3.21 The noise survey was undertaken using 4 Class-1 Sound Level Meters (SLM), consisting of: 3 x Rion NL-52 and 1 x Rion NL-32. This was connected to a half inch microphone type UC-53A, and fitted with a double skin foam ball wind shield type WS-15 with the NL-52 and WS-10 with the NL-32. The microphone was mounted at a height of 1.2m from ground. Site calibration was carried out using a Rion NC-74 calibrator. All calibration certificates are in Appendix 5.2.

Wind Shear

5.3.22 In order to account for potential wind shear on site, the hub height wind speed has been calculated using two simultaneously measured wind speeds (taken at 40 m and 70 m) using the derived wind shear exponent. The wind speed at 10 m has then been calculated using a 'ground roughness' of 0.05.

Correction of Baseline Data for Non Representative Events

5.3.23 Graphs of the noise data from the measurement location were analysed to identify time periods where the measurements may have been influenced by unusual,

temporary or otherwise extraneous noise sources which are not considered to be part of the representative background noise climate.

5.3.24 Graphs showing the baseline noise data histories are shown in Appendix 5.3.

Noise Predictions

5.3.25 The International Standard ISO 9613, Acoustics – Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation has been used to calculate the predicted noise levels of the turbines.

5.3.26 Noise predictions have been undertaken using a calculation height of 4m, and a ground coefficient of G=0.5, a temperature of 10 degrees Celsius and a relative humidity of 70%, as recommended in the IOA Bulletin article.

5.3.27 A three dimensional noise model of the proposed site has then been built using Datakustik Cadna/A noise modelling package in order to graphically present contours of the ISO 9613 calculated levels. Calculation tables verifying the noise model results using Cadna/A are presented in Appendix 5.4.

Source Noise Data

5.3.28 This proposal is based around a candidate turbine, the REpower MM92, which has a nominal power of 2MW at a hub height of 80m, with a blade diameter of 92m.

5.3.29 The sound power data for the MM92 (see Table 5.2) has been obtained from the datasheet provided by the turbine manufacturer presented in Appendix 5.5. The measurement test report for the turbine demonstrates that the data has been obtained in accordance with IEC 61400-11 standard. The data is 'guaranteed' by REpower and includes a measurement uncertainty of 1dB(A).

Table 5.2: Sound power levels for REpower MM92.

Wind Speed at 10m height (m/s)	Sound Power Level as provided by REpower $L_{W(A)}$, dB
1	-
2	-
3	-
4	96.0
5	101.4
6	103.3
7	104.2
8	104.2
9	104.2
10	104.2
11	-
12	-

5.3.30 The following octave band spectrum shape has been used for all the noise calculations, which has been taken from the datasheet provided by the turbine manufacturer presented in Appendix 5.5.

Table 5.3: REpower MM92 Octave band spectrum

Octave Band Centre Frequency (Hz) / Sound Power (dB)								Overall dB(A)
63	125	250	500	1000	2000	4000	8000	
111.8	108.8	106.2	102.4	98.8	91.9	83.6	75.3	104.2

Assessment locations

5.3.31 The assessment locations have been determined based on the proximity of the receptor to the proposed wind turbines. Table 5.4 details the assessment locations, and the measurement position that has been selected to represent the receiver location for each property for the purpose of 3D noise modelling. These are the properties that are closest to the proposed development and therefore represent the surrounding noise sensitive receptors. The assessment locations are presented in Appendix 5.7.

Table 5.4: Assessment location details

Ref	Name	Area	Coordinates		Proxy Location Used	Distance to closest turbine (m)
			Easting	Northing		
NL1	165 Middlecliff Lane	Little Houghton	442251	405699	NL1	1,000
NL2	19 Pear Tree Close	Houghton Green	440617	406338	NL2	850
NL3	2 Woodland Terrace	New Park Spring	441906	408297	NL3	990
NL4	2 Crook House Court	Edderthorpe	442824	406679	NL4	1,400
L1	169 Middlecliff Lane	Little Houghton	442234	405721	NL1	980
L2	Mill House, Ings Lane	Little Houghton	441957	405676	NL1	990
L3	1 Crabtree Drive	Houghton Green	442650	407023	NL2	750
L4	28 Chestnut Street	New Park Spring	441874	408304	NL3	990
L5	38 Tudor Court	New Park Spring	441211	408520	NL3	1,300
L6	Deep Car House, Storrs Mill Lane	Edderthorpe	440077	407207	NL4	1,652
L7	Ridgeway House,	Edderthorpe	440710	406345	NL4	1,300

Ref	Name	Area	Coordinates		Proxy Location Used	Distance to closest turbine (m)
			Easting	Northing		
	Crook House Lane					

5.3.32 Table 5.5 details the properties that are closest to the proposed Development and therefore represent the surrounding noise sensitive receptors. The assessment of operational noise has been undertaken at these locations and is considered to represent the worst-case scenario for properties in that location.

5.3.33 The assessment of construction noise has been undertaken at all locations identified in Table 5.4 to allow for the changing nature of construction activities and to ensure all potential impacts are identified.

Table 5.5: Operational assessment receptors

Map Ref	Name	Coordinates		Proxy Location Used	Distance to closest turbine (m)
		Easting	Northing		
Little Houghton (L1)	169 Middlecliff Lane	442234	405721	NL1	980
Houghton Green (L3)	1 Crabtree Drive	442650	407023	NL2	750
New Park Spring (NL3)	2 Woodland Terrace	441906	408297	NL3	990
Edderthorpe (L7)	Ridgeway House, Crook House Lane	442824	406679	NL4	1,300

5.4 Baseline conditions

Measurement Results

5.4.1 Due to the large number of properties assessed and the distances involved, a selection of the closest properties have been used to derive the ETSU-R-97 curves and subsequent safety margins. This will provide a worst-case situation for each assessment area and will demonstrate the noise impacts at the worst affected properties (see Table 5.5). The use of proxy data has been determined by the proximity of the property to the measurement location and likely sources of baseline noise level at each location.

5.4.2 Appendix 5.8 presents the results of the background noise measurements for the day and night periods at the properties in Table 5.5, using the relevant proxy background noise data (see Table 5.4). This is plotted against the wind speeds at 10m derived from the calculation of wind shear for each measurement period and the 80m hub height.

5.4.3 Included on the plots is a second order polynomial regression line that has been calculated through the background noise data to give a trend line of prevailing

background noise vs. standardised wind speed (including wind shear) as required for the derivation of the ETSU-R-97 noise limits.

5.4.4 Measured amenity hours data at Middlecliff Road showed elevated noise levels on 7th April between 18:00 and 19:00. Wind speeds during this period were between 7 and 10m/s. It is likely that activity close to the noise equipment influenced the background noise measures during this period (e.g. lawn mower). Therefore, background noise data for this period has been removed.

5.4.5 Properties found to be outside of the predicted 35 dBA noise contour have sufficient protection from noise generated by the proposed wind turbine and do not require noise monitoring, in accordance with ETSU-R-97.

ETSU-R-97 Limits

5.4.6 The lower daytime fixed limit of 35 dB(A) is deemed applicable to this Development based on the generating capacity of the Development and the proximity of other proposed wind turbines.

5.4.7 The noise limits derived from ETSU-R-97 for this assessment are therefore:

- Daytime: The higher of 35 dB(A) or 5 dB(A) above the derived quiet daytime background noise level
- Night-time: The higher of 43 dB(A) or 5 dB(A) above the derived night time background noise level

5.4.8 A summary of the ETSU-R-97 derived noise limits is shown in Table 5.6 and Table 5.7.

Table 5.6: ETSU derived noise limits (day periods)

Assessment Location	Standardised 10m Wind Speed								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	11m/s	12m/s
L1	42.0	42.0	42.3	42.8	43.6	44.8	46.2	46.2	46.2
L3	39.3	40.3	41.6	43.0	44.7	46.5	48.6	48.6	48.6
NL3	36.1	36.7	37.6	38.6	39.8	41.2	42.9	42.9	42.9
L7	39.5	40.5	41.9	43.7	46.1	48.9	52.2	52.2	52.2

Table 5.7: ETSU derived noise limits (night periods)

Assessment Location	Standardised 10m Wind Speed								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	11m/s	12m/s
L1	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
L3	43.0	43.0	43.0	43.0	43.0	43.0	45.0	45.0	45.0
NL3	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
L7	43.0	43.0	43.0	43.0	43.0	45.4	48.5	48.5	48.5

5.5 Assessment of Operational Noise Levels

Assessment of noise during operation of Park Spring wind farm

5.5.1 The calculated immission level of the proposed Park Spring wind turbines at a height of 4m at each receptor is shown in Table 5.8 below.

Table 5.8: Predicted immission levels for Park Spring Wind Farm

Assessment Location	Standardised 10m Wind Speed								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	11m/s	12m/s
L1	24.4	29.8	31.7	32.6	32.6	32.6	32.6	32.6	32.6
L3	28.4	33.8	35.7	36.6	36.6	36.6	36.6	36.6	36.6
NL3	24.2	29.6	31.5	32.4	32.4	32.4	32.4	32.4	32.4
L7	26.5	31.9	33.8	34.7	34.7	34.7	34.7	34.7	34.7

5.5.2 The margin between the immission values (from Table 5.8) and the derived ETSU-R-97 limits for each receptor (from Table 5.6 and Table 5.7) are shown in Table 5.9 and Table 5.10 for the day and night periods respectively.

Table 5.9: Margin between immission values and day limits

Assessment Location	Standardised 10m Wind Speed								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	11m/s	12m/s
L1	17.6	12.2	10.6	10.2	11.0	12.2	13.6	13.6	13.6
L3	10.9	6.5	5.8	6.4	8.0	9.9	12.0	12.0	12.0
NL3	12.0	7.2	6.1	6.2	7.5	8.9	10.5	10.5	10.5
L7	13.0	8.5	8.1	9.0	11.4	14.2	17.5	17.5	17.5

Table 5.10: Margin between immission values and night time limits

Assessment Location	Standardised 10m Wind Speed								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	11m/s	12m/s
L1	18.6	13.2	11.3	10.4	10.4	10.4	10.4	10.4	10.4
L3	14.6	9.2	7.3	6.4	6.4	6.4	8.4	8.4	8.4
NL3	18.8	13.4	11.5	10.6	10.6	10.6	10.6	10.6	10.6
L7	17.7	23.4	25.4	26.4	26.4	26.3	26.1	29.6	33.4

5.5.3 It can be seen from the tables above that the predicted turbine immission levels for Park Spring Wind Farm are below the noise limits derived following the guidance of ETSU-R-97 for both amenity day time and night time periods. Sufficient uncertainty is built into the predictions to ensure the noise limits will not be breached in practice.

Assessment of Cumulative Wind Farm Noise

5.5.4 A cumulative assessment has been undertaken to consider operational noise levels from nearby existing and proposed Wind Farms.

5.5.5 There is a proposed wind farm development approximately 1.5 km north-east of the Park Spring site which has been included in the cumulative assessment. This site, Mount Pleasant, comprises of two turbines, Table 5.11 provides details. All other operational, consented and in-planning wind farm schemes are at sufficient distances (over 9km) from the Park Spring scheme such that there will no further cumulative noise impacts.

Table 5.11: Details of cumulative wind farm sites

Site	Turbine Type	Hub Height (m)	No. Turbines	Data Source
Mount Pleasant	WES80	24.8	2	NIA January 2013

5.5.6 The sound power levels used in the cumulative assessment are shown in Table 5.13.

Table 5.12: Sound power levels used in the cumulative assessment

Turbine	Sound Power Level, $L_{W(A)}$, dB Standardised 10m Wind Speed							Corrections
	4m/s	5m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	
WES80	*95.5*	*95.5*	*95.5*	*95.5*	95.5	*95.5*	*95.5*	Uncertainty and corrections included from the NIA

Italics denotes assumed sound power levels in the absence of data

5.5.7 The octave band spectrums for the turbines considered in the cumulative assessment are shown in Table 5.13.

Table 5.13: Octave band spectrum used in the cumulative assessment

Turbine	Octave Band Centre Frequency (Hz) / Sound Power (dB)								Overall dB(A)
	63	125	250	500	1000	2000	4000	8000	
WES80	66.6	74.6	79.6	87.6	89.6	89.6	89.6	69.6	95.5

5.5.8 The calculated immission level of the proposed Park Spring Wind Turbines and the Mount Pleasant scheme in the cumulative assessment at a height of 4 m of each receptor is shown in Table 5.14 below.

Table 5.14: Predicted cumulative immission levels (dB(A)) for cumulative wind turbines

Assessment Location	Standardised 10m Wind Speed								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	11m/s	12m/s
L1	25.4	30.1	32.0	32.9	32.9	32.9	32.9	32.9	32.9
L3	29.6	34.2	36.1	36.9	36.9	36.9	36.9	36.8	36.8
NL3	28.4	31.2	33.4	34.2	34.2	34.2	34.2	34.2	34.2
L7	27.5	32.2	34.0	34.9	34.9	34.9	34.9	34.7	34.7

5.5.9 The margin between the cumulative immission values (from Table 5.14) and the derived ETSU-R-97 limits for each receptor (from Table 5.6 and Table 5.7) are shown in Table 5.15 and Table 5.16 for the day and night periods respectively.

Table 5.15: Margin between cumulative immission values and day limits dB(A)

Assessment Location	Standardised 10m Wind Speed								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	11m/s	12m/s
L1	16.7	11.9	10.2	9.9	10.7	11.9	13.3	13.3	13.3
L3	9.7	6.1	5.5	6.1	7.7	9.6	11.7	11.8	11.8
NL3	7.7	5.5	4.1	4.4	5.6	7.1	8.7	8.7	8.7
L7	12.0	8.2	7.8	8.9	11.2	14.0	17.3	17.5	17.5

Table 5.16: Margin between cumulative immission values and night time limits dB(A)

Assessment Location	Standardised 10m Wind Speed								
	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10m/s	11m/s	12m/s
L1	17.6	12.9	11.0	10.1	10.1	10.1	10.1	10.2	10.2
L3	13.4	8.8	6.9	6.1	6.1	6.1	8.1	8.2	8.2
NL3	14.6	11.8	9.6	8.8	8.8	8.8	8.8	8.8	8.8
L7	11.8	8.1	7.5	8.1	9.8	11.6	13.7	13.9	13.9

5.5.10 It can be seen from the tables above that the predicted turbine immission levels for the cumulative noise assessment are below the noise limits derived following the guidance of ETSU-R-97 for both amenity day time and night time periods at all wind speeds. Sufficient allowance for uncertainty is built into the predictions to ensure the noise limits will not be breached in practice.

5.6 Construction / decommissioning noise impact assessment

Construction Noise

5.6.1 It is considered that the principal sources of potential construction noise impact are likely to be associated with the construction of the turbine foundations, the traffic movements to and from the site, and the erection of the turbines.

5.6.2 Predictions of the worst-case construction noise for these activities have been carried out based on the methodology outlined in BS5228:2009 ‘Noise and vibration control on construction and open sites’. Estimates of the source sound power and the associated levels at the Assessment Locations are presented in Table 5.17 and Table 5.18.

Table 5.17: Example sound power levels associated with typical construction activities

Plant	LAeq @ 10m, dB(A)	Number	Sound Power Level, dB(A)
Turbine Foundation Construction			
30t tracked excavator	75 dB(A)	1	103 dB(A)
Dump truck (tipping)	74 dB(A)	2	105 dB(A)
Dump truck (moving)	81 dB(A)	2	112 dB(A)
Site Dumper	76 dB(A)	2	107 dB(A)
Large rotary bored piling rig	83 dB(A)	1	111 dB(A)
70t mobile crane	70 dB(A)	1	98 dB(A)
Concrete mixer truck	80 dB(A)	2	111 dB(A)
Diesel generator	74 dB(A)	2	105 dB(A)
Vibrating poker	69 dB(A)	2	100 dB(A)
Total			**117 dB(A)**
Access Track Construction			
Tracked Excavator	85 dB(A)	3	118 dB(A)
Dump Truck	85 dB(A)	2	116 dB(A)
Tipper Lorry	79 dB(A)	4	113 dB(A)
Dozer	81 dB(A)	1	109 dB(A)
Vibratory Roller	74 dB(A)	1	102 dB(A)
Total			**121 dB(A)**
Turbine Erection			
120t crane	67 dB(A)	1	95 dB(A)
600t mobile crane	71 dB(A)	1	99 dB(A)
Articulated HGV	81 dB(A)	3	114 dB(A)
Diesel generator	65 dB(A)	1	93 dB(A)
Total			**114 dB(A)**

Table 5.18: Predicted construction noise levels at assessment locations

Ref	Closest Distance to work site (m)	Worst Case Construction Noise Level		
		Turbine Foundation Construction	Access Track Construction	Turbine Erection
NL1	1,010	49	53	46
NL2	800	50	55	47
NL3	950	49	53	46
NL4	1,125	46	52	43
L1	935	49	54	46
L2	975	49	53	46
L3	600	52	57	49
L4	950	49	53	46

Ref	Closest Distance to work site (m)	Worst Case Construction Noise Level		
		Turbine Foundation Construction	Access Track Construction	Turbine Erection
L6	1,152	47	52	44
L6	1,615	45	49	42
L7	1,120	47	52	44

5.6.3 The estimated sound pressure levels shown are worst-case estimates based on propagation attenuation only, and do not consider any screening, directivity or absorptive effects. Table 5.18 shows that the adopted construction noise criterion of 65 dB(A) is not predicted to be exceeded at any of the Assessment Locations.

5.6.4 Considering the short-duration, temporary and changing nature of the proposed construction works and the large distances between the majority of construction activities and NSR locations, construction noise is unlikely to cause a disturbance to local residents.

5.6.5 Notwithstanding this, the appointed contractor will minimise the impact of construction activities through successful implementation of an agreed Construction Environmental Management Plan (CEMP) and communication with local residents.

Construction Vibration

5.6.6 Some construction activities can be a source of ground-borne vibration, which can be a cause for concern at the nearest receptors. Typical activities that would lead to vibration effects include compaction and breaking.

5.6.7 The impact at the nearest properties from any vibration activities is a function of the vibration source and the propagation path to the receptor; larger distances reduce the impact. Due to the large distances involved (over 600m) it is unlikely that construction vibration will be noticeable at the receptor locations.

Mitigation

5.6.8 Aside from the implementation of an agreed CEMP by the appointed contractor in order to minimise the impact of construction activities no further mitigation measures are proposed.

5.7 Conclusions

5.7.1 An assessment of the likely noise impact due to the construction and decommissioning phase of the proposed Park Spring Wind Farm has been undertaken. No significant noise levels are predicted at the nearest receptors from construction and decommissioning activities due to the distances involved between the Development and the receptors.

5.7.2 Background noise data at the nearest receptors has been collected and analysed in accordance with current accepted practice, and ETSU-R-97 noise limits have been derived. The background noise data has been corrected for the influence of periods of precipitation and other extraneous noise events.

5.7.3 One proposed wind farm development has been defined within 2 km of the Park Spring site and has been considered in the cumulative assessment of wind turbine noise.

5.7.4 The operation of the proposed Park Spring Wind Farm, both in isolation and cumulatively, would be compliant with the ETSU-R-97 methodology, and that it can meet the relevant ETSU-R-97 noise limits. This can be achieved and controlled by the council through a suitable planning condition based on the ETSU-R-97 limits described.

SECTION 6

LANDSCAPE AND VISUAL

6 LANDSCAPE AND VISUAL

6.1 Introduction

6.1.1 This chapter presents the findings of an assessment of the effects that three wind turbines (overall height to blade tip of up to 126.5 m) at Park Spring, Barnsley, South Yorkshire would have on the character of the landscape and visual amenity within the surrounding area. Effects are assessed during construction, operation and decommissioning.

6.1.2 Effects on the landscape include physical changes to the landscape as well as changes to landscape character. Effects on the landscape may also include effects on areas designated for their scenic or landscape qualities at a national, regional or local policy level. Effects on visual amenity relate to changes to views, and the appearance and prominence of the wind farm in those views.

6.1.3 The assessment was undertaken by a chartered landscape architect at Parsons Brinckerhoff who has extensive experience of similar assessments for wind farm projects.

6.1.4 The assessment comprises 6 main sections:

- Assessment Methodology.
- Landscape legislation and policy.
- Baseline Conditions.
- Assessment of Landscape and Visual Effects.
- Potential Cumulative Landscape and Visual Effects.
- Conclusions.

6.1.5 All figures referred to in this chapter can be found in Volume 3 of this Environmental Statement (ES).

6.2 Scoping

6.2.1 The Scoping Opinion provided by Barnsley Metropolitan Borough Council (BMBC), dated 14 September 2011, requested the ES should address the following issues that are relevant to this assessment:

- Landscape and Visual Impacts including any cumulative effects.
- Impact on the Green Belt.
- Impact on residential amenity including Shadow Flicker.

6.2.2 Natural England responded to BMBC on 25 August 2011 regarding the following landscape and visual issues:

- *It will be important for any assessment to consider the potential cumulative effects of this proposal, including all supporting infrastructure, with other similar proposals and a thorough assessment of the 'in combination' effects of the proposed development with any existing developments and new applications.*

- *This assessment should include a thorough consideration of any impacts on National Parks, Areas of Outstanding Natural Beauty (AONB), Heritage Coast and National trails.*
- *The methodology for the assessment is to reflect the approach set out in the Guidelines for Landscape and Visual Impact Assessment (The Landscape Institute and IEMA, 2002).*
- *The cumulative impact assessment should include wind farm proposals currently at Scoping stage.*
- *The assessment should refer to the relevant National Character Areas (refer to Natural England website).*
- *The landscape and visual assessment shall have regard to any wind capacity studies for the area.*
- *The assessment shall consider landscape and visual effects on Open Access land, whether direct or indirect.*

6.2.3 Stephenson Halliday (landscape architects) undertook a landscape and visual feasibility study for the proposed Park Spring Wind Farm on behalf of EDF Energy Renewables in 2010. The study identified nine locations for viewpoints that were agreed with BMBC, and subsequently expanded to include additional locations, as set out in the Scoping Report.

6.3 Scope of the Assessment

Spatial Scope

6.3.1 The site location and study area are shown on Figure 6.1, Volume 3. It was agreed with BMBC in February 2013 that the spatial scope of the landscape and visual assessment should extend over an area 20 km in radius from the centre of the proposed development. The study area for visual effects has been determined by a Zone of Theoretical Visibility (ZTV) map within the 20 km radius, to identify approximately where the proposal would have an effect on visual amenity. Areas within the 20 km study area with no or minimal predicted visibility, i.e. where there is no likelihood of significant effects on landscape character types, designations, viewpoints, settlements or routes, have been 'scoped out' of the assessment.

6.3.2 Cumulative impacts have been assessed within a 20 km radius of the development in agreement with BMBC. The assessment does not consider the effects of introducing all developments at once, and considers separately a number of scenarios with wind farms that are either existing/under construction, consented or awaiting planning determination.

Temporal Scope

6.3.3 The baseline studies were undertaken between November 2012 and March 2013. Landscape and visual impacts are assessed for the construction phase, at operation and at decommissioning. Visual impacts are assessed for the winter situation when the screening effect of vegetation is at its least effective.

Landscape and Visual Issues Addressed

6.3.4 The landscape and visual issues which have been addressed in this assessment are listed in Table 6.1 below. These were based on the experience and professional

judgment of the landscape architect undertaking the assessment and consultation with BMBC and other stakeholders.

Table 6.1: Key landscape and visual issues

Issue	Description
Landscape Character	Landscape effects of the proposed development on sensitive landscape character types identified during the assessment
Landscape Elements	Direct or physical effects on landscape elements which may include agricultural use and vehicular access to the site.
Local Community	Views from the nearest residential properties and settlements at Edderthorpe, Grimethorpe, Great Houghton, Little Houghton, Cudworth, Billingley, Darfield and Middlecliffe. Views from roads in the vicinity of the site.
National Park	Views from the Peak District National Park.
Registered Parks and Gardens / Country Park	These landscapes are substantially screened by intervening woodland and/or landform. The assessment considers potential visual effects on views from these landscapes within 10km of the proposed development.
Green Belt	The visual impact of the development within areas of Green Belt.
Recreational Routes	Views from local and long distance walking routes including the Trans Pennine Trail, Barnsley Boundary Walk, Dearne Way and Dove Valley Trail.
Major Transport Routes	Specific routes considered in this assessment are the A6195, A635, A1, M18, and M1 roads.
Cumulative Assessment	The cumulative assessment includes viewpoint analysis within the 20km study area where simultaneous and/or successive views of more than one wind farm may be available, and or sequential cumulative assessment, where more than one wind farm may be viewed along transport routes (simultaneous or successive).
Planning policy	The assessment will consider whether the proposed development will accord with the objectives of relevant landscape policy and guidance.

6.4 Assessment Methodology

Assessment – General Approach

6.4.1 The LVIA methodology is set out below. Its purpose is to describe and evaluate separately baseline landscape character and visual amenity, and to assess potential impacts arising from the development of the site for wind turbines. It considers impacts in relation to:

- Landscape character and resources, including effects on the aesthetic values of the landscape caused by changes in the elements, characteristics, character and qualities of the landscape;
- Designated landscapes, historic gardens and designed landscapes, and recreational interests;
- Visual amenity, including effects upon potential viewers and viewing groups caused by changes in the appearance of the landscape as a result of the project; and
- Cumulative effects arising in conjunction with existing and proposed wind farm developments.

6.4.2 Landscape character and resources are considered to be of importance in their own right and are valued for their intrinsic qualities irrespective of whether they are seen by people. Impacts on visual amenity as perceived by people, are therefore clearly distinguished from, although closely linked to, impacts on landscape character and resources. Landscape and visual assessments are therefore separate although linked processes.

6.4.3 The sequence of the LVIA is as follows:

Legislation and planning policy

↓

Baseline Studies

Landscape characteristics and sensitivity

Site visibility and sensitivity

↓

Landscape and Visual Impact Assessment

Predicted impact sources

Mitigation and enhancement

Significance of landscape effects

Significance of visual effects

Compliance with planning policy

Significance of cumulative effects

Conclusions of development and appropriateness of site

6.4.4 The majority of the landscape and visual impact assessment (LVIA) has been carried out following guidance set out in the Guidelines for Landscape and Visual Impact

Assessment 2nd Edition, (GLVIA) published by the Landscape Institute and Institute for Environmental Management and Assessment (2002). Although the third edition of GLVIA was published in April 2013 before the assessment was completed the Landscape Institute guidance was followed regarding the transition to its use, confirming that "assessment started using GLVIA 2 should be completed using that edition". The assessment has also followed guidance and best practice set out in:

- Landscape Character Assessment and Guidance for England and Scotland, Countryside Agency in conjunction with SNH (2002).
- Visual Assessment of Windfarms: Best Practice, SNH (2002).
- Siting and Designing Wind Farms in the Landscape, Version 1, Scottish Natural Heritage (SNH), December 2009.
- Visual Representations of Wind Farms, Good Practice Guidance SNH (2006).
- Assessing the Cumulative Impact of Onshore Wind Energy Development, SNH (March 2012).
- Assessing the impact of small-scale wind energy proposals on the natural heritage, SNH (February 2012).
- Advice Note 01/11: Photography and Photomontage in Landscape and Visual Impact Assessment, Landscape Institute (2011).
- The National Planning Policy Framework (March 2012).
- National Policy Statement for Energy (EN-1) (July 2011).
- National Policy Statement for Renewable Energy Infrastructure (EN-3) (July 2011);

6.4.5 Generic Significance Criteria presented in Chapter 2 of this Environmental Statement have not been applied to this assessment, and criteria derived from the GLVIA and other landscape guidance has been used instead. The criteria in Table 6.5 have been applied because they define the types of landscape or visual impact that would occur at each level of significance. For the purpose of this assessment, impacts that are assessed as being either moderately adverse or above are considered significant in EIA terms. Although slight adverse or beneficial and neutral impacts are not considered significant, they remain worthy of consideration throughout both the design and the decision making process. Significance of effect also needs to be qualified with respect to the scale or extent over which it is experienced. An effect may be locally significant, or significant with respect to a small number of receptors, but not significant when judged within a wider context.

Approach to Landscape Character Baseline

6.4.6 Landscape character is what makes an area unique. It is defined as 'a distinct, recognisable and consistent pattern of elements, be it natural (soil, landform) and/or human (for example settlement and development) in the landscape that makes one landscape different from another, rather than better or worse.'

6.4.7 The essential components of landscape character are:

- A distinct and recognisable pattern of elements. Landscape elements are the dominant features which characterise, contribute to or detract from the overall landscape impression, i.e. the built form, the landform, land use, vegetation, water, field patterns, walls etc. They are quantifiable and can be described; and

- Landscape Type: These are identifiable at the broader scale and are understood in terms of areas with a homogeneous character based on geology, topography, geomorphology, vegetation and / or land use or dominant elements, e.g. moorland, rolling upland, historic parkland, urban. These are elements or groups of elements which can be classified as a landscape type of a particular quality and value. Sensory experiences, e.g. tranquillity and wildness, are also considered as part of the overall make up of the character type.

6.4.8 The quality and sensitivity of the baseline landscape has been assessed and categorised in accordance with the criteria shown in Table 6.1 Sensitivity of Receptors. The capacity of the landscape to accept development is reflected in the degree to which it is able to accommodate change (due to a particular development or land use change) without adverse effects on its character. Landscapes that have the highest sensitivity to change have the lowest capacity to accept change. Sensitivity is not absolute, it will vary according to the character of the existing landscape and the extent and nature of the Development proposed.

6.4.9 Quality relates to the physical state of the landscape and its intactness from visual, functional and ecological perspectives. It also reflects the state of repair of individual features and elements that make up the character in any one place.

6.4.10 The sensitivity of a landscape to change varies according to the nature of the existing resource and the nature of the proposed change. Considerations of value, integrity and capacity are all relevant when assessing sensitivity.

6.4.11 Value relates to the value or importance attached to a landscape for its scenic or aesthetic qualities or cultural associations. It may be recognised through national, regional or local designations.

6.4.12 Integrity is the degree to which the value and condition has been retained.

Approach to Visual Amenity Baseline

6.4.13 The Zone of Theoretical Visibility (ZTV) extends over a 20 km radius from the proposed Park Spring Wind Farm and indicates the areas where views of the proposed turbines are theoretically available. All ZTVs contained in the LVIA are computer-generated and have been prepared using intervisibility software with Ordnance Survey Digital Terrain Mapping (DTM) and a model of the proposed turbine. It indicates where views of the turbine are available theoretically. The ZTV does not take account of the screening effect of surface features, including minor landform, woodlands, hedgerows and built development, and as such present the 'worst case' scenario.

6.4.14 Visual receptors, such as users of buildings, recreational spaces, footpaths and transport routes, have differing sensitivities to their visual environment. Generally, this is dependent upon their interest in the visual environment, their viewing opportunity and duration, and the context of the views. These factors may be expressed in terms of:

- The value of the view/viewpoint reflects the intrinsic character and scenic qualities of its location and context. Where recognised through the designation of an area, such as a National Park, Area of Outstanding Natural Beauty, value is increased, while the presence of detracting features in a view will generally reduce value. Higher value views/viewpoints are likely to be more sensitive to change;

- The importance of the viewpoint – as indicated by some form of recognition, e.g. as noted in a guidebook, marked on a map or indicated on the ground by a sign or other visible feature. The provision of facilities e.g. seating, parking, footpath may also indicate a location of higher importance. Views gained from locations where people gather outdoors may also be of higher importance; and
- Viewers' expectations, occupation and activities when experiencing the view.

Assessment of Receptor Sensitivity

6.4.15 The approach to assessing the sensitivity of receptors is set out in Table 6.2 below.

Table 6.2: Sensitivity of receptors

Sensitivity	Landscape Receptors	Visual Receptors
High	Important / highly valued landscape recognised by national or regional designation; Sense of tranquility or remoteness noted in Landscape Character Assessment (LCA); High sensitivity to disturbance specifically noted in LCA; and The qualities for which the landscape is valued are in good condition, with a clearly apparent and distinctive character. The key characteristics are fragile and unable to accommodate change without significant character change Wind energy development conflicts the majority of the key aspects of landscape character and widespread significant landscape impacts would arise	Viewers' attention likely to be focused on the landscape or have proprietary / high interest in their everyday visual environment and/or with prolonged and regular viewing opportunities. Such receptors would include: - Residents experiencing views from dwellings. - Users of public rights of way and access land - Strategic recreational footpath and cycleways - People experiencing views from important landscape features of physical, cultural or historic interest, beauty spots and picnic areas Large number of viewers and/or location in highly valued landscape could elevate viewer sensitivity to highest level.
Medium	Landscape of moderately valued characteristics reasonably tolerant of changes; Landscape is not recognised by national or regional designation; The landscape is relatively intact, with a distinctive character;	Viewers with moderate interest in their environment, and discontinuous and/or irregular viewing periods. Such receptors would include: - Road or rail users - Users engaged in outdoor sport or recreation other than appreciation of the

Sensitivity	Landscape Receptors	Visual Receptors
	Key characteristics of the landscape are vulnerable but with some limited ability to accommodate development in limited situations without significant character change; and Wind energy development relates to some aspects of landscape character.	landscape (i.e., hunting, shooting, golf, water-based activities) - Users of secondary footpaths or footpaths that may be already impacted by intrusive features. A view including some overt or intrusive man-made elements. A view experienced by a moderate number of receptors.
Low	Relatively degraded or low value landscape with no designations; Landscape integrity is low, with a landscape in poor condition and a degraded character; and Key characteristics of landscape are robust and able to accommodate development without significant character change; and Wind energy development relates to character.	Small number or low sensitivity of viewers assumed. Viewers with a passing interest in their surroundings and momentary viewing periods. Such receptors include: - Drivers/travellers and/or passengers of moving vehicles including trains. - People at their place of work, including agricultural workers and other non-motorised users on most roads or those already impacted by intrusive features. A view including a number of overt or intrusive man-made elements.

Assessment of Effects

6.4.16 Consideration is given to the potential effects of the proposed development, with mitigation, on landscape character and resources, and on visual amenity. Effects can be direct, indirect, cumulative, adverse or beneficial, permanent (i.e. operational) or temporary (often associated with the construction phase) and are defined below. The assessment distinguishes between impacts on landscape character and those associated with visual amenity and views across the site.

- Direct impacts are those imposed on landscape elements on the site as a direct result of development, such as the loss of existing trees or other vegetation;

- Indirect impacts may occur some distance from the site, e.g. removal of screen vegetation on the site would allow views in from surrounding areas;
- Cumulative impacts occur when additional developments of similar type appear in an area or when a development might impose several different impacts on the same resource or receptor;
- Short Medium or Long Term describes the duration of an impact; and
- Permanent or Temporary relates for example to additional impacts during construction compared to the permanent change caused by the new development.

6.4.17 The assessment considers the magnitude of change the development would exert on the landscape because of:

- The proximity of the turbines to the landscape receptor – generally the magnitude of effect reduces with increasing distance as it exerts progressively less influence on the landscape; and
- The extent to which the turbines can be seen, and the extent to which landform, woodland, buildings etc. intervene; and
- The extent to which a landscape receptor would experience visibility of the turbines and its resulting effects on character.

6.4.18 Criteria used to assess the magnitude of predicted landscape effects range from high through to negligible/no change and are set out below in Table 6.3 Magnitude of Change.

Table 6.3: Magnitude of Change

Magnitude	Landscape Effects	Visual Effects
High	Total permanent / long term loss or substantial change to key landscape features or elements of the baseline that are important to character resulting from the proposed wind farm; The proposed wind farm lies within or close to highly sensitive landscape; and Size of turbines out of scale with existing elements	Major permanent / long term change in the existing view, change very apparent and dominant involving high level of change in character and composition of baseline, i.e. pre-development view
Medium	The proposed wind farm forms a visible and recognisable feature in the landscape; Proposed wind farm is some distance from highly sensitive landscape; Notable partial permanent / long term	Medium permanent / long term change in the existing view, change apparent involving change in character and composition of baseline, i.e. pre-development view

Magnitude	Landscape Effects	Visual Effects
	loss or alteration to one or more key landscape features or elements of the baseline that are important to character resulting from the proposed wind farm; Other built elements or human activities in views; and The scale of turbines fits with existing features.	
Low	Changes to the physical landscape, its character and the perception of the landscape are slight or short term; The proposed wind farm is a long distance from highly sensitive landscape; and Effect reduced by the presence of many other built elements or human activities in views;	Minor permanent / long term change in baseline, i.e. pre-development view, - change will be distinguishable but not prominent from the surroundings, whilst composition and character of view, although altered will be broadly similar to pre-change circumstances
Negligible / No Change	The effect of change on the perception of the landscape, the physical landscape or landscape character resulting from the proposed wind farm is minimal, approximating to the 'no-change' situation	Very slight permanent / long term change in the existing view- change barely distinguishable from surroundings. Character and composition of view substantially unaltered

6.4.19 The Guidelines for Landscape and Visual Impact Assessment (GLVIA) identifies a higher level of significance is generally attached to large scale effects and effects on sensitive or high-value receptors; thus small effects on highly sensitive sites can be more important than large effects on less sensitive sites.

6.4.20 The GLVIA provides the following general guidance when judging the significance of effects on the landscape:

- Loss of mature or diverse landscape elements, or features;
- Effects on character areas, which are distinctive or representative;
- Greater weight should be given to those elements, features and areas if they are identified as being of high value or importance, i.e. effects on those recognised as being of national importance are likely to be of more significance than effects on those of local importance;

- Landscapes of high value and sensitivity to the type of change proposed are likely to be more seriously affected by development than those with a lower sensitivity; and
- A test of significance is not directly related to planning policy.

6.4.21 The significance of an effect may be beneficial but more usually it will be adverse, at least initially. Significance will be determined using informed and well-reasoned professional judgment. The two principal criteria determining significance are the sensitivity of the receptor to change of the nature proposed by the development, and the magnitude of the effect. By combining the sensitivity of the receptor with the predicted magnitude of change the level of significance is established as shown in Table 6.4 below. Where effects are substantial or moderate, the selection of the level of effect is a professional judgement based upon site visit, interpretation of visual aids as well as the spatial extent and duration of effect. Table 6.5 describes the potential changes that would arise.

Table 6.4: Significance of landscape or visual effect

		Landscape or Visual Sensitivity		
		High	**Medium**	**Low**
Magnitude of Change	**High**	Substantial	Substantial or Moderate	Moderate or Slight
	Medium	Substantial or Moderate	Moderate or Slight	Slight
	Low	Moderate or Slight	Slight	Slight or Neutral
	Negligible / No Change	Slight or Neutral	Neutral	Neutral

Table 6.5: Significance of effects

Significance	Landscape effects	Visual effects
Substantial	The proposed Wind Farm would result in effects that: Cannot be fully mitigated and may cumulatively amount to a severe adverse effect; Are at a considerable variance to the landscape thus degrading the integrity of the landscape; and Will be substantially damaging to a high quality landscape	The scheme would result in a substantial change and significant deterioration in the existing view.

Significance	Landscape effects	Visual effects
Moderate	The proposed Wind Farm would: Be out of scale with the landscape or at odds with the local pattern and landform; and Will leave an adverse impact on a landscape of recognised quality	The scheme would cause a clearly visible change or noticeable deterioration in the existing view.
Slight	The proposed Wind Farm would: Not quite fit into the landform and scale of the landscape; and Will affect an area of recognised landscape character	The development would cause a slight change or slight deterioration in the existing view.
Neutral	The proposed Wind Farm would: Complement the scale, landform and pattern of the landscape; and Maintain existing landscape quality	The development would be barely discernible deterioration or would not change the existing view. Note that this includes no effect.

Visual Assessment Methodology

6.4.22 The assessment of the magnitude of potential impacts is an assessment of the extent of change upon visual amenity as a direct result of the development, depending upon factors including:

- The scale of change in the view with respect to the loss and/or addition of new features.
- The degree of contrast, or integration of/compatibility with any new features with existing features in the view.
- The duration of the effect (temporary or permanent, intermittent or continuous) (temporary effects are considered to be less significant than longer term or permanent effects).
- The distance of the receptor from the source of the effect.
- The angle of view and presence of intervening vegetation or features.
- The dominance of the impact feature in the view.
- Seasonal variation.

6.4.23 This assessment assumes that the change would be seen in clear visibility and under appropriate lighting conditions and considers:

- The attributes of the landscape in which the proposed turbines would be sited. i.e. the scale and character of the landscape in which it would be viewed; the

presence or absence of landscape features; and the scale / enclosure of the landscape within the field of view.

- The design and siting of the proposed turbine itself.
- The atmospheric conditions prevalent at the time of viewing.

6.4.24 SNH guidance, 'Siting and Designing wind farms in the landscape' provides guidelines concerning Scottish Executive's document PAN 45: Renewable Energy Technologies (now revoked) in relation to the effect distance has on the perception of wind farms in an open landscape. Whilst it should be noted that the guidelines are limited in their application they do provide a starting point for understanding how wind farms are perceived. Several other factors influence perception including the height of the turbines and the nature of the view, e.g. a framed / open view or backclothed / skyline view. The distances in Table 6.6 have been increased by 20% based on current 3rd generation turbines of 100m+ as suggested in a study in 2002 by the University of Newcastle for SNH.

Table 6.6: General perception of a windfarm in an open landscape

Distance	Perception
Up to 2.4 km	Likely to be a prominent feature
2.4 - 6 km	Relatively prominent
6 - 18 km	Only prominent in clear visibility - seen as part of the wider landscape
18 - 36 km	Only seen in very clear visibility - a minor element in the landscape.

6.4.25 It is assumed that the visual effects of the Project will reduce as viewing distance increases. The magnitude of visual effects at any given distance will vary according to the range of factors described. Table 6.3 Magnitude of Change describes differing degrees of effect on visual amenity.

6.4.26 Computer generated Zone of Theoretical Visibility (ZTV) maps were produced to appreciate the potential influence of the development in the wider landscape and to assist in viewpoint selection.

6.4.27 The ZTV maps indicate areas where potential views to all or part of the proposed development are available. They are provided as a tool to assist in assessing the visibility of the project; they do not present an absolute measure of visibility and do not represent the "visual impact" of the proposed development.

6.4.28 The ZTV maps have a number of limitations: They do not take account of screening and/or filtering of views from intervening features, such as buildings, trees and hedgerows; and they represent a fixed viewpoint and do not account of the orientation of a moving viewer, for example when walking or travelling in a vehicle. Consequently, the ZTV maps tend to over-estimate the extent of visibility – both in terms of the land area from which the project is visible and the extent of visibility (e.g. number of turbines) from a particular viewpoint.

6.4.29 The assessment of visual effects has been carried out from a number of viewpoints from publicly accessible locations, which were agreed with BMBC. The locations are representative of views experienced by different receptors at different distances and

directions from the site, as well as from the various landscape character types identified in the study area.

6.4.30 Detailed analysis of the viewpoints includes descriptions of the existing and predicted view, analysis of the magnitude of change, and the effects on visual amenity.

6.4.31 The viewpoint analysis is illustrated with reference to a range of illustrative material, including photographs, wireframes and photomontages for each of the viewpoint locations described in Table 6.10 Baseline Views. The computer generated wireframe and photomontage images represent a 76.39^0 angle of view to illustrate the potential visual effects of the turbine from each viewpoint. They should be read in conjunction with the descriptions of wider visual changes that are likely to occur at each location, based on findings made during the site survey.

6.4.32 All of the photographs, wireframes and photomontages provided in the assessment have been produced in accordance with best practice guidance, the Landscape Institute Advice Note 01/11, 'Photography and Photomontage in Landscape and Visual Impact Assessment'.

6.4.33 All photographs were taken with a 35mm SLR camera, with 50mm focal length lens, mounted on a level panoramic head tripod. Photographs were supplied as digital converted images, and computer generated panoramas were constructed using computer software, for example Adobe Photoshop. They record a 76.39 degree angle of view and illustrate the full extent of the proposals within the local landscape context experienced at the viewpoint.

6.4.34 For each viewpoint a wireframe diagram has been prepared using Wind Farm computer software, based on OS Landform Panorama and/or OS Landform Profile data.

Cumulative Assessment Methodology

6.4.35 Cumulative landscape and visual effects are the additional effects that would arise from constructing and operating the proposed wind turbines, assuming all other similar projects subject to planning applications and recently built developments are already present within the landscape. Projects at feasibility or scoping stage have not been included. Potential effects arising from the intervisibility of these developments and the wind turbines at Park Spring have been assessed and detailed. The assessment considers whether the proposed wind turbine development in conjunction with these new developments would alter the baseline landscape and/or create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes.

6.4.36 The following types of cumulative effects are assessed, as recommended by SNH guidance 'Cumulative Effect of Wind Farms':

- Static cumulative impacts including:
  - Combined or simultaneous visibility - in which two or more Wind Farms are seen together at the same time, from the same place, in the same (arc of) view where their visual effects are combined.
  - Successive or repetitive visibility - in which two or more Wind Farms are present in views from the same place but cannot be seen at the same time together, because they are not in the same (arc of) view. The

observer has to turn his head to see new sectors of view other Wind Farms unfold succession.

- Sequential cumulative visual impacts - in which two or more Wind Farms are not present in views from the same place and cannot therefore be seen together at the same time. The observer is required to move to another viewpoint to see the second or more Wind Farms, so that they appear in sequence. Sequential cumulative visual impacts are usually assessed in terms of progression along a route.
- Cumulative landscape impacts – including impacts on landscape designations, designed landscapes, sense of scale, sense of distance, focal points, skyline, wildness and remoteness and special landscape areas.

6.4.37 As with the assessment of 'stand alone' Wind Farms, assessment to determine whether cumulative effects are likely to be 'significant' or 'not significant' involves the combined consideration of the sensitivity of the landscape receptor or visual receptor to the Wind Farm proposal, and the magnitude of change, or scale of the effect that would occur in the landscape or in the view. Although the sensitivity of the landscape receptor or visual receptor is no different for cumulative assessment, different criteria are used to assess cumulative magnitude of change and the significance of cumulative effects.

6.4.38 The assessment considers the additional contribution to the magnitude of change arising from the proposal as High, Medium, Low and Negligible / No Change based on the following factors:

- The location of the Park Spring turbines in relation to other developments.
- The direction and arrangement of existing and proposed development in relation to the proposed project.
- The distance between the turbines and the receptor - magnitude will decrease as distance increases.
- The number and scale of wind turbine developments seen simultaneously, successively or sequentially.
- Landscape setting, context and degree of visual coalescence of existing and proposed developments.
- The relationship between developments in terms of the relative size (height) of wind turbines and distance.
    - o The extent of the developed skyline.
    - o The effects on a sense of wildness and remoteness.

6.4.39 Cumulative landscape and visual effects may be beneficial or antagonistic. Where they comprise a range of benefits, for instance extensive mitigation or enhancement planting, they may be beneficial.

6.4.40 The duration of construction of the developments is also an important consideration when the visual impacts of construction cranes and lighting can be visible on certain sites for several years.

6.4.41 The significance and definition of cumulative landscape and visual effects is set out in Table 6.7 below.

Table 6.7: Magnitude of cumulative effects

Magnitude of Effect	Cumulative effects
High	The addition of the Wind Farm proposal would lead to a major alteration in the cumulative baseline of the receiving landscape or visual receptor, such that it may be perceived as a 'Wind Farm landscape'
Medium	The addition of the Wind Farm proposal would lead to an alteration in the cumulative baseline of the receiving landscape or visual receptor, such that the addition would be notable
Low	The addition of the Wind Farm proposal would lead to a minor alteration in the cumulative baseline of the receiving landscape or visual receptor, such that the addition would not be conspicuous
Negligible / No Change	The addition of the Wind Farm proposal would have a negligible effect on the cumulative baseline of the receiving landscape or visual receptor, such that the addition approximates to the 'no change ' situation

6.4.42 The assessment of the significance of cumulative effects will be based on the combined consideration of all of the factors relating to the sensitivity of landscape and visual receptors and the cumulative magnitude of change that would result from the proposed Park Spring Wind Farm proposal to the existing baseline.

6.4.43 Table 6.8 provides a guide to the assessment of significance and should not be regarded as prescriptive. The effects judged to be of 'substantial' or 'substantial / moderate' significance may be regarded as analogous with 'likely significant impacts' as referred to in the Town and Country Planning (Environmental Impact Assessment) Regulations 2011. These will occur where a wind energy development would have a material cumulative effect on the landscape receptor / view gained from a viewpoint, such that the landscape receptor / the turbines would be a notable addition to the view. No significant effects occur where although the turbines may be present, the landscape receptor / view continue to be characterised and defined by its baseline characteristics, rather than the wind energy development.

Table 6.8: Assessment of significance of cumulative effects

		Landscape / visual receptor sensitivity		
		Low	**Medium**	**High**
Magnitude of effect	**High**	Moderate	Substantial / Moderate	Substantial
	Medium	Moderate / Slight	Moderate	Substantial / Moderate
	Low	Slight	Moderate / Slight	Moderate
	Negligible / No Change	Slight / Negligible	Slight	Moderate / Slight

6.4.44 The assessment of cumulative effects is covered in Section 6.14 of this ES.

6.5 Legislation and policy context

6.5.1 The following legislation, policy and supplementary planning guidance are relevant to landscape and visual aspects of the Project.

European Landscape Convention

6.5.2 The European Landscape Convention (ELC) became binding in 2007 and is the first international convention to focus specifically on landscape issues in order to protect, manage and plan landscapes in Europe. The ELC defines landscape as:

6.5.3 "An area, as perceived by people, whose character is the result of the action and interaction of natural and / or human factors."

6.5.4 The ELC applies to natural, rural, urban and peri-urban areas including land, inland water and marine areas. Its purpose is to promote landscape protection, management and planning in relation to all landscapes regardless of whether their quality and condition is considered outstanding, ordinary or degraded.

Countryside and Rights of Way Act 2000

6.5.5 The Countryside and Rights of Way Act 2000 provides a statutory framework for statutorily protected landscapes and introduced an additional right of access requiring the identification of Open Access Land.

National Planning Policy Framework (March 2012)

6.5.6 National planning policy is covered by the National Planning Policy Framework (NPPF) issued March 2012, which replaces Planning Policy Statements (PPS) and Planning Policy Guidelines (PPG) unless they comprise evidence to local and

regional development plans. In this instance PPG2 Green Belts (amended March 2001) informed policy for the protection of Green Belt set out in BMBC's Core Strategy, which was adopted in September 2011 pre-dating the NPPF.

6.5.7 The NPPF sets sustainable development at the core of its guidelines and focuses its interpretation of sustainable development into three dimensions: economic, social and environmental. These dimensions form the core of the EIA, and each impact will be considered in terms of their affect on these dimensions.

6.5.8 Paragraph 58 of the NPPF states *"Local and neighbourhood plans should develop robust and comprehensive policies that set out the quality of development that will be expected for the area. Such policies should be based on stated objectives for the future of an area and an understanding and evaluation of its defining characteristics."* The objectives of planning policies and decisions are to:

- *establish a strong sense of place, using streetscapes and buildings to create attractive and comfortable places to live, work and visit;*
- *respond to local character and history, and reflect the identity of local surroundings and materials, while not preventing or discouraging appropriate innovation;*
- *are visually attractive as a result of good architecture and appropriate landscaping."*

6.5.9 The integration of new development into the existing landscape is noted in paragraph 61 of the NPPF which states, *"Although visual appearance and the architecture of individual buildings are very important factors, securing high quality and inclusive design goes beyond aesthetic considerations. Therefore, planning policies and decisions should address the connections between people and places and the integration of new development into the natural, built and historic environment."*

6.5.10 NPPF paragraph 9 Protecting Green Belt land Paragraph 79 states: *"the fundamental aim of Green Belts is to prevent urban sprawl by keeping land permanently open; the essential characteristics of Green Belts are their openness and permanence."* Paragraph 80 states Green Belt serves five purposes:

- To check the unrestricted sprawl of large built-up areas.
- To prevent neighbouring towns merging into one another.
- To assist in stopping urban sprawl; preventing 'coalescence' (or joining together) of settlements; safeguarding the countryside from encroachment.
- To preserve the setting and special character of historic towns.
- To assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

6.5.11 NPPF paragraph 10. Meeting the challenge of climate change, flooding and coastal change, provides guidance in paragraph 97 for the supply of renewable energy, and requires local planning authorities to, *"design their policies to maximise renewable and low carbon energy development while ensuring that adverse impacts are addressed satisfactorily, including landscape and visual impacts".*

6.5.12 Footnote 17 to paragraph 97 requires local planning authorities to determine windfarm applications following the approach set out in the Overarching National Policy Statement for Energy Infrastructure (EN1) and National Policy Statement for Renewable Energy Infrastructure (EN3).

6.5.13 NPPF paragraph 109 provides guidance for conserving and enhancing the natural environment. It requires the planning system to contribute to enhance the natural and local environment by, *"protecting and enhancing valued landscapes, geological conservation interests and soils".*

Overarching National Policy Statement for Energy (EN-1) (July 2011)

6.5.14 National policy seeks to protect and enhance environmental quality specifically for new energy infrastructure through the Overarching National Policy Statement for Energy (EN-1) July 2011. It recognises that nationally significant infrastructure projects will have effects on the landscape and that the scale of such projects means they will be visible within many miles of the site of the proposed infrastructure.

6.5.15 *Section 5.9, Landscape and Visual, requires, "The applicant's assessment to include effects during construction of the project and the effects of the completed development and its operation on landscape components and character. The assessment should include the visibility and conspicuousness of the project during construction and of the presence and operation of the project and potential impacts on views and visual amenity. This should include light pollution effects, including on local amenity and nature conservation"*.

6.5.16 With regard to landscape impacts it states, *"Landscape effects depend on the existing character of the local landscape, its current quality, how highly it is valued and its capacity to accommodate change. All of these factors need to be considered in judging the impact of a project on landscape. Virtually all nationally significant infrastructure projects will have effects on landscape. Projects need to be designed carefully, taking account of the potential impact on the landscape. Having regard to siting, operational and other relevant constraints the aim should be to minimise harm to the landscape, providing reasonable mitigation where possible and appropriate."*

6.5.17 *With reference to visual impact it states, "All proposed energy infrastructure is likely to have visual effects for many receptors around proposed sites. The [Secretary of State] will have to judge whether the visual effects on sensitive receptors ….. outweigh the benefits of the project.*"

6.5.18 *The following guidance is given in relation to mitigation, "Within a defined site, adverse landscape and visual effects may be minimised through appropriate siting of infrastructure within that site, design including colours and materials, and landscaping schemes, depending on the size and type of proposed project. Materials and designs of buildings should always be given careful consideration*."

National Policy Statement for Renewable Energy Infrastructure (EN-3) (July 2011)

6.5.19 National Policy Statement for Renewable Energy Infrastructure (EN-3) paragraphs 2.7.29 and 2.5.35 states that careful consideration will be required for onshore wind farm developments proposed within Green Belt.

"When located in the Green Belt, elements of many biomass and EfW projects (including onshore wind farms) will constitute inappropriate development, which may impact on the openness of the Green Belt. Careful consideration will therefore need to be given to the visual impacts of projects, and developers will need to demonstrate very special circumstances that clearly outweigh any harm by reason of inappropriateness and any other harm if projects are to proceed. Such very special circumstances may include the wider environmental benefits associated with increased production of energy from renewable sources"

6.5.20 EN-3 paragraph 2.7.48 advises the IPC (National Infrastructure Planning) when making decisions that, *"Modern onshore wind turbines that are used in commercial wind farms are large structures and there will always be significant landscape and visual effects from their construction and operation for a number of kilometres around a site."*

6.5.21 EN-3 paragraph 2.7.49 requires*, "The arrangement of wind turbines should be carefully designed to minimise effects on the landscape and visual amenity while meeting technical and operational siting requirements and other constraints."*

6.5.22 EN-3 paragraph 2.7.50 advises the IPC where turbines are sited close to residential dwellings that it should consider all submitted evidence of similar scale turbines at similar distances to residential properties.

6.5.23 EN-3 paragraph 2.7.51 notes that the number and scale of wind turbines cannot be changed without affecting the electricity generation output, and reduction in scale is not practical to mitigate landscape and visual impact.

The Yorkshire and Humber Plan: Regional Spatial Strategy to 2016 (May 2008)

6.5.24 Although the Yorkshire and Humber Plan: Regional Spatial Strategy (RSS) was revoked following publication of the Barnsley Core Strategy, the Core Strategy was prepared in the context of being in conformity with the RSS.

Planning for Renewable Energy Targets in Yorkshire and Humber, Final report, Volume 3 (December 2004)

6.5.25 Planning for Renewable Energy Targets in Yorkshire and Humber (PRETYH), Volumes 1 to 3: and the RSS provide the evidence base for renewable energy targets in the Core Strategy.

6.5.26 PRETYH Volume 3: Strategic Locational Guidance For Wind Energy Development in Respect of the Natural Heritage, sets out to define, on the basis of natural heritage, the sensitivity or potential capacity of different areas of Yorkshire and the Humber to accommodate onshore wind energy development. This guidance forms the first tier of the baseline landscape information from which this assessment is developed.

Barnsley Local Development Framework

6.5.27 The Barnsley LDF comprises a number of different documents that provide the main planning policies and proposals previously contained in the Unitary Development Plan (UDP). No saved policies from the UDP are relevant to this assessment. The documents are at varying stages in their production. Supplementary Planning Documents giving further details on how various policies will be applied, including guidance for Renewables and Landscape Character, are not available at the time of writing the assessment.

Core Strategy, adopted September 2011

6.5.28 The Core Strategy sets out the Dearne Valley Eco-Vision at paragraph 3.24, *"A vision for the Dearne has been established which will seek to transform the Dearne over the next 25 to 30 years. The work has been led by Sheffield City region, and aims to see the 'Dearne Valley re-imagined by an eco-vision'. This would involve the Dearne Valley being at the forefront in terms of applying solutions to reduce carbon*

emissions, with a view to becoming the lowest carbon community of its type in the UK".

6.5.29 Several landscape specific policies within the Core Strategy (CS) are relevant to wind turbine development.

6.5.30 Core Strategy Policy CSP 6 Development that Produces Renewable Energy, states *"We will allow development that produces renewable energy as long as there is no significantly harmful effect on*:

- *the character of the landscape and appearance of the area.*
- *living conditions.*
- *biodiversity, geodiversity and water quality.*
- *heritage assets, their settings and cultural features and areas.*
- *highway safety.*
- *infrastructure including radar."*

6.5.31 Paragraph 9.38 *states "Inevitably, some proposals for renewable energy will have significant effects on the local area. For example, large scale renewable energy developments will be prominent in the landscape. In these cases we will carefully weigh up the environmental, social and economic benefits against effects on the local area including any effects on the National Park, the Green Belt and European and Natura 2000 designations*.

Undulating landscapes, such as those in the west of the borough, can increase the prominence of turbines. Careful consideration will need to be given to the capacity of the landscape to accommodate turbines, the ability to mitigate visual intrusion and the cumulative impacts of individual sites when they are grouped rather than dispersed. We will use the Landscape Character Assessment and Policy CSP 37 to assess the effect of development proposals"

6.5.32 Core Strategy Policy CSP 29 Design, requires high quality development that respects topography, Green Infrastructure assets, natural features including woodland, views and vistas to key buildings, landmarks, skylines and gateways. Development should respect heritage, townscape and landscape character including the scale, layout and built form within Barnsley town centre, Penistone and rural villages to the west of the borough, and Conservation Areas and their settings. New development that is appropriate to its context should, through good design, contribute to economic and physical regeneration.

6.5.33 Core Strategy Policy CSP 37 Landscape Character states, *"Development will be expected to retain and enhance the character and distinctiveness of the individual Landscape Character Area in which it is located (as set out in the Landscape Character Assessment of Barnsley Borough 2002)*."

6.5.34 The objective of CSP 37 is to ensure no damage to landscape character will arise as a result of new development. It requires all new development should be in keeping with the surrounding landscape, particularly when sited in prominent positions on the edges of towns and villages, where it is important to maintain clear distinction between urban areas and the countryside, and to ensure that development is not obtrusive on the skyline.

6.5.35 Core Strategy Policy CSP 34 Protection of Green Belt states, *"In order to protect the countryside and open land around built up areas the extent of the Green Belt will be safeguarded and remain unchanged."*

6.5.36 Paragraph 9.240 notes most of Barnsley's countryside is Green Belt and accounts for 77% of the borough. Whilst it notes some uses proposed by national guidance in PPG2 Green Belts 1995 would be acceptable within the Green Belt, the guidance is replaced by the National Planning Policy Framework (March 2012).

6.5.37 Core Strategy Policy CSP 33 identifies the Dearne Valley Corridor, River Dove Valley Corridor and the Historic landscape Corridor as strategic parts of Barnsley's Green Infrastructure network. Core Strategy Policy CSP 34 seeks to protect the Green Belt, the primary purpose of which is to prevent the built up areas merging with the surrounding settlements of Cudworth, Royston, Darfield, Wombwell, Dodworth and Higham in order to maintain the separate identity and character of these settlements in relation to surrounding countryside and landscape features.

6.5.38 Core Strategy Policy 12 anticipates the allocation of between 70 – 80 hectares of employment land in Cudworth over the plan period, which may include expansion of the Park Springs, Grimethorpe employment land into Green Belt land between Cudworth and Grimethorpe. Further west, Core Strategy Policy 12 anticipates the allocation of between 50 – 65 hectares of employment land in Hoyland, primarily along the Dearne Valley Parkway, which may include Green Belt land adjacent to the Dearne Valley Parkway and Junction 36 of the M1.

6.5.39 Chapter 4 Planning, in this ES, and the Planning Statement, discuss planning issues associated with the proposed siting of Park Spring Wind Farm within the Green Belt.

Guidance

6.5.40 The following documents have provided guidance in the preparation of this landscape and visual assessment:

Barnsley Borough Landscape Character Assessment, May 2002

6.5.41 The study includes an appraisal of the strength of character and condition of each landscape character area within Barnsley, which is used to determine landscape strategies and management guidelines for each character area. A broad statement about the landscape sensitivity to change and landscape capacity for built development, primarily for housing, is made for each landscape character area.

Planning for Renewable Energy Target in Yorkshire and Humber, Volume 3

6.5.42 This study provides strategic locational guidance for wind energy development based on landscape sensitivity and the potential for wind capacity within a locality, including the scale of development that could be accommodated in different areas.

6.5.43 The approach to designated landscape sensitivity has been to include all landscapes that are protected at national level within Zone 2. Therefore, it assumes Green Belt, a national designation, is highly sensitive and the landscape character could be significantly adversely affected by wind energy development.

Scottish Natural Heritage Guidance

6.5.44 Scottish Natural Heritage provides a suite of guidance to aid in the process of assessing the potential landscape and visual impacts of a wind farm. Strategic Locational Guidance for Onshore Wind farms in Respect of Natural Heritage (2009), sets out the following principles which should guide the location of renewable development so as to minimise effects on the natural heritage:

- The proposed layout of wind turbines should present a clearly structured, balanced arrangement which achieves a good fit with the key landscape characteristics of the local and wider area.
- Consideration of the location and design in relation to the landscape character and sensitivity of the area.
- The design of a wind farm composition from key viewpoints and sequential routes should be an overriding factor in layout design to achieve a simple balanced composition.
- Attention should be given to other design issues, including turbine colour, size siting, design and form of the sub-station/control building and alignment of access tracks to ensure this relates to the key characteristics of the landscape.
- The legibility of the pattern evident within the turbine layout, or its relevance to the existing view/pattern of development.
- The overall aesthetic appearance of the wind farm within a view. Contributing factors include simplicity of layout, visual permeability, outliers (single turbines apparently disconnected from the main group), colour contrast of turbines against their backdrop, and the general juxtaposition of all components within the view.

6.5.45 Adoption of these design principles aims to minimise adverse views from local communities, road corridors, recreational areas, footpaths, popular hilltops and designated landscape areas.

6.5.46 Visual Representation of Wind Farms Good Practice Guidance (2006) (currently under review) - Advises on the different purposes, uses and limitations of tools and techniques for the production of visual representations of proposed wind farm developments;

6.5.47 Assessing the Cumulative Impact of Onshore Wind Energy Developments (2012) – provides guidance on the issue of cumulative effects of wind farms

6.6 Landscape Context

6.6.1 The location of the site and key landscape features are shown on Figure 6.1 Site Location and Study Area and Figure 6.2 Landscape Context.

6.6.2 The Peak District National Park (PDNP) is located approximately 18 km south west of the site at its nearest point. The nationally designated landscape of the PDNP is considered to be of a high aesthetic quality, high landscape condition and of a high landscape value, with an overall High landscape sensitivity rating

6.6.3 Extensive areas of Green Belt surround Barnsley, and the application site is located in Green Belt within the Dearne Valley Corridor. The most important attribute of Green Belt is its openness, which helps to protect the countryside from encroachment by

urban development and coalescence of settlements. Green Belt is a national designation with an overall High landscape sensitivity rating.

6.6.4 Statutory designations include the following Registered Parks and Gardens within the vicinity of the development site:

- Hickleton Hall (Grade II* listed building), Grade II registered park and garden, 6.5 km, south east.
- Locke Park (Locke Park Tower Grade II* listed building), Grade II registered park and garden, 7.5 km west.
- Brodsworth Hall (Grade I listed building), Grade II* registered park and garden, 8.5 km, west.
- Wentworth Woodhouse (Grade I listed building), Grade II* registered park and garden, 9.4 km, south west.
- Wentworth Castle (Grade I listed building), Grade I registered gardens and historic estate, 9.6 km, west.

6.6.5 Effects on heritage assets and their settings are assessed in Chapter 7 of this ES. Registered Parks and Gardens and their settings have an overall High landscape sensitivity rating.

6.6.6 Biodiversity issues are covered in Chapters 9 and 10 of this ES. No Special Protection Area, Special Area of Conservation, or Ramsar sites lie within the 20 km study area. No Sites of Special Scientific Interest lie within or adjacent to the development site.

6.6.7 National Trails and Recreational Paths lying within the 20 km study area include the following:

- Trans Pennine Trail passes within 3.9 km of the closest turbine to the south west of the site.
- Barnsley Boundary Walk passes within 12 km of the closest turbine to the north west of the site.
- Dearne Way passes within 1 km of the closest turbine to the south west along Dearne Valley.
- Rotherham Round Walk passes to the north of Rotherham within 8km of the closest turbine to the south of the site.
- Dove Valley Trail passes within 3.8 km of the closest turbine to the south west of the site.

6.6.8 National Cycle Network routes 62 and 67 lie within the 20 km study area and in close proximity to the site.

6.6.9 An extensive area of Borough Landscape Value lies within the western rural area of Barnsley Metropolitan Borough. Although Areas of High Landscape Value within the upland landscapes in the adjacent Metropolitan Borough of Kirklees are no longer designated they are included on Figure 6.2 to provide an indication of the extent of high quality landscape within the study area.

6.6.10 Several country parks (non-statutory designation) lie within the study area and the following are within 10km of the site:

- Fitzwilliam (approximately 8.5 km north).
- Howell Wood (approximately 3 km north east).
- Worsbrough Mill (approximately 8.5 km west).
- Anglers (approximately 8 km north, north west).
- Phoenix Park (approximately 4.5 km north east).

6.6.11 The Dearne Valley Nature Improvement Area covers an area of 20 square miles in the Dearne Valley and hinterland, with a core 'Green Heart' local scale project area of 1270 ha of valley/river corridor, within a wider watershed/ settlement pattern context. It is a large scale environmental regeneration project intended to redevelop post-industrial sites by recreating and enhancing green spaces for the benefit of people and wildlife, and to manage flood risk within the Dearne Valley.

6.6.12 Particular sensitivities in relation to the setting of national and local designations include:

- The visual impact of the project within areas of Green Belt.
- Open sequential views from long distance footpaths and recreational routes.

6.7 The Site and its Surrounding

6.7.1 The site lies within Green Belt land in the Dearne Valley to the north of Little Houghton, between the villages of Great Houghton and Grimethorpe approximately 5 km to the east of Barnsley. The A6195 Dearne Valley Parkway road and River Dearne lie close to the western boundary of the site. (Refer to Figure 6.1).

6.7.2 The site and surrounding area have undergone dramatic social, economic and environmental changes since the late 1970s when Grimethorpe colliery was one of the most productive coal mines in Britain and Grimethorpe was regarded as a coal town. A decline in mining related services in the 1980s and 1990s led to the closure of the colliery in 1993 bringing with it hardship for the community and extensive areas of derelict land.

6.7.3 A long term (15-20 years) major plan for regeneration was initiated in 1997 and large areas of land were remediated between 1997 and 2008. A 52 page self guided walk around Grimethorpe, 'Memories and Futures' (www.discoveringbritain.org 2012) gives an illustrated account of the rise, fall and regeneration of this area over the past 40 years or so. Whilst it presents an interesting history of how the area has changed, it gives insight into the profound impact the changes have had and are still having on people who live and work in this area and how they perceive their new landscape.

6.7.4 As well as removing contamination and despoiled land, regeneration has provided a diverse landscape with opportunities for informal recreation, employment opportunities at the Grimethorpe Park Spring and Houghton Park Spring employment sites, the ASOS distribution centre, new housing, new roads including the Dearne Valley Parkway, and a RSPB wetland area at Edderthorpe and other areas of new ecological habitats.

6.7.5 Land uses within the application site include mixed use agricultural land, small areas of woodland and areas of recently restored open cast coal workings which extend over an area of 90.4 ha. The undulating topography of the site comprises a broad mound with convex slopes ranging in height between 35 and 80 metres Above Ordnance Datum (m AOD). The topography of the 20 km study area is shown in

Figure 6.3. Access tracks, a public footpath, a bridleway and several permissive paths cross the site. The medium sized, irregular shaped fields are delineated by low hedgerows with widely spaced hedgerow trees. Hedgerows within the site range from species rich intact hedgerows to species poor defunct hedgerows, they are discussed and assessed in Section 9 Ecology of this ES.

6.7.6 Extensive areas of woodland to the east of the site include West Haigh Woods, White City Wood, the former Park Spring Wood and Houghton Common which are now known collectively as the White City Woods. The woods are managed by The Community Partnership and BMBC for informal recreation, public access, landscape conservation, wildlife conservation, and for the manufacture of woodland products such as charcoal.

6.7.7 Pylons and communication masts are prominent on skylines in the study area. Existing turbines at Marr are visible to the east of the study area. Worked out quarries, wetland areas and restored coal workings are common throughout the Dearne valley to the south of the site.

6.7.8 Extensive regeneration in the vicinity of the site has produced a landscape that appears relatively immature and lacking in distinctive character. With reference to Table 6.2 the sensitivity of the landscape within the site and surrounding area would be categorised as Low: key characteristics of the landscape are robust and able to accommodate development without significant character change. Although this judgement would be confirmed by a visual appraisal of the landscape, it does not take into consideration the value the local community may place on the newly reclaimed landscape. It may be considered to be of higher value by those who lived or worked in the area during the decline of the Grimethorpe area and are now witnessing economic, social and environmental regeneration following the recent (award winning) programme of works. Pockets of industry and associated settlements within a semi-rural landscape were distinctive characteristics of this area historically, and public consultation undertaken by Parsons Brinckerhoff in 2013 recorded enthusiasm for new industry / businesses in this area, which could be designed to be compatible with landscape improvements (refer to the Statement of Community Involvement accompanying the planning application).

6.8 Landscape Character Throughout the Study Area

6.8.1 Regional landscape character is described using the following published assessments:

- Natural England's web based national character area assessment, 'NCA Profile: 38. Nottinghamshire, Derbyshire and Yorkshire Coalfield (NE402)', (Uploaded 31-1-2013); and
- 'Planning for Renewable Energy Targets in Yorkshire and Humber, Volume 3', published by the Government Office for Yorkshire and Humber and the Yorkshire and Humber Assembly, (December 2004).

6.8.2 Figure 6.4 National Landscape Character Areas and Figure 6.5 Regional Landscape Character shows the location of the landscape character areas and types described below.

<u>NCA Profile 38 Nottinghamshire, Derbyshire and Yorkshire Coalfield</u>

6.8.3 The large Nottinghamshire, Derbyshire and Yorkshire Coalfield character area extending from Bradford and Leeds in the north to Sheffield in the south, is bounded

by the hills of the Peak District to the west, by the Pennine Dales Fringe to the north and by the Southern Magnesian limestone ridge to the east. It describes the key characteristics as follows:

- *"A low-lying landscape of rolling ridges with rounded sandstone escarpments and large rivers running through broad valleys, underlain by Pennine Coal Measures.*
- *Local variations in landscape character reflecting variations in underlying geology.*
- *Several major rivers flow through the rural and urban areas of the NCA, generally from west to east in broad valleys.*
- *A mixed pattern of built-up areas, industrial land, pockets of dereliction and farmed open country.*
- *Small, fragmented remnants of pre-industrial landscapes and more recent creation of semi-natural vegetation, including woodlands, river valley habitats and subsidence flashes, with field boundaries of clipped hedges or fences.*
- *Many areas affected by urban fringe pressures creating fragmented landscapes, some with a dilapidated character, separated by substantial stretches of intact agricultural land in both arable and pastoral use.*
- *A strong cultural identity arising from a history of coal mining, steel making and other heavy industry which resulted from the close relationship between underlying geology and resource availability, notably water power, iron ore and coal.*
- *Features of industrial heritage such as mills, golts, tips, old railway lines, canals and bridges are evident, along with former mining villages.*
- *Many large country houses and estates established by wealthy industrialists in the 18th and 19th centuries and ancient monuments create focal points and important recreational opportunities within the landscape, such as Bretton Hall, Wentworth, Woodhouse, Temple Newsam, Nostell Priory, Bolsover castle and the ruins of Condor castle.*
- *Widespread influence of transport routes, including canals, roads and railways with ribbon developments emphasising the urban influence in the landscape.*
- *An extensive network of multi-user trails on former railway lines and canal towpaths, such as the Trans Pennine Trail and the Ebor Way.*
- *Continuing development pressure including land renewal and regeneration projects, especially along river corridors and around towns."*

6.8.4 It notes 64% of the NCA is currently designated as Green Belt land in order to maintain distinction between settlements and represents areas that are often under pressure for development and changes in land use.

<u>Planning for Renewable Energy Targets in Yorkshire and Humber, Volume 3</u>

6.8.5 This document provides strategic guidance to wind energy capacity within the NCA 38 Nottinghamshire, Derbyshire and Yorkshire Coalfield character area through an evaluation of the sensitivity of the following physical and perceptual criteria:

Landform and shape

The area is defined by the underlying bedrock of Shallow Coal Measures, which give rise to an unremarkable but variable landform of low hills, escarpments and broad valleys. Further topographical variation arises from glacial deposits and alluvium or from recent human activity in the form of subsidence flashes and reclaimed colliery spoil tips. Wind energy development could relate to the landform, but would need to avoid visual conflict with distinctive local features. Low sensitivity (refer to paragraph 6.8.7).

Settlement

This is a densely settled landscape, with a number of major towns and cities including the conurbations of Leeds, Bradford and Sheffield as well as smaller towns and villages. Transport infrastructure has a widespread influence including the A1 (M), M62, mainline railways and canals with ribbon development along these routes adding to the complex mosaic of land uses. As a densely settled landscape there are pressures for new housing, commerce and industry together with their associated transport and infrastructure. Turbines could relate to the large-scale industrial buildings and infrastructure, but care should be taken to avoid further coalescion of settlement and comparisons of scale with domestic buildings. Low sensitivity.

Landscape pattern

The area displays a complex intermingling of built up areas, industrial land, modern commercial developments and areas of intact agricultural land in both arable and pastoral use. The pattern is further complicated by the small fragmented remnants of pre industrial landscape and semi natural vegetation, including many areas of woodland, river valley vegetation, subsidence flashes and other relic habitats. Pockets of broadleaved woodland remain on steeper slopes where they help to contain urban development, but tree cover is generally low. Throughout much of this area turbines would become one of a series of manmade vertical elements in the landscape, but development should avoid the stretches of intact farmland. Low sensitivity.

Visual composition

Much of the landscape is dominated by extensive urban areas and industrial activity and as such has a complex visual composition. Historically, mills and factories tended to follow watercourses along the valleys, whilst the underlying coal measures gave rise to an active coal mining industry. More recent developments for commerce and industry have tended to follow the main transport corridors, this ribbon development adding to the disturbed landscapes of intermingled housing, industrial buildings, business parks, roads, railways, dereliction and fragmented rural areas. The landscape has less complexity where agriculture is the dominant land use. Turbines could compound the clutter of vertical elements in some areas and may create an overly complex and visually confusing character. Medium sensitivity (refer to paragraph 6.8.6).

Summary of physical criteria

Although there are some stretches of intact farmland in both arable and pastoral use, much of this lowland landscape exhibits a complex mix of built up areas, industrial land, urban fringe farmland and dereliction. There is scope for medium-scale

development although care should be taken to avoid creating further visual confusion. Low sensitivity.*

How landscape is experienced

From major roads and from the many settlements within the area, although views are generally already degraded by existing development and neglect. Low sensitivity.

Remoteness / modification / naturalness

There are some areas of relatively unspoilt farmland but generally the landscape is highly modified, with continuing pressures for housing, commerce and industry and little sense of tranquillity. Although there area pockets of semi natural woodlands and river valley habitats, these are scattered and fragmented, and frequently surrounded by urbanisation and dereliction. Low sensitivity.

Summary of Perceptual Criteria

Most of the landscape is densely settled and highly modified. Many of the remaining rural areas around the main towns suffer from urban fringe pressures often creating a landscape of neglect. The introduction of turbines would have little further effect on the already down graded landscape. Low sensitivity.

Findings in Relation to Location and Typology

Development should consider the following:

- *Development could relate to this highly modified, often degraded area;*
- *Development should aim to retain separation between settlements; it should avoid locally distinctive landform variations, areas of fragmented woodlands and river valley habitats and stretches of unspoilt farmland;*
- *Small to medium-scale wind energy development would need to be adopted to relate to the overall scale and settlement pattern of the area. Development would be dependent on the proximity of domestic buildings and the scale of natural or modified landforms;*
- *Small to medium-scale development could be associated with former mining activities, although turbines may also increase the prominence of these areas;*
- *Care should be taken not to cause visual confusion when locating turbines close to existing vertical structures;*
- *The potential for cumulative impacts should be carefully considered; and*
- *Combined sensitivity score **low**."*

6.8.6 Medium scale development is defined in 'Planning for Renewable Energy Targets in Yorkshire and Humber, Volume 2' as a wind farm comprising 6 – 25 turbines ranging in height between 93 – 120 m.

6.8.7 Low sensitivity is defined in 'Planning for Renewable Energy Targets in Yorkshire and Humber, Volume 3' as areas where a significant number of developments could be acceptable, if they are undertaken sensitively and with due regard to cumulative impact.

6.8.8 It should be noted that although the landscape is highly modified, extensive areas of degraded land have been restored since PRETYH Volume 3 was published in 2004.

Barnsley Borough Landscape Character Assessment 2002 (BBLCA)

6.8.9 At a local level, the site is located within the D Settled Slopes landscape character type, and within the East Dearne Settled Arable Slopes landscape character area.

6.8.10 The Settled Arable Slopes landscape type is found in three landscape character areas: D1 North East Barnsley Settled Arable Slopes; D2 East Dearne Settled Arable Slopes where the site is located; and D3 West Dearne Settled Arable Slopes. The BBLCA describes the landform and land use characteristics of the Settled Arable Slopes, *"The landform varies from stronger undulations to areas of gentle, even slopes with the latter particularly evident at lowland elevations close to the adjacent river valleys, and at higher elevations on the broader ridge tops. Land use activity is largely characterised by large scale arable farming and residential settlement. There are significant tracts of relatively intact arable farmland but many areas on the urban-rural interface exhibit signs of landscape decline. Settlements are typically former colliery villages or towns and are predominantly residential although light industrial estates are a feature. The settlements indicate the area's heavy industrial past, further emphasised by the presence of disused spoil heaps, workings, and railway lines found across the landscape. Low tree cover results in a sense of exposure. The dominance of infrastructure and built development, commonly located on ridge or hilltops, but often spreading down valley sides, compound a striking sense of urbanisation across much of the landscape."*

6.8.11 The site lies within the East Dearne Settled Arable Slopes landscape character area, and its key characteristics are:

- *"Topographically varied landscape ranging from sinuous undulations at the higher elevation to subtle slopes on lower ground;*
- *Network of large open, predominantly arable farmland, of medium to large field units of no consistent or obvious pattern;*
- *Remnant hedgerow field boundaries occurring sporadically and in generally poor condition;*
- *Plethora of dykes running across the arable land;*
- *Traditional mining settlements at Thurnscoe, Bolton Upon Dearne and Goldthorpe;*
- *Evidence of past and present industrial activity due to presence of disused tips and spoil heaps, and working warehouse units on settlement edges and within the rural landscape;*
- *Sense of urbanisation with skyline views of settlement roofscapes;*
- *Proliferation of scrubby compartmentalised field units adjacent to settlements at the urban interface;*
- *Lack of vertical elements in the rural landscape with little to break up the horizontal plane; and*
- *Far reaching views providing a sense of openness and exposure."*

6.8.12 Landform within this character area ranges between 15 metres Above Ordnance Datum (m AOD) and 80 m AOD traversing through sinuous undulations within the

Dearne Valley to subtle slopes that level out in the areas of lowest elevation. It describes, *"The area is characterised by three dominant land use patterns – agriculture, industry and landscape renewal. Agriculture is predominantly intensive arable farming contained within a pattern of medium to large fields with little sense of enclosure. The industrial landscape is largely historic with spoil heaps, disused tips and old open cast workings providing strong visual cues to the previously thriving industrial core. Landscape renewal is evident through measures to mitigate the impacts of previous industrial activity; reclaimed spoil heaps and large swathes of young tree planting, such as those along the A6195, are all indicators of landscape restoration and provide opportunities for improved aesthetic and ecological value."*

6.8.13 With BBLCA provides an appraisal of the strength and character of each landscape character area and its sensitivity to change and capacity for built (residential) development. Landscape sensitivity within local landscape character areas in the vicinity of the development site are set out in Table 6.9 below.

Table 6.9: Landscape Sensitivity

Character Area	Description	Sensitivity
D1 North East Barnsley Settled Arable Slopes	The enclosed landform reduces the degree of intervisibility from within and outside the character area. Undeveloped slopes on more open ground would be vulnerable to development and highly sensitive to change. Settlements exist on areas of highest elevation making the higher, flatter ground less sensitive than the slopes. Significant tracts of degraded urban fringe offer scope for (built) development	Medium
D2 East Dearne Settled Arable Slopes	Lack of enclosure results in a landscape that is visually sensitive to change. Although undulating topography in the more elevated areas provides some localised enclosure there is an overriding sense of openness and exposure. Built development on open slopes would be conspicuous from within and outside the character area. High visual sensitivity in places combined with areas of low landscape quality tends to balance out.	Medium
D3 West Dearne Settled Arable Slopes	This character area is generally open with slightly more enclosure on valley sides. Distant views available from the other sides of the Dearne and Dove valleys. Valley sides are visible from the adjacent valley floor. Built development would be highly visible from	Medium

	within and outside the character area.	
E3 Grimethorpe Settled Wooded Farmland	Although this character area is partially enclosed by landform and woodland blocks there is extensive intervisibility with the adjacent character areas, particularly from the upper slopes.	High

6.8.14 To summarise, landscape character in the vicinity of Park Spring has been substantially altered by man made features and activities. The site comprises a large-scale convex landform that has been extensively modified by coal mining with subsequent reinstatement to grassland and woodland planting within recent years. It lies within an industrialised part of the Dearne Valley at an altitude of ~45m AOD, where the valley sides rise to ~60m AOD. The recently built A6195 Dearne Valley Parkway follows the valley bottom and provides access between the M1 motorway and large scale industrial development at Park Spring. With reference to Table 6.1, the key characteristics of this landscape are robust and able to accommodate development without significant character change, and the sensitivity of the landscape is assessed to be Low.

Visual baseline

6.8.15 The site lies within an elevated, undulating landscape where long distance views along the broad Dearne Valley are widely available. The site is west, south west facing with open views across the Dearne Valley towards Barnsley. It is a visually exposed area viewed in the context of a semi-wooded ridge from the west and overlooking the undulating landscape and colliery towns to the east. Views of a large scale industrial unit (ASOS) located off the A6195 road are prominent within the Dearne Valley. The varied, undulating topography of the site limits potential views of the full development. Young woodland planting on restored land between the northern edge of the application site and Park Springs Industrial Estate will alter the visual characteristics of the site as the planting matures.

6.8.16 The site is located near to the villages of Great Houghton, Little Houghton and Grimethorpe (refer to Figure 6.1 Site Location and Study Area). Great Houghton lies in an elevated position 0.8 km to the east of the nearest turbines (T2 and T3); Grimethorpe lies 1.0 km due north of turbine T1, and Little Houghton 1.0 km to the south of turbine T3. Middlecliffe, Billingley, Darfield and Edderthorpe all lie within 2.0 km of the site. Properties on the outer edge of these settlements, closest to the site may experience open views towards the turbines.

6.8.17 Settlements lying between 2 km and 5 km of the proposed development include Wombwell, the eastern edge of Barnsley, Cudworth, South Kirkby, Thurnscoe, Goldthorpe, Bolton upon Dearne and Brampton. Properties on the outer edge of these settlements closest to the site may experience views of the turbines in their landscape setting.

6.8.18 Views of the turbines from settlements at Barnsley, Royston, Rawmarsh, Mexborough, Conisborough and Hemsworth at distances of 5km to 10km would be experienced in the context of open and expansive landscape views.

6.8.19 Route receptors within the study area which may experience visibility of the site include:

- A6195 road, the Dearne Valley Parkway, between Hoyland and Shafton;
- A635 road between Doncaster and Barnsley;
- A1 and A1(M) west of Doncaster; and
- M18 motorway between Rotherham and Doncaster.

6.8.20 There are a number of locally and nationally promoted long distance recreational routes within the study area with potential views of the proposed development. They include the following routes:

- The Trans Pennine Trail;
- Barnsley Boundary Walk;
- Dearne Way;
- Dove Valley Trail; and
- Rotherham Round Walk

6.8.21 Figure 6.6, Zone of Theoretical Visibility 20 km and Viewpoint Locations, represents the maximum visibility scenario. It should be noted that the extent of visibility varies considerably depending on the time of year, weather and atmospheric conditions. Turbines, by virtue of their slender profile and colour, can have comparatively low visual impact, which is reduced further during periods of low visibility (10km or less).

6.8.22 A site survey was undertaken in March 2013 to assess the likely visual changes that would arise from the Park Spring Wind Farm. The viewpoints described in Table 6.9 below were selected to represent the main areas from which the development would be seen, and for the different types of viewing opportunities they offer. These locations provide representative views from highly sensitive receptors including residential properties, frequently used tracks and roads, recreational resources and heritage assets in the vicinity of the development.

6.8.23 Figures 6.7 to 6.22 illustrate Viewpoints VP1 to VP16 respectively, and provide a photograph of the existing view. It should be noted that the photograph represents a comparatively narrow field of view and should be read in conjunction with Table 6.9 Baseline Views, which describes the wider field of view observed during the site survey.

6.8.24 From Table 6.10, Baseline Views, it can be concluded that views of communications masts and electricity transmission infrastructure are widely available throughout the study area.

Table 6.10: Baseline views

Receptors: H = residential; R = recreational; T = road user or worker; C = cultural heritage

Sensitivity: H = High; M = Medium, L = Low

Viewpoint number / Figure No.	Location, Distance & Direction from site	Grid Ref. Easting, Northing	Receptor	Components in Existing View	Viewpoint Sensitivity
VP1 Fig. 6.7	A6195 Park Spring Road 0.6km NW	441089E 407499N	R, T	Viewpoint is located within Green Belt. The application site lies on the left side of the road and comprises a recently restored colliery tip that has been grass seeded and planted with woodland species and a boundary hedgerow. large-scale industrial unit (ASOS) and rising ground at Billingley to the south east. Wetland areas, River Dearne and agricultural land to the west of the A6195. Visual detractors: anemometer visible in the foreground; pylons and overhead power lines; and large scale industrial units.	H, M
VP2 Fig. 6.8	Park Lane, Great Houghton 0.6km E	442616E 407015N	R	Viewpoint is located within Green Belt. High ground within the application site is visible on the left hand side of the view and comprises recently restored colliery tip that has been grass seeded and planted with woodland species. Agricultural land under pasture in the foreground. Mature woodland at Little Park, Park Spring Visual detractors: anemometer visible in the foreground; and pylons and overhead power lines.	H
VP3 Fig. 6.9	Church St. / Rodes Ave, Great Houghton 1.0km SE	442995E 406520N	H, R	Viewpoint is located within Green Belt. Rural landscape in mixed agricultural use within the Dearne Valley. Fields enclosed with low hedgerows and hedgerow trees. Urban fringe and woodland at Little Park on the right hand side of the view. Semi-mature woodland following restoration of former colliery workings. Large scale industrial unit (ASOS) near Little Houghton visible on the left hand side of the view. Urban development on the eastern edge of Barnsley visible in the distance. Visual detractors: anemometer visible in the foreground; large scale industrial unit.	H
VP4 Fig. 6.10	Chestnut St, Grimethorpe	441832E 408365N	H, T	Viewpoint is located within Green Belt and from an elevated location affording long distance views over the Dearne Valley. Unenclosed grassland crossed by formal and informal footpaths. Extensive areas of semi-mature woodland and scrub to the south east of Grimethorpe, possibly on the site of former colliery	H, M

Viewpoint number / Figure No.	Location, Distance & Direction from site	Grid Ref. Easting, Northing	Receptor	Components in Existing View	Viewpoint Sensitivity
	1.1km N			workings. Visual detractors: anemometer visible in the foreground over woodland; and pylons and overhead power lines.	
VP5 Fig. 6.11	A635 / B6096 roads, Darfield; near Dearne Way 1.8km S, SW	441685E 404894N	H, R, T	Viewpoint is located within Green Belt and from an elevated location with long distance views over the Dearne Valley. Rural landscape under pasture within Dearne Valley. Fields enclosed with low fragmented hedgerows and few hedgerow trees. Woodland at White City Woods visible on the horizon. Large scale industrial unit (ASOS) at Little Houghton prominent on the right hand side of the view. Settlements at Grimethorpe and Cudworth visible in the distance. Visual detractors: anemometer visible in the application site; large scale industrial unit; and pylons and overhead power lines.	H, M
VP6 Fig. 6.12	Cudworth Common, Darfield Road, Cudworth 1.9km NW	439709E 407624N	H, T	Viewpoint is located within Green Belt and from an elevated location with long distance views to the south. Rural landscape comprising restored workings under pasture and woodland plantations within the Dearne Valley. Fields enclosed with low fragmented hedgerows and few hedgerow trees. Settlements at Great Houghton and Darfield visible in the distance. Visual detractors: anemometer in the application site; and pylons and overhead power lines.	H, M
VP7 Fig. 6.13	High Street, Billingley 2.3km SE	443693E 405082N	H, T	Viewpoint is located within Green Belt with long distance views to the north in the direction of the site. Large scale rectangular fields enclosed with low, mechanically trimmed hedgerows in the foreground. Settlements at Great Houghton, Middlecliffe and Little Houghton visible in the middle distance. Higher ground at Park Spring and woodland at White City Woods visible on the horizon Visual detractors: pylons and overhead power lines.	H, M
VP8	B6411 Clayton Lane,	444715E 406140N	H, T	Viewpoint is from an open location with long distance views to the west over a rural, agricultural landscape.	H, L

Viewpoint number / Figure No.	Location, Distance & Direction from site	Grid Ref. Easting, Northing	Receptor	Components in Existing View	Viewpoint Sensitivity
Fig. 6.14	Thurnscoe 2.8km E, SE			Large scale rectangular fields enclosed with low, mechanically trimmed hedgerows. Settlements at Great Houghton and Billingley visible in the distance. Visual detractors: pylons and overhead power lines.	
VP9 Fig. 6.15	A6196 road, Trans Pennine Way, Nr Barnsley Boundary Walk, NNR, Premier Inn, Brampton 4.5km S	441996E 40222N	H, R	Viewpoint is located close to the A633, A6195 and Highgate interchange on low lying, level ground. Scrub and rough grassland in the foreground. Woodland plantations and scrub in the immediate vicinity of the interchange limit views to the north. Several extensive water bodies from former mineral or coal extraction lie close to the River Dearne. Visual detractors: Various types of pylons and overhead power lines; street lighting and signage; and traffic.	H
VP10 Fig. 6.16	Hunningley Lane, B6100, Barnsley 5.6km W, SW	436724E 404509N	H, T	Viewpoint is located in urban fringe on the eastern edge of Barnsley looking north east across undulating agricultural land and woodland. Residential development on higher ground on the northern edge of Wombwell is visible on the left hand side of the view and Swaithe Hill Farm on the right hand side. Distant views of West Haigh Woods and White City Wood on the horizon in the vicinity of Park Spring. Despite the apparent rural character several transport routes including a branch line railway and three main roads are concealed from view by undulating ground. Intervening undulating land and woodland screen views of the site. Visual detractors: Pylons and overhead power lines.	H, L
VP11	Pools Lane, Royston;	437040E 411132N	H, R, T	Viewpoint is located in urban fringe on the south eastern edge of Royston, a former colliery village, looking south east across undulating grazing land and woodland in the foreground.	H, L

Viewpoint number / Figure No.	Location, Distance & Direction from site	Grid Ref. Easting, Northing	Receptor	Components in Existing View	Viewpoint Sensitivity
Fig. 6.17	National Cycle Route 67 6.0km N, NW			Extensive areas of spoil heaps, workings and railways on the left hand side of the view have been restored to woodland and grazing land. Undulating ground in the foreground of the view screens views of intervening residential development at Cudworth and North Field. Visual detractors: Pylons and overhead power lines, horticulture.	
VP12 Fig. 6.18	Harlington Road, Sticking Lane, Adwick Upon Dearne, Mexborough 7.0km SE	446641E 401492N	H, T	Viewpoint is located on the north western edge of the village looking north west towards Park Spring across the Dearne Valley, agricultural land and residential settlements. Extensive areas of restored mineral workings characterised by semi-mature woodland i.e. adjacent to the River Dearne in the foreground of the view. Modern large scale industrial units between Bolton upon Dearne and Wath upon Dearne can be seen on the left hand side of the view. Residential development at Bolton upon Dearne and Goldthorpe is visible in the middle distance. White City Wood in the vicinity of Park Spring is visible on the horizon. Visual detractors: Pylons and overhead power lines, large scale industrial units.	H, L
VP13 Fig. 6.19	Minsthorpe Lane, A638 / B6474 roundabout, North Elmsall 7.8km NE	446860E 413150N	H, T	Viewpoint is located in a comparatively elevated location on the western edge of the village looking south west towards Park Spring across agricultural land and residential settlements. Settlements at South Kirkby and South Elmsall can be seen in the middle distance. Woodland at White City Wood (Howell Wood and West Haigh Wood) is visible on the horizon in the vicinity of the Park Spring site. High ground on the south western edge of the village screens views of railway lines and main roads. Visual detractors: Pylons and overhead power lines, road lighting and signage.	H, L
VP14 Fig. 6.20	Queen Anne's Obelisk, Stainborough Park,	433246E 402903N	C, R	Viewpoint is located in rural landscape on the eastern edge of Stainborough Park looking north east towards Park Spring over agricultural land and residential settlements. Parkland in the foreground of the view lies within the Wentworth Castle and Stainborough Park Grade I registered landscape.	H

Viewpoint number / Figure No.	Location, Distance & Direction from site	Grid Ref. Easting, Northing	Receptor	Components in Existing View	Viewpoint Sensitivity
	Wentworth Castle 9.4km W, SW			Settlements at Worsbrough and Wombwell on rising ground in the middle distance. The M1 motorway, which follows the eastern edge of Stainborough Park, is screened by cutting slopes and woodland planting. Extensive areas of woodland at Birdwell Wood, Wombwell Wood and Worsbrough country park. Visual detractors: Pylons and overhead power lines.	
VP15 Fig 6.21	B6376, New Edlington 14.5km SW	453474E 397823N	H, T	Viewpoint is located in a comparatively elevated location on the western edge of the village looking north west towards Park Spring across agricultural land and residential settlement at New Edlington. The view is limited to a distance of less than 2km in the direction of Park Spring by rising ground on the western edge of the village. Woodland at Conisbrough and part of the Dearne Valley are visible on the horizon. Visual detractors: None	H
VP16 Fig 6.22	Grenoside Mount, OS Viewpoint 15.5km SW	433282E 393841N	T	Distant view from an elevated location on the western edge of the village looking north east towards Park Spring across agricultural land and residential settlement. Extensive areas of woodland at Greno Wood, Chapeltown and Wentworth Park in the middle distance. Landscape features in the vicinity of Park Spring are inconspicuous at this distance and would only be visible during periods of good visibility. Visual detractors: None.	H

6.9 Predicted Impact Sources

6.9.1 The project description, technical siting requirements, and construction details are described in Chapter 3 of this ES. The proposal has evolved through consideration of a range of factors, including the preliminary assessment of impacts and measures to avoid or ameliorate impacts, as part of the iterative design process.

6.9.2 The following two aspects of the proposals have the potential to cause an effect on landscape character and quality, and on visual amenity:

- The activities and elements of the development that would affect the landscape fabric of the site.
- The activities and visual characteristics of the elements that would be visible from the surrounding locality.

6.9.3 These activities and elements will occur in three distinct phases: the short-term construction phase, a long-term operational phase and a short-term decommissioning phase. They are described below.

Potential Effects during Construction

6.9.4 This phase is expected to last for approximately 6-9 months, and would involve construction of the turbine foundations, road infrastructure, turbines, control building and grid connection. The turbines would be fabricated in sections elsewhere and assembled on site using cranes. During this time additional areas of land would be required for construction activities such as hardstanding for cranes and a site compound. Where appropriate, disturbed land would be reinstated to its former condition on completion of construction.

6.9.5 During the construction phase there would be a number of landscape and visual impacts. They would be temporary and of short duration, and only affect a limited part of the overall application site. The activities and temporary features that have potential to cause an effect on local landscape and visual amenity include:

- Upgrading and construction of access tracks;
- Provision of a temporary contractors compound and site cabins;
- Excavation and construction of turbine base foundations and temporary crane hard standing;
- Construction of the control building (incorporating substation);
- Excavations for underground cables;
- HGV deliveries to site and movement of vehicles on and off-site;
- Erection of turbines using tall cranes; and
- Reinstatement works, including the removal of the temporary construction compound and site cabins.

Potential Effects during Operation

6.9.6 The operational elements of the development with the potential to affect the landscape and visual amenity of the study area are:

- Wind turbines;
- Control building; and
- Site access tracks.

6.9.7 The Development will comprise of three turbines, each capable of producing approximately 2 MW, a control building and an access road between and the A6195 and the turbine positions. The proposed layout is shown in Figure 3.2.

6.9.8 The exact type of turbine to be used at the Development site has not been confirmed and will be finalised when a construction contractor has been selected in the event of a successful planning application to BMBC. For this reason, the EIA is based on the scenario which utilises the maximum number of three turbines at the maximum envisaged size of 2 MW to ensure the maximum potential environmental impacts are assessed. It is envisaged, at this stage, that each turbine tower will be up to 80 m high with an overall maximum height to tip of up to 126.5 m. The rotor of each turbine will consist of three blades and will rotate at approximately 16 revolutions per minute (rpm). The rotors will turn to track the prevailing wind direction.

6.9.9 The turbines will require a connection to the control building housing the switchgear and transformers. A Control Building, approximately 5.8 m high, would be constructed between turbine T2 and turbine T3. It will include a: control room; switchgear; junction boxes; in-door breakers; relaying equipment; metering and, steel support structures. The switchgear would allow particular collector lines and turbines to be turned off or isolated for maintenance and repair without shutting down all three turbines.

6.9.10 The power generated by the turbines would be exported off site to a suitable existing substation close to the site. At this stage the details of the electrical connection, which may be either by underground cables or overhead lines, have not been finalised. The routing of the cables will be designed to minimise disruption to existing services and other land.

6.9.11 Access to the site during operation will be from the A6195, Park Spring Road. An internal site access track with a total length of approximately 1.45 km would be retained throughout the life of the Development to provide access for maintenance vehicles leading to and running between the turbines. The tracks would be approximately 5 m wide and surfaced with stone to reflect surrounding farm tracks.

6.9.12 The proposed linear arrangement of the turbines presents a simple balanced arrangement which achieves a good fit with the key landscape characteristics of the local and wider area.

6.9.13 During operation the proposed development might impact on the existing landscape and visual amenity in the following ways:

- The scale and form of the proposals may prove intrusive in the context of the existing landscape elements and overall character;
- The final form of the development may involve the loss or fragmentation of landscape elements (buildings, open space, urban form, woodland and trees);
- The extent to which the proposals may intrude into existing views experienced by residents and day to day users of the area; and
- The extent to which current users of the landscape such as local residents, tourists and visitors may be subject to new effects.

Decommissioning

6.9.14 The turbines are expected to remain in operation for approximately twenty five years. At the end of this period the Development would be decommissioned and all the turbine components and associated infrastructure removed in line with prevailing regulations and best practice guidance. At this stage it is assumed the turbines and the foundations would be removed. The foundations would be excavated out to a depth of 1.0 m below the reinstated ground level, backfilled with subsoil and topsoil and re-seeded for agricultural use. All ancillary structures would be removed and disturbed areas re-seeded.

6.10 Mitigation and Enhancement

6.10.1 As an integral part of the design work for the development, mitigation opportunities were considered in order to 'design out' the worst of the potential impacts. The design has been developed in accordance with the following SNH guidance which is appropriate to this location:

- Retention of 'simplicity of image', by relating the layout design to the underlying character; and
- Relating the scale of wind farm and turbine size to the existing landscape scale and character aiming to achieve a 'sensitive, sculptural and simple' effect that appears rational in the setting.

6.10.2 By its nature, the proposed turbines would result in visual effects which it would not be feasible to mitigate by adjusting the siting, or providing screening. Further opportunities to mitigate the effects of the development through changing the location of the individual turbines are limited on this site. The linear arrangement of the turbines is considered to be a good fit with the existing site, and relates well to the linear form of large-scale man-made elements nearby in the Dearne Valley.

6.10.3 From most viewpoints the turbines would be viewed against the background sky. For this reason the visual impact would be reduced if the turbines are coloured pale grey to blend with the predominant colour of the sky, and have a semi-matt finish to minimise reflectance. Furthermore, the turbines should be uniform in colour and not support company logos or similar. The rotor speed of the turbines would be approximately 16 rpm which is generally considered more restful than older technologies which turned at higher speeds.

6.10.4 The construction of the Development has been carefully planned and various environmental mitigation measures are proposed including the siting and management of features and activities that are designed to limit the temporary effects of the construction phase.

6.10.5 Large areas of woodland have been planted recently during the restoration of former spoil tips in the vicinity of the application site and A6195 Dearne Valley Parkway. In the longer term the planting would provide unintentional mitigation for the Project by reducing views of the turbine towers as it matures.

6.10.6 All land within the application site, excluding the turbine bases, access tracks and control building site, will continue to be managed for agricultural production when the project is operating.

6.10.7 Hedgerow enhancement and other ecological enhancement works are proposed, see Chapter 9 Ecology. These enhancement works, in particular the creation/gapping up

of hedgerows on the site may increase the levels of screening/filtering effects of the proposal. The detailed design of the measures proposed would be subject to consultation with the Local Planning Authority and statutory consultees prior to their implementation.

6.11 Assessment of Potential Landscape Effects

6.11.1 The methodology and assessment criteria for landscape effects are described in paragraphs 6.4.16 to 6.4.21.

6.11.2 Landscape effects include the effect on landscape receptors such as landscape elements and features, as well as the effects upon the general landscape character and its quality, or condition and value. The effects of the turbines may be negative (adverse) or positive (beneficial) and may vary in their duration from temporary to permanent.

6.11.3 Changes to the landscape elements and features would only occur within the application site for the Project and along the associated grid connection route to the offsite substation.

6.11.4 The effects of construction activities described in paragraph 6.9.4 to 6.9.5 will increase in magnitude over the construction period as the wind farm nears completion and would be no greater than when the turbines are in operation. Construction effects are by their nature usually adverse including stages of work in progress, movement of coloured machinery, excavation and signage, but also features of interest such as the erection of the turbines by large cranes.

6.11.5 The assessment considers the operational period following commissioning of the turbines and reinstatement of the temporary construction areas leaving a settled and co-ordinated character.

Predicted Landscape Effects on the Nottinghamshire, Derbyshire and Yorkshire Coalfield NCA

6.11.6 Strong local variations within the characteristic features and quality of the Nottinghamshire, Derbyshire and Yorkshire Coalfield NCA are described in paragraphs 6.8.3 to 6.8.8. It is a varied landscape ranging between scattered settlements frequently associated with former mining activities, prominent transport corridors, large-scale modern industrial development, broad river valley corridors, extensive woods, and agricultural land. Strong contrasts exist in the vicinity of the site between the extensive man-made landscapes, modern industrial development and associated transport infrastructure resulting from major regeneration following the demise of coal mining in the early Nineties, and adjacent rural areas comprising semi-natural woodlands and river valley habitat.

6.11.7 Other wind farms that are either in operation or under construction within the study area include Marr (4 turbines), Hampole (4 turbines) and Penny Hill Lane (6 turbines).Generally, they are all situated in large scale agricultural landscapes where hedges and field margins have been grubbed out to facilitate crop production, resulting in large fields that match the scale of the windfarm developments. Considering all these factors, and the presence of existing turbines, the landscape has a capacity to accommodate turbines and is of a **Low** sensitivity to wind farm development.

6.11.8 During construction the magnitude of effect on the Nottinghamshire, Derbyshire and Yorkshire Coalfield NCA as a whole would be **Negligible** to **Low**, and the effect of the construction activities would be slight and temporary. Therefore the predicted effects would be **Slight, short term (reversible)** and **adverse**.

6.11.9 During operation, the effects of the proposed new turbines at Park Spring on the local landscape character would be localised within the regional landscape character. Effects would be experienced within areas with views of the windfarm up to a distance of approximately 2 km. The three proposed turbines would result in a **Low** magnitude of change on the physical landscape within the Nottinghamshire, Derbyshire and Yorkshire Coalfield NCA, leading to a **Slight adverse, long term (reversible) landscape effect**. However, visually there would be a greater magnitude of change locally which is described in section 6.12.

Predicted Landscape Effects on the East Dearne Settled Arable Slopes (D2) LLCA

6.11.10 The Nottinghamshire, Derbyshire and Yorkshire Coalfield NCA within the Barnsley area is divided in to Local Landscape Character Areas (LLCA) identified in the Barnsley Landscape Character. LLCAs used to assess the landscape of the study area are described in paragraphs 6.8.9 to 6.8.13. The host LLCA is the East Dearne Settled Arable Slopes.

6.11.11 The proposed development would be set within a landscape which has the typical characteristics of this LLCA.

6.11.12 The landscape is characterised by three dominant land use patterns – agriculture, industry and landscape renewal. It comprises a variety of modern industrial development, settlements and agricultural land traversed by main roads including the A6195 Dearne Valley Parkway. Urban development is interspersed with scattered residential settlements and farmsteads within a predominantly grazed agricultural landscape which includes extensive areas of reclaimed spoil heaps with large swathes of young woodland planting. With the exception of pylons there are few tall vertical elements within the rural landscape. The undulating topography and lack of vegetative screening would leave the proposed development conspicuous from both within and outside of the character area.

6.11.13 The overall quality of the landscape varies. High visual sensitivity in the more elevated areas combined with areas of low landscape quality balances out to a landscape that is considered to have **Medium** sensitivity to development.

6.11.14 The magnitude of change during the construction phase would vary. Much of the construction work would be visible within the wider landscape due to the elevated location of the site but ground level activities would be contained from some directions by local undulating topography, woodland and hedgerows and other development. The magnitude of change would range from **Negligible** to **High** as the construction progressed towards completion.

6.11.15 The predicted effect on the local landscape character at Park Spring would be **Moderate** and **Significant**. The type of landscape change would be short term and **adverse**.

6.11.16 Woodland at Park Spring and Little Houghton, hedgerows, and the undulating topography would provide some containment of the proposed development at ground level. These screening effects would be limited and the turbines would be large elements that are out of scale with nearby built elements within a relatively open

landscape. The turbines would be prominent within the wider landscape. However, the landscape has been extensively modified by urban development and mining operations. The magnitude of change, during operation, within the localised part of this LLCA would be **High**.

6.11.17 The development would result in a **Moderate** landscape effect, which would be **Significant**. The type of effect would be **long term (reversible)**.

Predicted Landscape Effects on Landscape Elements

6.11.18 The proposed development would retain as much of the local hedgerows, trees/scrub and agricultural land within the application site as possible during construction. Existing formal and informal paths would be retained for public access. The temporary construction site would be located carefully to minimise effects on existing vegetation and established field boundaries, and existing agricultural land use would be retained at all stages of the development. The sensitivity of the landscape elements is low – medium, with much of the land in agricultural use for permanent pasture, which is common throughout the LLCA and easy to replicate.

6.11.19 The magnitude of effect would be **Low**, leading to a **Slight adverse** level of effect on landscape elements during construction.

6.11.20 During operation, the effects of the development on existing landscape elements would be fairly static assuming site areas and access tracks are maintained adequately.

6.11.21 There would be long term, permanent, but reversible effects on the landscape fabric of the site during the construction and operational stages of the proposed development as a result of the loss of agricultural land along the new site tracks, at the Control Building, and at the three wind turbine bases. The losses would be small and fully reversible when the turbines were decommissioned. The remaining agricultural land would continue in agricultural use and there would be no loss of landscape features including trees, hedges and ditches. Therefore the effect on the landscape resource would not be significant.

6.11.22 The magnitude of effect would be **Negligible**, leading to a **Slight adverse** level of effect on landscape elements during operation.

6.11.23 Beneficial landscape/ecological indirect effects would arise from the proposed on site mitigation within the Dearne Valley Green Heart Nature Improvement Area.

Predicted Landscape Effects on the Peak District National Park

6.11.24 The Peak District National Park (PDNP) is located ~18 km south west of the proposed development at its nearest point to the development site, therefore there would be no direct landscape effects on the designated area. From this distance the small cluster of three turbines at Park Spring would be barely discernible in views, and they would be insignificant in scale within the wider field of view.

6.11.25 The nationally designated landscape of the PDNP is considered to be of the highest quality, of high landscape condition and value, and it has a high sensitivity to development of the nature proposed.

6.11.26 The Park Spring Wind Farm would not affect indirectly the key or distinctive characteristics of the PDNP's 'natural beauty, wildlife or cultural heritage'. The

predicted magnitude of change arising from the proposed development is considered to be no change in landscape terms due to the intervening distance. The resulting landscape effects are considered to be **Neutral**, and not significant.

Predicted Landscape Effects on Registered Parks and Gardens / Country Parks

6.11.27 The ZTV and site survey indicated there will be no or extremely limited visibility of the proposed development from the following designated landscapes or country parks. As a result it is considered that there will be no significant effects upon the following landscapes arising from the proposed development:

Registered Parks and Gardens

- Hickleton Hall, Grade II, 6.5km, south east.
- Locke Park, Grade II, 7.5km west.
- Brodsworth Hall, Grade II*, 8.5km, west.
- Wentworth Woodhouse, Grade II*, 9.4km, south west.
- Wentworth Castle, Grade I, 9.6km, west.

Country Parks

- Fitzwilliam (approximately 8.5 km north).
- Howell Wood (approximately 3 km north east).
- Worsbrough Mill (approximately 8.5 km west).
- Anglers (approximately 8 km north, north west).
- Phoenix Park (approximately 4.5 km north east).

Summary of Significance Evaluation

6.11.28 Table 6.11 summarises the conclusion of the assessment of predicted landscape effects of the proposed development on the landscape character of the site and surrounding area within the 20km radius study area.

Table 6.11: Evaluation of significance of landscape effects

Landscape Receptor	Effect			Significance	
	Sensitivity	Magnitude	Level of Effect	Level	Type of Effect
Nottinghamshire, Derbyshire and Yorkshire Coalfield NCA					
Construction	Low	Low	Slight	Not Sig	The effects would be direct, short term (reversible) and adverse
Operation	Low	Low	Slight	Not Sig	The effects would be direct, long term (reversible) and

Landscape Receptor	Effect			Significance	
	Sensitivity	Magnitude	Level of Effect	Level	Type of Effect
					adverse.
East Dearne Settled Arable Slopes (D2) LLCA					
Construction	Medium	High	Moderate	Not Sig	The effects would be direct, short term (reversible) and adverse
Operation	Medium	High	Moderate	Not Sig	The effects would be direct, long term (reversible) and adverse.
Landscape Elements					
Construction	Low (grassland, hedges and trees)	Low	Slight	Not Sig	The effects would be direct, short term (reversible) and adverse
Operation	Low (grassland, hedges and trees)	Negligible	Slight	Not Sig	The effects would be direct, long term (reversible) and adverse. Positive effect from off site enhancement works
Designated Landscapes					
Construction	High	No Change	Neutral	Not Sig	There would be no direct or indirect effects.
Operation	High	No Change	Neutral	Not Sig	There would be no direct or indirect effects.
Registered Parks and Gardens / Country Parks					
Construction	Medium to High	Negligible / No Change	Neutral	Not Sig	There would be no direct or indirect effects.
Operation	Medium to High	Negligible / No Change	Neutral	Not Sig	There would be no direct or indirect effects.

6.12 Assessment of Potential Visual Effects

6.12.1 The assessment of visual effects is concerned wholly with the effect of the development on views, and general visual amenity. The methodology and assessment criteria for visual effects are described in paragraphs 6.4.22 to 6.4.34.

6.12.2 Opinions about the visual effects of wind farms vary widely, resulting in subjective opinions as to whether a wind farm is a positive or adverse feature within the landscape. This assessment has considered factors such as the visual composition of the landscape in the view together with the Park Spring turbines, and whether they

are reasonably accommodated within the scale and character of the landscape as perceived by receptors at each viewpoint location.

6.12.3 The appearance and visibility of the proposed turbines will change according to the prevailing weather patterns and local climatic conditions. Views will be limited during periods of low visibility due to fog, haze or low cloud. In some instances (e.g. during sunset/sunrise and periods of pale or white blanket cloud) and from some locations the turbines may appear darker in colour. Under other conditions they may appear brighter and more prominent (e.g. during stormy periods that combine dark clouds with bright sunshine). This assessment is based on a 'worst case scenario' assuming a clear day with good visibility.

6.12.4 The ZTV map for the proposed development and viewpoint locations are shown on Figure 6.6. Each viewpoint is illustrated with a photograph of the existing view, a wireframe showing the bare landform with the proposed development and a photomontage. The viewpoints are illustrated on Figures 6.7 to 6.22.

6.12.5 The ZTV map indicates that within 10 km of the site widespread theoretical visibility is predicted. Although the theoretical visibility extends throughout this area, views would be limited by landform, woodland and built development, as well as the intervening distance. Between 10 and 20 km theoretical visibility is patchy and generally limited to high ground to the east and west of the site. Generally the ZTVs demonstrate that where there would be views of the proposed development all three turbines would be visible.

6.12.6 Visual impacts predicted to arise during construction and operation from the representative viewpoints are described in Table 6.12 and summarised in Table 6.13 below. The assessment considers the sensitivity of the receptor, the composition of the existing view, the magnitude of change that would arise, and the significance of the resulting visual impact.

For multiple landscape pages, insert a page break

Table 6.12: Viewpoint Assessment

Key: Receptors: H = residential; R = recreational; T = road user or worker; C = cultural heritage.
Magnitude: H = high; M = medium; L = Low; N/NC = Negligible

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
VP1 Fig. 6.7	Lay-by on Park Spring Road - A6195.	0.6km NW	The viewpoint and application site are located within Green Belt. The site lies on the left side of the road and comprises a recently restored colliery tip that has been grass seeded and planted with woodland species and a boundary hedgerow. Large-scale industrial unit (ASOS) and rising ground at Billingley to the south east. Wetland areas, River Dearne and agricultural land to the west of the A6195. Visual detractors: pylons and overhead power lines; main distributor road; and large scale industrial units.	The following changes to view would be experienced by travellers using the road, and they would be of temporary duration: <u>During Construction</u> Construction activities including ground level operations, assembling the turbines and high level crane activity would be prominent in views from this location.	T - Medium / Low	High	**Moderate**
				<u>During Operation</u> The turbines would be prominent features. They would be of a contrasting scale to the key elements that make up the landscape pattern, and would be dominant in the surrounding landscape. at this distance they would be seen against the sky at close range, and would extend across much of the field of view. The movement of rotating blades would be obvious and draw the eye. There would be a localised significant change to the existing view.	T - Medium / Low	High	**Moderate**

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
VP2 Fig. 6.7	Park Lane, Great Houghton	0.7km E	The viewpoint and application site are located within Green Belt. High ground within the application site is visible on the left hand side of the view and comprises recently restored colliery workings that have been grass seeded and planted with woodland species. Agricultural land under pasture in the foreground. Mature woodland at Little Park, Park Spring Visual detractors: pylons and overhead power lines.	The following changes to view would be experienced by people using the public bridleway and they would be of temporary duration: <u>During Construction</u> Construction activities associated with assembling the upper parts of the turbines (hub and rotor blades) would be clearly visible this location. Landform would screen views of ground level activities.	R – High	High	**Substantial**
				<u>During Operation</u> The turbine rotor blades would be prominent in the view over intervening woodland. They would be of a contrasting scale to the key elements that make up the landscape pattern, and would be dominant landscape features. The turbine would be seen against the sky and the movement of rotating blades would be obvious and draw the eye.	R – High	High	**Substantial**
VP3 Fig. 6.8	Church St. / Rhodes Ave, Great Houghton	1.0km SE	The viewpoint and application site are located within Green Belt. Rural landscape in mixed agricultural use within the Dearne Valley. Fields enclosed with low hedgerows and hedgerow trees. Urban fringe and woodland at Little Park on the right	The following changes to view would be experienced by residents who would have frequent viewing opportunities, and by people using the public footpath and public open space where they would be of temporary duration:			

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
			hand side of the view. Semi-mature woodland following restoration of former colliery workings. Large scale industrial unit (ASOS) near Little Houghton visible on the left hand side of the view. Urban development on the eastern edge of Barnsley visible in the distance. Visual detractors: anemometer visible in the foreground; large scale industrial unit.	<u>During Construction</u> Construction activities including ground level operations, assembling the turbines and high level crane activity would be prominent in views from this location.	H - High R - High	High	**Substantial**
				<u>During Operation</u> The turbines would be prominent features. They would be of a contrasting scale to the key elements that make up the landscape pattern, and would be dominant in the surrounding landscape. They would be seen against the sky at close range and would extend across much of the field of view. The movement of rotating blades would be obvious and draw the eye. There would be a significant deterioration in the existing view.	H – High R - High	High	**Substantial**
VP4 Fig. 6.9	Chestnut St, Grimethorpe	1.1km N	Viewpoint is located within Green Belt and from an elevated location affording long distance views over the Dearne Valley. Unenclosed grassland crossed by formal and informal footpaths. Extensive areas of semi-mature woodland and scrub to the south east of Grimethorpe, possibly on the site of	The following changes to view would be experienced primarily by people using the public open space and local road where they would be of temporary duration; and by a limited number of residents in Chestnut Street who would have frequent viewing opportunities:			

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
			former colliery workings. Visual detractors: anemometer visible in the foreground over woodland; and pylons and overhead power lines.	<u>During Construction</u> Construction activities associated with assembling the upper parts of the turbines (hub and rotor blades) would be clearly visible from this location. Intervening woodland would screen views of ground level activities.	H- High R – High T - Medium / Low	High	**Substantial**
				<u>During Operation</u> The turbines would be prominent in the view. They would be of a contrasting scale to other vertical elements that make up the landscape pattern, and would overwhelm surrounding landscape features. The turbines would be seen against the sky and the movement of rotating blades, particularly T1, would be obvious and draw the eye. There would be a noticeable deterioration in the existing view.	H- High R – High T - Medium / Low	High	**Substantial**

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
VP5 Fig. 6.10	A635 / B6096 roads, Darfield; Dearne Way recreational trail	1.8km S, SW	Viewpoint and site are located within Green Belt and from an elevated location with long distance views over the Dearne Valley. Rural landscape under pasture within Dearne Valley. Fields enclosed with low fragmented hedgerows and few hedgerow trees. Woodland at White City Woods visible on the horizon. Large scale industrial unit (ASOS) at Little Houghton prominent on the right hand side of the view. Settlements at Grimethorpe and Cudworth visible in the distance. Visual detractors: anemometer visible in the application site; large scale industrial unit; and pylons and overhead power lines.	The following changes to view would be experienced by residents who would have frequent viewing opportunities, and by people using the public footpath and roads where they would be of temporary duration: <u>During Construction</u> Construction activities including ground level operations, assembling the turbines and high level crane activity would be visible from this location.	H – High R – High T – Medium / Low	Medium	Moderate
				<u>During Operation</u> The upper part of the turbines would be relatively prominent in the view and the movement of rotating blades would be obvious and seen against the sky. Although the turbines relate to the adjacent large scale modern industrial unit (ASOS), there would be a noticeable change to the existing rural view.	H – High R – High T – Medium / Low	Medium	Moderate
VP6 Fig. 6.11	Cudworth Common, Darfield Road, Cudworth	2.0km NW	Viewpoint and site are located within Green Belt and from an elevated location with long distance views to the south. Rural landscape comprising restored workings under pasture and woodland plantations within the Dearne Valley. Fields enclosed with low fragmented hedgerows and few hedgerow trees.	The following changes to view would be experienced by residents who would have frequent viewing opportunities, and by people using the public footpath and roads where they would be of temporary duration: <u>During Construction</u> Construction activities including assembling the turbines and high level	H – High R – High	Medium	Moderate

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
			Settlements at Great Houghton and Darfield visible in the distance. Visual detractors: anemometer in the application site; and pylons and overhead power lines.	crane activity would be clearly visible from this location. Intervening landform and hedgerows would reduce views of most ground level activities.	T - Medium / Low		
				<u>During Operation</u> The upper part of the turbine towers and rotor blades would be relatively prominent in the view. The movement of rotating blades would be obvious and seen against the sky. Other man-made vertical features (tall pylons) are also prominent in views from this location. The turbines would cause a noticeable deterioration in the existing rural view.	H – High R – High T - Medium / Low	Medium	Moderate
VP7 Fig 6.12	High Street, Billingley	2.4km N, NW	Viewpoint and site are located within Green Belt with long distance views to the north in the direction of the site. Large scale rectangular fields enclosed with low, mechanically trimmed hedgerows in the foreground. Settlements at Great Houghton, Middlecliffe and Little Houghton visible in the middle distance. Higher ground at Park Spring and woodland at White City Woods visible on the horizon Visual detractors: pylons and overhead power lines.	The following changes to view would be experienced by residents who would have frequent viewing opportunities, and by people using footpaths and roads where they would be of temporary duration: <u>During Construction</u> Construction activities associated with assembling the upper parts of the turbines (hub and rotor blades) would be visible from this location. Intervening landform, woodland and settlements would screen views of lower level operations.	H – High R – High T – Medium / Low	Low	Slight

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
				During Operation The upper part of the turbines and the movement of rotating blades would be visible on the skyline. There would be a slight deterioration in the existing view which also has views of pylons in the foreground from this location.	H – High R – High T – Medium / Low	Low	Slight
VP8 Fig. 6.13	B6411 Clayton Lane, Thurnscoe	2.8km E, SE	Viewpoint is from an open location with long distance views to the west over a rural, agricultural landscape. Large scale rectangular fields enclosed with low, mechanically trimmed hedgerows. Settlements at Great Houghton and Billingley visible in the distance. Visual detractors: pylons and overhead power lines.	The following changes to view would be experienced by residents who would have frequent viewing opportunities, and by people using footpaths and roads where they would be of temporary duration: During Construction Construction activities associated with assembling the upper parts of the turbines (hub and rotor blades) would be visible from this location. Intervening landform and settlements would screen views of ground level activities.	H - High T - Low	Low	Slight
				During Operation The upper part of the turbines and the movement of rotating blades would be visible on the skyline. They would be of a contrasting scale to settlements visible in the middle distance of the view. They would be out of scale with the landscape pattern, and would overwhelm the surrounding landscape features. There would be a deterioration in the existing view which	H - High T - Low	Low	Slight

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
				also has views of tall pylons from this location.			
VP9 Fig. 6.14	A6196 road, Trans Pennine Way, Nr Barnsley Boundary Walk, NNR, Premier Inn, Brampton	4.5km S	Viewpoint is located close to the A633, A6195 and Highgate interchange on low lying, level ground. Scrub and rough grassland in the foreground. Woodland plantations and scrub in the immediate vicinity of the interchange limit views to the north. Several extensive water bodies from former mineral or coal extraction lie close to the River Dearne. Visual detractors: Various types of pylons and overhead power lines; street lighting and signage; and traffic.	The following changes to view would be experienced by people using footpaths and roads where they would be of temporary duration: <u>During Construction</u> Construction activities would be barely discernible from this location.	H – High R – High T - Low	Low	Slight
				<u>During Operation</u> The upper part of the turbine and the movement of rotating blades would be discernible on the skyline. There would be a slight deterioration in the existing view which also has distant views of other turbines from this location during good visibility.	H – High R – High T - Low	Low	Slight
VP10 Fig. 6.15	Hunningley Lane, B6100, Barnsley	5.6km W, SW	Viewpoint is located in urban fringe on the eastern edge of Barnsley looking north east across undulating agricultural land and woodland. Residential development on higher ground on the northern edge of Wombwell is visible on the left hand side of the view and Swaithe Hill Farm on the right hand side. Distant views of	The following changes to distant views would be experienced by residents who would have frequent viewing opportunities, and by people using footpaths and roads where they would be of temporary duration: <u>During Construction</u> Construction activities would not be discernible from this location.	H – High T - Low	Negligible / No Change	Neutral

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
			West Haigh Woods and White City Woods on the horizon in the vicinity of Park Spring. Despite the apparent rural character several transport routes including a branch line railway and three main roads are concealed from view by undulating ground. Intervening undulating land and woodland screen views of the site. Visual detractors: Pylons and overhead power lines.	<u>During Operation</u> The upper part of the turbines and the movement of rotating blades would be barely discernible at this distance in clear visibility. The turbines would be a minor element in the wider landscape and would not change the existing view.	H – High T - Low	Negligible / No Change	Neutral
VP11 Fig. 6.16	Pools Lane, Royston; National Cycle Route 67	6.0km N, NW	Viewpoint is located in urban fringe on the south eastern edge of Royston, a former colliery village, looking south east across undulating grazing land and woodland in the foreground. Extensive areas of spoil heaps, mineral workings and railways on the left hand side of the view have been restored to woodland and grazing land. Undulating ground in the foreground of the view screens views of intervening residential development at Cudworth and North Field. Visual detractors: Pylons and overhead power lines, horticulture.	The following changes to distant views would be experienced by residents who would have frequent viewing opportunities, and by people using footpaths and roads where they would be of temporary duration: <u>During Construction</u> Construction activities would not be discernible from this location.	H – High R – High T - Low	Negligible / No Change	Neutral
				<u>During Operation</u> The upper part of the turbines and the movement of rotating blades would be barely discernible at this distance in clear visibility. The turbines would be a minor element in the wider landscape and would not change the existing view.	H – High R – High T - Low	Negligible / No Change	Neutral
VP12 Fig.	Harlington Road, Sticking Lane,	7.0km SE	Viewpoint is located on the north western edge of the village looking north west towards Park Spring across the Dearne Valley, agricultural land	The following changes to distant views would be experienced by residents who would have frequent viewing opportunities, and by people using			

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
6.17	Adwick Upon Dearne, Mexborough		and residential settlements. Extensive areas of restored mineral workings characterised by semi-mature woodland lie adjacent to the River Dearne in the foreground of the view. Modern large scale industrial units between Bolton upon Dearne and Wath upon Dearne can be seen on the left hand side of the view. Residential development at Bolton upon Dearne and Goldthorpe is visible in the middle distance. White City Wood in the vicinity of Park Spring is visible on the horizon. Visual detractors: Pylons and overhead power lines, large scale industrial units.	footpaths and roads where they would be of temporary duration: <u>During Construction</u> Construction activities would not be discernible from this location until the turbines were nearing completion.	H – High T - Low	Negligible / No Change	Neutral
				<u>During Operation</u> The upper part of the turbines and the movement of rotating blades would be barely discernible at this distance in clear visibility. The turbines would be a minor element in the wider landscape and would not change the existing view.	H – High T - Low	Negligible / No Change	Neutral
VP13 Fig. 6.18	Minsthorpe Lane, A638 / B6474 roundabout, North Elmsall	7.8km NE	Viewpoint is located in a comparatively elevated location on the western edge of the village looking south west towards Park Spring across agricultural land and residential settlements. Settlements at South Kirkby and South Elmsall can be seen in the middle distance. Woodland at White City Wood (Howell Wood and West Haigh Wood) is visible on the horizon in the vicinity of the Park Spring site. High ground on the south western edge of the village screens views of railway lines and main roads. Visual detractors: Pylons and	The following changes to distant views would be experienced by residents who would have frequent viewing opportunities, and by people using footpaths and roads where they would be of temporary duration: <u>During Construction</u> Construction activities would not be discernible from this location until the turbines were nearing completion.	H – High T - Low	Negligible / No Change	Neutral
				<u>During Operation</u> Movement of the tips of rotating blades would be barely discernible at this distance, and only in clear visibility. There would be no perceptible change	H – High T - Low	Negligible / No Change	Neutral

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
			overhead power lines, road lighting and signage.	to the existing view.			
VP14 Fig. 6.19	Queen Anne's Obelisk, Stainborough Park, Wentworth Castle	9.4km W, SW	Viewpoint is located in rural landscape on the eastern edge of Stainborough Park looking north east towards Park Spring over agricultural land and residential settlements. Parkland in the foreground of the view lies within the Wentworth Castle and Stainborough Park Grade I registered landscape. Settlements at Worsbrough and Wombwell on rising ground in the middle distance. The M1 motorway, which follows the eastern edge of Stainborough Park, is screened by cutting slopes and woodland planting. Extensive areas of woodland at Birdwell Wood, Wombwell Wood and Worsbrough country park. Visual detractors: Pylons and overhead power lines.	The following changes to distant views would be experienced by people using public open space where they would be of temporary duration: <u>During Construction</u> Construction activities would not be visible from this location.	C – High R - High	Negligible / No Change	Neutral
				<u>During Operation</u> The turbines would be substantially screened by the intervening landform and woodland cover, and there would be no change to the existing view.	C – High R - High	Negligible / No Change	Neutral
VP15 Fig 6.20	B6376, New Edlington	14.5km SW	Viewpoint is located in a comparatively elevated location on the western edge of the village looking north west towards Park Spring across agricultural land and residential settlement at New Edlington. The view is limited to a distance of less than 2km in the direction of Park Spring by rising ground on the western	The following changes to distant views would be experienced by residents who would have frequent viewing opportunities, and by people using footpaths and roads where they would be of temporary duration: <u>During Construction</u> Construction activities would not be visible from this location.	H – High T - Low	Negligible / No Change	Neutral

Viewpoint/ Figure No.	Location	Distance / direction	Components in Existing View	Predicted View during Construction and Operation	Receptor / Sensitivity	Magnitude of change	Significance of Impact
			edge of the village. Woodland at Conisbrough and part of the Dearne Valley are visible on the horizon. Visual detractors: None	<u>During Operation</u> The turbines would be substantially screened by the intervening landform and woodland cover.	H – High T - Low	Negligible / No Change	Neutral
VP16 Fig 6.19	Grenoside recreational ground,	15.5km SW	Distant view from an elevated location on the western edge of the village north east towards Park Spring across agricultural land and settlements. Extensive areas of woodland at Greno Wood, Chapeltown and Wentworth Park in the middle distance. Landscape features in the vicinity of Park Spring are inconspicuous at this distance and would only be visible during periods of good visibility. Visual detractors: None.	The following changes to distant views would be experienced by people using public open space where they would be of temporary duration: <u>During Construction</u> Construction activities would not be visible from this location.	R - High	Negligible / No Change	Neutral
				<u>During Operation</u> The turbines would be substantially screened by the intervening landform and woodland cover.	R - High	Negligible / No Change	Neutral

Table 6.13: Summary of viewpoint assessment at operation

View-point	Location	Distance / direction	Assessment			
			Sensitivity	Magnitude	Level of effect	Significance
VP1	Park Spring Road - A6195	0.6 km NW	Medium Low	High	**Moderate**	**Moderate**
VP2	Park Lane, Great Houghton	0.6 km NE	High	High	**Substantial**	**Significant**
VP3	Church St. / Rhodes Ave, Great Houghton	1.0 km SE	High	High	**Substantial**	**Significant**
VP4	Chestnut St, Grimethorpe	1.1 km N	High, Medium Low	High	**Substantial**	**Significant**
VP5	A635 / B6096 roads, Darfield; Dearne Way recreational trail	1.8 km S, SW	High	Medium	**Moderate**	**Significant**
VP6	Cudworth Common, Darfield Road, Cudworth	2.0 km NW	High Medium Low	Medium	**Moderate**	**Significant**
VP7	High Street, Billingley	2.4 km N, NW	High Medium Low	Low	Slight	Not Significant
VP8	B6411 Clayton Lane, Thurnscoe	2.8 km E, SE	Low	Low	Slight	Not Significant
VP9	A6196 road, Trans Pennine Way, Nr Barnsley Boundary Walk, NNR, Premier Inn, Brampton	4.5 km S	High	Low	Slight	Not Significant
VP10	Hunningley Lane, B6100, Barnsley	5.6 km W, SW	High Low	Negligible / No Change	Neutral	Not Significant
VP11	Pools Lane, Royston; National Cycle Route 67	6.0 km N, NW	High Low	Negligible / No Change	Neutral	Not Significant
VP12	Harlington Road, Sticking	7.0 km SE	High Low	Negligible / No Change	Neutral	Not Significant

View-point	Location	Distance / direction	Assessment			
			Sensitivity	Magnitude	Level of effect	Significance
	Lane, Adwick Upon Dearne, Mexborough					
VP13	Minsthorpe Lane, A638 / B6474 roundabout, North Elmsall	7.8 km NE	High Low	Negligible / No Change	Neutral	Not Significant
VP14	Queen Anne's Obelisk, Stainborough Park, Wentworth Castle	9.4 km W, SW	High Low	Negligible / No Change	Neutral	Not Significant
VP15	B6376, New Edlington	14.5 km SW	High Low	Negligible / No Change	Neutral	Not Significant
VP16	Grenoside recreational ground	15.5 km SW	High Low	Negligible / No Change	Neutral	Not Significant

Effects on Views from Residential Properties within 2 km of the Proposed Development during Operation

6.12.7 The proposed development is located in a well populated area where nearby ex-colliery towns and villages may experience views of the proposed turbines. The larger settlements of Barnsley, Doncaster, Rotherham and Sheffield are all within 20 km of the site. The screening effects of built form and tree cover will generally limit views to the outer edge of settlements except where varied topography permits views over adjacent settlements towards the site.

6.12.8 Residential visual amenity can be defined as a collective term describing the views and general visual amenity of a residential property, relating to the garden area and main drive, views to and from the house, and the relationship of the outdoor garden space to the house. Residential visual amenity overall depends on more than one view in one direction except in unusual individual cases where the principal and only view lies in the direction of the wind farm.

6.12.9 Local residents are the main visual receptors most likely to experience views of the proposed development. The following assessment has been undertaken of those properties with a 2 km radius of the turbine locations most likely to be affected, and provides an indication of the likely level of visual effects experienced from locations close to the proposed development. A representative range of groups of residential properties was visited and judgements made from publicly accessible locations. It should be noted that not every property was identified or visited.

6.12.10 Visual effects from settlements will vary depending on the potential for shadow casting, view proximity and the percentage of the view occupied by the proposed turbines from the residential property. Views from individual properties within each group will also vary depending on their orientation in relation to the proposed development and the degree of screening provided by garden or nearby vegetation.

6.12.11 Individual occupier opinions regarding wind turbines cannot be assumed to be either negative or positive. Therefore, where the assessment notes occupiers may experience a significant visual effect valency does not influence the assessment itself: some occupiers will consider the result to be adverse, some will be indifferent and others will consider the change positively.

6.12.12 Regard has been paid to what is frequently referred to as the 'Lavender Test', which is a useful principle for considering the potential visual effect of a wind energy development with respect to residential amenity. The 'Lavender Test' refers to Inspector David Lavender's decision in respect of a proposed wind farm at Enifer Downs, North Dover (Appeal Ref: APP/X2220/A/08/2071880). He stated, *'However, when turbines are present in such number, size and proximity that they represent an unpleasantly overwhelming and unavoidable presence in main views from a house or garden, there is every likelihood that the property concerned would come to be widely regarded as an unattractive, and thus unsatisfactory (but not necessarily uninhabitable) place in which to live. It is not in the public interest to create such living conditions where they did not exist before.'*

6.12.13 When applying the 'Lavender Test' significant factors to consider are whether the number of turbines, their size and proximity (assuming an open and unconstrained view) would give rise to an 'unpleasantly overwhelming and unavoidable presence' when judged from main views from the dwelling or garden. Visual effect is considered to be 'unavoidable' where there are no alternative views from a property. It is possible for the occupier of a property to be the subject of a significant visual effect when viewing in one particular direction without the change being significant in terms of overall visual amenity when judged in the round.

6.12.14 The assessment did not identify any properties where it was considered likely that the visual effect of the scheme could render occupation unacceptable by converting the property into one which would come to be widely regarded as 'an unattractive and thus unsatisfactory (but not necessarily uninhabitable) place to live.'

6.12.15 Receptors within 2 km of the site include the villages of Grimethorpe, Great Houghton, Little Houghton, Middlecliffe, Darfield, Cudworth Common, and the hamlet of Edderthorpe. Views were also assessed from Billingley Conservation Area which lies ~2.5 km to the south east of the proposed development.

6.12.16 The assessment set out in Table 6.14 below relates to the high sensitivity of residential properties and the predicted magnitude of change. It is also subject to limitations of access to properties, which have been assessed from publicly accessible locations, and the assessment has been precautionary in this respect. The majority of properties have mature garden vegetation or screening from adjacent trees/hedgerows, local landform as well as from out buildings/farm buildings and walls. Many others are orientated so that the principal views from what may be the main living rooms would face away from the proposed turbines.

Table 6.14: Visual effects on settlements

Settlement / distance / direction from the proposed development	Potential Visual Effects on Settlements
Grimethorpe 1.0 km	A medium sized, dispersed ex-colliery village with two distinct areas of settlement separated by Brierley Road. Views of the proposed

Settlement / distance / direction from the proposed development	Potential Visual Effects on Settlements
N Refer to Fig 6.10, Viewpoint VP4	development would be restricted to properties on the south western edge of the village along the southern side of Charles Street. Here the properties are set in a slightly higher location than the proposed turbines and are orientated north east /south east. Views of the proposed development would be partly screened by New Park Spring wood. From a limited number of properties in Charles Street there would be oblique views of the turbines which would be viewed as a small cluster ranging in height. Modern industrial units at Park Spring industrial estate are also visible from this location. During Construction Ground level construction is not likely to be visible from these properties. There is the potential for views of the cranes during construction of the turbines, resulting in a **Low - High** magnitude of change for a restricted period of time. During Operation All three turbines would be viewed at close to medium range. Turbine T1 would be nearest to the properties and at a slightly lower level, turbines T2 and T3 would be set at increasingly lower levels and would be less prominent. The turbines would be a dominant element in views from properties in this part of Grimethorpe. Movement of turbine T1 rotating blades would be obvious and draw the eye. The magnitude of change for properties in this location would be **High**. Significance The level of effect on the view from properties in Charles Street with oblique views of the proposed development would be **Substantial** and **Significant** due to the proximity of turbines to the properties.
Great Houghton 0.8 km E Refer to Fig 6.9, Viewpoint VP3	A medium sized linear village situated on the B6411 / B6273 comprising mainly residential properties. An ex-colliery settlement that lies in an elevated location in relation to the site on the upper slopes of the eastern side of the Dearne Valley. Views of the proposed development would be limited to properties in side roads off the western side of the B6411 / B6273. Generally views from these properties are orientated north west / south east which would allow oblique views only of the proposed development. Views of the proposed development from properties at Houghton Green on the northern edge of the village would be substantially screened by Little Park wood. During Construction There would be filtered views of ground level construction activity which would be visible across the undulating landscape. There would be clear views of cranes assembling all three turbines resulting in a **High** magnitude of change for a restricted period of time. During Operation The turbines would be viewed at close range, and would be set at a lower location than the properties. The row of turbines would be a dominant element in views from properties in this area of Great Houghton. They would extend across much of the field of view and the movement of rotating blades would be obvious and draw the

Settlement / distance / direction from the proposed development	Potential Visual Effects on Settlements
	eye. The magnitude of change for properties in this location would be **High**. Significance The level of effect on the view from properties facing towards the proposed development would be **Substantial** and **Significant** due to the limited screening available and proximity of turbines to the properties.
Little Houghton 1.0 km S,SE	A small village on the upper slopes of the eastern side of the Dearne Valley, Views of the proposed development would be limited to properties in Middlecliffe Lane and Chapel Lane on the north western edge of the village. Generally views from these properties are orientated towards the proposed development. Views would be filtered by intervening trees and hedgerows and garden vegetation/boundaries During Construction Ground level construction is not likely to be visible from these properties. There is the potential for views of the cranes during construction of the turbines, resulting in a **Low - High** magnitude of change for a restricted period of time. During Operation All three turbines would be viewed at close to medium range. Turbine T3 would be nearest to the properties and most dominant in views, turbines T1 and T2 would be set at slightly higher levels and would be less prominent due to the greater distance from receptors. The turbines would be a dominant element in views from properties in this part of the village. The movement of rotating blades would be obvious and draw the eye. The magnitude of change for properties in this location would be **High**. Significance The level of effect on the view from properties in parts of Middlecliffe Lane and Chapel Lane with unobstructed views of the proposed development would be **Substantial** and **significant** due to the close proximity of turbines.
Middlecliffe 1.7 km S,SE	A small village on the eastern side of the Dearne Valley, Views of the proposed development would be limited to properties in George Street and Windsor Crescent on the north western edge of the village. Generally views from these properties are orientated towards the proposed development. Views would be filtered by intervening built development, trees and hedgerows and garden vegetation/boundaries. Most properties in this location lie at a lower level than the proposed development. During Construction Ground level construction is not likely to be visible from these properties. There is the potential for views of the cranes during construction of the turbines, resulting in a **Low - Medium** magnitude of change for a restricted period of time. During Operation The turbines would be viewed at medium range. They would appear as a small cluster and the movement of rotating blades would be clearly discernible at this distance. The magnitude of

Settlement / distance / direction from the proposed development	Potential Visual Effects on Settlements
	change on the views from properties facing towards the turbines would be **Medium**. Significance The level of effect on the view from properties in parts of George Street and Windsor Crescent would be **Slight** and **not significant.**
Darfield 1.5 km S,SW Refer to Fig 6.11, Viewpoint VP5	A large village on the western side of the Dearne Valley. Views of the development would be available from properties on the north eastern edge of the village on the eastern side of Edderthorpe Lane. There would be open views of the proposed turbines from these properties across the lower slopes of the Dearne Valley. During Construction Ground level construction is not likely to be visible from these properties. There is the potential for views of the cranes during construction of the turbines, resulting in a **Low - Medium** magnitude of change for a restricted period of time. During Operation The row of turbines would be viewed at medium range and the turbine rotors would be seen against the sky. Movement of the rotating blades would be noticeable at this distance. The magnitude of change on views from properties facing towards the turbines would be **Medium**. Significance The level of effect on the view from properties on the eastern side of Edderthorpe Lane would be **Slight** and **not significant**.
Edderthorpe 1.1 km W,SW	Edderthorpe is a small hamlet on the western side of the Dearne Valley lying at a lower level than the proposed development. There would be views from properties on the outer edge of the settlement which have views in a north east direction. The turbines would be seen in the context of a peri-urban landscape already modified by the large scale modern industrial unit (ASOS) and Dearne Valley Parkway. The turbines would be prominent elements in views at this distance. During Construction Ground level construction is not likely to be visible from these properties. There is the potential for views of the cranes during construction of the turbines, resulting in a **Low – High** magnitude of change for a restricted period of time. During Operation The row of turbines would be viewed at close to medium range and the turbine rotors would be seen against the sky. The movement of rotating blades would be obvious and draw the eye. The magnitude of change on the views from properties facing towards the turbines would be **High**. Significance The level of effect on the view from properties in Edderthorpe Lane would be **Substantial** and **significant** due to the close proximity of turbines.
Cudworth Common	A large ex-colliery village on the western side of the Dearne Valley. Views of the development would be available from properties on the

Settlement / distance / direction from the proposed development	Potential Visual Effects on Settlements
1.9 km W,NW Refer to Fig 6.12, Viewpoint VP6	eastern edge of the village along Darfield Lane. Generally properties are at a higher level than the proposed development and would have open views of the proposed turbines across the lower slopes of the Dearne Valley. During Construction Ground level construction is not likely to be visible from these properties. There is the potential for views of the cranes during construction of the turbines, resulting in a **Low - Medium** magnitude of change for a restricted period of time. During Operation The row of turbines would be viewed at medium range and the turbine rotors would be seen against the sky. The movement of rotating blades would be noticeable at this distance. The magnitude of change on the views from properties facing towards the turbines would be **Medium**. Significance The level of effect on the view from properties the eastern side of Cudworth Common would be **Slight** and **not significant**.
Billingley Conservation Area 2.4km SE Refer to Fig 6.13, Viewpoint VP7	Billingley is situated on the crest of a hill between Darfield and Thurnscoe from where there are spectacular views in almost every direction out of the small village. The Conservation Area includes most of the buildings within the village. Views of the development would be available from several properties on the western side of the village along Chapel Lane and High Street. During Construction Ground level construction would not be visible from these properties. There is the potential for views of the cranes during construction of the turbines, resulting in a **Low - Medium** magnitude of change for a restricted period of time. During Operation The turbines would be viewed at medium range and would appear as a small cluster. The movement of rotating turbine blades would be clearly discernible at this distance. The magnitude of change on the views from properties facing towards the turbines would be **Medium**. Significance The level of effect on the view from properties within Billingley Conservation Area would be **Slight** and **not significant**.

Visual Effects on Views from Selected Route Corridors

6.12.17 The following assessment considers views towards the proposed development theoretically obtainable within the 20 km study area from selected route corridors; potential changes to views from a greater distance would be negligible. These routes are:

- A6195 road, the Dearne Valley Parkway, between Middlecliffe and Shafton.
- A635 road Doncaster and Barnsley.

- A1 and A1(M) road west of Doncaster.
- M18 motorway between Rotherham and Doncaster.

6.12.18 Table 6.15 summarises the predicted visibility of the Park Spring turbines in views from each route and assesses the magnitude of any predicted effects and their significance. In assessing theoretical visibility, views from a route have been assessed as those available in the direction of travel and up to approximately 900 to either side.

Table 6.15: Potential Visual Effects on Selected Route Corridors at Operation

Route	Theoretical Visibility from Route Corridor
A6195 road, Dearne Valley Parkway Middlecliffe to Shafton	The Dearne Valley Parkway (also referred to as the Dearne Valley Link Road) runs broadly diagonally across the study area over a distance of approximately 18km. It was built in the late 1990's and 2000s to provide a link road across the former coalfields between the A61 / M1Junction 36 at Tankersley to the south east of Barnsley and the A628 road at Shafton. The route contains many junctions, all of which are roundabouts to allow for future developments. The route follows the eastern side of Barnsley and lies close to the River Dearne over several kilometres in the vicinity of the proposed development. The entire route lies within the ZTV and the distance from the closest point to the proposed development is approximately 0.2km. Travelling north between Hoyland and Brampton the ZTV indicates there are potential views of the proposed turbines along this section which would be limited by built development and vegetation adjacent to the road. After the A6195 / A633 roundabout at Brampton the road heads north along the floor of the Dearne Valley close to the River Dearne towards Shafton where there is minimal screening along the road giving open views over the shallow valley. There would be potential views from the A6195 of the proposed turbines between Brampton and Park Spring over a distance of approximately 5km. Travelling south from Shafton potential visibility of the proposed turbines would be substantially limited by landform, vegetation and built development between Shafton and Grimethorpe. After travelling past Grimethorpe there would be potential open views of the turbines for a distance of approximately 1.5km, after which the turbines would be behind the viewer. Road users along this road are considered to be of low sensitivity due to the quality of the landscape through which it passes. The magnitude of change to views from the road arising from the proposed turbines varies from **Negligible to High**, depending on proximity to the site, resulting in a slight visual effect on road users, which reduces to **Slight – Neutral** with increased distance from the turbines. This would be a long term (reversible), direct and **not significant** visual effect.
A635 road, Doncaster to Barnsley	The A635 road runs west to east through the study area over a distance of approximately 17km, and lies within approximately 2.5km at its nearest point to the site. Although most sections of the road lie within the ZTV it passes through a visually complex landscape where potential views in both directions are limited by landform, woodland and built development between Goldthorpe in the east and the edge of Barnsley in the west. This would give travellers potential intermittent views of limited duration in both directions. Generally the potential views would be limited to

Route	Theoretical Visibility from Route Corridor
	sections of the turbine rotors with few opportunities for prolonged open views of the turbines. Road users along this road are considered to be of low sensitivity due to the quality of the landscape through which it passes. The magnitude of change to views from the road arising from the proposed turbines would be **Low**, resulting in a **Slight** visual effect on road users, which reduces to **Negligible** with increased distance from the turbines. This would be a long term (reversible), direct and **not significant** visual effect.
A1 road, west of Doncaster	The A1 and A1(M) road runs north to south through the eastern side of the study area over a distance of approximately 25km. It lies between Nottingley in the north and Wadworth in the south, and is approximately 10km at its nearest point to the site. The ZTV indicates no visibility along most of the route except for limited visibility over a distance of approximately 8km between Wentbridge in the north and Adwick Le Street in the south. Views in both directions over this stretch would be limited by landform, woodland at White City Woods and built development at North Emsall and South Emsall. This would give travellers potential intermittent views of limited duration. Generally the potential views would be limited to sections of the turbine rotors with few opportunities for full views of the turbines. Road users along this road are considered to be of medium sensitivity due to the quality of the landscape through which it passes. The magnitude of change to views from the road arising from the proposed turbines would be low, resulting in a **Slight** visual effect on road users, which reduces to **Negligible** with increased distance from the turbines. This would be a long term (reversible), direct and **not significant** visual effect.
M18 motorway, between Rotherham and Doncaster	The M18 motorway runs between Bramley on the outskirts of Rotherham in the west to Doncaster in the east over a distance of approximately 9km across the south eastern edge of the study area. Approximately 2km lies within the ZTV and the distance from the closest point to the proposed development is approximately 15km. Although this short section of the M18 lies in an open elevated location views of the turbines would be limited to periods of clear visibility and they would be insignificant at this distance. Road users along this road are considered to be of medium sensitivity due to the quality of the landscape through which it passes. The magnitude of change to views from the road arising from the proposed turbines would be **Negligible**, resulting in a neutral visual effect on road users. This would be a long term (reversible), direct and **not significant** visual effect.

Visual Effects on Recreational Receptors

6.12.19 Users of public footpaths and designated recreational routes may experience views of the proposed turbines at the locations assessed in Table 6.16 below.

Table 6.16 Potential Visual Effects from Recreational Route

Route	Theoretical Visibility from Route
Trans Pennine Trail Refer to Fig 6.14, Viewpoint VP6	The Trans Pennine Trail (TPT) is a nationally promoted recreational route approximately 330km long which links the Irish and North Seas and runs through the Pennines. The route is for walkers, cyclists and horse riders. Approximately 15km of the route lies within the southern part of the study area where some sections are contiguous with the Dove Valley Trail. It passes within 5km at its nearest point to the site. Although the ZTV indicates the proposed development would in theory be visible on the horizon from a number of locations, views along the route would be extensively limited by woodland, landform and settlements. Between Worsbrough in the west and Wombwell in the east there are potential views of the turbine rotors. The sensitivity of footpath users is high. The magnitude of effects would be **Low** where the path lies within 6km of the turbines. This would lead to **Slight** visual effects in places from this section of the route and would be **not significant**.
Dearne Way	There is a network of public footpaths and bridleways within close proximity of the proposed development, notably the Dearne Way which passes within 1km of the site to the south west within the Dearne Valley. Approximately 22km of the Dearne Way runs from north west to south east across the study area. Visibility from the Dearne Way and other public rights of way would be extensive between the eastern edge of Barnsley and Bolton Upon Dearne with limited screening from landform and built development. The predicted magnitude of change would be **High** due to close proximity of the routes to the proposed turbines, which would be new features in the landscape. The overall visual effects on recreational receptors using the Dearne Way and adjoining footpaths and bridleways would be **moderate – substantial,** and **significant**.
Barnsley Boundary Walk	The Barnsley Boundary Walk is a circular walk 117km long around Barnsley. The route was designed to take in views of the varied countryside, industrial heritage and other points of interest including reservoirs and country parks. It passes within 3km of the site to the north east. Although the ZTV indicates extensive visibility of the proposed development from most of the route lying within the study area, views would be substantially limited by woodland, landform and built development. There would be intermittent views of the turbines on the horizon to the west of the route between Houghton Common and Thurnscoe at a distance of between 2 – 4km. The sensitivity of footpath users is high. The magnitude of effects would be **Medium** decreasing to low as distance from the turbines increases. This would lead to **Moderate** visual effects in places from this section of the route that is likely to be **significant**.

Visual effects on Landscape Designations

6.12.20 One statutory designated landscape of national importance, the PDNP, lies within the study area. It lies within approximately 18km to the site at its closest point as shown on Figure 6.2.

6.12.21 The proposed development would not affect important views from the PDNP and none of the key or distinctive characteristics of the PDNP's 'natural beauty, wildlife or cultural heritage' would be lost or changed as a result of its construction. The Park Spring turbines would only be visible during periods of clear visibility and, at this

distance would be a minor element within the wider landscape. The magnitude of effect would be **Negligible** and **not significant**.

Visual effects on the Green Belt

6.12.22 Viewpoints VP1 to VP7 (Figures 6.7 to 6.13 respectively) illustrate views of the proposed development within the Green Belt.

6.12.23 The primary objective of Core Strategy Policy CSP 34 is to protect the Green Belt, it states, *"the main purpose of which is to prevent the built up areas merging with the surrounding settlements of Cudworth, Royston, Darfield, Wombwell, Dodworth and Higham in order to maintain the separate identity and character of these settlements in relation to surrounding countryside and landscape features"*. CS paragraph 9.240 notes that Green Belt helps to conserve the natural environment by restraining development and assisting in the process or urban renaissance.

6.12.24 National Planning Policy Framework paragraph 81 requires local planning authorities to plan positively to enhance the beneficial use of the Green Belt by, for instance, looking for opportunities for outdoor sport and recreation; by retaining and enhancing landscapes, visual amenity and biodiversity; or by improving damaged and derelict land.

6.12.25 Development of this nature and scale with a small area of development footprint would retain the openness of the Green Belt, whilst allowing visual permeability between the Green Belt and surrounding areas. Openness is not a measure of landscape quality but a requirement to keep land permanently open within Green Belt and viewpoints VP1 to VP7 illustrate how the turbines would not obstruct views across the landscape to any great degree.

6.12.26 The large scale simplicity of the restored landscape within the application site, which lies in Green Belt land, lends itself to the introduction of large scale features more easily than other areas of more complex landscape nearby. It is inevitable wind turbines will be visible over a relatively large area, and their scale and man-made appearance mean they will not naturally 'fit in' with a rural landscape.

6.12.27 The turbines would be viewed in the context of the nearby Dearne Valley Parkway main distributor road, extensive industrial development at the Park Spring Grimethorpe and Park Spring Houghton employment land, and the adjacent ASOS distribution centre. Although prominent, they would not appear out of place close to nearby large scale industrial buildings. Green Belt in the vicinity of Park Spring has been tightly drawn around these urban industrial urban areas and settlements at Grimethorpe, Middlecliffe, Great Houghton and Darfield. In this location the Green Belt also includes a varied mix of natural and modified landscapes including extensive areas of grass and young woodland planting on restored colliery workings, the River Dearne and associated riverine habitats, agricultural land and the A6195 Dearne Valley Parkway road. The turbines and access tracks would occupy a small area of land and would allow the wider application site to remain in agricultural use. Overall, the landscape within the vicinity of the site is assessed to be of low sensitivity with a high capacity to accommodate change.

6.12.28 The layout of the Park Spring turbines has been designed to provide a simple, clearly structured, balanced composition that relates to the scale of the landform, as well as the grain of the site contours. The scale and number of turbines proposed are considered appropriate to this landscape. They have been sited to avoid the locally prominent hill to the south, which is the most visually sensitive area of the site.

Aspects of the turbine design, including a recessive matt neutral colour and low turbine rotation speed, would help mitigate visual effects. The control building, ancillary structures and access roads would be sited to take advantage of screening provided by the existing landform and/or trees and hedgerows. The proposed development would result in the loss of 0.98 ha from Green Belt, which would be a long term (25 years) and reversible. Additional screen planting would be undertaken if necessary. Through consideration of these factors the proposed development has been designed to protect the visual amenity of the surrounding landscape and Green Belt.

6.12.29 Development of this nature and scale with a small area of development footprint would retain the openness of the Green Belt, whilst allowing visual permeability between the Green Belt and surrounding areas. Openness is not a measure of landscape quality but a requirement to keep land permanently open within Green Belt and viewpoints VP1 to VP7 illustrate how the turbines would not obstruct views across the landscape to any great degree.

6.12.30 It is acknowledged that the proposed development would add large scale man-made elements to the Green Belt establishing a new landmark feature and a point of reference in views from the wider landscape. However, they would not be incongruous with nearby large scale industrial development adjoining this narrow area of Green Belt land. The turbines would be designed and sited to relate to the landscape whilst retaining views within and through the Green Belt. Overall, it is considered that the visual effects of the proposed turbines would not conflict with the objective of Core Strategy Policy CSP 34 to protect the Green Belt.

6.13 Landscape Effect on BMBC Planning Policy

6.13.1 The proposed development would not conflict with the five main purposes that Green Belt serves, as set out in the National Planning Policy Framework.

6.13.2 The Core Strategy (adopted September 2011) is the primary document for all planning purposes. The relevant policies listed below are described in paragraphs 6.5.27 to 6.5.36. Table 6.17 below considers whether the proposed development would comply with the objectives of applicable policies.

Table 6.17: Landscape effect on planning policy

Policy / Landscape Objective	Predicted Effect
Core Strategy Policy CSP 6 Development that produces renewable energy would be allowed as long as there is no significantly harmful effect on the character of the landscape and appearance of the area.	Potential effects during construction and operation on landscape elements and character are described in section 6.11 and visual effects in section 6.12 above. Landscape effects were assessed mostly to be not significant. There would be moderate adverse and significant (reversible) effects on a localised part of the East Dearne Settled Arable Slopes local landscape character area. The landscape is classified as being of low quality with low sensitivity to wind energy development. Significant visual effects would be experienced by a limited number of properties within settlements less than 2km from the proposed development. In most locations views would be either at an oblique angle to the turbines and/or filtered by vegetation. The turbines would have an adverse impact on the localised

Policy / Landscape Objective	Predicted Effect
	landscape but will generally be non-intrusive to the broader landscape. Therefore, the proposed development would not undermine the objective of this policy.
Core Strategy Policy CSP 29 Design of development should be of a high quality that respects topography, Green Infrastructure assets, and natural features including woodland, views and vistas to key buildings, landmarks, skylines and gateways. It should respect heritage, townscape and landscape character.	Landscape mitigation and enhancement is described in section 6.10. The proposed development has been designed to respond to the topography of the site and surrounding context of the shallow undulating slopes of the Dearne Valley. The layout of the development has been designed to provide a simple, clearly structured, balanced composition that relates to the scale of the landform, as well as the grain of the site contours. The scale and number of turbines proposed are considered appropriate to this landscape. They have been sited to avoid the locally prominent hill to the south of the site, which is the most visually sensitive area of the site. Elements of the turbine design, including a recessive matt pale grey colour and low turbine rotation speed would help mitigate visual effects. The control building, ancillary structures and access roads would be sited to take advantage of screening by existing landform and/or trees and hedgerows. Offsite landscape and biodiversity enhancement works would be undertaken in the vicinity of the application site within the Dearne Valley Green Heart project area. The design of the proposed development, based upon these considerations, would fulfil the objectives of this policy.
Core Strategy Policy CSP 34 In order to protect the countryside and open land around built up areas the extent of the Green Belt will be safeguarded and remain unchanged.	The assessment of potential visual effects on the Green Belt is described in paragraphs 6.12.17 to 6.12.21. The three turbines would allow the wider application site to remain in agricultural use, and would result in the loss of 0.98 ha from Green Belt, which would be a long term temporary (25 years) and reversible change of use. Development of the nature and scale would retain the openness of the Green Belt and allow visual permeability between the Green Belt and surrounding areas. Due to the modest scale, siting and visually permeable nature of the three turbines it is considered that the visual amenity of the Green Belt would not be damaged and the proposed development would meet the objectives of this policy. Future expansion of the Park Springs Grimethorpe employment land into Green Belt between Cudworth and Grimethorpe is anticipated in Core Strategy Policy CSP 12.
Core Strategy Policy CSP 37 Development will be expected to retain and enhance the character and distinctiveness of the individual Landscape Character Area in which it is located (as set out in the Landscape Character Assessment of Barnsley Borough 2002)."	The proposed development would be located within the East Dearne Settled Arable Slopes local landscape character area. This landscape is classified as being of low quality with low sensitivity to wind energy development. Approximately 0.98 ha of land would be required for operational purposes within the 90.4 ha application site. All remaining land would remain in agricultural use thereby retaining the key elements and features that make up the character of this area. Therefore, the overall fabric and quality of the wider East Dearne Settled Arable Slopes

Policy / Landscape Objective	Predicted Effect
	landscape character area will not be significantly changed. Proposed offsite landscape and biodiversity enhancement works in the vicinity of the application site within the Dearne Valley Green Heart project area would enhance the wider landscape. The turbines would be sited within an already modified landscape which is capable of absorbing development of this scale and nature. Whilst there would be an impact on the localised site, they would not be intrusive in the wider landscape so would not undermine the objectives of this policy.

6.14 Assessment of Cumulative Effects

6.14.1 The methodology and assessment criteria for the cumulative landscape and visual impact assessment (CLVIA) are described in paragraphs 6.4.36 to 6.4.45.

6.14.2 The cumulative landscape and visual effects are those that would result from additional changes to the landscape or to visual amenity caused by the Park Spring Wind Farm in conjunction with other existing or proposed wind farm developments. CLVIA differs from LVIA in that the baseline is partially speculative, and considers developments which are consented but not built as well as some of those awaiting determination by the relevant consenting authority.

6.14.3 This assessment has considered developments that are submitted applications or consented schemes, and those that either exist or are in the process of being constructed at 1st March 2013. The CLVIA considers only those developments within 20 km of the site with the potential to have significant cumulative relationships with the Park Spring proposal.

6.14.4 Figure 6.23 shows the location of the existing and proposed wind farms considered in this assessment within the 20 km study area. The figure indicates the number of wind farms (rather than the number of turbines) that would be visible with the proposed development.

6.14.5 To construct the cumulative ZTVs for each existing or proposed wind farm, the ZTVs to tip height for each development were generated to a 20 km radius. These were then combined with the Park Spring proposal (20 km radius) to create the cumulative ZTV. The cumulative ZTVs are colour coded to distinguish between areas where the proposed wind farm is predicted to be visible (either on its own, or in conjunction with another development), and areas where other wind farms would be visible but the proposed wind farm would not.

6.14.6 All the viewpoints included in the LVIA have presented a cumulative visual wireframe based on the information available and as set out in Table 6.18. These viewpoints are illustrated in Figures 6.7 to 6.22 Viewpoints VP1 to VP16 respectively.

6.14.7 Table 6.18 sets out details of existing, consented and in planning wind farms within the 20 km study area that have been considered within this CLVIA.

Table 6.18: Wind Farms within 20 km of Park Spring included in the CLVIA

Site Name	Status	Turbines	Hub Height	Rotor Diameter	Tip Height	Distance / direction from site	Grid ref (centre of site)
Hampole	Under construction	4	80m	90m	125m	9.4km	451027E 409056N
Marr	Operational	4	80m	90m	125m	9.0km	450417E 404292N
Norton	In planning	2	80m	80m	120m	13.0km	452395E 414557N
Fieldhouses	In planning	1	55m	48m	79m	16.0km	450858E 393758N
Asda Normanton	Consented	1	65m	52m	91m	16.6km	440181E 423480N
Darrington Quarry	In planning	8	80m	90m	125m	16.8km	450347E 421456N
Infield Farm	In planning	1	52m	50m	76m	19.9km	422035E 405235N
Penny Hill Lane	Operational	6	80m	90m	125m	20.0km	447548E 387626N

Cumulative Landscape Impacts

Landscape / Planning Designations

6.14.8 The LVIA found the Park Spring site does not lie within or adjacent to an area of landscape designated for its landscape value and the proposal would have no significant effect on any designated landscape.

6.14.9 The proposed site lies within Green Belt as shown on Figure 6.2 Landscape Context. The LVIA found the proposed Park Spring development would retain the openness of the Green Belt whilst allowing visual permeability with surrounding areas. From an analysis of Figures 6.23 to 6.32 there are potential cumulative views with the Hampole and Marr wind farms from the upper slopes of the Dearne Valley within the Green Belt. The existing wind farms would be visible from the Green Belt over distances ranging between 6 km and 12 km where they would be seen as part of the wider landscape. The addition of the Park Spring turbines to the Green Belt would be a notable addition to the cumulative baseline, and the magnitude of change would be **Medium**. Green Belt has a high sensitivity to wind energy development and the significance of cumulative landscape effects would be **Moderate** and would be **Significant**.

Landscape Character

6.14.10 The Park Spring site lies within the Nottinghamshire, Derbyshire and Yorkshire Coalfield national character area.

6.14.11 Hampole and Marr wind farms are sited in relatively close proximity to each other and both lie to the east of the proposed site and less than 1km west of the A1 (M). These and the Park Spring wind farm would be sited in elevated locations where the

enclosure pattern is less distinct. This location and arrangement would avoid locally distinctive landform variations, areas of fragmented woodlands and unspoilt farmland within this landscape character area which are more sensitive to wind energy development.

6.14.12 The Park Spring turbines would not be seen on the skyline with the Hampole and Marr turbines in views from within the local area. Therefore, it is concluded that no detrimental 'sky lining' effects would occur.

6.14.13 The magnitude of effect of the Park Spring wind turbines on the cumulative baseline of the receiving landscape would be low, i.e. its addition would lead to a minor alteration in the cumulative baseline of the receiving landscape. In a landscape that has a low sensitivity to wind energy development of this typology the significance of cumulative landscape effects would be **Slight** and would be **Not Significant**.

Cumulative Visual Impacts

Combined and Successive Effects within 20km

6.14.14 The potential cumulative visual effects of the operational and consented wind farms within the 20 km study area and the proposed Park Spring Wind Farm are illustrated on Figure 6.23 Zone of Theoretical Visibility for Existing and Consented Wind Farms.

6.14.15 Cumulative effects have been assessed in relation to the four existing and consented wind farms that lie within the 20km CZTV study area and have combined visibility with the Park Spring turbines. Figure 6.24 illustrates the proposed Park Spring Wind Farm and In Planning Wind Farms. This study also includes an assessment of potential cumulative impacts that would arise in conjunction with proposed turbines at Mount Pleasant Farm, Great Houghton.

6.14.16 A series of cumulative ZTVs are illustrated in the following figures which show various combinations of wind farms that are either in operation, under construction or approved in conjunction with the proposed development:

- Figure 6.25, Zone of Theoretical Visibility for Park Spring and Hampole.
- Figure 6.26, Zone of Theoretical Visibility for Park Spring and Marr.
- Figure 6.27, Zone of Theoretical Visibility for Park Spring and Asda Normanton.
- Figure 6.28, Zone of Theoretical Visibility for Park Spring and Penny Hill Lane.

6.14.17 Cumulative ZTVs are illustrated in the following figures to show potential combinations of the known wind farms that are awaiting determination in conjunction with the proposed development:

- Figure 6.29, Zone of Theoretical Visibility for Park Spring and Norton.
- Figure 6.30, Zone of Theoretical Visibility for Park Spring and Fieldhouses.
- Figure 6.31, Zone of Theoretical Visibility for Park Spring and Darrington Quarry.
- Figure 6.32, Zone of Theoretical Visibility for Park Spring and Infield Farm.
- Figure 6.33, Zone of Theoretical Visibility for Park Spring and Mount Pleasant.

6.14.18 Table 6.19 should be read in conjunction with Figures Nos. 6.25, 6.26, 6.28 and 6.31 to ascertain where combined and successive cumulative impacts with existing and proposed wind farms comprising 4 or more turbines would arise in relation to the 16 viewpoints assessed in the LVIA. It also identifies whether the change to the view arising from the addition of the Park Spring turbines would be significant. Refer to Table 6.12 for a description of changes to existing views arising from the addition of the Park Spring turbines at each viewpoint location.

ZTV Analysis

6.14.19 The 20km ZTV study (Figure 6.6 Zone of Theoretical Visibility and Viewpoint Locations) indicates that Park Spring would add new areas of visibility of wind turbines within a 20km radius of the development site, broadly in a band running northwest – southeast across the study area between Wakefield and Rotherham. Another band of visibility runs east – west between Doncaster and Upper Denby / Worsbrough. In both of these areas there is relatively low visibility of the existing and approved windfarms. All of the existing and consented wind farms with the exception of Infield Farm lie to the east of Park Spring; Infield Farm lies due west. Park Spring and the existing, consented and in planning proposals are separated by distances ranging between 9km and 20km. Therefore views would generally be limited to good weather conditions. However, there would be no cumulative visibility with either the Asda Normanton or Darrington Quarry windfarms.

Table 6.19: Summary of cumulative visual effects

View point No.	Location	Visual analysis	Park Spring Turbines Visible in Addition To Existing and Proposed Windfarms C = combined view; S = successive view								Likely Significant Effect
			Penny Hill	Marr	Hampole	Asda	Norton	Field-houses	Darrington Quarry	Infield Farm	
VP1	Park Spring Road - A6195	Two existing windfarms and one under construction are currently visible in views to the east from this viewpoint. The Fieldhouses windfarm is potentially visible in successive views to the southeast. They are visible at distances between 9 -20km where the turbines are only prominent in clear visibility and form part of the wider view of the landscape. The magnitude of effect arising from the addition of the Park Spring turbines would be Negligible. **No cumulative effects**	√S	√S	√S	-	-	√S	-	-	No
VP2	Park Lane, Great Houghton	Two existing windfarms and one under construction are currently visible in views to the east from this viewpoint. The Fieldhouses windfarm is potentially visible in successive views to the southeast. They are visible at distances between 9 -20km where the turbines are only prominent in clear visibility and form part of the wider view of the landscape. The magnitude of effect arising from the addition of the Park Spring turbines would be Negligible. **No cumulative effects**	√S	√S	√S	-	-	√S	-	-	No
VP3	Church St, Great Houghton	Two windfarms would potentially be visible in successive views to the east and southeast and one to the west at distances between 9 -20km. At these distances the turbines are only prominent in clear visibility and are viewed as part of the wider landscape. The magnitude of effect arising from the addition of the Park Spring turbines would be Negligible. **No cumulative effects**	-	√S	-	-	-	√C	-	√S	No
VP4	Chestnut St, Grimethorpe	There are potential views with Fieldhouses windfarm at a distance of 15km. At this distance the turbine would only be seen in clear visibility and would be a minor element in the landscape. the magnitude of effect arising from the addition of the Park Spring turbines would be Negligible. **No cumulative effects**	-	-	-	-	-	√C	-	-	No

View point No.	Location	Visual analysis	Park Spring Turbines Visible in Addition To Existing and Proposed Windfarms C = combined view; S = successive view								Likely Significant Effect
			Penny Hill	Marr	Hampole	Asda	Norton	Field-houses	Darrington Quarry	Infield Farm	
VP5	A635 / B6096, Darfield; Dearne Way	Cumulative effects on this viewpoint would arise from four windfarms in successive views to the east and south east at distances of 9-17km. At these distances the turbines are visible under good weather conditions and are viewed as part of the wider landscape. The magnitude of effect arising from the addition of the Park Spring turbines would be Low to Negligible. **No cumulative effects**	√S	√S	√S	-	-	√S	-	-	No
VP6	Cudworth Common,	Views of both existing windfarms are available from this viewpoint at distances of 11-17km during good weather conditions. Potential views are available with Fieldhouses and Infield Farm windfarms at distances of approximately 15km. At these distances the turbines are viewed as part of the wider landscape. The magnitude of cumulative effect arising from the addition of the Park Spring turbines would be Low to Negligible. **No cumulative effects**	√C	√C		-	-	√S	-	√S	No
VP7	High Street, Billingley	Existing and in planning windfarms would be visible from this viewpoint at distances of 8-17km. At these distances the turbines are visible under good weather conditions and are seen as part of the wider landscape. The magnitude of cumulative effects arising from the addition of the Park Spring turbines with Marr windfarm would be Medium to Low, and Low to Negligible with other windfarms. **No cumulative effects**	√S	√S	√S	-	√S	√S	-	-	No
VP8	B6411 Thurnscoe	Existing and in planning windfarms would be visible from this viewpoint at distances of 9-17km. At these distances the turbines are visible under good weather conditions and are viewed as part of the wider landscape. The magnitude of cumulative effects arising from the addition of the Park Spring turbines with Marr windfarm would be Medium to Low, and the other windfarms would generate a Low to Negligible effect. **No cumulative effects**	√S	√S	√S	-	-	√S	-	-	No

View point No.	Location	Visual analysis	Park Spring Turbines Visible in Addition To Existing and Proposed Windfarms C = combined view; S = successive view								Likely Significant Effect
			Penny Hill	Marr	Hampole	Asda	Norton	Field-houses	Darrington Quarry	Infield Farm	
VP9	A6196 road, Trans Pennine Way, Barnsley Boundary Walk, Brampton	Although the ZTVs indicate potential cumulative effects with the existing Penny Hill, Marr and Hampole windfarms, they are substantially screened by local vegetation and buildings. Fieldhouses may potentially be visible to the southwest and Norton to the north east. At these distances the turbines are visible only under good weather conditions and are seen as part of the wider landscape. Cumulative effects at this viewpoint arising from the addition of the Park Spring turbines would be of Low magnitude. **No cumulative effects**	√S	√S	√S	-	√S	√S	-	-	No
VP10	B6100, Barnsley	The existing Penny Hill, Marr and Hampole windfarms are visible at distances of 12-15km. However, in reality they will be almost entirely obscured by vegetation and buildings, and at this distance the turbines would be seen in clear visibility and would be viewed as part of the wider landscape. Cumulative effects at this viewpoint arising from the addition of the Park Spring turbines would be of Negligible magnitude. **No cumulative effects**	-	√S	√S	-	-	√S	-	-	No
VP11	Pools Lane, Royston	Infield Farm windfarm would be visible from this viewpoint at a distance of 13km. At this distance the turbine would be seen in clear visibility and would be viewed as part of the wider landscape. The magnitude of cumulative effect arising from the addition of the Park Spring turbines would be Low. **No cumulative effects**	-	-	-	-	-	-	-	√S	No
VP12	Harlington Road, Adwick Upon Dearne	The existing Marr and Hampole windfarms are visible at distances of 4 - 9km. At these distances the turbines are relatively prominent, particularly during clear visibility. Cumulative effects at this viewpoint arising from the addition of the Park Spring turbines would be of Low magnitude. **No cumulative effects**	-	√S	√S	-	-	-	-	-	No
VP13	A638 / B6474 North Elmsall	The existing Marr and Hampole windfarms are visible at distances of 4 - 8km. Norton windfarm mat potentially be visible to the north east at a	-	√S	√S	-	√S	-	-	-	No

View point No.	Location	Visual analysis	Park Spring Turbines Visible in Addition To Existing and Proposed Windfarms C = combined view; S = successive view								Likely Significant Effect
			Penny Hill	Marr	Hampole	Asda	Norton	Field-houses	Darrington Quarry	Infield Farm	
		distance of 5km. At these distances the turbines are relatively prominent, particularly during clear visibility. Cumulative effects at this viewpoint arising from the addition of the Park Spring turbines would be of Low magnitude. **No cumulative effects**									
VP14	Queen Anne's Obelisk, Wentworth Castle	Although the existing Penny Hill, Marr and Hampole windfarms are potentially visible at distances of 15-20km, in reality they will be almost entirely obscured by vegetation and buildings. Views would only be available under good weather conditions. At these distances the turbines are only seen in very clear visibility and form a minor element in the wider landscape. Cumulative effects arising from the addition of the Park Spring turbines at this viewpoint would be of Negligible magnitude. **No cumulative effects**	√S	√S	√S	-	-	-	-	-	No
VP15	B6376, New Edlington	The existing Marr and Hampole windfarms are visible at distances of 6 - 11km. Turbines at Marr are relatively prominent. At Hampole and Norton they are/would be prominent during clear visibility. Cumulative effects at this viewpoint arising from the addition of the Park Spring turbines would be of Low to Negligible magnitude. **No cumulative effects**	-	√C	√S	-	√S	-	-	-	No
VP16	Grenoside recreational ground	Although the existing Marr windfarm is visible at a distance of 15km, in reality it will be almost entirely obscured by vegetation and buildings. The Fieldhouses turbines would be visible at a distance of 12km; both windfarms would be minor elements in the landscape during clear visibility. Cumulative effects at this viewpoint arising from the addition of the Park Spring turbines would be of Negligible magnitude. **No cumulative effects**	-	√S	-	-	-	√S	-	-	No

6.14.20 Hampole and Marr both lie within 10 km radius and to the east of the proposed site at Park Spring. The Hampole and Marr ZTVs are very similar, being determined largely by the upland topography of the surrounding area. The cumulative ZTV for both sites illustrates that the proposed turbines at Park Spring would not extend the current visibility of the existing turbines at Hampole or Marr within much of the 20 km study area. Opportunities for viewing all three sites in the same field of view and from the same place would be very limited.

6.14.21 The proposed turbines and wind farm typology at Park Spring are similar to those at Hampole and Marr. From this distance the juxtaposition of both sites with Park Spring would not have a scale effect on nearby receptors.

6.14.22 Due to the distance between the wind farms assessed in Table 6.19 and the Park Spring turbines there would be no potential significant cumulative visual effects on residential receptors within 2 km of the proposed site.

6.14.23 The Norton turbines would be sited in an open, upland landscape approximately 13 km north east of the proposed site. The cumulative ZTV indicates widespread patchy visibility of both wind farms from areas of high ground to the east of the Dearne Valley. However, there would be limited cumulative effects in relation to visibility given the distance between the two developments.

6.14.24 The remainder of the operational, consented and in planning schemes are located over 15 km away and the combination would add only negligible cumulative effects.

6.14.25 Sequential cumulative visual impacts occur when two or more wind farms are not present in views from the same place and the observer is required to move to another viewpoint to see the second or more wind farms, so that they appear in sequence.

6.14.26 Proposals for a small, non-commercial wind turbine development approximately 2km due east of Park Springs at Mount Pleasant Farm, Great Houghton are currently the subject of a planning appeal. The proposed development comprises two turbines with twin blade rotors and an overall height of 35m. The turbines would be sited <0.5km from Mount Pleasant Farm where they would relate to the scale and cluster of farm buildings. Potential cumulative effects would arise from viewpoints VP1 to VP8 and would be limited to views of the tips of the Mount Pleasant turbines. Although they would be of a different design and noticeably smaller in scale compared to the Park Spring turbines, views would be substantially screened by intervening vegetation and landform. The magnitude of effect arising from the addition of the Park Spring turbines would be Medium and would be of Slight significance.

6.14.27 Generally, cumulative visibility within 10 km of the proposed development is likely to be sequential along the recreational and local road routes within the area of open upland farmed landscape to the east of the more visually constrained Dearne Valley.

6.14.28 There is a predicted sequential visibility from short sections of the Barnsley Boundary Walk in both directions where the route passes between Clayton and Thurnscoe within 3.5 to 5 km of the site boundary with Hampole and Marr to the east. Potential visibility along this route varies from sections with open views from upland areas to more enclosed areas with woodland and settlements further south in the vicinity of the River Dearne. People using recreational walking routes are considered to be of high sensitivity. The magnitude of change from the proposed turbines at Park Spring alongside the existing turbine would be **Low**. The cumulative visual effect of the proposed development on the Barnsley Boundary Walk would be **not significant**.

6.14.29 From an analysis of Figures 6.23 to 6.32 sequential views theoretically available from the roads assessed within the LVIA (refer to Table 6.15) would be limited.

6.14.30 The A6195 Dearne Valley Parkway runs broadly diagonally across the study area over a distance of approximately 18km between the A61/M1Junction 36 at Tankersley to the south east of Barnsley and the A628 road at Shafton. The route follows the eastern side of Barnsley and lies close to the River Dearne in the vicinity of the proposed development. The magnitude of change resulting from the proposed turbines at Park Spring alongside the operational / under construction turbines would be **Low**. The cumulative visual effect of the proposed development on the A6195 would be **not significant**.

6.14.31 The A635 road runs west to east through the study area over a distance of approximately 17 km, and lies within approximately 2.5 km at its nearest point to the site. The road passes through a visually complex landscape where potential views in both directions are limited by landform, woodland and built development between Goldthorpe in the east and the edge of Barnsley in the west. There are potential cumulative views with the Marr and Hampole wind farms for eastbound travellers between the eastern edge of Barnsley and Darfield. Road users along this route are considered to be of low sensitivity and the magnitude of change from the proposed turbines at Park Spring alongside the existing turbines would be **Low**. The cumulative visual effect of the proposed development on the A635 would be **not significant**.

6.14.32 The magnitude of change in views arising from the Park Spring turbines from the A1 road west of Doncaster and M18 motorway between Doncaster and Rotherham was assessed in the LVIA to be **Negligible**. Therefore the cumulative visual effect of the proposed development on the A1 and M18 roads would be **not significant**.

6.14.33 These effects are not considered adverse because the proposed development at Park Spring is not introducing a new landscape element.

6.14.34 In terms of the Park Spring proposal, 15 of the selected viewpoints have potential for theoretical visibility of more than one existing or proposed Wind Farm and Park Spring in successive views.

6.14.35 It is concluded that cumulative sequential visual effects arising from the addition of the Park Spring turbines to other existing and consented wind farms within the 20 km study area would be Not Significant.

6.15 Conclusion

6.15.1 The proposed Park Spring Wind Farm has been designed to provide a simple, clearly structured, balanced composition that relates to the scale of the landform, as well as the grain of the site contours. The scale and number of turbines proposed are considered appropriate to this landscape. They have been sited to avoid the locally prominent hill to the south, which is the most visually sensitive area of the site. Elements of the turbine design, including a recessive matt pale grey colour and low turbine rotation speed, would help mitigate visual effects. Ancillary facilities would be sited to take advantage of screening by existing landform and/or trees and hedgerows, with additional screen planting where necessary. Through consideration of these factors the proposed development has been designed to protect the character and visual amenity of the surrounding landscape.

6.15.2 The assessment has concluded that significant direct effects on the landscape fabric of the site during construction and operation would be limited in extent, would be fully

reversible when the turbines and ancillary structures were decommissioned, and would be acceptable in landscape terms.

6.15.3 The landscape is classified as being of low quality with low sensitivity to wind energy development. The proposed development conforms to the appropriate small scale wind energy development that could be accommodated within the Nottinghamshire, Derbyshire and Yorkshire Coalfield national character area, as described in Planning for Renewable Energy Targets in Yorkshire and Humber.

6.15.4 The potential for significant effects on landscape character within the 20 km study area would be substantially limited by the undulating topography, extensive areas of woodland and built development.

6.15.5 There would be no significant effects on properties listed on the English Heritage Register of Parks and Gardens of Special Historic Interest within the 20km study area.

6.15.6 The proposed Park Spring Wind Farm would not affect important views from the Peak District National Park. None of the key or distinctive characteristics of the National Park's 'natural beauty, wildlife or cultural heritage' would be lost or changed because of its construction.

6.15.7 Significant visual effects would be limited to views from settlements up to 2.5 km radius of the proposed development. These comprise localised parts of Great Houghton, Little Houghton, Grimethorpe and Edderthorpe where residents would experience clear visibility of the proposed turbines within principal views. It is important to note that in many cases visibility from settlement would either be from an oblique angle or would be restricted by tree and hedgerow vegetation and intervening buildings, thereby limiting the potential for significant effects.

6.15.8 The residential visual amenity assessment did not identify any properties where it was considered likely that the visual effect of the scheme could render occupation unacceptable by converting the property into one which would come to be widely regarded as an 'unattractive and thus unsatisfactory (but not necessarily uninhabitable) place to live.'

6.15.9 Significant effects on users of recreational walking routes would be limited to parts of the Barnsley Boundary Walk and Dearne Way within a radius of 4 km from the proposed development.

6.15.10 It should be noted that all on-shore wind farm developments lead to significant landscape and visual effects, and that significant effects are not necessarily unacceptable. The changes arising from the proposed development may engender positive or negative responses depending on individual perceptions regarding wind energy development.

6.15.11 The significant effects identified in this assessment are long term and reversible. If the decision is taken to decommission the Park Spring Wind Farm at the end of its 25 year operational life, the turbines would be dismantled and removed, and the site fully restored.

6.15.12 Development of the nature and scale proposed would retain the openness of the Green Belt and allow visual permeability between the Green Belt and surrounding areas.

6.15.13 The proposed development would be sited in an area of Green Belt which comprises an intimate mix of natural and modified landscapes including extensive areas of restored colliery workings, the River Dearne and associated riverine habitats, agricultural land, and the A6195 Dearne Valley Parkway. The turbines would allow the wider application site to remain in agricultural use. The proposed development would result in the loss of 0.98 ha from Green Belt, which would be a long term (25 years) and reversible. Overall, it is considered that the visual effects of the proposed turbines would not conflict with the objective of Core Strategy Policy CSP 34 or the National Planning Policy Framework to protect the Green Belt.

6.15.14 No significant cumulative landscape and visual effects are likely to arise from the proposed Park Spring wind turbines in addition to other existing and proposed wind farms in designated landscapes. No detrimental 'sky lining' effects would occur with other existing or proposed wind farms within 10 km of the site. Potential cumulative visual effects would arise within localised areas of Green Belt from the addition of the Park Spring turbines with existing wind farms at Hampole and Marr (>6 km distance). The magnitude of change would be Medium and Significant. Successive cumulative visual effects would be most notable in conjunction with wind farms at Hampole (under construction) and Marr (operational), where views would be over long distances and would be Not Significant.

6.15.15 The three turbines of the Park Spring Wind Farm proposal would be appropriate to local landscape character and correspond with the scale and composition of the landscape. Significant landscape and visual effects would be localised because of the limited size and scale of the proposed development. The site is located within an area identified as having the capacity to accommodate small turbine groups similar to the number and scale of the cluster proposed. The conclusion is therefore that in landscape and visual terms the proposal should be considered acceptable in this location.

SECTION 7

ARCHAEOLOGY AND CULTURAL HERITAGE

7 ARCHAEOLOGY AND CULTURAL HERITAGE

7.1 Introduction

7.1.1 This chapter of the Environmental Statement (ES) provides an assessment of the existing archaeological and cultural heritage assets of the proposed Park Spring Wind Farm and surrounding area. It considers the potential impact that the proposed development may have on these resources. The area of land subject to the proposals is hereinafter referred to in this document as the 'Scheme Area' (Appendix 7.1, Figure 1).

7.1.2 The objectives of this assessment are to:

- Describe the survival and extent of any known or potential archaeological features and cultural heritage assets which may be disturbed by the proposed development.
- Provide an assessment of the importance of these assets.
- Assess the likely scale of any impacts on the archaeological and cultural heritage resource posed by the proposed development.
- Outline suitable mitigation measures to avoid, reduce or remedy likely significant adverse effects.
- Provide an assessment of any residual effects remaining after mitigation.

7.1.3 This chapter of the ES has been completed with detailed reference to an archaeological Desk-based Assessment undertaken for the Park Spring project by Parsons Brinckerhoff in March 2013 (Appendix 7.1, Desk-based Assessment).

7.1.4 A site inspection of the Scheme Area and its Study Area in order to visit key assets was also undertaken as part of the assessment which noted site topography, earthworks, services, boundaries, buildings and any remains of archaeological or cultural heritage significance not already recorded by other sources.

7.2 Legislation

7.2.1 Heritage assets, including historic buildings, possessing statutory designations are protected under a legal framework, depending on their category. There are a number of statutory designations used for sites of architectural or historic significance in the UK, which are made depending upon the importance of the site in a local, regional, national or international context. These are detailed below for those relevant to sites in England:

- World Heritage Sites (WHS): These are international designations under the UNESCO Convention for the Protection of the World Cultural and Natural Heritage. There are no WHSs within the Scheme Area.
- Scheduled Monuments (SM): The Secretary of State can schedule any building, structure or other work below or above ground which appears to be of national importance due to its historic, architectural, traditional, artistic or archaeological interest, under the Ancient Monuments and Archaeological Areas Act 1979. There are four Scheduled Monuments within 5km of the site.

- Areas of Archaeological Importance (AAIs): areas such as historic town centres can be designated as AAIs. This is done under the Areas of Archaeological Importance, Part II of the Ancient Monuments and Archaeological Areas Act 1979. The responsible body is the Local Planning Authority (LPA). This does not apply to the Scheme Area.
- Listed Buildings: Under Section I of the Planning (Listed Buildings & Conservation Areas) Act 1990 the Secretary of State for National Heritage is required to compile lists of special architectural or historic interest on advice from English Heritage. Listed Buildings are classified in grades according to their importance and are afforded protection as a means of planning control. Such buildings cannot be demolished, altered or extended in a way that would affect its architectural or historic character unless Listed Building Consent has been obtained from the LPA. Similarly, unlisted buildings in Conservation Areas are also protected from demolition without consent. The LPA would consult EH prior to granting permission for Listed Building Consent or Conservation Area Consent. There are 54 listed buildings within five kilometres of the study area.
- Grade I listed buildings are those which are considered to be of exceptional national architectural or historic importance. Grade II* listed buildings are of particular national importance and special interest. Both Grade I and II* listed buildings are of great importance to the nation's built heritage and their importance will generally be beyond dispute. There is one Grade I listed building within 5km of the Scheme Area and two Grade II*.
- Grade II listed buildings are usually designated for their architectural and historic interest. They are usually of a more local or regional significance and make up around 95 per cent of all listed buildings. There are 51 such buildings within 5km of the Scheme Area.
- When considering whether to grant planning permission for development which affects a Listed Building or its setting, Section 66 of the Planning (Listed Buildings and Conservation Areas) Act 1990 (the "1990 Act") places a statutory duty on a local planning authority (LPA) or, as the case may be, the Secretary of State to "*have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses*".
- With respect to any buildings or other land in a conservation area, Section 72 of the 1990 Act places a general duty on planning authorities to pay "*special attention … to the desirability of preserving or enhancing the character or appearance of that area*".
- Building Preservation Notices. Should a non-listed building be in an area of special architectural or historic interest and in danger of demolition or alteration in a way that would affect its character, the LPA can serve a Building Preservation Notice. This can be effective immediately and remain for 6 months with the effect being as if the building had been listed. This allows the Secretary of State the time required to list the building or post notification that it intends to do so. There are no notices known within the study area.
- Parks and Gardens of Special Historic Interest. EH compiles a non-statutory Register of Parks & Gardens of Special Historic Interest to highlight the existence of such areas to highway and planning authorities, and developers, in order that they can be considered for safeguarding during the planning for developments. The grading system used for Listed Buildings applies to parks and gardens. There are six sites of interest within 10km of the Scheme Area, although none within 2km.

- Historic Battlefield Sites. The EH published a non-statutory Register of Historic Battlefields in 1995, in which 43 sites were listed. The sites are not graded, as with parks and gardens, but only those sites that are both important and sufficiently documented to be located on the ground are recorded. In a similar way to the parks and gardens register, the Register of Historic Battlefields is a planning document to highlight sites during the planning process. There are no historic battlefield sites within 1 km of the study area.
- Conservation Areas. The LPA may designate a section of land or buildings with special architectural or historic interest as a Conservation Area. This is designed to enhance or preserve the character or appearance under Section 72 (I) of the Planning (Listed Buildings & Conservation Areas) Act 1990. The proposed scheme lies within 4km of three Conservation Areas.
- Areas of Archaeological Potential: the LPA may designate a section of land as an Area of Archaeological Potential (AAP). There are no AAPs within the scheme area.

7.3 Planning and Guidance

National Planning Policy

7.3.2 National Planning Policy Framework (DCLG 2012): this states that in considering any planning application for development, local planning authorities are bound by the policy framework set by government guidance. This guidance provides a material consideration that must be taken into account in development management decisions, where relevant. In accordance with central and local government policy, this assessment has been prepared in order to clarify the study site's archaeological potential and to assess the need for any further measures to mitigate the impact of the proposed development. The NPPF sets out planning policies on the conservation of the historic environment:

7.3.3 Policy 126: Sites of archaeological or cultural heritage significance that are valued components of the historic environment and merit consideration in planning decisions are grouped as *'heritage assets' 'heritage assets are an irreplaceable resource', the conservation of which can bring 'wider social, cultural, economic and environmental benefits...'*

7.3.4 Policy 128: The policy framework states that the *'significance of any heritage assets affected including any contribution made by their setting' should be understood in order to assess the potential impact. In addition to standing remains, heritage assets of archaeological interest can comprise sub-surface remains and, therefore, assessments should be undertaken for a site that 'includes or has the potential to include heritage assets with archaeological interest'.*

7.3.5 Policy 129: It is normally accepted that non-designated sites will be preserved by record, in accordance with their significance and the magnitude of the harm to or loss of the site as a result of the proposals, to *'avoid or minimise conflict between the heritage asset's conservation and any aspect of the proposals'.*

7.3.6 Policy 132: NPPF draws a distinction between designated heritage assets and other remains considered to be of lesser significance; *'great weight should be given to the asset's conservation. The more important the asset, the greater the weight should be. Significance can be harmed or lost through alteration or destruction of the heritage asset or development within its setting. Substantial harm to or loss of a Grade II listed building, park or garden should be exceptional. Substantial harm to or loss of*

designated heritage assets of the highest significance, including scheduled monuments, protected wreck sites, battlefields, Grade I and II listed buildings and Grade I and II* registered parks and gardens and World Heritage Sites, should be wholly exceptional'.* Therefore, preservation in-situ is the preferred course in relation to such sites unless exceptional circumstances exist.

7.3.7 Policy 135: Non-designated heritage assets of archaeological interest will also be subject to the policies reserved for designated heritage assets. A balanced judgement will be required having regard to the scale of any harm or loss and the significance of the asset.

Local Planning Policy

7.3.8 The relevant local planning policy can be found in the Core Strategy element of Barnsley's statutory Redevelopment Plan adopted September 2011. The policy requires "*...developers to embrace good design and protect and enhance the historic environment..." (Section 9, 7:120).* The policy suggests "*...'at risk' buildings, sites, monuments or Conservation Areas receive particular attention to ensure they have an identified path to safeguard their long term future..."* and when implementing policy solutions *"...protecting important landscapes both directly and indirectly by ensuring their settings and key views are respected and not subject to inappropriate development..."* .

English Heritage Guidance

7.3.9 English Heritage has published guidance on the potential impacts of Wind Farm developments on remains that have archaeological and cultural heritage significance in their guidance document Wind Energy and the Historic Environment. This document recommends that the construction of wind turbine foundations, access roads, and control buildings all have the potential to impact significantly on buried archaeological remains. It also states that indirect impacts from Wind Farm developments on cultural heritage may result from detrimentally effecting a historic landscape or historic setting of a Scheduled Monuments or important Listed Building. Both of these impacts, direct and indirect, have been assessed.

7.3.10 English Heritage has also published guidance on the assessment of The Setting of Heritage Assets (2011). This states that the significance of a heritage asset derives not only from its physical presence and historic fabric but also from its setting - the surroundings within which it is experienced.

7.4 Approach and Methodology

Approach

7.4.2 The archaeological assessment focuses on the site of the proposed development, although information for the immediate environs were considered in order to provide an essential contextual background. Consideration was also taken of the visual impact of the proposed development on the heritage assets, especially those with statutory designated statuses. The assessment was carried out in accordance with the relevant Institute for Archaeology (IfA) and English Heritage guidelines (IfA 2011, Standard and Guidance for Archaeological Desk-based Assessments; IfA 2010 Code of Conduct; English Heritage 2006, Management of Research Projects in the Historic Environment (MoRPHE)). The assessment provided the baseline conditions for this ES statement.

7.4.3 The subject receptors of this report – Cultural Heritage Assets are defined as the historic environment encompassing archaeology and scheduled monuments, listed buildings, conservation areas and historic parks, gardens and landscapes.

Methodology

7.4.4 The results of the impact assessment (both direct and indirect) have identified the significance of the archaeological resource of the Scheme Area. Although the assessment utilised criteria as set out in the Design Manual for Roads and Bridges (Highways Agency 2007), it should be stressed that enhancements were made to the criteria more appropriate to archaeology and cultural heritage. Furthermore, professional judgement was applied throughout the assessment process.

7.4.5 In order to assess the potential impact of the proposed development, consideration has been afforded to:

- assessing in detail any impact and the significance of the effects arising from any future development of the Scheme Area.
- reviewing the evidence for past impacts that may have affected the archaeological sites of interest identified during the desk-based assessment.
- outlining suitable mitigation measures, where possible at this stage, to avoid, reduce, or remedy adverse impacts.

7.4.6 Each potential impact has been determined as the predicted deviation from the baseline conditions.

Study Areas

7.4.7 The cultural heritage assessment study considered two concentric areas:

- The Inner Study Area: This extends 1.5 km from the centre of the application area as agreed with the South Yorkshire HER. Within it all nationally important designated assets (scheduled monuments, listed buildings, registered parks and gardens, registered battlefields), conservation areas and undesignated assets identified by consultees as being at risk of significant impacts upon setting were considered in relation to potential operational impacts upon setting.
- The Outer Study Area: This extends 5 km from the centre of the application area. Within it designated assets have been considered for operational impacts upon setting where the assessor considers there to be potential for a significant impact or where an asset has been raised specifically by consultees.

Evaluating the Archaeology and Cultural Heritage Resource

7.4.8 This chapter of the ES assesses the value or sensitivity of each heritage asset in relation to typical descriptors as shown in Table 7.1 (below). These descriptors reflect the statutory designated and non-statutory designated nature of the assets. It should be noted that not all the qualities listed need be present in every case and professional judgement is used in balancing the different criteria.

Table 7.1: Criteria for establishing relative cultural value (sensitivity of the receptor)

Cultural value/Sensitivity	Criteria	Mitigation (direct impacts only)
Very high (international)	World Heritage Sites; Sites of International Importance.	To be avoided
High (National)	Scheduled Monuments; All Listed Buildings; Registered Parks and Gardens.	To be avoided
Medium (Regional/County)	Conservation Areas containing buildings that contributes significantly to its historic character; Areas of Archaeological Importance; Locally listed buildings.	Avoidance recommended
Low (Local/Borough)	Archaeological sites and remains with a local or borough interest for education, cultural appreciation, locally listed buildings; Assets which contribute to local or cultural understanding of the area.	Avoidance recommended
Negligible (Neighbourhood/ Negligible)	Relatively numerous types of remains, of some local importance; Isolated findspots with no context; Areas in which investigative techniques have revealed no, or minimal, evidence of archaeological remains, or where previous large-scale disturbance or removal of deposits can be demonstrated.	Avoidance not envisaged
Uncertain /Potential	Potential archaeological sites for which there is little information. It may not be possible to determine the importance of the site based on current knowledge. Such sites are likely isolated findspots, place names or cropmarks identified on aerial photographs.	Avoidance unnecessary

7.4.9 It is also important to describe how the types of factors that help to define the sensitivity of the setting of a heritage asset. This is detailed in Table 7.2, below.

Table 7.2: Definitions of sensitivity for setting of heritage assets

Sensitivity	Contribution to significance	Examples for settings
Very high	Very substantial	A defined setting that is contemporary with and historically and functionally linked with the heritage asset, may contain other heritage assets of international or national importance, has a very high degree of intervisibility with the asset and makes a very substantial contribution to both the significance of the heritage asset and to the understanding and appreciation of the significance of the asset.
High	Substantial	Contemporary with and historically and functionally linked with the heritage asset, with minor alterations (in extent and/or character), has a high degree of intervisibility with the asset and which makes a substantial contribution to both the significance of the heritage asset and to the understanding and appreciation of the significance of the asset.
Medium	Moderate	Contemporary with and/or historically and/or functionally linked with the heritage asset but with alterations which may detract from the understanding of the heritage asset, and/or with a moderate degree of intervisibility with the asset and/or which makes a moderate contribution to the significance of the heritage asset and/or a moderate contribution to the understanding and appreciation of the significance of the asset.
Low	Minor	Largely altered so that there is very little evidence of contemporaneous and/or historic and/or functional links with the heritage asset, and/or with a low degree of intervisibility with the asset and/or which makes a minor contribution to both the significance of the heritage asset and to the understanding and appreciation of the significance of the asset.

Magnitude of Effects

7.4.10 The magnitude of effects for both direct and indirect effects, and for individual, additional and combined cumulative effects, is determined by considering the predicted effects that would be brought about by the proposed development on the significance of each heritage asset (that is, on its archaeological, architectural, artistic and/or historic interest and/or its setting, taking into account the contribution that its setting makes to the significance of the asset (indirect effects only)) and on the ability to understand and appreciate the significance of each asset.

7.4.11 For direct (physical) effects, the principal factors that are taken into account are the significance of the heritage asset itself and what proportion of the asset would be directly affected. If only partially rather than totally affected then the significance of that part of the asset affected, and its contribution to the overall understanding and appreciation of the archaeological, architectural, artistic or historic interest of the asset, needs to be established.

7.4.12 For indirect (visual) effects on the significance of each heritage asset, a number of aspects and specific factors have been taken into account, as set out in Table 7.3 below. These are largely derived from published guidance (specifically English Heritage 2005 and 2011b) and professional experience. Their relevance to the assessment and the potential to mitigate (avoid, reduce, remedy or compensate) for the effects of wind energy developments and the potential to mitigate (avoid, reduce, remedy or compensate) for these effects is also noted in Table 7.3 below.

Table 7.3: Factors relevant to the magnitude of indirect (visual effects)

Aspects	Factors	Relevance to wind energy developments
Location and siting of development	Proximity to asset Extent Position in relation to landform Degree to which location will physically or visually isolate asset Position in relation to key views	Where a heritage asset is one of the most visually dominant features within the surrounding landscape the adjacent construction of wind turbines may affect its dominance within its setting. Potential effects may occur if wind turbines were to intervene into or obscure views, or sever links between associated heritage assets that were intended to be seen from each other. A number of heritage assets, but designed landscapes in particular, involve key vistas, prospects, panoramas and sight-lines, or use topography to add to drama. Wind turbines may affect such key views, which may extend beyond any designated area or its setting. The consequences of these factors can be partially mitigated (avoided or reduced) by the choice of location and careful siting of a wind energy development in relation to the local topography and the heritage assets in the surrounding area.
Form and appearance of development	Dominance, prominence, or conspicuousness Competition with or distraction from the asset Dimensions, scale and massing Proportions	The extent, number, density, proximity and disposition of the wind turbines would influence the potential effect upon the setting of a heritage asset. The consequences of these factors can be partially mitigated (avoided or reduced) by the location and scale of the development in relation to the local topography and the heritage assets in the surrounding area.

Aspects	Factors	Relevance to wind energy developments
	Visual permeability Materials (texture, colour, reflectiveness, etc) Architectural style or design Introduction of movement or activity Diurnal or seasonal change	Movement, noise and shadow flicker effects may affect the settings of heritage assets if wind turbines are located in close proximity. All these factors are generally the same with all wind energy developments. Wind farms are permeable due to the distance between turbines to reduce array losses; they are standardised in terms of design and the use of materials; they usually have a mid or light grey, minimal reflective surface finish; they do introduce movement as a result of the movement of the rotor and their visibility varies with the light levels and weather conditions.
Other effects of the development	Change to built surroundings and space Change to skyline Change to general character (e.g. suburbanising or industrialising)	The degree to which the setting of a specific historic asset has changed since first constructed would influence any potential effects, Largely unaltered settings may, therefore, be more sensitive to wind turbines. Wind turbines do result in changes to the skyline and general character of an area.
	Changes to public access, use or amenity Changes to land use, land cover and tree cover Changes to communications/ accessibility/ permeability	The amenity value of a heritage asset, and the degree of its accessibility to the general public both physically and through interpretative information, may be a factor relevant to the magnitude of any impact upon its setting. Wind turbines do not normally result in changes to public access, use or amenity, land use, land cover or tree cover.
Permanence of the development	Anticipated lifetime/ temporariness Recurrence Reversibility	The effects of wind energy developments are generally time limited and reversible.
Longer term or consequential effects of the development	Changes to ownership arrangements Economic and social viability Communal use and social viability	Wind energy developments are unlikely to result in any longer term changes to ownerships, economic and social viability or communal use and social viability of a heritage asset.

7.4.13 With regards to the indirect (visual) effects of the proposed development, this stage of the assessment is informed by computer-generated zones of theoretical visibility (ZTVs) and wireframe views of the proposed wind turbines (together with the operational, under construction, consented and/or other proposed wind turbines in each scenario) in views of and from these heritage assets, together with fieldwork observations and professional judgement.

7.4.14 For both direct and indirect effects, a quantifiable assessment of magnitude has been undertaken where possible. In cases where only qualitative assessment is possible, magnitude has been defined as fully as possible. In all cases, the various levels of predicted adverse magnitudes of effects have been defined in accordance with the scales of change provided in Tables 7.4 and 7.5 below.

Table 7.4: Magnitude of direct (physical effects)

Magnitude	Scale of change – direct (physical)
Extreme	Complete destruction of the archaeological, architectural, artistic and/or historic interest of the heritage asset
Very substantial adverse	Almost complete destruction of the archaeological, architectural, artistic and/or historic interest of the heritage asset.
Substantial adverse	Considerable destruction of or damage to the archaeological, architectural, artistic and/or historic interest of the heritage asset.
Moderate adverse	Partial destruction of or damage to the archaeological, architectural, artistic and/or historic interest of the heritage asset.
Slight adverse	Limited destruction of or damage to the archaeological, architectural, artistic and/or historic interest of the heritage asset.
Negligible adverse	Very limited destruction of or damage to the archaeological, architectural, artistic and/or historic interest of the heritage asset.
No change	No material change to the archaeological, architectural, artistic and/or historic interest of the heritage asset.

Table 7.5: Magnitude of indirect (visual effects)

Magnitude	Scale of change – indirect (visual) effects
Extreme	Total loss of contribution of setting to the significance of the heritage asset.
Very substantial adverse	A change to its archaeological, architectural, artistic and/or historic interest and/or its setting which would very substantially change its significance and/or the contribution of its setting to its significance and/or the understanding and appreciation of the significance of the asset.
Substantial adverse	A change to its archaeological, architectural, artistic and/or historic interest and/or its setting which would substantially change its significance and/or the contribution of its setting to its significance and/or the understanding and appreciation of the significance of the asset.
Moderate adverse	A change to its archaeological, architectural, artistic and/or historic interest and/or its setting which would moderately change the significance and/or the contribution of its setting to its significance and/or the understanding and appreciation of the significance of the asset.
Slight adverse	A change to its archaeological, architectural, artistic and/or historic interest and/or its setting which would slightly change the significance and/or the contribution of its setting to its significance and/or the understanding and appreciation of the significance of the asset.
Negligible adverse	A change to its archaeological, architectural, artistic and/or historic interest and/or its setting which would have a negligible effect on the significance and/or the contribution of its setting to its significance and/or the understanding and appreciation of the significance of the asset.

Magnitude	Scale of change – indirect (visual) effects
No change	No change in its archaeological, architectural, artistic and/or historic interest or its setting and so no change to its significance, the contribution of its setting to its significance or the understanding and appreciation of the significance of the asset.

Importance of the Setting of a Heritage Asset

7.4.15 The definition of setting used here is taken from the PPS Practice Guide as produced by English Heritage (2010): setting is the surroundings in which an asset is experienced. All heritage assets have a setting, irrespective of the form in which they survive and whether they are designated or not. Furthermore, the English Heritage document Conservation Principles, Policies and Guidance (2008) states that setting also relates to the assets local context, embracing present and past relationships to the adjacent landscape. More recently (2011) English Heritage considers that the significance of a heritage asset derives not only from its physical presence and historic fabric but also from its setting - the surroundings within which it is experienced.

7.4.16 English Heritage have more recently produced a document, The Setting of Heritage Assets (2012), which recommends a broad approach to the assessment of effects on the settings of heritage assets, undertaken as a series of steps:

- Step 1: Identify the heritage assets and their settings that are (potentially) affected.
- Step 2: Assess whether, how and to what degree these settings make a contribution to the significance of the heritage asset(s).
- Step 3: Assess the effects of the proposed development on the significance of the asset(s).
- Step 4: Maximise enhancement and avoid or minimise harm.
- Step 5: Make and document the decision and monitor outcomes.

7.4.17 Full details of the Landscape and Visual Impact Assessment are presented in Chapter 6 of the ES. A ZTV within a 5km radius of the proposed site was established for the purposes of assessing the visual impact on the setting of the heritage assets. However, the ZTV only takes ground level and topography into account and, therefore, existing screening from features, such as bands of trees or the built environment is not considered; as such, the ZTV presents a worst-case scenario. An assessment of impact upon the Scheduled Monuments, Registered Parks and Gardens, Grade I and Grade II* listed buildings and Conservation Areas is also presented in Chapter 6.

7.4.18 English Heritage (2005) has provided a list of factors to be considered when assessing impacts upon setting from wind farms in particular. These are broad factors and have been taken into consideration when assessing magnitude of impact and sensitivity and are summarised in Table 7.6.

Table 7.6: Factors to be considered when assessing impacts upon setting from wind farms

Factor	Discussion
Visual dominance	Wind turbines are far greater in vertical scale than most historic features. Where an historic feature (such as a hilltop monument or fortification, a church spire, or a plantation belonging to a designed landscape) is the most visually dominant feature in the surrounding landscape, adjacent construction of turbines may be inappropriate.
Scale	The extent of a wind farm and the number, density and disposition of its turbines will also contribute to its visual impact.
Intervisibility	Certain archaeological or historic landscape features were intended to be seen from other historic sites. Construction of wind turbines should respect this intervisibility.
Vistas and sight-lines	Designed landscapes invariably involve key vistas, prospects, panoramas and sight-lines, or the use of topography to add drama. Location of turbines within key views, which may often extend beyond any designated area, should be avoided.
Movement, sound or light impacts	The movement associated with wind turbines as well as their scale may be a significant issue in certain historic settings. Adequate distance should always be provided between important historic sites and wind turbine developments to avoid the site being overshadowed or affected by noise and shadow flicker effects.
Unaltered settings	The setting of some historic sites may be little changed from the period when the site was first constructed, used or abandoned. Largely unaltered settings for certain types of sites, particularly more ancient sites, may be rare survivals and especially vulnerable to modern intrusions such as wind turbines. This may be a particular issue in certain upland areas.

7.4.19 Additional criteria for assessing the sensitivity of an asset to visual impact and the magnitude of the impact are presented below (Table 7.7). The sensitivity of a cultural heritage asset to changes in its setting can be evaluated in the first instance by reference to any relevant designation, whereby those designated as nationally important will generally be considered the most sensitive.

Table 7.7: Criteria for assessment of magnitude of an impact on the setting of a cultural heritage asset

Magnitude	Guideline Criteria
Major beneficial	The contribution of setting to the cultural heritage asset's significance is considerably enhanced as a result of the development; a lost relationship between the asset and its setting is restored, or the legibility of the relationship is greatly enhanced. Elements of the surroundings that detract from the asset's cultural heritage significance or the appreciation of that significance are removed.

Magnitude	Guideline Criteria
Moderate beneficial	The contribution of setting to the cultural heritage asset's significance is enhanced to a clearly appreciable extent as a result of the development; as a result the relationship between the asset and its setting is rendered more readily apparent. The negative effect of elements of the surroundings that detract from the asset's cultural heritage significance or the appreciation of that significance is appreciably reduced.
Minor beneficial	The setting of the cultural heritage asset is slightly improved as a result of the development, slightly improving the degree to which the setting's relationship with the asset can be appreciated.
Negligible	The setting of the cultural heritage asset is changed by the development in ways that do not alter the contribution of setting to the asset's significance.
Minor adverse	The contribution of the setting of the cultural heritage asset to its significance is slightly degraded as a result of the development, but without adversely affecting the interpretability of the asset and its setting; characteristics of historic value can still be appreciated, the changes do not strongly conflict with the character of the site, and could be easily reversed to approximate the pre-development conditions.
Moderate adverse	The contribution of the setting of the cultural heritage asset to its significance is reduced appreciably as a result of the development. Relevant setting characteristics can still be appreciated but less readily.
Major adverse	The contribution of the setting of the cultural heritage asset to its significance is effectively lost or substantially reduced as a result of the development, the relationship between the asset and its setting is no longer readily appreciable.

7.4.20 Changes may occur in the surroundings of an asset that neither effect their contribution to the significance of the asset, nor the extent to which its significance can be experienced. In such instances it will be considered that there is no impact upon setting.

Assessment of Harm

7.4.21 The Framework refers to "substantial harm" and "less than substantial harm" and planning policies often refer to effects on heritage assets in terms of "harm". Whilst not required under the EIA Regulations 2011, it can be helpful to consider the predicted significant effects of the proposed development on the significance of the heritage assets in terms of the degree of harm that would occur in order to place appropriate weight on these predicted effects within the planning balance.

7.4.22 The scale of harm for direct (physical) and/or indirect (visual) effects are defined as shown in Table 7.8 below.

Table 7.8: Scale of harm arising from levels of direct and/or indirect effects

Levels of direct (physical) and indirect (visual) effects	Degrees of harm (as referred to in the Framework)
Very severe adverse	Total loss or total loss of significance

Levels of direct (physical) and indirect (visual) effects	Degrees of harm (as referred to in the Framework)
Severe adverse Severe/ major adverse Major adverse	Substantial harm
Major/ moderate adverse Moderate adverse Moderate/ minor adverse Minor adverse	Less than substantial harm
No change	No harm

Significance of effects

7.4.23 Assessing the significance of the effects of the proposed scheme brings together the value and sensitivity of the resource and the magnitude of the impact for each cultural heritage asset, using the matrix illustrated in Table 7.9 below. The parameters of the matrix have a degree of flexibility, and so professional judgement is applied as appropriate.

Table 7.9: Significance of effects matrix

VALUE/SENSITIVITY						
	Very high	**Neutral**	**Slight**	**Moderate/ large**	**Large/very large**	**Very large**
	High	**Neutral**	**Slight**	**Moderate/ slight**	**Moderate/large**	**Large/very large**
	Medium	**Neutral**	**Neutral/slight**	**Slight**	**Moderate**	**Moderate/large**
	Low	**Neutral**	**Neutral/slight**	**Neutral/slight**	**Slight**	**Slight/ moderate**
	Negligible	**Neutral**	**Neutral/slight**	**Neutral/slight**	**Neutral/slight**	**Slight**
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
		MAGNITUDE OF IMPACT				

7.4.24 The receptors and impacts have been assessed against each other to provide the likely significant effects. Each of these will be considered in relation to the following:

- Adverse or beneficial impact;
- Magnitude (size of impact);
- Sensitivity of the surrounding environment and receptors;
- Spatial extent (size of the area affected);
- Duration (short, medium or long term);
- Nature of the effect (direct or indirect, reversible or irreversible);
- Inter-relationships and cumulative effects;

- International, national or local standards; and
- Relevant policy guidance.

7.5 Baseline Conditions

Historical and Archaeological Potential of the Site

7.5.1 A detailed historical and archaeological background and historical context for the site is presented in the Desk-based Assessment (Appendix 7.1, Volume 2). What follows is an outline summary of the known cultural heritage resource and potential archaeological assets.

Table 7.10: Summary of the British archaeological periods and date ranges.

Period	Date Range
Prehistoric Period: Palaeolithic Mesolithic Neolithic Bronze Age Iron Age	 30,000 – 10,000 BC 10,000 – 3,500 BC 3,500 – 2,200 BC 2,200 – 700 BC 700 BC – AD 43
Romano-British	AD 43 – AD 410
Early Medieval	AD 410 – AD 1066
Late Medieval	AD 1066 – AD 1540
Post-medieval	AD 1540 – c1750
Industrial Period	cAD1750 – 1901
Modern	Post-1901

7.5.2 Nineteen heritage assets were identified during the desk-based assessment as being within the 1.5 km inner study area. Of these two have statutory designation (two elements of a Grade II* listed building) and 17 are non-designated. Both of the designated sites lie outside of the Scheme Area but within the 1.5k m inner study area. Two of the non-designated assets lie within the Scheme Area, and the remainder within 1.5 km of it. The non-designated assets are presented by period below and are followed by a summary of the designated assets.

7.5.3 Prehistoric Period (30,000BC - AD43): The available sources list no entries of a prehistoric date within the site boundary or within a 1.5km radius of the site.

7.5.4 A number of assets are dated to the Iron Age and Romano-British period. These follow in the summary of the later period, below.

7.5.5 Romano-British Period (AD43 - AD410): A total of nine entries relating to the Romano- British period are recorded on the South Yorkshire HER. One of these assets one lies within the Scheme Area.

Table 7.11: Heritage assets dating to the Romano-British period (AD43 - AD410)

Asset No	Type	Description	Lies Within Site/outside of site
01	Enclosure	Enclosure with field system	Within
09	Field system	Cropmarks	Outside
12	Enclosure	Enclosure with field system	Outside
13	Field system	Cropmarks	Outside
14	Field system	Cropmarks	Outside
15	Enclosure	Enclosure with lane	Outside
16	Field system	Aerial photography	Outside
17	Enclosure	Enclosure with field system	Outside
19	Enclosure	Earthworks (part of multi-period site	Outside

7.5.6 Medieval to late Medieval Periods (AD410 - AD1540): Two HER entries are recorded within 1.5km of the site. Neither of the assets lies within the Scheme Area.

Table 7.12: Heritage assets dating to the Medieval to Late Medieval periods (AD410 - AD1540)

Asset No	Type	Description	Lies Within Site/outside of site
04	Barn	Internal elements of a timber-framed barn	Outside
11	Stone cross	Socket stone and part of shaft	Outside

7.5.7 Post-medieval Period (1540 - 1750): Four heritage assets of this period are recorded on the HER. One of these assets lies within the Scheme Area.

Table 7.13: Heritage assets dating to the Post-medieval period (1540 – 1750)

Asset No	Type	Description	Lies Within Site/outside of site
02	Farmstead	Site of	Within
05	Farmhouse	Extant with re-used tie-beam	Outside
06	Farmhouse	Farmhouse with cruck roof	Outside
10	Hall	Site of	Outside
19	Multi type	Multi period wood and common	Outside

7.5.8 Industrial to Modern Periods (1750 - 1901): One heritage asset relating to the Industrial Period was identified within 1.5 km of the Scheme Area.

Table 7.14: Heritage assets dating to the Industrial to Modern periods (1750 – 1901)

Asset No	Type	Description	Lies Within Site/outside of site
18	Colliery	Site of	Outside

7.5.9 Undated Heritage Assets: One asset in the HER is not closely dated. This lies outside of the Scheme Area.

Table 7.15: Undated heritage assets

Asset No	Type	Description	Lies Within Site/outside of site
08	Monument	Holy Well	Outside

7.5.10 Scheduled Monuments: No scheduled monuments lie within 1.5 km of the Scheme Area. Those within 5 km of the site are described in detail within the Landscape Assessment (Chapter 6). These include South Kirkby Camp, Hallsteads Moated site, Monk Bretton Priory and All Saints cross. These scheduled monuments are briefly described and the impact of the proposed development on the setting of these assets is assessed below.

7.5.11 South Kirkby Camp is a prehistoric, probably Iron Age, enclosed settlement defined by a ditch and bank. It lies approximately 2.5 km to the north-east of the proposed development. According to the wireframes (Figure 7.2 and Figure 7.12, Volume 3), only the tips of the wind turbines would be visible from the camp. The camp is largely screened by an undulating topography and a belt of mature trees in the summer. The setting is rural farmland, although close to the settlement of South Kirkby. The significance of effect is considered to be slight.

7.5.12 The remains of the medieval moated site of Hallsteads are still visible as earthworks. A line of fishponds run eastwards from the northern arm of the moat. A manor house was once constructed on this site, which was granted permission to crenellate in 1479, although no remains exist of this structure. The site lies approximately 2 km north of the proposed development. According to the wireframe (Figure 7.3, Volume 3), only one of the proposed turbines would be visible. A belt of trees and the tops of houses screen the view to this turbine suggesting that that the proposed development would have a negligible effect on the setting of the asset. The setting is rural farmland and the significance of effect is considered to be slight.

7.5.13 Monk Bretton Priory was founded in 1154 to house Cluniac monks and later became a Benedictine monastery in 1281. It was dissolved in 1538 by Henry VIII. Numerous standing remains are still extant including the outlines of buildings, such as the church and administrative buildings. Monk Bretton Priory is located 5 km to the west of the proposed development. According to the wireframe (Figure 7.4, Volume 3), two of the turbines will be clearly visible, whilst just the tips from the other one would be seen. A belt of tall trees runs along the eastern edge of the site, which would obscure the views of the turbines, particularly during the summer months. The setting is semi-rural with farmland to the east, but twentieth century housing borders the rest of the Priory. The proposed development would have a negligible effect on the setting of the priory and the significance of effect is considered to be slight.

7.5.14 All Saints Cross is located within the graveyard at All Saints Church in Darfield and is a medieval cross thought to have functioned as a waymaker. The site is located 2 km

to the south of the proposed development. According to the wireframe (Figure 7.5, Volume 3), all three turbines would be visible from the churchyard. However, the Church is located in a relatively built up area with houses and trees to the north of the Church in the direction of the proposed development. It is unlikely that the wind turbines would be visible from the churchyard suggesting that the setting is unlikely to be effected by the proposed development. The significance of effect is considered to be slight.

7.5.15 Listed Buildings: A total of two elements of a Grade II* listed building were identified as being in close proximity to the Scheme Area and are presented in the table below. A Grade I listed building lies within the 5km study area (All Saints Church) and similarly a Grade II* listed building (Grimethorpe Hall). These are discussed below and in Chapter 6.

Table 7.16: Statutory designated heritage assets (listed buildings)

Asset No	Listing grade	Description
03	Grade II *	Chapel, part of
07	Grade II *	Chapel, part of

7.5.16 Asset Numbers **03** and **07** are both part of the same church, St Michael's and All Angels in Great Houghton. This was originally a Presbyterian Chapel built around 1650 with alterations in the twentieth century. It passed out of non-conformist use in the nineteenth century to become a chapel of ease to Darfield Church. It is located 1km to the east of the proposed development and is likely to be the most affected according to the wireframe (Figure 7.1, Volume 3). However, a belt of trees and farm buildings lie to the immediate west of the church, which would provide some screening, especially during the summer months. The church lies adjacent to a housing estate built in the twentieth century and its setting has already been compromised. The significance of effect is considered to be slight.

7.5.17 All Saints Church in Darfield is a Grade I listed building, which lies approximately 2km to the south of the proposed development. It was originally constructed in the eleventh century, but has been altered and restored in the fourteenth, fifteenth and nineteenth centuries. According to the wireframe (Figure 7.8, Volume 3), all the wind turbines would be visible from the church. However, the church lies within the centre of Darfield and is surrounded by houses and trees, especially to the north in the direction of the proposed development. The significance of effect is considered to be slight.

7.5.18 Grimethorpe Hall is a Grade II* listed building and lies within the small town of Brierley. The site is located approximately 2km to the north of the proposed development. It was constructed around 1670 and altered in the eighteenth, nineteenth and twentieth centuries. The wireframe (Figure 7.6, Volume 3) suggests that all three turbines would be visible from Grimethorpe Hall and indeed, the land does comprise open farmland to the south in the direction of the proposed development. However, the Hall is located within a suburban setting with twentieth century houses, a farm and a main road in close proximity. The significance of effect is considered to be moderate/slight.

7.5.19 Site visit: No additional heritage assets were observed within the boundary of the Scheme Area during the site visit. An additional site visit was carried out within the

Study Area in order to make a visual assessment of the key assets and take photographs of the setting of the designated assets and the views towards the Scheme Area to aid the magnitude of impact assessment. These photographs are displayed in Appendix 7.2, Volume 2.

7.5.20 The cultural value or sensitivity of the heritage assets identified during the course of the desk-based assessment and the site visit is shown below in Table 7.17, and was calculated using the factors shown in Table 7.1, during consultation of the South Yorkshire HER and professional judgement.

Table 7.17: Cultural value or sensitivity of the assets

Cultural value/Sensitivity	Asset Nos	Preferred Mitigation Direct Impacts
Very high (international)	0	To be avoided
High (National)	**03** and **07**	To be avoided
Medium (Regional/County)	**01**	Avoidance recommended
Low (Local/Borough)	**02**, **04** -**06**, **08** to **19**	Avoidance recommended
Negligible (Neighbourhood/ Negligible)	0	Avoidance not envisaged
Uncertain /Potential	0	Avoidance unnecessary

7.6 Likely Significant Environmental Effects

7.6.1 The likely significant environmental effects have been determined based on the scheme as proposed in the planning application and the present baseline condition of the heritage assets. The assessment has considered the location and extent of the development.

7.6.2 The predicted impacts are assessed for the construction, operational and de-commissioning stages of the proposed wind farm which proposes three turbines. Typically, wind turbines require a deep foundation to prevent them from becoming unstable in high winds. The development will also include ancillary infrastructures such as a control room, cabling, access tracks, and areas of hardstandings.

7.6.3 To construct and service the wind turbines approximately 1.45 km of access tracks (550m of existing tracks and 900m of new tracks), including a turning point adjacent to turbine T1, will be utilised/constructed or improved to link the turbines to the site entrance. A crane pad of 45 m x 20 m, formed from compacted stone will be required adjacent to each turbine location to accommodate the cranes required for installation of the turbine components. The crane hardstandings are also used as a laydown area. In addition to the crane hardstanding a blade laydown area of 45 m x 10 m next to each crane hardstanding is required. The blade laydown area will be managed open areas of land adjacent to the crane hardstandings which provide space to laydown and manoeuvre turbine components during the construction phase. These are generally level areas utilising existing materials on site.

7.6.4 The individual turbines will be connected by underground cables to external switchgear and transformers housed in a cabinet adjacent to the individual turbines and from there to the onsite control building and compound that will house switchgear any grid transformers as necessary. The power generated by the turbines will then be exported to the grid network, most likely at Houghton Main primary substation.

7.6.5 The proposed control building would be a small single-storey building measuring 10 m by 5.8 m. The foundations of the control building would have an enclosed trench about 1 m deep where the underground electrical cables from the turbines enter. A buried earthing ring and earthing rods tied to the collection system and a common neutral would also be fitted. A secure temporary storage area / site compound of approximately 50 m by 50 m will be required during the construction period. The site compound will be constructed of compacted stone. Following the construction period the construction compound area will be restored.

7.6.6 The likely impacts on the designated assets would be, for the most part, negligible adverse, although the proposed development would have a minor adverse effect on Grimethorpe Hall. The significance of effects would be slight for all designated assets, apart from Grimethorpe Hall, which would be moderate/slight (See Table 7.19, below).

Construction

7.6.7 The excavation of foundations for turbines and the control building and the construction of site access tracks and ancillary structures (e.g. transformers) all have the potential to directly impact on buried archaeology, both known and unknown. In terms of upstanding remains of archaeological and cultural heritage significance, impacts are likely to be more indirect and related to changes in the cultural and historical settings of the heritage assets. The sites of buried archaeological remains are equally subject to indirect changes relating to their setting.

7.6.8 Two Heritage Assets (**HA01** and **HA02**) are located within the Scheme Area; **HA01** is considered to be of medium (regional) value, and **HA02** low (local) value. The magnitude and nature of the impact and the significance of the effect on the non-designated assets is shown below in Table 7.18. Despite, the low value of **HA02**, this asset will be directly impacted upon by the access track.

Table 7.18: Nature and significance of impact during construction phase on no

Heritage Asset	Magnitude of Impact	Nature of Environmental Impact	Significance of Effect (degree of change)	Duration of effect
HA01	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Moderate/Slight	Temporary
HA02	Moderate adverse	Direct and Indirect: Change to the site resulting in a moderate change in our ability to understand and appreciate the resource	Slight	Permanent
HA04	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary

Heritage Asset	Magnitude of Impact	Nature of Environmental Impact	Significance of Effect (degree of change)	Duration of effect
HA05	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA06	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA08	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA09	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA10	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA11	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA12	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA13	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA14	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA15	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary

Heritage Asset	Magnitude of Impact	Nature of Environmental Impact	Significance of Effect (degree of change)	Duration of effect
HA16	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA17	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA18	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary
HA19	Minor adverse	Indirect: Change to the site resulting in a small change in our ability to understand and appreciate the resource	Neutral/Slight	Temporary

7.6.9 None of the statutory designated assets lie within the Scheme Area, and so will not be subject to direct impacts. Therefore, the following assessment (Table 7.19) focuses on the indirect impacts to the setting of the designated assets. Two statutory designated assets lie within the 1km of the Scheme Area (**HA03** and **HA07** being part of the same Grade II* listing). All of the statutory designated assets are of high value (national) as reflected in their designation, and those up to 5km in distance have been included. The visual impact would only apply to those assets which have a direct line of sight to the construction of the Development, and not those within intervening topography, built developments (village cores for example) or large-scale planting.

Table 7.19: Significance of visual impact on setting of statutory designated assets during construction

Heritage Asset	Magnitude of impact	Within ZTV	Nature of Environmental Impact	Significance of effect	Duration of effect
HA03; HA07	Negligible adverse	Yes	The setting of the cultural heritage asset is changed by the development in ways that do not alter the contribution of setting to the asset's significance.	Slight	Temporary
SM: South Kirkby Camp	Negligible adverse	Borderline	As above	Slight	Temporary
SM: Hallsteads moated site	Negligible adverse	Yes	As above	Slight	Temporary
SM: Monk Bretton Priory	Negligible adverse	Yes	As above	Slight	Temporary

SM: All Saints cross	Negligible adverse	Yes	As above	Slight	Temporary
Grade I LB: Grimethorpe Hall	Minor adverse	Yes	The contribution of the setting of the cultural heritage asset to its significance is slightly degraded as a result of the development, but without adversely affecting the interpretability of the asset and its setting; characteristics of historic value can still be appreciated, the changes do not strongly conflict with the character of the site, and could be easily reversed to approximate the pre-development conditions.	Moderate/Slight	Temporary
Grade II LBs: Thurnscoe	Negligible adverse	Yes	The setting of the cultural heritage asset is changed by the development in ways that do not alter the contribution of setting to the asset's significance.	Slight	Temporary
Grade II LBs: Darfield	Negligible adverse	Yes	As above	Slight	Temporary
Grade II LBs: Cudworth	Negligible adverse	Yes	As above	Slight	Temporary
Grade II LBs: Grimethorpe	Negligible adverse	Yes	As above	Slight	Temporary
Grade II LBs: Wombwell	Negligible adverse	Yes	As above	Slight	Temporary
Grade II LBs: South Kirkby	Negligible adverse	No	As above	Neutral/slight	Temporary

Operation

7.6.10 Once the Development is operational, the main potential impacts are likely to be to the disruption of the cultural setting and appreciation of cultural heritage, particularly scheduled monuments and tall Grade I and Grade II* listed buildings such as churches, but not excluding the sites of buried archaeological remains.

7.6.11 The nature and significance of impact on the heritage assets during the operational phase remain as were considered during the construction phase, and as presented in Table 7.19 above. Almost all the assets within the Inner Study Area lie within the ZTV (based on turbine tips) and will have, in theory, a degree of intervisibility with the

turbines. However, as during the construction phase, the visual impact would only apply to assets which have a direct line of sight to the construction of the Development, and not those within intervening developments or screened by large-scale planting schemes. Whilst the majority of the designated assets will be screened by later developments and belts of trees, Grimethorpe Hall will be subject to visual impacts by the proposed development based on the wireframe and the site visit (See Plate 6, Appendix 7.2, Volume 2).

De-commissioning

7.6.12 During the decommissioning stage, it is not anticipated that there will be any additional impacts other than those mentioned for construction. This will comprise the removal or making good of the turbine bases, and also the removal of the ancillary structures. Generally, de-commissioning will have a minor benefit on the assets by slightly improving the degree to which the setting's relationship with the assets can be appreciated.

7.7 Mitigation

Construction

7.7.2 If, on review by the Planning Archaeologist, some previously undisturbed areas of the Scheme Area are considered to have the potential for buried remains, it may be possible to steer foundation construction away from these areas by micro-siting the turbines and preserve remains in situ – as is recommended by NPPF. If this was not feasible then a programme of archaeological mitigation would be required in order to preserve any remains by record. This would almost certainly take the form of a watching brief.

7.7.3 Heritage asset **HA02** will be disturbed by the construction of a proposed access track, and a second proposed access track will run in close proximity to the heritage asset. It is recommended that these proposed tracks are micro-sited in order to avoid the heritage asset and its immediate environs. If this is not feasible, then an archaeological watching brief will be required. Similarly, if it became necessary to disturb heritage asset **HA01** then a programme of archaeological mitigation would be required in order to preserve any remains by record.

7.7.4 In the event that archaeological remains are encountered during ground works, construction work would be halted pending agreement with the Planning Archaeologist on the most appropriate way to proceed with the construction works.

7.7.5 Due to the scale of the turbines it is not anticipated that mitigation will be able to effectively reduce the visual impacts on the setting of all of the heritage assets (both statutory designated and non-designated). It is considered very unlikely to be of benefit to **HA01** and **HA02** due to their very close proximity to the turbines. It is possible that localised sympathetic planting/screening schemes could be of minor benefit to individual properties and assets, but this cannot be easily or effectively assessed for every listed building and asset within the ZTV. Indeed, there are extant trees or buildings that enable some protection of the settings of all the scheduled monuments and listed buildings (See Appendix 7.2, Volume 2 for plates of the settings of the designated assets and descriptions are detailed above in Section 7.5).

Operation

7.7.6 As a system of totally effective mitigation is not anticipated the nature and significance of the impacts during the operational phase of the plant remains unchanged - being for the most part minor adverse in nature and moderate/slight to neutral/slight in significance for the undesignated and designated assets.

Decommissioning

7.7.7 No mitigation measures are considered necessary during the decommissioning phase of the proposed development. The decommissioning phase is likely to be of a similar duration to the construction phase and ground disturbance will be kept to a minimum (foundations will most likely be left *in situ*).

7.8 Assessment of Residual Impacts

7.8.1 Failing the implementation of an effective mitigation strategy for all of the effected assets, the impacts will remain minor adverse/negligible adverse in nature and moderate/slight to neutral/slight in significance.

7.9 Assessment of Cumulative Impacts

7.9.1 The nature and proposed design of the development, considered together with the nature of the heritage assets, does not suggest that cumulative effects arising from small impacts across the Scheme Area will be an issue. However, there would be some cumulative impacts at St Michael's and All Saints Church (**HA02** and **HA07**) as a housing development constructed in the twentieth century lies adjacent to this Grade II* listed building. The construction of wind turbines would add to this change in setting. This same cumulative impact would also occur at Monk Bretton Priory (scheduled monument), All Saints Cross (scheduled monument) and Grimethorpe Hall (Grade II* listed building). The impact would be negligible adverse with a slight significance of effect for St Michael's and All Saints Church, Monk Bretton Priory and All Saints Cross, but there would be a minor adverse impact with moderate/slight significance of effect for Grimethorpe Hall.

7.9.2 Whilst a number of schemes (in planning, consented and operational) have been considered in the LVIA Chapter (Chapter 6), there is only one scheme within the 5km Study Area that is relevant here. The scheme is located at Mount Pleasant approximately 1.5km to the east of the Scheme Area. This scheme is currently seeking permission to build two wind turbines, which would have a cumulative impact on St Michael's and All Saints Church (**HA03** and **HA07**). However, as this church is already surrounded by a modern housing estate, the impact on the setting of this church is considered to be slight.

7.10 Conclusions

7.10.1 During construction, the proposed development has the potential to have a minor adverse effect on any undiscovered archaeology that may be present within the majority of the Scheme Area, and the potential for any undiscovered remains to be present is moderate. Two assets are present within the Scheme Area (**HA01** and **HA02**), one of which (**HA02**) will be disturbed by development related ground works. This will require either micro-siting the pertinent proposed access tracks or a watching brief.

7.10.2 The construction of the proposed development also has the potential to have an indirect adverse effect upon on the setting of four Scheduled Monuments, and the nature of this visual impact on their setting would be negligible adverse to minor adverse and slight to moderate/slight in significance. This also applies to one Grade I Listed Building within 5km of the Scheme Area, two Grade II* listed buildings and a number of Grade II listed buildings. The setting on the listed buildings would be negligible adverse and slight in significance. Additionally, seventeen non-designated assets will also be subject to a visual impact on their setting. No totally effective programme of mitigation is considered to be possible, although the magnitude of the effect upon the Listed Buildings is a worst-case scenario.

7.10.3 There will be no reduction in the nature or significance of the impact and its effects during the plant operation phase.

7.10.4 The indirect adverse visual effects on the heritage assets will be residual. There are no known cumulative effects upon any of the heritage assets. A further discussion of visual impacts of the proposed turbines is also given in Chapter 6 (Landscape and Visual Impacts) of this ES.

SECTION 8

HYDROLOGY, GEOLOGY, HYDROGEOLOGY

8 HYDROLOGY, GEOLOGY, HYDROGEOLOGY

8.1 Introduction

8.1.1 This chapter details the baseline geological, hydrological and hydrogeological conditions at the site and surrounding area, outlining the potential environmental impacts of the proposed Development on these resources during construction, operation and decommissioning. Where potential impacts have been identified, mitigation measures have been proposed to reduce these impacts as appropriate.

8.1.2 This chapter is supported by Figure 8.1 Hydrology, and Appendices 8.1 Envirocheck Report, 8.2 Coal Authority Report and 8.3 Flood Risk Assessment.

8.2 Site Description

8.2.1 The site area comprises 90.4 ha of primarily agricultural pasture land, some of which is restored open cast workings, with small areas of woodland in the northern part of the site boundary. Fields are divided by hedgerows, tracks and fences. The site has a gently undulating topography with a general fall from the north-east to the south-west direction. This general topography is interrupted in the southern section of the site boundary which is dissected by a narrow channel, which crosses the site from north east to south west and within which the elevation drops to 30 mAOD before rising back to 50 at the sites southern boundary. The highest point of the site is at approximately 80 mAOD, in the vicinity of turbine location T1, dropping down to around 40 mAOD near the industrial unit on Park Spring Road (ASOS).

8.2.2 The most prominent geological, hydrological and hydrogeological features of the local environment are the River Dearne with its tributaries to the north east and associated floodplain to the south, and the history of coal mining in the area, in particular Grimethorpe opencast colliery to the north of the site boundary. Colliery operations ceased at Grimethorpe in 1993, following which the land has been restored. Worked out quarries, wetland areas and restored workings are common throughout the Dearne valley.

8.3 Assessment methodology and significance criteria

Legislation, guidance and best practice

8.3.2 The proposed Development has been assessed with reference to the following key relevant documents:

- National Planning Policy Framework (NPPF) (2012).
- National Policy Statements for Energy Infrastructure (EN-1 and EN-3) (2011).
- Technical Guidance to the National Planning Policy Framework (2012).
- Water Framework Directive (2000/60/EC).
- Environment Act (1995).
- Part 2A of the Environmental Protection Act (1990).
- Environmental Permitting (England and Wales) Regulations (2010).

- Pollution Prevention Control Act (1999).
- Environment Agency Pollution Prevention Guidance Notes (PPG).
- Construction Industry Research and Information Association (CIRIA) Environmental good practice on site (2005).
- CIRIA Control of water pollution from construction sites (2001).
- The Contaminated Land Regulations (2006).
- Contaminated Land Report (CLR) 11 – Model Procedures for the Management of Land Contamination.

Assessment methodology

8.3.3 The methodology adopted for the assessment of impacts of the proposed Development on the geology, hydrology and hydrogeology of the site has drawn on a range of guidance, including; Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10: Road Drainage and the Water Environment HD 45/09, November 2009, and has followed the process as detailed below.

- Consultation.
- Desk study.
- Evaluation of potential effects.
- Evaluation of significance of the identified potential effects.
- Identification of mitigation measures.
- Discussion of residual impacts and conclusions.

8.3.4 The assessment approach has been undertaken with a clear understanding of the following:

- Previous land uses.
- Underlying ground conditions.
- Existing physical baseline.
- The Development proposal.
- Receptor importance.
- Sensitivity to change.
- Magnitude of change.
- Significance of impacts.
- Potential to mitigate impacts.

8.3.5 Tables 8.1 to 8.3 have been used to assess the attribute importance of receptors and the significance criteria against which the magnitude of potential impacts from the Development may have on geology, hydrology and hydrogeology.

Desk study

8.3.6 The baseline geological, hydrological and hydrogeological conditions of the proposed Development site have been assessed with reference to the following:

- Envirocheck Report (Appendix 8.1), which includes:

  Historical mapping data from 1854 to 2012 (1:2,500 scale).
  Historical mapping data from 1854 to 2012 (scales 1:10,560 & 1:10,000).
  BGS Boreholes Datasheet.
  Soil Chemistry mapping data.
  Groundwater Vulnerability mapping data.
  Bedrock Aquifer Designation mapping data.
  Superficial Aquifer Designation mapping data.
  Source Protection Zones mapping data.

- Coal Authority Report (Appendix 8.2).
- The BGS Digital mapping.
- Soilscape (1:25,000 scale map showing soil types in Britain – Cranfield University).
- Natural Environment Research Council (NERC) soil records.
- Ordnance Survey (OS) 1:25,000 and 1:10,000 mapping.
- Details of discharge and waste consents, contaminated land sites and areas of sensitive land.
- Environment Agency flood maps, via http://maps.environment-agency.gov.uk/wiyby.

Significance Criteria

Tables 8.1 to 8.3 define the criteria against which the magnitude and significance of impacts has been defined on a variety of receptors.

Table 8.1: Defining attribute importance for receptors

Importance	Criteria	Example
Very High	Attribute has a high quality and rarity on regional or national scale	Water body of very good chemical or biological quality, i.e. Water Framework Directive (WFD) Class 'High'. Site protected/designed under EC or UK habitat legislation (Special Areas of Conservation. (SAC), Special Protection Area (SPA), Site of Special Scientific Interests (SSSI), Water Protection Zone (WPZ), Ramsar site, species protected by EC legislation. EC designated Salmonid fishery. Principal aquifer providing a regionally important resource or supporting site protected under EC and UK habitat legislation. Source Protection Zone (SPZ) 1. A source used for public or local potable water supply. Water body of high amenity value, including areas of bathing and where water emersion sports are regularly practised. Floodplain or defence protecting more than 100 residential properties from flooding. Areas which are highly vulnerable. With reference to NPPF, these can include essential infrastructure, emergency services and basement dwellings. Source protection zone 1 within a Principal or Major Aquifer.

Importance	Criteria	Example
High	Attribute has a high quality and rarity on local scale	Water body of good chemical and biological quality, i.e. WFD Class 'Good' Species protected under EC or UK habitat legislation EC designated Cyprinid fishery. Principle aquifer providing locally important resource or supporting river ecosystem. SPZ 2. A source used for domestic non-potable water supply. Water body of a moderate amenity value including public parks, boating, non-contact water sports, popular footpaths adjacent to watercourses, or watercourses running through housing developments/town centres. Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding. Areas which are more vulnerable. With reference to NPPF, these can include hospitals, residential units, educational facilities and waste management sites. Source protection zone 2 within a Principal or Major Aquifer.
Medium	Attribute has a medium quality and rarity on local scale	Water body of fair chemical or biological quality, i.e. WFD Class 'Moderate'. Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ 3. Water body of particular local social/cultural/educational interest. Water body of low amenity value with only casual access, e.g. along a road or bridge in a rural area. Floodplain or defence protecting 10 or fewer industrial properties from flooding. Areas which are less vulnerable. With reference to NPPF, these can include retail, commercial and general industrial units, agricultural/forestry sites and water/sewage treatment plants. Secondary or Minor Aquifers. Source protection zone 1 within a Secondary or Minor Aquifer.
Low	Attribute has a low quality and rarity on local scale	Water of poor or bad chemical or biological quality, i.e. WFD Class 'Poor' Low sensitivity aquatic ecosystem. Non-Aquifer. Water body of no amenity value, seldom used for amenity purposes, in a remote or inaccessible area. Floodplain with limited constraints and a low probability of flooding of residential and industrial properties. Areas which are considered to be water-compatible. With reference to NPPF, these can include flood control infrastructure, docks/marinas, pumping stations and recreational/landscape areas.

Table 8.2: Criteria for assessing the magnitude of impacts

Significance Criteria		Description
Major Impact	Adverse	A permanent or long term adverse impact on the integrity and value of an environmental attribute or receptor, or exposure to acutely toxic contaminants. For example, harm to human health, designated habitats or pollution to controlled waters.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Moderate Impact	Adverse	An adverse impact on the integrity and/or value of an environmental attribute or receptor, but recovery is possible in the medium term and no permanent impacts are predicted.
	Beneficial	Benefit to, or addition of, key characteristics, features, or elements or improvement of attribute quality.
Minor Impact	Adverse	An adverse impact on the value of an environmental attribute or receptor, but recovery is expected in the short-term and there would be no impact on its integrity. For example, temporary effects on receptors not designated under environmental legislation.
	Beneficial	Minor benefit to, or addition of key characteristics, features or elements; some beneficial impact on attribute or a reduction in the risk of a negative impact occurring.
Negligible impact		No impact would be detectable, either positive or negative.

Table 8.3: Defining significance of effect

		Magnitude of Impact			
		Negligible	***Minor***	***Moderate***	***Major***
Importance of Attribute	***Very High***	Neutral	Moderate to Large	Large to Very Large	Very Large
	High	Neutral	Slight to Moderate	Moderate to Large	Large to Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Slight to Moderate

8.3.7 In Table 8.3 both moderate and large significance criteria are deemed as significant in accordance with the EIA Regulations.

8.4 Consultation

8.4.1 During the development process consultation with key geology, hydrology and hydrogeology stakeholders was undertaken. This was primarily through the Scoping exercise, relevant Scoping responses are summarised below.

Table 8.4: Consultation

Barnsley Metropolitan Borough Council - Scoping Response received from Keith Pell Planning Officer 14 September 2011 The Scoping Opinion from BMBC stated that the main issues on which the Environmental Statement should focus included: Hydrology and hydrogeology, geology, past coal mining activity and site stability.
BMBC Drainage - No comments received
BMBC South Yorkshire Mining Advisory Service - Scoping Response The site encompasses areas of New Park Spring and Houghton Main/Dearne Valley colliery tips and areas which were previously subject to opencast coal extraction. Dependent on the final chosen positions, the turbines may be located on soft unconsolidated colliery spoil or areas which may be subject to further ground settlement. An adequate desk top study and on site geotechnical investigation will therefore be required at the turbine positions. The foundations of the turbines and associated infrastructure should be appropriately designed to ensure the future integrity and stability of the scheme.
Coal Authority- Letter to Parsons Brinckerhoff dated 04/08/2011 The proposed EIA development is located within the defined coalfield area. It has been subject to past coal mining activity and is located within an area of surface coal resource. The Coal Authority is therefore of the opinion that the past coal mining activities and the presence of coal with the site should be fully considered as part of the Environmental Statement, together with any necessary mitigation measures. There are a number of potential issues that should be considered as part of an Environmental Statement for development proposals within coalfield areas: The location and stability of abandoned mine entries, the extent and stability of shallow mine workings, outcropping coal seams and unrecorded mine workings, hydrogeology, minewater and mine gas. In addition, development proposals should consider: if surface coal resources are present, whether prior extraction of the mineral resource is practical and viable. Whether Coal Authority permission is required to intersect, enter or disturb any coal or coal workings during site investigation or development work.
Environment Agency - Scoping Response

Agree with the proposed contents of the Environmental Statement (ES). A Flood Risk Assessment dealing with the drainage of the site will be required in accordance with PPS25 (now NPPF). This could be undertaken separately or incorporated in the ES.
Sheffield Area Geological Trust - Scoping Response The South Yorkshire RIGS Group is listed as a data provider, but the Sheffield Area Geological Trust should be added as a key stakeholder in and added to the list of consultees for the EIA. The main area of concern is that the temporary exposures as a result of access roads and excavation associated with the bases of the turbines are documented into geological records. This is of particular importance given the proximity of to Carlton Main Brickworks SSSI. A Geodiversity Assessment should cover the issues.

8.5 Baseline conditions

Historical land-use

8.5.2 Historical mapping shows the site from 1854 to the present day (Appendix 8.1). From these maps, it can be seen that the site area has primarily been in agricultural use throughout its history. To the north of the site, New Park Spring woodland remains relatively unchanged, whilst to the east of the site, Little Park woodland is partially deforested to make way for increased agricultural production from around the 1930s.

8.5.3 The historical mapping shows a long history of mining in the wider area. The Great Houghton sandstone quarry is evident in the 1854 map to the north-east of the site boundary. This continues to be worked until sometime between 1867 and 1962 (it is shown as disused in the 1962 mapping). The landfill records show that waste was deposited at the site from 1949 and so it is considered likely that this would also represent the end of quarrying operations. Further information relating to the landfill operations is described below in 8.5.27.

8.5.4 By 1894, the Houghton Main Colliery has been developed, approximately 200 m south of the site boundary. Over the next 95 years, the area of workings expands in an easterly and northerly direction, into the fields within the southern part of the site boundary. Between 1989 and 2006, the colliery ceases to extract coal from the site and the area is restored to agricultural land and by 2012, a large industrial unit (ASOS) has been built on the site of the main colliery buildings. The colliery was an opencast site and there is no mapping evidence to suggest that any coal seams were worked underneath the proposed area of the Development.

8.5.5 North of the site, the Grimethorpe Colliery (established sometime in the early 1900s) works the coal seams over a large area, which increases in a southerly direction over the next 80 years, to approximately 50 m from the northern site boundary. There is no evidence that any coal seams were worked underneath the proposed site.

8.5.6 The River Dearne originally flowed approximately 75 m to the west of the site (at the nearest point. However, sometime just prior to 1983, works were undertaken to straighten the course of the river, with the result that the watercourse is moved further away from the site boundary to the south, making way for a series of drains that feed from the Grimethorpe Slag Heaps.

8.5.7 A waterbody, designated as a Local Wildlife Site has been created to the south of Park Spring Road on the former floodplain of the River Dearne in the area where the drains from the landfill had been constructed. Further information on this Local Wildlife Site is provided in Chapter 9, Ecology and Chapter 10, Ornithology.

Geology and soils

8.5.8 Investigation of the British Geological Survey (BGS) records[4] shows that the site is primarily underlain by bedrock deposits of the Pennine Upper Coal Measures Formation – Sandstone and Pennine Upper Coal Measures Formation – Mudstone, Siltstone and Sandstone. These are made up of interbedded grey mudstone, siltstone and pale grey sandstone, commonly with coal seams. In the areas where mudstones are present, marine fossils may be found. Also present under the site is Ackworth Rock – Sandstones. Again these are made up of grey mudstones, siltstones and sandstones with thin coals.

8.5.9 According to the BGS data there are no superficial deposits reported within the site boundary, and the only superficial deposits within close proximity to the site are the Quaternary Alluvium – Clay, Silt and Sand deposits found within the Dearne Valley. These largely follow the course of the river and are found along the western site boundary, with a small part along the northern site boundary.

8.5.10 Date provided by Soilscape (1:25,000 scale map showing soil types in Britain – Cranfield University) describe the soils on the site as '*freely draining slightly acid loamy soils typical of neutral and acid pastures and deciduous woodlands, which are suitable for acid communities such as bracken and gorse in the uplands. As such, they have relatively low fertility.'*

8.5.11 Examination of the Natural Environment Research Council (NERC) soil records[5] show that the soils across the site vary from clayey to sandy and silty loams, depending upon the underlying bedrock, with the heavier clayey/silty soils overlaying the Pennine Upper Coal Measures Formation – Mudstone, Siltstone and Sandstone and the sandy loams overlaying the sandstone bedrock (Ackworth and Pennine Upper Coal Measures Formation – Sandstone).

8.5.12 The land upon which the development is proposed has been classified under the Department of Environment, Food and Rural Affairs (DEFRA) Agricultural Land Classification (ALC) as Grade 3 agricultural land which is defined as *"Good to moderate quality land, with moderate limitations that affect the choice of crops, timing and type of cultivation, harvesting or the level of yield"*[6].

8.5.13 Further investigation has found that the majority of the site comprises colliery spoil from New Park Spring and Houghton Main collieries and has also been restored following open cast coal mining operations within the site boundary. The ground is therefore likely to be made from soft unconsolidated colliery spoil. A BGS borehole record, supplied within the Envirocheck report, found that in the vicinity of Turbine T3 the soil depth was 12.19 m before reaching bedrock.

Ground Stability

8.5.14 The Envirocheck report shows that, at the site, the risks of:

- Potential for Collapsible Ground Stability Hazards is *No Hazard* to *Moderate*
- Potential for Landslide Ground Stability Hazards is *Very Low* to *Low*.

[4] http://www.bgs.ac.uk/opengeoscience/home.html
[5] http://www.bgs.ac.uk/nercsoilportal/home.html
[6] http://archive.defra.gov.uk/foodfarm/landmanage/land-use/documents/alc-guidelines-1988.pdf

- Compressible Ground Stability Hazards around the site range from *No Hazard* to *Moderate*.

8.5.15 Measurements taken at the site show:

- Potential for Running Sand Ground Stability Hazards (5 measurements taken from the site) range from *No Hazard* to *Low*.
- Potential for Shrinking of Swelling Clay Ground Stability Hazards (5 measurements taken from within the site only) range from *No Hazard* to *Low*.

8.5.16 The Coal Authority Report states that the site is in the likely zone of influence from workings in 16 seams of coal at 90 m to 900 m depth, last worked in 1992 and that any ground movement from these coal workings should have stopped by now. There have been 2 claims for damage to property within 50 m of the site, the last claim being in 1997. Both of these claims relate to land outwith the site boundary.

Hydrogeology

8.5.17 The Envirocheck Bedrock Aquifer Designation shows that the site is underlain by Secondary A Aquifers. These are described by the Environment Agency as '*permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers*'. There are no Superficial Aquifer designations within the site boundary.

8.5.18 Groundwater Vulnerability plans show that approximately two thirds of the site is underlain by Minor Aquifers with Low Vulnerability, with approximately one third of the site underlain by Minor Aquifers with High Vulnerability. The proposed wind turbines and associated infrastructure would be located in the area of the site that is underlain by Minor Aquifers with Low Vulnerability

8.5.19 The soil classifications for the site show that underlying soils are classed as low fertility, Grade 3 and that there are areas of Low Leaching Potential and areas of High Leaching Potential. Low Leaching Potential indicates that pollution is unlikely to penetrate the soil layer because either water movement is horizontal or the soils have the ability to attenuate any diffuse pollutants. High Leaching Potential soils are coarse in texture or shallow and readily transmit non-absorbed pollutants but, due to the presence of clay or organic matter, may also attenuate some pollutants. The proposed positions of the turbines and associated infrastructure are such that the only development to occur over the soils of High Leaching potential will be a short section of the access track.

8.5.20 The Envirocheck Report indicates that there are no licensed public or private groundwater abstractions within 50 m of the site boundary.

Hydrology

8.5.21 The principal hydrological features within the immediate vicinity of the site are shown on Figure 8.1. The main feature is the River Dearne, which flows in a south-easterly direction, approximately 380 m from the site at the nearest point. This reach of the Rive Dearne is classified as a heavily modified waterbody, likely due to its realignment to facilitate the construction of the railway and later the A6195. Its current ecological quality is classified as 'Moderate', as is its overall physio-chemical quality, although levels of Phosphate are bad, levels of Ammonia are good, and dissolved oxygen and pH are High. The overall specific pollutants quality of this reach is good.

8.5.22 Within the site are a number of field drains, which, in the main, follow field boundaries and ultimately discharge into the River Dearne.

8.5.23 The Envirocheck Report states that there are no licensed surface water abstractions present within a 500 m radius of the landownership boundary.

8.5.24 Environment Agency Flood Maps and the Scoping Response from the Environment Agency indicate that the Development is within Flood Zone 1 (an area with less than 0.1% annual probability of experiencing a flooding event from the sea or rivers. There is a small area within the wider site boundary that is subject to flooding from extreme events (Flood Zone 2) most likely attributed to the smaller field drains that are located within the site boundary.

8.5.25 The FRA (provided as an appendix to the ES) identified a low risk of flooding across the site most likely associated with surface water runoff from local drains which may result in some standing water within the northern part of the site area.

Contamination

8.5.26 Soil chemistry analysis from the site and its surroundings, provided by Envirocheck, show that soils on the site contain no more than 35-45 mg/kg arsenic, less than 150 mg/kg lead and 15-45 mg/kg nickel. Chromium concentrations are above 180 mg/kg. Examination of the Soil Guideline Values[7] show that these levels are within acceptable limits.

8.5.27 The data provided as part of the Envirocheck report show that there are two landfill sites in and around the Development site:

- The former Great Houghton Quarry is adjacent to the site boundary, approximately 370m east of turbine T1. The quarry site has been used as a commercial waste landfill since 1949, albeit it would appear that operations at the site have ceased.
- In the centre of the site boundary, a Local Authority landfill is recorded. It is currently unclear as to the contents of this landfill, however the location correlates with the location of the demolished Park Field House farmstead, see Chapter 7 Cultural Heritage for details. There are no landfill operations occurring at present.

Sensitive Land Uses

8.5.28 The Carlton Main Brickworks Site of Special Scientific Interest (SSSI) lies 625 m to the north of the site and is designated for geological reasons. The site is an operational clay pit and the special interests of the site are within the Coal Measures strata, which have been exposed by the extraction of clay. This includes one of the best available exposures of the Top Marine Band in the Pennines coalfields. This Top Marine Band is the highest Coal Measures marine band in Britain and is the last evidence of normal marine conditions in this country during the Carboniferous Period. It has yielded an anomalous *Myalina*-facies fauna, a shelly fauna which contrasts with the other facies fauna found elsewhere in this area of Yorkshire. The SSSI is considered to be of considerable scientific interest. (Natural England, 2013)

[7] Soil Guideline Value Reports, Environment Agency, http://www.environment-agency.gov.uk/research/planning/64015.aspx

8.5.29 The West Haigh Woods Local Nature Reserve (LNR) lies 657 m to the north east of the site and is a mixed age oak-birch woodland, including some areas of ancient woodland.

8.5.30 Edderthorpe Ings Local Wildlife Site (LWS) is 77 m to the west of the site boundary. This is an area of open water habitats, inundation grassland, wet woodland and shoreline habitats which supports a range of bird species. See Chapter 9 and Chapter 10 for details.

8.5.31 In line with Table 8.1, SSSI's are classed as attributes of Very High importance. Edderthorpe Ings LWS is determined to be of High importance as it supports species protected under EC or UK habitat legislation and its moderate amenity value.

8.5.32 The site itself does not have any such designations, although it is located within a Nitrate Vulnerable Zone, and is within an area of Adopted Green Belt.

8.6 Impact Assessment

Construction

Geology and soils (including Ground Stability)

8.6.2 Given that the underlying soils at the site are classed as low fertility, Grade 3, their attribute importance has been assessed as low.

8.6.3 The area of land take required for the development is 0.98 ha (0.053 ha turbines + harstandings for the crane, control building and access tracks of 0.92 ha) of a total site area in excess of 90 ha, It is considered that the construction of the Development and associated loss of land will have a negligible impact on the underlying soils of the site given that only a small amount of land will be temporarily lost from agricultural production. The significance of effect is therefore deemed to be ***neutral.***

8.6.4 The importance of the underlying geology has been assessed as Low to Medium, as although it is unlikely to be exploited in the short to medium term, the Coal Authority Report and associated BGS borehole records indicate that the site is underlain by reserves of Coal. It is clear from the Coal Authority Report that reserves of coal exist in the local area which could be worked at some time in the future, although the site is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods or where a licence has been granted. As such, there is the potential for temporary mineral sterilisation of the site, as it would not be possible to extract the coal from beneath the site with the turbines in place.

8.6.5 The impact of the development on underlying geology is deemed to be ***slight adverse***, as although some mineral sterilisation would occur, this will be temporary in nature and no measures will be in place to prevent the exploitation of coal reserves once the Development is decommissioned.

8.6.6 The Envirocheck report provides a large body of data relating to ground stability and risk of ground stability hazards. These data sets illustrate that there is very minimal risk of any such hazards occurring. As such, the impacts of such hazards are considered negligible, subject to appropriate geotechnical investigations during the detailed design of the Development.

8.6.7 There is the potential that the construction of the Development may disturb the geological and mining conditions such as voids or ground gas. There will need to be an intrusive ground investigation of the development area prior to construction.

8.6.8 Ground investigation works will be undertaken prior to construction works to assess the ground conditions. The ground investigations will assess the ground stability, which will in term determine the design of the turbine foundations.

8.6.9 The combination of the turbine design features, and the foundation used would mean that any vibrations produced by a certified and maintained wind turbine would be too small to cause physical or structural damage to the surrounding area, or to cause land instability. The impact in this regard is therefore predicted to be negligible.

Hydrogeology

8.6.10 The site is underlain by secondary A aquifers, and the ground water vulnerability below the areas to be developed is classed as low vulnerability. The hydrogeology attribute importance of the site is therefore Medium.

8.6.11 There is the potential for disruption to groundwater levels for example as a result of dewatering the turbine foundations.

8.6.12 Dependant upon the final design of the turbine foundations there is the potential for contaminants present within the site, or introduced as part of the construction works to be mobilised. Given that the depth of superficial deposits is unknown it is possible that concrete foundations could be laid directly on bedrock, creating a potential pathway for contaminants. This could result in contaminants entering the underlying secondary A aquifer if mitigation measures are not applied. Further information on contamination is included in sections 8.6.22 to 8.6.33 below.

8.6.13 The earthworks are likely to be limited in extent and temporary however, the risk to ground water, either by disruption to flow or from potential contaminants has been assessed as Medium. Therefore the overall significance of effect is considered ***moderate adverse.***

Hydrology

8.6.14 Construction activities on any site may, if uncontrolled, cause changes to surface and water drainage due to:

- Runoff from stockpiles;
- Increased runoff from compacted soils caused by e.g. movement of heavy equipment;
- Removal of vegetated top soil; and
- The provision of additional hardstanding.

8.6.15 The area of permanent land take required for the development is 0.98 ha (0.053 ha turbines + harstandings for the crane, control building and access tracks of 0.92 ha) of a total site area in excess of 90 ha. An additional 0.42 ha of land would be required during the construction and decommissioning phases (temporary construction compound and blade laydown areas).

8.6.16 This increase in hardstanding may result in a localised increase in surface water runoff, although this is not considered to pose a significant increase in flood risk within

the catchment considering the relatively small percentage of new impermeable area in comparison to the wider site area.

8.6.17 As discussed in the FRA (Appendix 8.3) the proposed works would be classed as 'Essential Infrastructure'. Table 3 indicates that Essential Infrastructure is appropriate within Flood Zone 1 and Flood Zone 2. The proposed development therefore passes the requirements of the Sequential Test. It is therefore considered that the potential impact upon surface water is considered to be **negligible**.

8.6.18 A small amount of water will be required each day for the general construction works and hygiene, which will be brought in by bowser. This water will be required for road construction and also dust suppression/wheel-washing facilities.

8.6.19 Nearby surface water quality may be temporarily affected by increased sediment load from site runoff. Silt transported within surface waters has the potential to cause damage to aquatic biology and if large quantities are built up could potentially contribute to flooding.

8.6.20 An ecological assessment of these water features is described in Section 9: Ecology of this Environmental Statement. The closest construction operations to a water body are likely to be approximately 60 m away at the location of Turbine 1 in the north of the site, and are associated with limited earthworks comprising the excavation of the foundation. The attribute importance of watercourses has been assessed as Medium, in line with Table 8.3.

8.6.21 Given the distance between the site and the River Dearne, and the distances between on-site works and on-site waterbodies (ditches) minimal amount of intrusive works adjacent to the nearby waterbody (River Dearne), it is unlikely that any significant quantities of material will be able to enter the watercourses. As such, the impacts on the hydrology are considered to be ***minor adverse***.

Contamination of land and water

8.6.22 An assessment of the potential contamination sources at the site has been undertaken through a desk based assessment involving the review of historical maps and other online resources. Based on this information, it is considered that the most likely source of contamination within the site boundary is from the Local Authority Recorded Landfill Site at Park Field House. There are also potential sources of pollution within the site boundary from leachate of former colliery spoil. The Conceptual Site Model (CSM) shown in Table 8.5 sets out potential pollutant linkages.

Table 8.5: Conceptual site model showing source, potential contaminants, pathways and potential receptors

Source	Potential Contaminants	Pathways	Potential Receptors
Park Field House Landfill	Landfill Gas	Variations in groundwater may release gas.	Surface water, Site users.
Park Field House Landfill	Leachate	Granular Soil, Excavation	Ground water, Surface water, Surface soils.

Park Field House Landfill	Waste	Granular Soil, Excavation	Surface water, Surface soils.
Colliery spoil	Leachate	Granular Soil, Excavation	Ground water, Surface water, Surface soils.

8.6.23 Based on the baseline information and conceptual site model presented in Table 8.4 it is considered that the most likely potential sources of pollution are from the former land fill located in the centre of the site, about which limited data was available at the time of writing.

8.6.24 With regards to the landfill, the area in question is already crossed by an onsite access track which will be utilised during construction of the development. As no geo-environmental investigations have been undertaken at the site, it is not known whether contamination is present or to what extent. Once a thorough ground investigation has been undertaken with an appropriate schedule of chemical testing, the potential risks to human health can be assessed in more detail. If required, a membrane will be used to construct the short section of access track over the landfill site such that excavation in this area would not be required.

8.6.25 At this stage, a precautionary approach has been taken. The attribute importance of construction workers has been judged as low - medium, as only moderate amounts of excavation are likely during construction of the project. There is also considered to be a potentially moderate adverse impact on these receptors. Therefore the overall significance of effect on construction workers, based on the potential of coming into contact with contaminated soils and groundwater is judged as moderate adverse without mitigation.

8.6.26 Part of the site is made from colliery waste of unknown type. Excavation through the waste has the potential to produce leachates or to allow contaminates to enter surface water courses, which without mitigation could potentially flow down stream into the River Dearne and Edderthorpe Ings. Contaminates from the colliery waste will be disturbed which could potentially mobilises contaminates.

8.6.27 There is the potential for spills/leakage of oil, fuel and other potentially polluting substances associated with construction machinery and vehicles. Spills could potentially contaminate groundwater, surface water or soils, having a detrimental impact on aquatic life, plants and human health.

8.6.28 There is also the potential that polluted water resulting from accidental spillages or excavated materials may be able to migrate from the site, and into the main River Dearne via the local network of field drains. Without mitigation, such pollution could have the potential to impact upon local water quality and aquatic ecology.

8.6.29 The most sensitive receptor on-site or linked to the site is considered to be Edderthorpe Ings, with a High attribute sensitivity. As the construction period is anticipated to be relatively short (6-9 months), this is considered to represent a potentially **moderate** adverse impact.

8.6.30 No oil will be stored on site and machinery will be left on hardstandings when not in use, at an appropriate setback distance from watercourses.

Sensitive Land Uses

8.6.31 The attribute importance of Carlton Main Brickworks SSSI is Very High. Due to the distance (625m) between the SSSI and the Development, it is considered that there will be no impact upon the SSSI caused as a result of the construction of the Development.

8.6.32 The attribute importance of Edderthorpe Ings LWS and West Haigh Wood LNR are High as these areas support protected species and have a moderate amenity value. Due to the distance (625m) between the LNR and the Development, it is considered that there will be no impact upon the LNR caused as a result of the construction of the Development.

8.6.33 Edderthorpe Ings is located 77m from the Development site boundary, and is hydrologically linked. The minor increase in surface water flow as detailed in the FRA as a result of the small increase in hardstand area constructed would result in a minor increase of surface water, assessed as a neutral impact. Without mitigation contaminates released as part of the construction works could potentially reach Edderthorpe Ings, this impact is assessed as **moderate to large**.

Operation

Geology and Soils

8.6.34 The operation of the wind farm is not considered to have any further impact on the soils or geology of the site or surrounding area.

8.6.35 Once the Development is operational, the site would still be in use as agricultural land minus the small footprint required for the Development.

Hydrogeology

8.6.36 The operation of the wind farm is not considered to have any additional impact on the hydrogeology of the site or surrounding area.

Hydrology

8.6.37 Although part of the site is located within Flood Zone 2, the turbines, access tracks or the control building are not situated within this area. As such, the development of the site will not have any impact on flows during peak flood events, or have an impact on flooding to adjacent areas.

8.6.38 In terms of surface water drainage, the introduction of a small amount of hardstanding (0.98 ha) onto a greenfield site of over 90 ha is not anticipated to have a large impact on the overall drainage regime and therefore there is not considered to be any significant increase in flood risk either within the site or elsewhere within the catchment.

8.6.39 Further information on flood risk can be found in Appendix 8.3, Flood Risk Assessment.

Contamination and Oil Spills

8.6.40 During operation, only relatively small quantities of potentially hazardous substances will be stored and used at the site. These substances mainly comprise transformer

and lubricating oils. Appropriate handling precautions will, in any case, be documented and practiced.

8.6.41 Each wind turbine will contain a small amount of oil. Most of the oil is contained in the gearbox and any leakage would be contained within the nacelle and tower structures. The turbines would be designed with fluid catch basins and containment systems to prevent accidental releases from leaving the nacelle.

8.6.42 Other leakages can come from the hydraulic brake system. However, the amount of oil contained in this system is minimal and any leaks would cause streaks on the side of the external tower. It is therefore generally possible to identify any leaks before oil reaches ground level and before any impact can occur.

8.6.43 The small quantity of sewage arising from the infrequent visits of maintenance staff would be treated in a septic tank which would be maintained by a suitable licensed contractor. A rainwater collection system would be installed to provide water for flushing which would be topped up with water brought to site in containers.

Sensitive Land Uses

8.6.44 A small increase in surface water as detailed in the FRA could result in a small increase in surface water runoff to Edderthorpe Ings LWS. This increase in surface water run-off is assessed as negligible and is therefore a **neutral** impact.

8.6.45 The operation of the wind farm is not considered to have any significant impacts on the nearby LWS, LNR or SSSI.

Decommissioning

8.6.46 The impacts on hydrology, hydrogeology and geology during the decommissioning phase will be temporary and moderate in nature and would be similar to those described above for construction.

8.6.47 Post decommissioning the concrete foundations will likely be left in the ground after decommissioning of the site. It is common for concrete foundations to remain in the ground for many years following decommissioning of sites. The environmental impact of this is anticipated to be negligible and less than if the foundations were to be removed as the foundations will be constructed of an appropriate grade of concrete to resist attack from any soil and groundwater contamination. Other than the remaining foundations, the ground will be reinstated back to its original state (before the turbine scheme was commissioned) with suitably clean topsoil and grass covering where appropriate.

8.7 Mitigation

8.7.1 The construction of the Park Spring Wind Farm has the potential to create several impacts relating to geology, hydrogeology and hydrology. The following mitigation measures outlined below will reduce predicted impacts and are considered best practice.

Construction

8.7.2 A Construction Environmental Management Plan (CEMP) will be prepared in consultation with the relevant authorities. The CEMP will identify the potential impacts such as pollution risks associated with each activity and will likely include:

- Drainage Management Plan.
- Accident Management Plan.
- Site Waste Management Plan.
- Procedures for dealing with surface water.
- Procedures for dealing with pollution/contamination.

Geology and Soils

8.7.3 Ground investigation works prior to construction would assess the site geology including ground stability and mining conditions such as voids.

8.7.4 A Working Practices Procedure for the Control of Pollution (WPPCP) will be drafted for the construction phase. This will provide guidance on good working practices in order to minimise impacts on the soil and geology resulting from the construction of the Development. This will be further developed by the Contractor and agreed with the Environment Agency and local planning authority prior to any works on site. All construction staff would be required to read the procedure and abide by its requirements.

8.7.5 The construction area will be delineated and measures taken to avoid vehicle use outside the working boundary through, for example, the erection of appropriate fencing.

8.7.6 To further limit disturbance, it is anticipated that the site access tracks will be constructed first to allow movement of vehicles around the site on areas of soft standing. Any vegetation, topsoil and subsoil will be removed to expose a suitable sub-grade. Any soils, sub-soils or aggregate suitable for reuse will be stockpiled on impermeable liners, in the vicinity of the turbine locations. Soils will be stored according to the guidelines in the DEFRA Construction Code of Practice for the Sustainable Use of Soils on Construction Sites and MAFF Good Practice Guide for Handling Soils, with the implementation of a Soil Resource Plan (SRP) if required.

8.7.7 A Site Waste Management Plan (SWMP) will be implemented during construction of the site. This SWMP will focus on the reduction, re-use and recycling of all waste spoil on site. As part of the SWMP any additional soil materials that are to be imported to the sites will be required to have certification of their chemical concentrations to ensure that contaminative materials are not being introduced to the area.

8.7.8 Throughout the works, the Waste Management Duty of Care and Special Waste Regulations will be strictly adhered to, including the collation of all required paperwork and checking of transport and disposal contractors.

8.7.9 Speed restrictions will be imposed on site to minimise disturbance of bare surfaces and the amount of disturbed surfaces left exposed for significant time periods will be minimised. Stockpiles of loose, fine materials will be damped down or covered over if necessary, again to reduce erosion and the production of dust.

Hydrogeology and Hydrology

8.7.10 A suitable drainage plan would be formulated following ground investigations, this would be either a Sustainable Drainage System (SUDS) or an alleviation scheme as appropriate.

8.7.11 Sulphate, pH and magnesium testing would be conducted as part of a ground investigation on the proposed turbine sites. Establishing the concentration of corrosive and organic contaminants (such as the above) allows the identification of the appropriate concrete such that the concrete mix used for foundations will resist corrosive attack.

8.7.12 The access roads will be constructed to manage drainage of surface water and a temporary wheel washing facility will be installed to prevent transfer of soil onto nearby public roads and discharging into highway drains.

8.7.13 Surface water, perched waters or groundwater from dewatering operations will not be discharged to surface water or drains, without the appropriate consents from the local water or Sewage Company and/or the Environment Agency. The disposal of this effluent will be the responsibility of the contractor. If necessary this water will be taken off-site for disposal at a suitable facility.

8.7.14 Cable trenches will be refilled and compacted to the same condition as the surrounding substrate to prevent creation of new sub-surface flow pathways and decrease the likelihood of ponded water in the excavations. Trenches will be back-filled promptly to minimise water ingress. If necessary temporary silt traps will be provided.

Contamination

8.7.15 A Phase 2 contaminated land intrusive investigation will be undertaken prior to construction works commencing on site to further assess the potential source, pathways and receptor links for potential contamination.

8.7.16 The procedures to prevent pollution will be detailed in the CEMP.

8.7.17 The contractor will provide a silt trap and/or oil interceptor at a location agreed with the Environment Agency to allow solids or immiscible liquids to settle/separate prior to discharge. The contractor will inspect, empty and maintain silt traps/interceptors. A registered waste carrier will remove from site all sludges or residues collected during cleaning operations, to a suitably licensed waste disposal facility.

8.7.18 Storage of fuel would be limited and secure. The storage of fuel, equipment and construction materials will be designed to minimise the risk of soil contamination or water pollution; for example through the use of bunds, drip trays and oil interceptors in accordance with Environment Agency guidelines.

8.7.19 Construction machinery will be checked regularly. Any maintenance required will occur over hardstanding or on a suitable impermeable ground cover. Refuelling will be limited to a designated area, on an impermeable surface, away from any drains or watercourses.

8.7.20 Spill kits, absorbent pads and absorbent sands will be available on site at all times. Any spills will be cleaned up as soon as possible, according to the spill response plan in the CEMP.

8.7.21 Any impacts will be minimised by restricting vehicle movements to specified routes and controlling the construction areas. In addition, a temporary site compound will be constructed for the parking of construction vehicles and equipment, staff vehicles, and the storage of materials.

Sensitive land uses

8.7.22 It is considered that the mitigation measures outlined above to manage the surface water and contamination will contribute to the mitigation of impacts upon Edderthorpe Ings.

Operation

8.7.23 All foundations will be appropriately designed to resist chemical attack from contaminated soils or groundwater. All foundations will also be designed appropriately to the underlying ground conditions to make sure the turbines have maximum stability.

8.7.24 The wind turbines would be equipped with sensors to automatically detect loss in fluid pressure and/or increases in temperature in the lubricating oils used, enabling the turbines to be shut down automatically in the event of a fluid leak.

8.7.25 Any accidental gear oil or other fluid leaks from the wind turbines would be contained inside the towers as they are sealed around the base and would be cleaned up as soon as possible.

8.7.26 Disposal of all waste materials, whether hazardous or not, will only be via appropriate and authorised routes.

Decommissioning

8.7.27 A decommissioning plan will be prepared and submitted to the local planning authority for approval 12 months prior to the commencement of decommissioning works. This will specify a number of mitigation measures reflecting best practice at that particular time.

8.7.28 At this stage it is anticipated that the decommissioning area will be delineated and measures taken to avoid vehicle use outside the working boundary. In order to further limit disturbance, the site access tracks will be taken out last.

8.7.29 Any soils, sub-soils or aggregate suitable for reuse will be stockpiled on impermeable liners, in the vicinity of the turbine locations.

8.7.30 Dust suppression measures will be put in place to minimise dust levels on the site and in the surrounding environment.

8.7.31 Any additional soil materials that are to be imported to the sites will be required to have certification of their chemical concentrations to ensure that contaminative materials are not being introduced to the area.

8.7.32 Speed restrictions will be imposed on site to minimise disturbance of bare surfaces and the amount of disturbed surfaces left exposed for significant time periods will be minimised.

8.8 Residual Impacts

8.8.1 The potential for the proposed Development to affect the geology, hydrogeology and hydrology of the site and surrounds is mitigated to acceptable levels through good site design and the adoption of mitigation measures as outlined above.

8.8.2 Provided the mitigation measures are strictly followed, and all but the concrete foundations are removed, with the site reinstated to its predevelopment state, there are not anticipated to be any residual impacts arising from the development on soils and geology, hydrology, drainage and hydrogeology.

8.8.3 Removal of the concrete foundations is likely to result in longer-term damage to the local environment and lasting residual impacts in comparison to them remaining in place and covered with appropriate soil and vegetation.

SECTION 9

ECOLOGY

9 ECOLOGY

9.1 Introduction

9.1.1 This section presents the assessment of the potential ecological effects associated with the proposed installation of a three turbine wind farm at the Park Spring site. It details the methods used to establish the features of ecological interest within the survey area. It then sets out the potential impacts on receptors during construction, operation and decommissioning and assesses the potential effects on populations at an appropriate geographic scale. Avoidance and measures to mitigate any significant effects are proposed and a summary of any residual effects is provided. An assessment of impacts and effects on Avian Ecology is provided within Chapter 10, Ornithology.

9.2 Legislation and policy

9.2.1 The following legislation and policy has been used to underpin the ecological impact assessment reported in this section:

- The Conservation of Habitats and Species Regulations 2010 (and subsequent amendments).
- Ramsar Convention on Wetlands of International Importance, 1971.
- Bern Convention (on the Conservation of European Wildlife & Natural Habitats; and on the Conservation of Migratory Species of Wild Animals) 1979.
- Wildlife and Countryside Act 1981 (and subsequent amendments).
- Countryside and Rights of Way Act 2000.
- Natural Environment and Rural Communities (NERC) Act 2006.
- Hedgerow Regulations 1997.
- Protection of Badgers Act 1992.
- The UK Biodiversity Action Plan (UKBAP).
- Barnsley Local Biodiversity Action Plan (LBAP).

9.3 Assessment methodology

9.3.1 The methodology for this ecological assessment is based on guidance issued by the Institute of Ecology and Environmental Management (IEEM, 2006)[8]. The method involves the following key stages:

- Consultations.
- Baseline studies and evaluation of ecological receptors.
- Identification of Valued Ecological Receptors (VER's).
- Identification and characterisation of potential impacts.
- Identification of effects from potential impacts upon VER's.

[8] IEEM (2006) Guidelines for Ecological Impact Assessment in the United Kingdom.

- Assessment of impact significance.

These stages are discussed further below.

Description of the Survey Area

9.3.2 Figure 9.1 sets out the proposed turbine locations and the ecology survey area boundary. The baseline was determined and appraised through a combination of a desk-based study (covering up to 10 km from the centre of the survey area), an extended Phase 1 Habitat Survey of the survey area and its surrounds, and further targeted surveys for particular protected species and species of conservation concern within the survey area.

9.3.3 The 'survey area' consisted of a combination of arable land and woodland.

9.3.4 The site is bordered to the north by heathland with an industrial area present further north. The disused Great Houghton Quarry, woodland and arable farmland border the site to the north east with the village of Great Houghton to the east. To the south of the site, a golf course and additional arable land is present, with the villages of Little Houghton and Middlecliffe beyond. Park Spring Road, an industrial unit and associated hard standing border the western site boundary. The River Dearne and Edderthorpe Ings are present beyond Park Spring Road to the northwest of the site. A full description of the habitats present within and adjacent to the survey area and a map showing the location of the survey area and habitats present is included in the Extended Phase 1 Habitat Survey Report (Appendix 9.1).

Consultations

9.3.5 The following ecological organisations were consulted on the proposed development:

- Barnsley Metropolitan Borough Council.
- Doncaster Metropolitan Borough Council.
- Environment Agency.
- Natural England (NE).
- South Yorkshire Wildlife Trust.

Baseline Studies and Evaluation of Ecological Receptors

9.3.6 Baseline information regarding ecological features including sites of importance for nature conservation, species populations, species assemblages and habitats was obtained from the following principal sources:

- Existing data and information relevant to the survey area, from published sources, data bases and local recorders.
- Ecological Surveys.

Identification of Valued Ecological Receptors

9.3.7 It is impractical and inappropriate for an assessment of the ecological effects of a proposed development to consider every species and habitat that may be affected. Instead, it focuses on Valued Ecological Receptors (VERs). VERs are species and habitats present within the zone of influence of the proposed Development that are of

sufficiently high value that certain levels of impact upon them, as a result of the proposed development, could be considered to be significant.

9.3.8 The value of sites, populations of species, species assemblages and habitats was evaluated with reference to: their importance in terms of 'biodiversity conservation' value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations); and their legal status.

9.3.9 For the purposes of this assessment, sites, species populations, species assemblages and habitats were valued using the following geographical scale:

- International.
- UK.
- National (i.e. England).
- Regional.
- County.
- District.
- Local.
- Neighbourhood.
- Negligible.

9.3.10 The valuation of sites makes use of established value systems (e.g. SSSIs are all of national importance, Local Wildlife Sites (LWSs) or Sites of Importance for Nature Conservation (SINCs) are of county importance, although professional judgement is required for the valuation of sites and species of less than district value.

9.3.11 The valuation of species populations assemblages of species and habitats uses accepted criteria, examples include:

- Species Populations

  The importance of populations is evaluated on the basis of their size, recognised status (e.g. published lists of species of conservation concern, BAP status) and legal protection status.

- Species Assemblages

  In some instances it is the species assemblage that is of importance. Criteria used to evaluate the importance of assemblages include SSSI selection criteria.

- Habitats

  Criteria for the evaluation of habitats and plant communities include Annex III of the EC Habitats Directive, guidelines for the selection of biological SSSIs and, where available, Local Authority and Wildlife Trust criteria for the selection of Local Sites (e.g. Local Wildlife Sites). Legal protection status is also a consideration for certain habitats.

9.3.12 IEEM guidelines on ecological impact assessment note the difficulty of devising valuation criteria that can be consistently applied to designated sites, habitats and species in the same way in all parts of the country, and recommends an approach to valuation that involves teasing apart the different values that can be attached to the ecological receptors under consideration. However, it is beneficial to give examples of the sorts of criteria used in the valuation process, summarised in Table 9.1 which

has been adapted from a similar table included in several of the earlier drafts of the IEEM guidelines.

Table 9.1: Examples of criteria used to evaluate ecology receptors

Level of Value	Examples of definitions
International	An internationally important site, e.g. Special Protection Area (SPA), Special Area of Conservation (SAC) or Ramsar site (or a site considered worthy of such designation); a regularly occurring population of an internationally important species (listed on Annex IV of the Habitats Directive); 1% of the known international population of a particular species.
National (UK)	A nationally designated site, e.g. SSSI, or a site considered worthy of such designation; a viable area of a habitat type listed in Annex 1 of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; any regularly occurring population of a nationally important species, e.g. listed on Schedules 5 and 8 of the Wildlife & Countryside Act (1981); a feature identified as of priority in the UK BAP; 1% of the known UK population of a particular species.
County	Areas of internationally or nationally important habitats which are degraded but are considered readily restored; viable areas of key habitat identified in Local BAPs, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; a site designated as a Wildlife Site or Site of Nature Conservation Interest (SNCI); a regularly occurring, locally significant number of a nationally important species; 1% of the known population of a particular species within the county.
District	Areas of habitat identified in a sub-county (district/borough) or in the relevant Natural Area profile; district sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves; sites or features that are scarce within the district or borough or which appreciably enrich the district or borough habitat resource; a diverse or ecologically valuable hedgerow network; a regularly occurring population of a species which is large enough to be considered to be of district level importance.
Local	Areas of internationally or nationally important habitats which are degraded and have little or no potential for restoration; a good example of a common or widespread habitat in the local area; a regularly occurring population of a species which is large enough to be considered to be of district level importance.
Neighbourhood (site and its vicinity, including areas of habitats contiguous with or linked to those on site)	Areas of heavily modified or managed vegetation of low species diversity or low value as habitat to species of nature conservation interest; common and widespread species.
Negligible	No intrinsic nature conservation value associated with habitat. Generally these are areas of hard standing or buildings with no nature conservation interest.

9.3.13 In this assessment, nature conservation sites, species populations, species assemblages and habitats can qualify as VER if they are close enough to the

proposals to be affected by the development and meet the following minimum level of importance:

- Nature conservation sites - local importance.
- Species populations and assemblages - local importance.
- Habitats - local importance.

9.3.14 It is considered unlikely that a significant effect can occur to features of lesser importance than those listed.

9.3.15 The description and valuation of ecological features will take account of any likely changes, including, for example, trends in the population size or distribution of species; likely changes to the extent of habitats; and the effects of other proposed developments or land-use changes.

9.3.16 Due consideration will be given to non-valued ecological receptors (i.e. those nature conservation sites, species and habitats below local importance), in particular with regard to legislative protection and local, regional and national conservation initiatives.

Identification and Characterisation of Potential Impacts

9.3.17 The likely impacts of the proposed Development during construction, operation and decommissioning, as well as cumulative impacts, and the potential ecological effects arising from them are identified and characterised, taking into consideration the following parameters:

- Positive or negative - whether the impact will result in net loss or degradation of a VER or whether it will enhance or improve it.
- Magnitude - the size or intensity of the impact measured in relevant terms, e.g. number of individuals lost or gained, area of habitat lost of created or the degree of change to existing conditions (e.g. noise or lighting levels).
- Extent - the spatial scope of the impact, for example the physical area affected or the geographical pattern of the impact.
- Duration - the length of time over which the impact occurs.
- Reversibility - the extent to which impacts are reversible either spontaneously or through active mitigation.
- Timing and frequency - consideration of the timing of events in relation to ecological change, some impacts may be of greater magnitude if they take place at certain times of year (e.g. breeding season). The extent to which an impact is repeated may also be of importance.

Magnitude of Potential Impacts

9.3.18 Ecological receptors are usually nature conservation sites, habitats, species assemblages or communities, or populations or groups of a species. Impacts can be permanent or temporary, direct or indirect, and can be cumulative. These factors are brought together to assess the magnitude of the impact on particular VER's and, wherever possible, the magnitude of the impact is quantified. Professional judgment is then used to assign the effects on the receptors to one of four classes of magnitude, defined in Table 9.2.

9.3.19 It should be noted that this step in the impact assessment procedure is additional to that described within the IEEM guidelines but has been included to allow comparison between other environmental disciplines which attribute a magnitude of impact, and also to provide transparency in how decisions over whether a resultant effect is significant has been reached.

Table 9.2: Definition of magnitude

Magnitude	Definition
High	A permanent or long-term effect on the extent or size or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is likely to threaten its sustainability; if beneficial, this is likely to enhance its conservation status.
Medium	A permanent or long-term effect on the extent or size or integrity of a site, habitat, species assemblage or community, population or group. A short-term effect which will adversely affect the integrity of a receptor in a permanent manner. If adverse, this is unlikely to threaten its sustainability; if beneficial this is likely to be sustainable but is unlikely to enhance its conservation status.
Low	A permanent, long-term reversible or short-term effect on a site, habitat, species assemblage or community, population or group whose magnitude is detectable but will not threaten/change its conservation status.
Negligible	A short-term reversible effect on the extent, size or integrity of a site, habitat, species assemblage or community, population or group that is within the normal range.

9.3.20 Potential impacts are characterised initially in the absence of any mitigation, except where this is integral to the design of the proposed development. Any additional mitigation or compensation proposed is identified and its likely effectiveness is assessed.

9.3.21 An indication of the confidence with which predictions of potential impacts are made is given in terms of certainty (uncertain, likely or near certain).

Defining Significance of Effect

9.3.22 The significance of the predicted effects on receptors arising from the identified impacts of the proposed development, including designed-in and additional mitigation measures, is assessed. Significance is assessed as Adverse, Beneficial or Not Significant. A significant impact is defined as an impact (negative or positive) on the integrity of a VER and/or the conservation status of a VER within a given geographical area.

9.3.23 In considering the integrity and conservation status of the receptor the key considerations are:

- Will any site/ecosystem processes be removed or changed or subject to disturbance?
- What will be the effect on the nature, extent, structure and function component habitats?

- What will be the effect on the average population size and viability of component species?

9.3.24 In determining the significance of a potential effect, all of the above factors including the value of the receptor, magnitude of the potential impact, and the duration of the impact are considered.

9.3.25 Where possible, the assessment of these parameters needs to be expressed quantitatively and to be based on research and published information. However, it is also recognised that many ecological effects are complex and poorly understood so professional and qualitative judgements are often required to prescribe the significance of the effect.

9.3.26 Using this approach, the value of any feature that would be significantly affected is then used to identify the geographical scale at which the impact is significant. Thus for example, if a population of a certain species valued as being of Regional biodiversity value is significantly affected by a development, then that impact is considered to be of Regional significance. If an impact is found not to be significant at the level at which the resource or feature has been valued, it may be significant at a lower geographic level.

9.3.27 In accordance with standard approaches to EIA and in terms of the EIA Regulations, mitigation or compensation measures are identified and will be implemented in order to reduce potential significant impacts once identified. With respect to nature conservation sites that support protected species, there may also be a legal obligation to provide such mitigation.

9.4 Survey Methodologies

Desk Study Methodology

9.4.2 A desk study was undertaken to collate and analyse existing records of notable and protected species historically found within 1 km of the survey area boundary (10 km for bat records). Data was also collected to identify any statutory and non-statutory designated sites of nature conservation interest. The search radius was 10 km for statutory designated sites and 2 km for non statutory sites. The following sources were consulted to obtain the data:

- Sheffield Biological Records Centre (consulted in January 2012).
- South Yorkshire Bat Group (consulted in December 2011).
- Multi-Agency Geographic Information for the Countryside (MAGIC) website (accessed in November 2012).

9.4.3 Desk study information received is provided in the Extended Phase 1 Survey Report, Appendix 9.1.

Field survey methodologies

9.4.4 Full copies of all additional field survey reports are presented in Appendices 9.1 – 9.4 and are summarised in this Chapter.

Phase 1 habitat survey

9.4.5 An Extended Phase 1 Habitat survey was undertaken on the 20th of April 2011 to assess the ecological value of the survey area and record any protected habitats, or

evidence/potential of any notable or protected species within or surrounding the survey area.

9.4.6 The survey followed standard methodology published by the Joint Nature Conservation Committee (2010)[9] but extended for use in Environmental Assessment[10] with habitat types present recorded on a Phase 1 habitat map.

9.4.7 The Extended Phase 1 habitat survey identified the need for the following protected species surveys:

- Badger (*Meles meles*).
- Otter *(Lutra lutra*).
- Water vole (*Arvicola amphibius*).
- Great crested newt (*Triturus cristatus*).
- Reptiles.
- Bats
- Birds (see Chapter 10).

Badger survey

9.4.8 A badger survey was undertaken on 22 August 2011.

9.4.9 The survey method was based on the standard approach detailed in the Mammal Society publication Surveying Badgers[11]. This involved searching for field signs associated with badgers, such as setts, latrines, foraging activity (e.g. snuffle holes), paths, hairs and footprints. Using nationally recognised sett classification criteria any setts found during the survey would be categorised as either main, annex, subsidiary or outlier. Full badger survey methodologies are included in Appendix 9.2.

Otter surveys

9.4.10 An otter survey was undertaken on the 22 and 23 August 2011. The survey method was based on standard guidance[12]. This involved searching for signs of otter, including feeding remains, spraints and other secretions, pathways, slides, paw prints, holts couches and direct sightings. Full otter survey methodologies are included in Appendix 9.3.

[9] Joint Nature Conservation Committee (2010) Handbook for Phase 1 Habitat Survey - A Technique for Environmental Audit, Joint Nature Conservation Committee, Peterborough.

[10] Guidelines for Baseline Assessment, Institute of Environmental Assessment, 1995

[11] Harris, S. Cresswell, P and Jefferies, D. (1989) Surveying Badgers. The Mammal Society Publication No. 9 Mammal Society

[12] Chanin, P., (2003) Monitoring the Otter, Conserving Natura 2000 Rivers, Monitoring Series No. 10

Water Vole Surveys

9.4.11 Water vole surveys were undertaken concurrently with the otter survey. The survey involved a search for signs of water vole presence including, latrines, feeding stations, burrow entrances, runs, pathways, footprints, feeding lawns around burrow entrances and direct sightings. Full water vole survey methodologies are included in Appendix 9.3.

Bat Survey

9.4.12 Field surveys were undertaken between May and October 2011, April and September 2012 and April and May 2013.

Table 9.3: Bat survey information

Survey aim	Survey technique	Method
To gather information on existing bat records and habitats in the local area.	Desk study	Local record centre data search and web-based search.
To assess the potential for bat roosts to be adversely affected.	Ground-based tree inspections	Trees categorised as having negligible - high potential to support roosting bats.
To assess the species assemblage within the survey area.	Transect survey	Surveyors walked predetermined transects monthly form May 2011 - October 2011 and in April 2013.
	Static detector surveys	Four locations monitored monthly for five consecutive nights in April - October 2011.
To assess the relative level of activity within the rotor swept zone and at ground level.	At height static detector surveys	SM2 detector mounted on the met mast with microphones monitoring at heights of 5 m and 50 m between April and September 2012.
	Vantage point survey	Surveyors watched the selected turbine locations, noting the number of bats, species and height of bat flights from half an hour before to two hours after sunset. April and May 2013.
To assess where bats were accessing the site from and whether any significant commuting routes crossing the site existed.	Commuting point survey	Surveyors stationed on the edge of the site recorded the flight paths of bats commuting onto or across the site. August 2011.

9.4.13 The methodologies used for the above surveys were designed (and wherever possible undertaken) in accordance with standard methodologies recommended in *The Bat Workers' Manual*[13]; *Guidance for Onshore Wind Farms*[14] and *Bat Surveys - Good Practice Guidelines*[15], taking into account *Bat Surveys - Good Practice Guidelines Surveying for Onshore Wind Farms*[16], and *Bat Surveys, Good Practise Guidelines 2nd edition*[17] and the updated Natural England guidance TIN[18] as they

[13] Bat Workers Manual (2004) 3rd Edition – Joint Nature Conservation Committee
[14] Bats and Onshore Wind Turbines (February 2009) – Interim Guidance – Natural England Technical Information Note TIN051
[15] Bat Conservation Trust (2007) Bat Surveys – Good Practice Guidelines
[16] BCT (2011) *Bat Surveys – Good Practise Guidelines: Surveying for onshore wind farms. Bat Conservation Trust*. London.
[17] Hundt L. (2012) *Bat Surveys: Good Practise Guidelines, 2nd edition.* Bat Conservation Trust. London.

were released. Full bat survey methodologies are included in the bat technical appendix (Appendix 9.4).

Survey limitations and constraints

9.4.14 During the completion of the baseline surveys to inform this assessment, some limitations and constraints were encountered, the details of which are included in each of the technical appendices (Appendices 9.1 to 9.4). In summary, none of the limitations or constraints to the surveys undertaken is considered to compromise the validity of the surveys or the assessments made.

Assumptions to inform future baseline and potential impacts

9.4.15 Significant changes in the baseline conditions between the present time and the proposed commencement of construction are considered unlikely, although it should be noted that the agricultural activities undertaken at the development site can influence the ecological diversity of the survey area based on the regimes being implemented. Despite this factor it is considered that agricultural practices will continue as existing and that the key components that have a fundamental bearing on ecological diversity are likely to remain similar.

9.5 Existing Baseline

Identification of Statutory Designated Sites

9.5.2 A review of existing statutory sites of nature conservation interest, such as Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPA), Ramsar, Special Areas of Conservation (SAC's) and National Nature Reserves (NNRs) and Local Nature Reserves (LNRs), was carried out to indicate any existing nature conservation interest within 10 km of the central grid reference using the Multi-Agency Geographic Information for the Countryside (MAGIC) website.

Internationally Designated Sites

9.5.3 There are no internationally designated sites of nature conservation importance (SPA, Ramsar, SAC) within 10 km of the Survey area.

Nationally Designated Sites

9.5.4 Six nationally designated sites were present within 10 km of the survey area; including Nostell Brickyard Quarry SSSI, South Elmsall Quarry SSSI, Carlton Main Brickworks SSSI, Stairfoot Brickworks SSSI, Bilham Sand Pits SSSI and Denaby Ings SSSI (see Figure 9.2).

9.5.5 SSSIs are notified by Natural England for the being the best examples of the UK's flora, fauna, or geological or physiographical features. SSSIs are designated under the Wildlife and Countryside Act 1981 (as amended). The government has a duty to notify as a SSSI any land which, in its opinion, is of special interest by reason of any of its flora, fauna, geological or physiographical features. The aim of the designation is to protect some of the best examples of wildlife, geological and physiographical heritage. These sites are also used to underpin other national and international nature conservation designations such as SACs and SPAs.

[18] Mitchell-Jones T. & Carlin C. (February 2012) Natural England Technical Information Note TIN051, Bats and Onshore Wind Turbines *Interim guidance*. Natural England.

9.5.6 Of the six sites within 10 km of the survey area, five are designated for their geological importance with the sixth designated for its ornithological interest and as such considered in Chapter 10. All six sites are considered to be outside the zone of influence for the receptors covered in the ecology chapter, therefore none of the nationally designated sites are considered to be a VER for ecology as part of this assessment.

Identification of Non-statutory Designated Sites

9.5.7 Information on non-statutory designated sites within 2 km of the Survey area was obtained from Sheffield Biological Records Centre.

Locally Designated Sites

9.5.8 Two non statutory designated sites were identified within the 2 km search area. These sites and their key features are summarised in Table 9.4 and their location is shown in Figure 9.2.

Table 9.4: Locally designated sites

Site	Status	~ Distance and orientation	Reason for designation	Value	VER?
Edderthorpe Ings	Local Wildlife Site (LWS)	77m west	Edderthorpe Ings is a site containing open water habitats, inundation grassland, wet woodland and shoreline habitats. The site supports a diversity of bird species. Species of note are those associated with wet lowland grasslands including redshank, snipe and lapwing.	County	Yes, situated within zone of influence. For the presence of birds (considered in the ornithological chapter)
West Haigh Wood	Local Nature Reserve/ Local Wildlife Site (LWS)	657m north east	West Haigh wood is ancient woodland (in existence since 1600). Habitats on site include mixed deciduous woodland dominated with oak (*Quercus robur*). Archaeological features within the woodland include abandoned Victorian ponds.	County	No as it is outside the zone of influence.

9.5.9 Local Wildlife Sites (LWS) are sites of significant wildlife interest within a county context. Impacts to ornithology receptors are addressed in Chapter 10. West Haigh Wood and its interest features are considered to be sufficiently distant from the

development that pathways for impacts are not present and would not materialise through the development, accordingly neither LWS is considered to be a VER for non avian ecology as part of this assessment.

Identification of Habitat Receptors

9.5.10 Habitats identified within the 'survey area' by the Phase 1 Habitat survey include: broadleaved semi natural woodland, broadleaved plantation woodland, scattered broad leaved trees, semi-improved neutral grassland, improved grassland, tall ruderal, mesotrophic standing water, arable land, species rich intact hedge, species poor intact hedge, species poor defunct hedge, species rich hedge with trees, species poor hedge with trees, dry ditch and bare ground.

9.5.11 A description of habitat receptors and ecological evaluation is provided in Section 9.5.12 to 9.5.40 below, their location is shown in Figure 3 - 6 of the Extended Phase 1 Habitat Survey report, Appendix 9.1.

Broad leaved semi natural woodland

9.5.12 This habitat type was identified at the south of the site, along Chapel Lane, adjacent to both sides of the main track through the site, to the east of the central area of the site and to the north and east of the north section of the site. Species present were dominated by beech (*Fagus sylvatica),* sycamore (*Acer pseudoplatanus)*, Norway maple *(Acer platanoides)* and sessile oak *(Quercus petraea)*. Other prominent species within this habitat type include elder *(Sambucus nigra)*, horse chestnut (*Aesculus hippocastanum)*, hawthorn (*Crataegus monogyna*), silver birch (*Betula pendula),* holly (*Ilex aquifolia)*, blackthorn *(Prunus spinosa*). The understorey species were dominated by bluebell *(Hyacinthoides non-scripta)*, greater stitchwort (*Stellaria holostea*), wood avens (*Geum urbanum*), garlic mustard (*Alliaria petiolata*) and dog's mercury (*Mercuralis perensis)*.

9.5.13 This habitat is not well represented in the local area, although a swathe is present to the north of the site. Mixed deciduous woodland is a local BAP habitat and that found within the site is considered to have good species diversity. Notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Local value and as such will be considered further in this assessment.

Broad leaved plantation woodland

9.5.14 Broadleaved plantation woodland occurs throughout the centre of the southern section of the site, to the west of the site and in parts of the northern section of the site. This habitat was dominated by alder (*Alnus glutinosa)*. Other species present include downy birch (*Betula pubescens)* rowan (*Sorbus aucuparia)*, pinus spp. whitebeam (*Sorbus aria*) and hawthorn.

9.5.15 Although much of the broad leaved plantation woodland within the site was young, it contains good species diversity and will develop into semi-mature woodland over the 25 year lifespan of the wind farm. Additionally mixed deciduous woodland is a local BAP habitat. Notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Local value and as such will be considered further in this assessment.

Scattered broad leaved trees

9.5.16 Scattered broad leaved trees occurred along Chapel Lane to the south of the site and along the north of the northern section of the site. Scattered broad leaved trees were predominantly alder, hawthorn, goat willow (*Salix caprea)* and downy birch. Other species present in this habitat type include blackthorn, rowan, cherry (*Prunus avium)*, dog rose (*Rosa canina),* lilac (*Syringa vulgaris*), broom (*Cytisus scoparius*), gorse (*Ulex europaeus)* and sessile oak.

9.5.17 The mature scattered broadleaved trees are considered to be of Neighbourhood value with immature trees considered to be of Negligible conservation value and as such this habitat type is not considered further in this assessment.

Semi-improved neutral grassland

9.5.18 Semi-improved neutral grassland occurs in the northern section of the site only. This habitat type occurs along the northern boundary of the site from Park Spring Road in the west to the quarry on the east side of the site. This habitat was dominated by Yorkshire fog (*Holcus lanatus*), sheep's fescue (*Festuca ovina)* with false oat-grass (*Arrhenatherum elatius),* and tufted hair-grass (*Deschampsia caespitosa)*. The herbaceous layers found within this habitat type were dominated by ribwort plantain (*Plantago lanceolata)* with curled dock (*Rumex crispus)*, coltsfoot (*Tussilago farfara),* ragwort (*Senecio jacobaea)*, hogweed (*Heracleum sphondylium),* creeping buttercup (*Ranunculus repens),* bird's-foot trefoil (*Lotus corniculatus*), wood vetch (*Vicia sylvatica)*, hairy tare (*Vicia hirsuta),* creeping cinquefoil, yarrow (*Achillea millefolium)*, and meadow vetchling (*Lathyrus pratensis)*.

9.5.19 This habitat is considered to be widespread and common in a local, county and national context. Notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Neighbourhood value and as such is not considered further in this assessment.

Improved grassland

9.5.20 Improved grassland occurs throughout the site concentrated to the north of the site and to the south of the site near to Chapel Lane. Improved grassland habitats on site are dominated by Cocksfoot (*Dactylis glomerata*) and Yorkshire fog with Sheep's Fescue, wavy hair-grass (*Deschampsia flexuosa)* meadow foxtail (*Alopecurus pratensis)* and creeping soft-grass *(Holcus mollis)*. The herbaceous layers for these habitats were dominated by dandelion spp. and white clover (*Trifolium repens)*. Other species present in this habitat include creeping buttercup, ribwort plantain, spear thistle (*Cirsium vulgare),* creeping thistle (*Cirsium arvense*), creeping cinquefoil, groundsel (*Senecio vulgaris),* curled dock, broad-leaved dock (*Rumex obtusifolius)* woolly thistle (*Cirsium eriophorum),* meadow vetchling, lupin (*Lupinus polypyllus),* coltsfoot and lesser trefoil (*Trifolium dubium).* The diversity of all areas of improved grassland is low with changes in species composition between grasslands.

9.5.21 This habitat is common in a local, county and national context and is not listed as a priority habitat within the UK or Barnsley BAP. Notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Neighbourhood value and as such is not considered further in this assessment.

Tall ruderal

9.5.22 This habitat was found surrounding the dry ditch bordering Chapel Lane to the south of the site. Tall ruderal habitats on site are dominated by rosebay willowherb (*Chamerion angustifolium)* spear thistle, creeping thistle, bramble (*Rubus fruticosus)* and common nettle (*Urtica diocia)*.

9.5.23 This habitat is common in a local, county and national context and is not listed as a priority habitat within the UK or Barnsley BAP. Notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Neighbourhood value and as such is not considered further in this assessment.

Mesotrophic standing water

9.5.24 There were five ponds recorded during the Phase 1 survey, pond locations are shown on Figure 9.3. Ponds 1 and 2 occur to the north of the central section of the site dominated by bulrush (*Typha latifolia)* and common reed (*Phragmites australis)* with creeping bent (*Agrostis capillaries)* and Juncus spp. Pond 1 was identified as being regularly disturbed by dogs whereas Pond 2 was a shaded pond with crack willow (*Salix fragilis)* and goat willow around the edge. There was some algae growth present on Pond 2 which was considered less disturbed.

9.5.25 A small ephemeral pond (Pond 3) occurred adjacent to a hedgerow along a track through the site without any emergent vegetation and dominated by creeping bent. A balancing pond (Pond 4) occurs adjacent to Park Spring Road dominated by common reed bordered by downy birch and gorse with limited aquatic vegetation. Pond 5 occurred to the north of the site and was dominated by bulrush with some areas of open water and well shaded from nearby broadleaved semi-natural woodland.

9.5.26 The water bodies present on site, particularly those which are permanent features, increase the biodiversity of the survey area. Ponds are registered as a priority habitat in the Barnsley BAP and UK BAP. The standing water is therefore considered to be of Local value and as such will be considered further in this assessment.

Arable

9.5.27 This was the most widespread habitat within the survey area but it did not contain any wild plant species.

Although arable field margins are listed as a priority habitat in the UK and Barnsley BAPs those present within the Park Spring site did not fit the criteria for inclusion within these BAPs. Due to the low species diversity this habitat is considered to be of Negligible conservation value and as such is not considered further in this assessment.

Species rich intact hedge

9.5.28 This hedge was identified bordering the access track through the central section of the site. Woody species are dominated by hawthorn and blackthorn with hazel (*Corylus avellana)*, field maple (*Acer campestre*), holly, Oregon-grape (*Mahonia aquifolium)*, ash (*Fraxinus excelsior)*. Undergrowth for this habitat consists of improved grassland as listed above with hogweed (*Heracleum sphondylium)* and cow parsley (*Anthriscus sylvestris)*.

9.5.29 Species rich hedgerows have a good species diversity and hedgerows are designated on both the Barnsley and UK BAPs. Hedgerows fulfilling certain criteria are considered 'important' and are afforded protection under the Hedgerow Regulations (1997). For the purposes of this assessment, species rich intact hedges and intact hedges with trees are considered to be important and afforded protection under the Hedgerow Regulations. Notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Local value and as such will be considered further in this assessment.

Species poor intact hedge

9.5.30 This hedge type is found spread throughout the survey area with a mixture of the woody species mentioned above but always less than five species present within each hedgerow. Dominant species present are hawthorn, blackthorn, elder and field maple.

9.5.31 Although all hedgerows are UK and local BAP Priority Habitat Features and are included on Section 41 of the NERC Act (2006) as Habitats of Principal Importance they are considered to be widespread and common in a local, county and national context. For this reason, notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Neighbourhood value and as such is not considered further in this assessment.

Species poor defunct hedge

9.5.32 This hedge type was found throughout the survey area with same species as species poor intact hedge, described above.

9.5.33 Although all hedgerows are a UK BAP Priority Habitat Features and are included on Section 41 of the NERC Act (2006) as Habitats of Principal Importance they are considered to be widespread and common in a local, county and national context. For this reason, notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Negligible value and as such is not considered further in this assessment.

Species rich hedge with trees

9.5.34 This habitat is found along the track through the central section of the site and to the northern section of the site (please refer to Figure 3 – 6 of Appendix 9.1). Species found within this habitat type are dominated by hawthorn, blackthorn, field maple and Norway maple *(Acer platanoides) with hazel, elder, silver birch,* sycamore, guelder rose (*Viburnum opulus*) and dog rose. The understorey species are dominated by improved grassland species as listed above with dog's mercury, nettle, bramble, rosebay willowherb, mugwort (*Artemisia vulgaris*) and greater stitchwort.

9.5.35 Species rich hedgerows have a good species diversity and hedgerows are designated on both the local and UK BAPs. Hedgerows fulfilling certain criteria are considered 'important' and are afforded protection under the Hedgerow Regulations (1997). For the purposes of this assessment, species rich intact hedges and intact hedges with trees are considered to be important and afforded protection under the Hedgerow Regulations. Notwithstanding the potential for this habitat to support protected species and/or species of conservation interest, this habitat is considered to be of Local value and as such will be considered further in this assessment.

Species poor hedge with trees

9.5.36 This hedge type is found spread throughout the survey area with the same species composition as described in section 9.4.43. For locations of this habitat type on site please refer to Figures 3, 4, 5 and 6 of Appendix 9.1.

9.5.37 Although a priority habitat in the local and UK BAP species poor hedgerows are widespread within a local, district, county and national context. This habitat type is therefore considered to be of Neighbourhood value and as such is not considered further in this assessment.

Dry ditch

9.5.38 This habitat was found throughout the survey area in the majority of the site boundary. The majority of this habitat was covered with improved grassland often dominated with creeping bent, sheep's fescue and *Agrostis* spp.

9.5.39 A common habitat both within the survey area and wider area supporting low species diversity and therefore considered to be of Negligible conservation value and as such is not considered further in this assessment.

Bare ground

9.5.40 An area of bare ground occurs on site to the south east of the site please refer to Figure 3 of Appendix 9.1. This area had recently been disturbed at the time of survey.

A small area of this habitat type is present within the site. This is a common habitat in the wider area and supports low species diversity. This habitat within the site is considered to be of Negligible conservation value and as such is not considered further in this assessment.

Identification of Species Receptors

Badger

9.5.41 Badgers are protected under the Protection of Badgers Act (1992) on animal welfare grounds rather than nature conservation value. It is an offence to wilfully take, kill, injure or ill-treat a badger, or possess a dead badger or any part of a badger. Under the Act their setts are also protected against obstruction, destruction, or damage in any part.

9.5.42 The badger group monitor setts in the area and returned two records of setts within 3.5 km of the centre of the site. One of these was an active sett and the second was a disused sett in close proximity to the first.

9.5.43 No active setts were found within the survey area, however latrines within the site boundary indicate that badgers cross and potentially forage within the site.

9.5.44 The full details of the badger survey report are included in Appendix 9.2.

9.5.45 Badgers are protected for welfare rather than conservation reasons, and are considered to be a common species. Therefore badgers are not considered to be of significant importance and as such will not be considered for detailed assessment as

a VER but will be considered for mitigation to ensure their protection within the survey area due to the legal protection they receive.

Otter

9.5.46 Otters are protected under Schedule 5 of the Wildlife and Countryside Act (1981, as amended) and listed under Schedule 2 of the Conservation of Habitats and Species Regulations 2010. It is therefore illegal to deliberately capture, injure or kill an otter, possess an otter (dead or alive), or any other part of an otter, or intentionally or recklessly disturb otters. It is also illegal to damage, destroy or intentionally or recklessly obstruct access to a holt or other resting place used by an otter.

9.5.47 Otters are a UKBAP priority species and are also listed on the Local Biodiversity Action Plan (LBAP) for Nottinghamshire. Otters are widespread across much of the UK following a reverse in population declines experienced in the last century up to the 1970's.

9.5.48 The desk study from the SBRC returned one otter record located approximately 1.7 km south of the boundary of the site. No signs of otter were recorded during the field surveys. The otter survey concluded that although dispersing otters may pass through the site during dispersal otters are unlikely to use terrestrial features in the area or site as a whole on a permanent basis.

9.5.49 In light of this, it was considered that the survey area was of Negligible value to this species and otters will not be considered further in this assessment.

9.5.50 Further information on the otter survey can be found in Appendix 9.3.

Water Vole

9.5.51 Water voles are fully protected under the Wildlife and Countryside Act (1981, as amended). It is an offence to possess, control or sell water voles or to intentionally kill, injure or take water voles. It is also an offence to intentionally or recklessly damage, destroy or obstruct access to a place that water voles use for shelter or protection or disturb them whilst they are using such a place. In addition to their legal protection, water voles are listed as a priority species within the UK and Barnsley BAP's.

9.5.52 Three pre-existing records of water vole were present approximately 1 km south of the site. During the field surveys signs of water vole were recorded in a ditch near the east of the site; four other water bodies were considered to have potential to support water voles although no signs of their presence were recorded during the surveys.

9.5.53 It was considered that the site supported low numbers of water vole or was part of a territory of water voles within the local area. Therefore it is considered that the survey area is of Local value for water voles and as such water voles will be considered further in this assessment.

Bats

General

9.5.54 All native UK bat species are protected by UK law under Schedule 5 and 6 of the Wildlife and Countryside Act (1981, as amended), and under Schedule 2 of the Conservation of Habitats and Species Regulations (2010 as amended). It is illegal to deliberately capture, injure or kill a bat or to intentionally or recklessly disturb bats. It

is also illegal to damage, destroy or intentionally or recklessly obstruct access to a breeding or resting place used by a bat. Furthermore, six bat species (barbastelle *Barbastella barbastellus*, noctule *Nyctalus noctula*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared bat *Plecotus auritus*, greater horseshoe bat *Rhinolophus ferrumequinum* and lesser horseshoe bat, *Rhinolophus hipposideros*) are listed as priority species within the UK BAP and all bats are listed as priority species within the Barnsley BAP.

Desk Study

9.5.55 The desk study recorded 41 roosts (two Leisler's bat roosts, ten unidentified pipistrelle roosts, one brown long-eared batroost, three Daubenton's bat hibernation roosts and one brown long-eared bat roost) within 10 km of the site. The closest record being a record of a pipistrelle roost containing 50 bats approximately 280 m[19] to the east of the site boundary (over 700m to the northeast of the nearest proposed turbine location).

9.5.56 The following eight bat species/groups were recorded within the survey area following analysis of the desk study and survey results:

- Common pipistrelle.
- Soprano pipistrelle.
- Natterer's bat (a *Myotis* species).
- Daubenton's bat (a *Myotis* species).
- *Myotis spp*.(bats identified to the genus Myotis may be either of the Myotis species mentioned above or, given the sites location, potentially whiskered bat or Brandt's bat).
- Brown long-eared bat.
- Noctule.
- Leisler's bat.

9.5.57 The local and national status of the bat species recorded/potentially recorded within the site is given in Table 9.5 below.

Table 9.5: Local and National Status of bat species

Species	Status within the Barnsley Area[20]	Status Nationally[21]
Common pipistrelle	common and widespread	common
Soprano pipistrelle	no data	common
Brown long-eared bat	common with a restricted distribution	common
Daubenton's bat	common and widespread	common

[19] Although the exact location of the roost is not known, a precautionary approach has been taken whereby this distance is taken using the nearest point of the road which the roost is known to be located on.
[20] Carr G. and Parker M. (2009) *Barnsley Biodiversity Action Plan 2008 – 2012*. Barnsley Biodiversity Trust
[21] Taken from Mitchell-Jones T. & Carlin C. (February 2012) Natural England Technical Information Note TIN051, Bats and Onshore Wind Turbines *Interim guidance*. Natural England.

Species	Status within the Barnsley Area[20]	Status Nationally[21]
Natterer's bat	common with a restricted distribution	fairly common
Whiskered bat	scarce	locally distributed
Brandt's bat	no data	common in the north and west of England rare or absent in the south and east
Noctule	scarce	uncommon
Leisler's bat	rare	Scarce

9.5.58 All nine species recorded / potentially recorded within the survey area are already known to be present in South Yorkshire.

Known Risk Level[22]

9.5.59 Of the species recorded three (the *Myotis* species (Daubenton's bat and Natterer's bat) and brown long-eared bat) are considered to be of low collision risk and two are considered to be of medium collision risk (common and soprano pipistrelle) but due to their abundance, nationally, the populations of these two species are considered to have a low risk from turbines; two of the species recorded are considered to be of high collision risk (noctule and Leisler's bat).

Tree Inspections

9.5.60 During the tree inspection four trees and one area of woodland were considered to have high potential to support roosting bats; a further seven trees had moderate potential and four further trees and a hedgerow were classed as having low potential to support roosting bats. No confirmed bat roosts were recorded in any of the trees or hedges surveyed.

Transect Surveys

9.5.61 Transect surveys recorded six bat species (Leisler's bat, common and soprano pipistrelle, Daubenton's bat, Natterer's bat and brown long-eared bat) at point counts, with additional *Myotis* species (that were unable to be identified to species level) recorded between points. Most bat activity was recorded along the north-eastern edge of the site. Most bat activity recorded was attributed to species regarded as being of low or medium risk of collision with wind turbines (all with low risks to their populations). The general level of bat activity was considered to be low – moderate. The exception was the Leisler's bat recorded at point count 21 and in-between point counts 1 and 24. The level of high risk bat activity recorded was considered to be very low.

[22] Taken from Mitchell-Jones T. & Carlin C. (February 2012) Natural England Technical Information Note TIN051, Bats and Onshore Wind Turbines *Interim guidance*. Natural England.

Commuting Route Surveys

9.5.62 Five commuting route surveys were undertaken around the perimeter of the survey area focusing on areas of adjacent high quality foraging habitat and potential roosts. The commuting surveys identified moderate levels of common pipistrelle commuting from the village of Great Houghton along the north-eastern site boundary presumably commuting from the pipistrelle maternity roost. Low levels of pipistrelle commuting were also recorded on the northern, western and southern boundaries. It was thought that low numbers of bats used the footbridge which linked the western site boundary with suitable foraging habitat beyond Park Spring Road.

Static Detector Surveys

9.5.63 Static detectors, installed at proposed turbine locations and a control site recorded the presence of at least five species of bat including noctules and *Nyctalus* species (either noctule or Leisler's bats which could not be determined to species level). Noctule and *Nyctalus* species are considered to be at "high risk" of collision with turbines[23].

9.5.64 Of the bat activity recorded on ground level static detectors the control detector, next to the wood on the north-eastern edge of the site, recorded Moderate levels of bat activity, the detector located at the location of Turbine T1 generally registered low levels of activity, with moderate levels recorded in May and July. All other detectors within the survey area recorded low levels of bat activity each month.

9.5.65 Although still relatively low, higher levels of *Nyctalus* activity were recorded during the May monitoring period. During May 95% of all *Nyctalus* activity was recorded during the time period half an hour before sunset to an hour and a half after sunset.

Vantage Point Surveys

9.5.66 Vantage point surveys undertaken in April and May 2013 recorded low numbers (five passes, likely to have been one or two individual bats) of *Nyctalus* bats (noctule or Leisler's bat) commuting across the northeast half of the site from the north. During the vantage point surveys the noctule did not forage extensively in the areas in which turbines were located.

9.5.67 Together with other survey data this indicates that *Nyctalus* activity within the site is likely to be limited to low numbers of bats regularly crossing but not usually foraging intensively within the site. The peak in activity recorded in May 2011 on the static detector surveys is most likely to represent low numbers of *Nyctalus* species foraging within the site, perhaps due to the emergence of the imago (adult) of a specific insect species.

At-Height Surveys

9.5.68 Overall, the level of bat activity at height was significantly lower than that recorded at ground level. The level of high-risk species activity recorded at height was slightly higher than that recorded at ground level however this difference was not statistically significant.

9.5.69 Because the relative population size of each bat species, their risk of collision and the way in which these species use the site is inherently different, high risk species

(*Nyctalus* species) will be assessed separately from low and moderate risk species, for which there is a low risk to their populations.

Moderate and Low Risk Bat Species

9.5.70 The level of activity across the Park Spring site is considered to be low to moderate and the species recorded are relatively common locally and nationally. The survey area is considered to be of Local importance for these species and will therefore be considered further in this assessment.

High Risk Bat Species

9.5.71 The level of high-risk bat activity is considered to be generally low across the site with occasional peaks in activity by relatively low numbers of bats. Given that the Nyctalus species recorded are considered to be scarce or rare locally and uncommon or scarce nationally it is considered that the survey area is of Local importance for these species.

Reptiles

9.5.72 The four common reptile species, adder (*Vipera berus*), grass snake (*Natrix natrix*), common lizard (*Zootoca vivipara*) and slow worm (*Anguis fragilis*), are protected under Schedule 5 of the Wildlife and Countryside Act (1981, as amended) against intentional killing, injuring and trade. All species of reptile are listed as priority species within the UK BAP.

9.5.73 The 2011 desk study search revealed a single record of a grass snake 1.5 km to the south west of the site. An additional grass snake record was made in the north of the site during the badger surveys.

9.5.74 Suitable habitat was present to support all four common reptile species in both summer and winter (during hibernation). Reptile habitat was also identified along a hedgerow in the centre of the site and associated with hedgerow and trees with refugia present. Although the cropped fields are considered to be of limited value to reptiles, the remainder of the survey area (including the field margins) was considered to present potential to support reptiles and therefore is considered to be of Local importance and will be considered further in this assessment.

Great Crested Newt

9.5.75 Great crested newts (GCN) (*Triturus cristatus*) are protected under Schedule 5 the Wildlife and Countryside Act 1981 (as amended), and under Schedule 2 of the Conservation of Habitats and Species Regulations 2010. It is illegal to possess a protected species (alive or dead), deliberately capture, injure or kill, to intentionally or recklessly disturb, or to deliberately take or destroy the eggs of these protected species. It is also illegal to damage, destroy or intentionally or recklessly obstruct access to a breeding or resting place used by these protected species. GCN are also listed as a priority species within the UK and Barnsley BAP.

9.5.76 There were 30 records of great crested newt (*Triturus cristatus*) within 10 km of the site with the nearest record 1 km to the west of the site (however, this area of recorded population is separated from the site by the River Dearne and the A6195).

9.5.77 The 2011 Extended Phase 1 Habitat Survey found that the survey area contained three ponds with potential for breeding GCN within 500 m of the survey area and some suitable terrestrial habitat was present within the survey area. Therefore the

site was considered to present potential to support great crested newts and therefore is of Local importance and will be considered further in this assessment.

White Clawed Crayfish

9.5.78 White clawed crayfish (*Austropotamobius pallipes*) receives legal protection through its inclusion on Schedule 5 of the Wildlife and Countryside Act, 1981. This section of the Act protects the white clawed crayfish and its places of shelter. It is illegal to take white clawed crayfish from the wild or to sell them.

9.5.79 This species is widespread in clean, calcareous streams, rivers and lakes in England and Wales but can only be found in rivers and streams with good cover and little sediment. It was considered that there were no habitats present on site with potential to support white-clawed crayfish and this species will not be considered further in this assessment.

Invertebrates (not white clawed-crayfish)

9.5.80 Notable butterflies including; dingy skipper (*Erynnis tages*), small heath (*Coenonympha pamphilus)* wall brown, (*Lasiommata megera*) and white-letter hairstreak (dingy skipper (*Erynnis tages*), small heath (*Coenonympha pamphilus)* wall brown, (*Lasiommata megera*) and white-letter hairstreak (*Lasiommata megera)* were recorded amongst desk study records present within the site boundary. The common habitats within the site are considered to provide some potential to support important populations/assemblages of these invertebrate species.

9.5.81 Therefore it is considered that the survey area has the potential to be of Local value for invertebrates and as such will be considered further in this assessment.

Flora

9.5.82 The survey area consists of locally widespread habitats which are likely to contain common species. No records of protected or notable plant species have been found therefore no further surveys are considered necessary. The majority of the habitats on site are to be retained and therefore it is considered that the survey area is of Negligible value for flora and this group will not be considered further in this assessment.

Summary of Valued Ecological Receptors

9.5.83 Each habitat and species or species assemblage recorded has been assigned an ecological value according to the geographical scale at which it is important, in accordance with the IEEM guidelines. Where sites have designations at different levels (International, National, and Regional/ County/ Local/ Neighbourhood) the highest value has been assigned. VERs are summarised in Table 9.6, below.

Table 9.6: Summary of Valued Ecological Receptors

Site/ Habitat/ Species	Value	Evaluation Rationale
Broadleaved semi-natural woodland	Local	This habitat is not well represented in the local area, although a swathe is present to the north of the site. Mixed deciduous woodland is a local BAP habitat and that found within the site is considered to have good species diversity.
Broad leaved plantation woodland	Local	Although much of the broad leaved plantation woodland within the site was young, it contains good species diversity and will develop into semi-mature woodland over the 25 year lifespan of the wind farm. Additionally mixed deciduous woodland is a local BAP habitat.
Mesotrophic standing water	Local	The water bodies present on site, particularly those which are permanent features, increase the biodiversity of the survey area. Ponds are registered as a priority Barnsley BAP and UK BAP.
Species Rich intact hedge	Local	Species rich hedgerows have a good species diversity and hedgerows are designated on both the local and UK BAPs. Hedgerows fulfilling certain criteria are considered 'important' and are afforded protection under the Hedgerow Regulations (1997).
Species rich hedge with trees	Local	Species rich hedgerows have a good species diversity and hedgerows are designated on both the local and UK BAPs. Hedgerows fulfilling certain criteria are considered 'important' and are afforded protection under the Hedgerow Regulations (1997).
Water Voles	Local	Although the site was only considered likely to support low numbers of water voles they are protected under the Wildlife and Countryside Act 1982 (as amended) and are listed as a priority species within the UK and Barnsley BAP's. Potential impacts are considered further to ensure the protection of this species within the survey area.
Bats - moderate and low risk species	Local	UK bat species are protected under the Wildlife & Countryside Act 1981 (as amended) and the Conservation Regulations 2010. This legislation ensures that individual bats and their breeding sites and resting places are protected as well as areas of particular importance for foraging. Their low – moderate use of the Park Spring site combined with their relatively common distribution both locally and nationally means that they are considered of Local value.

Site/ Habitat/ Species	Value	Evaluation Rationale
		Potential impacts to low and moderate risk bat species are considered further including consideration of their protected status.
Bats - high risk species	Local	UK bat species are protected under the Wildlife & Countryside Act 1981 (as amended) and the Conservation Regulations 2010. This legislation ensures that individual bats and their breeding sites and resting places are protected as well as areas of particular importance for foraging. The low use of the Park Spring Site by these species is offset by the fact that they are considered scarce or rare locally and uncommon or scarce nationally. Potential impacts to high risk bat species are considered further including consideration of their protected status.
Reptiles	Local	The survey area contains habitat suitable to support common reptile species and grass snake are known to be present within the site. Potential impacts are considered further to ensure the protection of this group within the survey area.
Great crested newt	Local	The survey area contains habitat suitable to support great crested newt and (although separated from the site) historical records exist for this group. Potential impacts are considered further to ensure the protection of this group if present within the survey area.
Invertebrates	Local	Although no records exist for the site itself a number of notable butterfly species are known to be present within the local area and the site contains habitat suitable to support locally important assemblages of these species. Potential impacts are considered further to ensure the protection of this group if present within the survey area.

9.5.84 Table 9.7 identifies the habitats and species that have been identified as potential receptors are not considered to be VER's in the context of the survey area.

Table 9.7: Ecological Receptors of Less than Local Value

Scattered broad leaved trees	Semi-improved neutral grassland
Improved grassland	Tall ruderal
Arable	Species poor intact hedge
Species poor defunct hedge	Species poor hedge with trees
Dry ditch	Bare ground
Badger	Otter

White clawed-crayfish	Flora

9.6 Assessment of Impact on Ecological Receptors during Construction

Description of baseline

9.6.2 Significant changes in the baseline conditions between the present time and the proposed commencement of construction are considered unlikely although it should be noted that the agricultural activities undertaken at the development site can influence the ecological diversity of the site based on the regimes being implemented. Despite this factor it is considered that the key components that have a fundamental bearing on ecological diversity are likely to remain similar.

9.6.3 The features of the proposed development are outlined in Chapter 3 and in summary will comprise of three wind turbines, turbine foundations and hard-standing areas, enhancement to existing and creation of new access tracks, a site compound, underground cabling and a control room (see Figure 9.1).

9.6.4 Construction is expected to last for approximately 6-9 months within the lifetime of any permission granted (i.e. within 5 years). Operation would commence shortly afterwards for a period of up to 25 years.

Potential Impacts

9.6.5 The methodology used to identify and characterise potential impacts, and assess the significance of these impacts is described in detail above. In summary, this section identifies the likely effects on VERs of the proposed development during construction and characterises the potential ecological impacts that are likely to arise, taking into consideration the following parameters: positive/negative effect, magnitude, extent, duration, reversibility, and timing/frequency.

9.6.6 The impacts are assessed on the basis of the details of construction and operation of the proposed development outlined in Chapter 5. For the purpose of this assessment it is considered that decommissioning impacts are similar to those of construction. This assessment is made with due regard to the possible micro-siting of the wind turbines on site and any changes for the location of turbines (proposed maximum of 50 m) and access roads (proposed maximum of 15 m) are covered by the assessment. More details on micro-siting are found in Chapter 3 of this ES.

9.6.7 The assessment focuses on likely impacts to identified VERs, as summarised above. The overall significance of any impacts is assessed as adverse (negative), beneficial (positive) or not significant.

9.6.8 The potential impacts of the proposed Development to the valuable ecological features are described below.

Construction Activities

9.6.9 The typical sequence of construction activities as detailed in Chapter 3 would comprise the construction of access tracks and the site compound, installation of underground services and the provision of temporary construction facilities and services (site compound and parking facilities). The construction of the turbine foundations will then follow, this would entail excavation and casting concrete foundations; backfilling; compacting; and, foundation site restoration. The turbines would then be delivered in sections and constructed on-site using high lift cranes.

9.6.10 The potential impacts without mitigation arising during construction include:

- Permanent and temporary habitat loss.
- Habitat fragmentation.
- Direct mortality during site clearance and construction.
- Direct and indirect disturbance from construction activities including visual, noise, vibration and lighting.
- Pollution caused by use of hazardous materials and incidental release of chemicals, fuels or waste materials.

9.6.11 The confidence in assessment predictions for the construction assessment milestone is provided in the summary Table 9.10 at the end of the construction assessment.

9.6.12 Where potential significant adverse effects have been identified, mitigation measures have been identified to avoid, reduce or remedy these effects.

Mitigation to Avoid Construction Impacts

Construction Environmental Management Plan

9.6.13 Construction impacts are assessed with consideration given to the implementation of a Construction Environmental Management Plan (CEMP).

9.6.14 The CEMP will be developed by the appointed Contractor and implemented along with detailed Works Method Statements for each stage of the construction programme.

9.6.15 General good construction site management will be implemented to avoid/minimize generation of excessive litter, dust, noise and vibration. These measures will be controlled and monitored through the CEMP.

9.6.16 Measures will be implemented to avoid/minimise potential for fuel and chemical spills and spill kits will be ready to hand in the unlikely event of a fluid spill. There will be no storage of potentially contaminating materials in areas of ecological / hydrological sensitivity. A Pollution Incident Response Plan will be included as part of the CEMP to ensure that impacts from any potential accidental spills can be reduced to a minimum.

9.6.17 In addition, the following measures will be included in the CEMP:

- Work compounds and access tracks etc will not be located in, or adjacent to, areas that maintain habitat value.
- Site fencing will be used to prevent access to areas outside working areas, particularly in areas adjacent to features of ecological value.
- Procedures will be implemented to address site safety issues, including storage of potentially dangerous materials.
- Briefings and instruction would be given to contractors regarding the biodiversity issues associated with the site.

9.6.18 Pollution prevention guidelines provided by the Environment Agency (including but not limited to PPG01, PPG02, PPG03, PPG05 and PPG06) would be followed to prevent pollution of water courses by silt or chemicals.

9.6.19 It is considered that through the delivery of the CEMP construction impacts to VERs associated with dust and pollution will be avoided.

Predicted impacts and effects of construction activities to habitats

Broadleaved semi-natural woodland

Predicted construction impacts

9.6.20 The construction of the proposed development will not result in the loss of any broadleaved semi-natural woodland.

Predicted effects of construction activities

9.6.21 It is considered that there will be no loss of broadleaved semi-natural woodland within the survey area as a result of the proposed installation of the wind turbines and associated infrastructure. It is therefore assessed that that construction of the proposed wind farm would result in no effects.

Broadleaved plantation woodland

Predicted construction impacts

9.6.22 The construction of the proposed access track will not result in the loss of any broadleaved plantation woodland.

Predicted effects of construction activities

9.6.23 It is considered that there will be no loss of broadleaved plantation woodland within the survey area as a result of the proposed installation of the wind turbines. It is therefore assessed that that construction of the proposed wind farm would result in effects that are not significant.

Mesotrophic standing water

Predicted construction impacts

9.6.24 The construction of the proposed development will not result in the loss of any Mesotrophic standing water and as discussed in Chapter 8 it will not significantly affect the water table or water flows within the site.

Predicted effects of construction activities

9.6.25 There will be no impact to areas of mesotrophic standing water within the survey area as a result of the proposed installation of the wind turbines and associated infrastructure. It is therefore assessed that that construction of the proposed wind farm would result in no effects.

Species rich intact hedge

Predicted construction impacts

9.6.26 The proposed access track will require the removal of up to 400 m of species rich hedgerows to allow the installation of new, wider access tracks within the Park Spring Wind Farm site. The species rich hedgerows qualify as “important” under the

Hedgerow Regulations and as a UK priority BAP and LBAP habitat. This loss would represent the entire length of species rich intact hedgerow within the site.

9.6.27 The 400 m length of species rich hedgerow comprises two approximately 200 m lengths on either side of an existing access track that is due to be widened to allow large vehicles to access the site. Where possible the hedgerows alongside the access track will be retained on both sides. However where this is not possible, either because the hedges are too close to the existing track or due to the requirement for shallow curves allowing long vehicles to access the site the track will be widened only on one side. This will allow the retention of the hedgerow on the other side of the track. It is therefore likely that the loss of species rich intact hedge can be restricted to a length of no more than 200 m however for the purpose of this assessment a worst case scenario of 400 m is assumed.

Predicted effects of construction activities

9.6.28 This loss is considered likely to result in an adverse effects significant at a Local level.

Mitigation

9.6.29 The area of intact species rich hedgerow to be removed will be kept to a minimum, as stated above. To compensate for unavoidable clearance required to facilitate access the local translocation of the lengths of hedgerow due to be removed will be undertaken. The lengths of hedgerow would be translocated as short a distance as possible. Any gaps will be filled with new planting and the new hedgerow will be managed to ensure that the translocated length and new planting successfully grow. The location of the areas of translocated and new hedge are shown in Figure 9.4.

9.6.30 A total of 229 m of new hedgerow will be planted; 596 m of defunct hedgerow will be gapped–up. The hedgerow improvements are located along the boundary of the Development, their location is shown in Figure 9.4.

Residual impacts

9.6.31 The net gain in species rich hedgerow is considered likely to result in a positive effect, significant at a Local level.

Species rich intact hedge with trees

Predicted construction impacts

9.6.32 The proposed development will not require the loss of species rich hedgerows with trees within the Park Spring Wind Farm site. As part of the proposed development 213 m of defunct hedgerow will be gapped-up with oaks managed to develop into standard trees. The location of this hedgerow improvement is shown in Figure 9.4.

Predicted effects of construction activities

9.6.33 The improvements associated with the development will result in the creation / restoration of 213 m of species rich hedgerow with trees. It is therefore assessed that the construction of the proposed development would result in a positive effect on species rich hedge with trees at a site level, therefore not significant in the terms of this assessment.

Predicted effects of construction to species receptors

Water Voles

Predicted construction impacts

9.6.34 The ditches and pond in the southeast of the survey area were found to support water vole with some additional ditches within the site also considered suitable to support water vole.

9.6.35 The construction of the proposed wind farm will not impact on any of the ditches or ponds which have the potential to support water vole. The nearest ditch in which water vole were recorded is over 450 m from the development footprint.

Predicted effects of construction activities

9.6.36 There will be no loss of water vole habitat and as much of the network of access tracks are already in situ there would not be any substantial increase in habitat fragmentation. As such the impact on water voles during this phase of the development would result in effects that are not significant.

Bats – Low and Medium Risk Species

Predicted construction impacts

Foraging and Commuting

9.6.37 A significant proportion of bat foraging was associated with mature woodland along the north-eastern site boundary. A relatively well used common pipistrelle commuting route was also recorded in this location. While most foraging activity comprised relatively light tolerant species (common and soprano pipistrelle), a light sensitive species (brown long-eared bat) was also recorded in the north-east of the survey area with additional light sensitive Myotis species recorded in the south of the site with low levels of Myotis and brown long-eared activity also recorded on static detectors positioned at proposed turbine locations.

9.6.38 Although it is assumed that most construction work will be undertaken between 7.30 am and 7 pm it is envisaged that occasional late working may need to be undertaken and security lighting may also be used outside of these hours.

Roosts

9.6.39 Four trees have high potential to be used by roosting bats, seven were found to have moderate bat roost potential and four trees and the vegetation in one hedgerow was considered to have low potential to support roosting bats. The level of bat activity recorded within the survey area suggested that any roosts present within the survey area were no more than small transitory roosts used by, at most, a few bats.

9.6.40 The proposed footprint including for access arrangements for the Development does not require the removal of any of the onsite trees considered to have moderate or high potential to support roosting bats. If micro-siting requirements meant that access arrangements were to change, avoidance of trees with bat roost potential would be sought in the first instance, if this was not possible, advice would be sought from a licensed bat worker prior to removal, to ensure compliance with legislation and if

deemed appropriate it would need to be completed under a European Protected Species Licence EPSL).

Predicted effects of construction activities

Foraging and commuting

9.6.41 The effects of lighting used during construction would result in a net reduction in the quality and area of foraging and commuting habitat available. Given the localised nature of the areas likely to be affected and the fact that substantial alternative habitat would be available in the surrounding area, it is considered that this would result in an adverse effect, of low magnitude at a Neighbourhood level and as such is not significant.

Roosts

9.6.42 It is considered unlikely that roosts would be adversely affected during construction. As such the impacts are considered to be Negligible therefore the effect on bat roosts within the survey area are considered not to be significant.

Summary of predicted impacts

9.6.43 Although lighting will be temporary in nature and restricted to the area around the site compound and task lighting during working hours (normal working hours: 07:30 – 19:00 Monday to Friday and 08:00 – 13:00 on Saturday), the adverse effects associated with lighting during the construction phase of the proposed wind farm are likely to be of low magnitude. As such the impact of lighting on bats during this phase of the development could result in an adverse effect, at no more than a Neighbourhood level and as such not significant.

Mitigation

9.6.44 Where lighting is required for work which cannot proceed in daylight hours or for regular lighting within the site compound, hoods / cowls will be used to prevent light spill onto adjacent areas and sensors / timers used to trigger security lighting when required, preventing its constant use.

9.6.45 Key hedgerows (shown on Figure 9.4) will be gapped up and managed to incorporate standard trees. Additional habitat strips at the edge of arable fields will also be created (as shown on Figure 9.4).

Predicted residual effects of construction activities

9.6.46 Following successful implementation of the appropriate mitigation measures it is considered that the construction works will result in no significant residual effects to foraging and commuting bats during construction.

Bats – High Risk Species

Predicted construction impacts

Foraging and Commuting

9.6.47 The high risk species of bat are known to be relatively light tolerant and are known to occasionally forage around floodlights and security lighting that attracts insects. The

level of activity recorded within the site was generally low with a distinctive peak in activity during May 2011.

9.6.48 Although it is assumed that most construction work will be undertaken between 7.30 am and 7 pm it is envisaged that occasional late working may need to be undertaken and security lighting around the site compound may also be used outside of these hours.

Roosts

9.6.49 The trees identified in Section 9.6.32 above could be used by high risk species but the level of activity recorded suggested that any roosts present within the survey area were no more than small transitory roosts used by, at most, one or two bats.

9.6.50 The proposed footprint including for access arrangements for the development does not require the removal of any of the onsite trees considered to have moderate or high potential to support roosting bats.

Predicted effects of construction activities

Foraging and commuting

9.6.51 Given the localised nature of the areas likely to be affected and the fact that substantial alternative habitat present locally, the effects of lighting used during construction would not be significant.

Roosts

9.6.52 No roosts would be likely to be adversely affected during construction for the proposed footprint or access arrangements. As such the impacts are considered to be Negligible therefore the effects on bat roosts within the survey area are considered not to be significant.

Reptiles

Predicted construction impacts

9.6.53 The survey area contains habitat suitable to support common reptile species and historical records exist for this group. Habitats with the potential to support common reptile species within the survey area include grassland, hedgerows woodland and raised banks.

9.6.54 The construction of the proposed wind farm will require vegetation clearance and ground works which would affect all of the habitats listed above. Therefore the construction of the proposed wind farm has the potential to result in the killing or injury of reptile species during both the vegetation clearance and ground works phases.

9.6.55 It is considered that the construction of access tracks will create a more diverse mosaic habitat with more micro-climates and more edge habitat. This is likely to lead to a net increase in the quality of reptile habitat across the site.

Predicted effects of construction activities

9.6.56 Due to the limited size of the suitable habitat for reptiles being affected the risk of adverse effects through killing and injury of reptiles in the relatively small footprint of

the development is low and the irreversible impact on the population would be would be of low magnitude and for a short duration. This would result in a significant adverse effect at no more than a Local level.

9.6.57 The increase in the quality of reptile habitat within the site is likely to be permanent, irreversible but of minor magnitude. As such the impact on reptiles during this phase of the development would result in a positive effect at no more than a Neighbourhood level.

Mitigation

9.6.58 Suitable habitats present within the survey area that could support several common species of reptile. It is considered that reptiles will likely be confined to areas of woodland, field margins, grassland, hedgerows and raised banks. Although not all of these habitats are due to be affected by the proposed development mitigation is necessary to ensure no reptiles are killed or injured as a direct result of the ground works undertaken as part of the construction phase.

9.6.59 Where areas of habitat are identified as suitable to support common reptiles it will be necessary to provide a Precautionary Method of Working (PMoW) to enable site clearance, excavation and other ground works required as part of the construction of the proposed wind farm. It is envisaged that the PMoW will include such measures as reducing the sward height of grassland, hedgerows and scrub habitats over the course of two stages to encourage any reptiles present to move away from the areas of potential risk. In addition, the PMoW will also include measures such as identifying the most suitable time of year to undertake site clearance works, so as to reduce impacts to reptiles.

9.6.60 Such mitigation measures would enable any reptiles present within the survey area to remain, without the need for translocation. Due to the very localised and limited nature of any habitat removal it is not considered necessary to install exclusion fencing for reptiles, or to implement a translocation programme.

Predicted residual effects of construction activities

9.6.61 Assuming successful implementation of the appropriate measures to negate killing or injury to reptiles it is considered that potential killing and injury of reptile species due to construction works will result in no significant residual effects to reptiles.

Great Crested Newt

Predicted construction impacts

9.6.62 The survey area contains habitat suitable to support great crested newt species and historical records exist for this group. Habitats with the potential to support common great crested newt species within the survey area include ponds and ditches, hedgerows, woodland and to a lesser extent grassland fields. The area of each habitat type likely to be lost within 500 m of a pond is given in the table below (NB the ephemeral pond (Pond 3) has not been included as this pond has been dry on each survey since the Phase 1 habitat survey was undertaken).

Table 9.8: Habitat types within 500m

	Distance from nearest pond		
Habitat Type	< 100m	100 – 250m	250 – 500m
Ponds	0	0	0
Ditches	0	0	0
Woodland	0	0	0
Hedgerow	0	0	~90 m (length)
Improved grassland	0	0	3462m^2
Arable	0	0	3565m^2

9.6.63 Given the extremely small area due to be affected and the distance from the nearest pond it is considered extremely unlikely that the construction of the proposed wind farm would result in the killing or injury of great crested newt. However as a precaution, the killing and injury of great crested newts will be considered further to ensure their protection under UK law.

Predicted effects of construction activities

Habitat loss

9.6.64 Given the small area likely to be affected (shown in the above section) the rapid risk assessment tool available on the Natural England great crested newt method statement template document WML-A14-2 suggests that the habitat take associated with the construction of the proposed wind farm would not be likely to cause an offence and it is therefore considered that the proposed habitat loss would result in impacts that were not significant.

Killing and injury

9.6.65 Due to the limited size of the habitat for great crested newts being affected the risk of adverse effects through killing and injury of great crested newts in the relatively small footprint of the development is low and the irreversible impact on the population would be would be of low magnitude and for a short duration. As such the impact on great crested newts during this phase of the development would result in impacts which were not significant.

Mitigation

9.6.66 Within the site it is considered that great crested newts will likely be confined to areas of woodland, field margins, grassland, hedgerows and raised banks. Although not all of these habitats are due to be affected by the proposed development the precautionary approach requires that mitigation is necessary to ensure no great crested newts are killed or injured as a direct result of the ground works undertaken as part of the construction phase.

9.6.67 Where areas of habitat are identified as suitable to support common great crested newts it will be necessary to provide a Precautionary Method of Working (PMoW) to enable site clearance, excavation and other ground works required as part of the construction of the proposed wind farm. It is envisaged that the PMoW will include such measures as reducing the sward height of grassland habitats over the course of

two stages to encourage any great crested newts present to move away from the areas of potential risk. In addition, the PMoW will also include measures such as identifying the most suitable time of year and time of day / weather conditions to undertake site clearance works, so as to reduce impacts to great crested newts.

9.6.68 Such mitigation measures would enable any great crested newts present within the survey area to remain, without the need for translocation. Due to the distance from potential breeding ponds and the very localised and limited nature of any habitat removal it is not considered necessary to install exclusion fencing for great crested newts, or to implement a translocation programme.

Predicted residual effects of construction activities

9.6.69 No significant effect.

Terrestrial Invertebrates

Predicted construction impacts

9.6.70 The survey area contains habitat suitable to support locally important assemblages of notable butterflies and historical records exist for this group. Suitable habitats within the survey area include ponds and ditches, hedgerows, raised banks and to a lesser extent grassland fields. It is considered unlikely that the arable fields within the survey area support important invertebrate assemblages. The area of each habitat type likely to be lost is given in the table below.

Table 9.9: Habitat type likely to be lost

Habitat Type	Area due to be lost
Woodland	0
Hedgerow (species rich and species poor)	< 1368 m
improved grassland	3462m^2
Arable	7480m^2

9.6.71 Most of the area of improved grassland and arable habitat to be lost will become hard standing, creating areas of bare ground and, overall, a more diverse mosaic of habitat within the site.

Predicted effects of construction activities

9.6.72 Given the small area due to be impacted it is considered that construction would result in effects which are not significant.

Table 9.10: Summary of Assessment of Valued Ecological Receptors for Construction Milestone

VER	Current Baseline Value	Nature of Construction Impact	Positive, Negative or Neutral and Impact Magnitude	Significance of pre-mitigation effect	Mitigation	Residual Significance of Effect	Duration and Reversibility	Confidence in Prediction
Broadleaved semi-natural woodland	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Broadleaved plantation woodland	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Mesotrophic standing water	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Species rich intact hedge	Local	Loss of up to 400 m	Low-level negative impact	Significant at a Local level	Where possible, translocation of the hedgerow due to be lost and planting of equivalent length of new hedgerow where not possible. Planting of 229 m of new species rich hedge and gapping up of 596 m of defunct hedge.	Positive impact significant at a Local level.	Permanent, irreversible	Near certain

VER	Current Baseline Value	Nature of Construction Impact	Positive, Negative or Neutral and Impact Magnitude	Significance of pre-mitigation effect	Mitigation	Residual Significance of Effect	Duration and Reversibility	Confidence in Prediction
Species rich hedge with trees	Local	As part of the development 213 m of defunct hedge with will be gapped up and managed to develop into species rich hedge with trees.	Low-level positive impact	No significant effect	N/A	No significant effect	N/A	Near certain
Water Voles	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Bats, Low and Medium Risk Species - *foraging and commuting*	Local	Habitat degradation due to light pollution	Low-level negative impact	No significant effect	Unavoidable lighting to incorporate hoods and cowls to prevent light spill and motion sensors and timers used to prevent constant security lighting.	No significant effect	Short term reversible	Near certain
Bats, Low and Medium Risk Species - *roosts*	Local	No loss of known roosts or trees considered to have high potential to support roosting bats	Negligible - no impact	No significant effect	N/A	No significant effect	Long term irreversible	Near certain

VER	Current Baseline Value	Nature of Construction Impact	Positive, Negative or Neutral and Impact Magnitude	Significance of pre-mitigation effect	Mitigation	Residual Significance of Effect	Duration and Reversibility	Confidence in Prediction
Bats High Risk Species - *foraging and commuting*	Local	Habitat degradation due to pollution	Negligible – - no impact	No significant effect	N/A	No significant effect	Short term reversible	Near certain
Bats, High Risk Species - *roosts*	Local	No loss of known roosts or trees considered to have high potential to support roosting bats	Negligible - no impact	No significant effect	N/A	No significant effect	Long term irreversible	Near certain
Reptiles	Local	Reptiles killed and injured during vegetation clearance and groundwork	Low-level negative impact	Significant at a Local level	Implementation of a Precautionary Method of Works	No significant effect	Long-term (for the duration of the operation) Irrecoverable	Near certain
		Installation of access tracks and turbines over existing habitat	Low-level positive impact due to the increase in variety and available edge habitat.	No significant effect	No mitigation required	Significant positive effect at a Neighbourhood level	Long-term (for the duration of the operation) irreversible	Near certain
Great Crested Newts (GCN)	Local	GCN killed and injured during vegetation clearance and groundwork	Negligible due to the small area affected and distance from the nearest pond.	No significant effect	Implementation of a Precautionary Method of Works	No significant effect	N/A	Near certain

VER	Current Baseline Value	Nature of Construction Impact	Positive, Negative or Neutral and Impact Magnitude	Significance of pre-mitigation effect	Mitigation	Residual Significance of Effect	Duration and Reversibility	Confidence in Prediction
		Habitat loss	Negligible due to the small area affected and distance from the nearest pond.	No significant effect	No mitigation required	No significant effect	N/A	Near certain
Terrestrial Invertebrates	Local	Habitat loss	Negligible due to the small area affected	No significant effect	No mitigation required	No significant effect	N/A	Near certain

9.7 Assessment of Impact on Valued Ecological Receptors during Operation

Baseline at operation

9.7.2 During the operation of the proposed development there are potential impacts on VERs that may result from the operation of the site. These potential impacts include:

- Mortality due to collision with the blades of wind turbines or barotrauma effects (e.g. bats); and
- Mortality associated with the movement of maintenance vehicles along access tracks.

9.7.3 Maintenance activities would be low intensity, it is anticipated that the likelihood for large scale component replacement using cranes is unlikely.

Predicted impacts and effects of operation on Habitats

Broadleaved semi-natural woodland

Predicted operational impacts

9.7.4 Turbine operation itself will have no effect on the broadleaved semi-natural woodland within the survey area. Therefore operational impacts on this habitat are not considered further.

Broadleaved plantation woodland

Predicted operational impacts

9.7.5 Turbine operation itself will have no effect on the broadleaved plantation woodland within the survey area. Therefore operational impacts on this habitat are not considered further.

Mesotrophic standing water

Predicted operational impacts

9.7.6 Turbine operation itself will have no effect on the mesotrophic standing water within the survey area. Therefore operational impacts on this habitat are not considered further.

Species rich intact hedge

Predicted operational impacts

9.7.7 Turbine operation itself will have no effect on the species rich intact hedge within the survey area. Therefore operational impacts on this habitat are not considered further.

Species rich intact hedge with trees

Predicted operational impacts

9.7.8 Turbine operation itself will have no effect on the species rich intact hedge with trees within the survey area. Therefore operational impacts on this habitat are not considered further.

Predicted impacts and effects of operation on species receptors

Water voles

Predicted operational impacts

9.7.9 Turbine operation itself will have no effect on water voles within the survey area. Therefore operational impacts on this species are not considered further.

Bats - low and medium risk species

Predicted operational impacts

9.7.10 Potential operational impacts on bats are primarily associated with the risk of mortality due to collision with the blades of the wind turbines and the effects of barotrauma[24].

9.7.11 Low and Medium risk bat species are unlikely to come in contact with the blades as they usually fly low (usually no more than 20 m above the ground)[25]. The level of activity from low and moderate risk species was generally low with areas of moderate levels of activity concentrated along the north-eastern site boundary. In addition the level of activity recorded at height was significantly lower than the level of activity recorded at ground level.

9.7.12 All three turbines would be erected at least the recommended 50 m[26] plus blade length from the nearest habitat feature but this doesn't take into account the potential for tree and hedgerow growth during the 25 year lifespan of the wind farm. It is concluded that as trees and hedgerows grow into the buffer zone this would encourage this group of species to regularly access areas that puts them at risk of collision or barotrauma.

Significance of effects from predicted operational impacts

9.7.13 As trees and hedgerows grow into the standoff buffer it is considered likely that the effect of collision and barotrauma impacts would be significant at a Local level.

Mitigation

9.7.14 To ensure the risk of injury and mortality doesn't increase as trees and hedges grow into the 50 m standoff buffer over the predicted 20-25 year operational life of the wind farm habitat management should be undertaken to ensure trees and hedges surrounding the turbines remain located at, and at heights which, allow the retention of the 50 m standoff buffer.

[24] Baerwald E. F., D'Amours G.H., Klug B. J. & Barclay R. M. R. (2008) Barotrauma is a significant cause of fatalities at wind turbines. Current Biology Volume 18, Issue 16, 26 August 2008, Pages R695-R696
[25] Natural England guidance http://www.bats.org.uk/publications_download.php/459/Carlin_and_Mitchell_Jones.pdf
[26] Natural England guidance TIN051

9.7.15 Hedges along the northeast and eastern site boundaries will be planted or gapped up, enhancing the level of connectivity along the north-eastern edge of the site between a large swathe of woodland to the north and the golf course to the south, both of which offer areas of high-quality foraging habitat. A 3-5 m strip along one edge of two arable fields (both strips will be more than 400 m from the nearest turbine location) will be sown with wild flower mixes to create high quality foraging habitat in areas to enhance the quality of the cropped agricultural land for invertebrates and therefore foraging bats.

Predicted residual effect of operation

9.7.16 The mitigation measures proposed here will result in a likely low magnitude positive effect on low to moderate risk bat species, for the lifespan of the wind farm (long term), at a Neighbourhood level.

Bats – high risk species

Predicted operational impacts

9.7.17 Potential operational impacts on bats are associated with the risk of mortality due to collision with the blades of the wind turbines and the effects of barotrauma[27]. High risk bat species often fly at a height which means that they may come in contact with the blades[28].

9.7.18 The level of high risk bat activity recorded at height was not significantly different to that recorded at the ground. Across the site, the level of high risk bat species activity was generally low with the exception of high levels of activity from low numbers of bats recorded for half an hour either side of sunset in May 2011. All three turbines would be located at least the recommended 50 m plus blade length[29] from the nearest habitat feature which is likely to reduce the level of high risk bat activity around the turbines.

9.7.19 Although Nyctalus species are not considered common either locally or nationally and the survey data shows that the number of Nyctalus bats using the site was low and the level of activity was, on the whole, also low; however because the risk of collision for these species is inherently high it is concluded that mortality caused by collision and barotrauma may impact this group.

Significance of effects from predicted operational impacts

9.7.20 It is currently not feasible to predict collision risks for bats in the same way as is done for birds and no regularly used commuting routes were observed during the surveys. However, the survey data shows that it is reasonable to assume that the site is usually used by a low number of individual Nyctalus bats and very occasionally for periods of continuous foraging. Therefore the likelihood that a small number of individual, high risk bats, within the survey area boundary would randomly come into close proximity with three well spaced, wind turbines, of which the rotor swept area makes up a very small percentage of the total airspace used by this species, is unlikely except on an very infrequent, potentially annual, basis.

[27] Baerwald E. F., D'Amours G.H., Klug B. J. & Barclay R. M. R. (2008) Barotrauma is a significant cause of fatalities at wind turbines. Current Biology Volume 18, Issue 16, 26 August 2008, Pages R695-R696
[28] Natural England guidance http://www.bats.org.uk/publications_download.php/459/Carlin_and_Mitchell_Jones.pdf
[29] Mitchell-Jones T. (2012*) Natural England Technical Information Note TIN051 Bats and onshore wind turbines.* Natural England

9.7.21 The potential effect of random collision impacts on high risk bat species would be considered, near certain, to be of low magnitude, at no more than a Neighbourhood level.

9.7.22 A review of European studies suggests that bats may be attracted to the aggregations of insects which congregate at the top of turbines[30,31]. Although research undertaken in mainland Europe is not always directly applicable to situations in the UK a precautionary approach should be taken. Due to the fact that this type of behaviour cannot be recorded or quantified until the turbines are in situ it is estimated (based on the level of activity recorded within the survey area) that the effect of mortality (caused by collisions and barotrauma) on high risk bat species foraging around the tops of the turbines should be revised to a high magnitude significant at a Local level although, due to the lack of available research, the confidence in this conclusion has to be considered uncertain.

Mitigation

9.7.23 Two field margins (over 400 m from the nearest turbine) will be sown with wild flower mixes to create high quality foraging habitat enhancing the quality of the cropped agricultural land for invertebrates and therefore foraging bats. To this purpose hedges along the northeast and eastern site boundaries will also be planted or gapped up, increasing the level of invertebrate prey in areas of the site away from turbine locations.

Predicted residual effect of operation

9.7.24 Through implementing these mitigation measures it is considered that the effect on high risk bat species will be reduced to a low level, negative impact, for the lifespan of the wind farm (long term) at a Neighbourhood level, therefore not significant in the terms of this assessment and would not be expected to constitute an adverse effect on the favourable conservation status of bat species in the local area. Due to the potential for bats to be attracted to aggregations of insects in the vicinity of turbines the confidence in this prediction must be considered uncertain hence monitoring will be implemented.

Proposed Monitoring to verify operational impacts

9.7.25 To verify the efficacy of mitigation measures a suite of operational phase monitoring will be implemented. The indicative monitoring considerations below are a combination of Natural England guidance[8], Bat Conservation Trust recommendations[6] and other best practise guidance available[32]:

Duration

9.7.26 Monitoring will be undertaken for a minimum of three years. The first year of monitoring will be undertaken during the construction phase with two years undertaken during the first two years of operation.

[30] Rydell J. Bach L. Dubourg-Savage M.J. Green M. Rodrigues L. And Hedenstrom A. (2010) *Bat Mortality at wind turbines in northwestern Europe.* Acta Chiropterologica 12(2) 261-274.
[31] Rydell J. Bach L. Dubourg-Savage M. Green M. Rodrigues L. Hedenstrom A. (2010) *Mortality of bats at wind turbines links to nocturnal insect migration?* European Journal of Wildlife Research.
[32] University of Bristol / BCT (2009). Determining the potential ecological impact of wind turbines on bat populations in Britain; Scoping and method development report. Report to Defra. http://www.bats.org.uk/pages/wind_turbines.html

9.7.27 Monitoring will involve repeating the surveys which were undertaken to inform the baseline to assess any change in the use of the survey area by bats. In addition dawn corpse searches will be undertaken to attempt to assess the actual level of bat mortality.

9.7.28 The results of monitoring surveys are anticipated to either verify the predictions of this assessment concluded that there will be no significant effects at higher than a neighbourhood level to bat populations or, identify the need for further mitigation measures. In the event the favourable conservation status of any species of bat is considered to be compromised by the continued operation of the turbines further mitigation measures e.g. operational cut ins for individual turbines would be considered to ensure that adverse significant effects are prevented. Specific details of additional mitigation measures would be developed in consultation with Natural England and the Barnsley Metropolitan Borough Council Ecologist.

Reptiles

Predicted operational impacts

9.7.29 Impacts during the operational phase of the development will include increased mortality due to vehicle movements along access tracks.

Significance of effects from predicted impacts at operation

9.7.30 Due to the limited additional traffic required to undertake maintenance works it is considered near certain that the negative effect due to increased traffic mortality would be limited to low magnitude effects significant at a Neighbourhood level. This effect is considered to be irreversible.

Mitigation

9.7.31 To reduce the impact of vehicle mortality each maintenance engineer will be made aware of the potential presence of these protected species within the site prior to site visits. A maximum speed limit of 15 mph will also be set for roads within the site. This will allow drivers plenty of time to spot any reptiles that may be basking within the site and also, potentially, allow reptiles time to move off the access track into trackside vegetation.

Predicted residual effect of operation

9.7.32 Given the proposed mitigation measures it is considered likely that the proposed operation of the wind farm would not have any significant residual effects on the reptile populations which use the site.

Great Crested Newts

Predicted operational impacts

9.7.33 Assuming that great crested newts are present within the water bodies near the Park Spring site the impacts during the operational phase of the development would be limited to increased mortality due to vehicle movements along access tracks.

Significance of effects from predicted impacts at operation

9.7.34 Due to the limited additional traffic required to undertake maintenance works it is considered near certain that the negative effect due to increased traffic mortality would be limited to low magnitude effects significant at a Neighbourhood level. This effect is considered to be irreversible.

Mitigation

9.7.35 To minimise the effect of road mortality maintenance visits should be undertaken during daylight hours or winter months (October to February inclusive) when great crested newts are unlikely to be present on access tracks. Should this be unavoidable each maintenance engineer will be made aware of the potential presence and identifying features of this protected species within the site prior to site visits. A maximum speed limit of 15 mph will be set for roads within the site. This will allow drivers time to spot newts which may be crossing the track.

Predicted residual effect of operation

9.7.36 Given the proposed mitigation measures it is considered near certain that the proposed operation of the wind farm would not have any significant residual effects on the great crested newt populations which potentially use the site.

Terrestrial Invertebrates

Predicted operational impacts

9.7.37 Turbine operation itself will have no effect on the assemblage of terrestrial invertebrates within the survey area. Therefore operational impacts on this group are not considered further.

Table 9.11 - Summary of Assessment of Valued Ecological Receptors for the operation of the wind farm

VER	Current Baseline Value	Nature of Operational Impact	Positive, Negative or Neutral and Impact Magnitude	Significance of pre-mitigation effect	Mitigation	Residual Significance of Effect	Duration and Reversibility	Confidence in Prediction
Broadleaved semi-natural woodland	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Broadleaved plantation woodland	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Mesotrophic standing water	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Species rich intact hedge	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Species rich hedge with trees	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain
Water Voles	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain

VER	Current Baseline Value	Nature of Operational Impact	Positive, Negative or Neutral and Impact Magnitude	Significance of pre-mitigation effect	Mitigation	Residual Significance of Effect	Duration and Reversibility	Confidence in Prediction
Bats, Low and Medium Risk Species	Local	Collision and barotrauma	Low level negative impact	Significant at a Local level	Enhance connectivity along the north-eastern edge of the site, enhance quality of foraging habitat in areas >200 m from turbines. Manage trees and hedgerows to ensure 50 m standoff buffer is maintained.	Low level impact resulting in a positive effect at a Neighbourhood level.	Long term irreversible.	Likely
Bats High Risk Species	Local	Collision and barotrauma	High-level adverse impact	Significant at a Local level	Enhance foraging in areas at least 200 m from turbines. Monitoring to verify the effectiveness of mitigation and provide data to refine the duration which it is effective for.	No significant effect	N/A	Uncertain
Reptiles	Local	Vehicle mortality	Low-level negative impact	No significant effect	Maintenance engineers to be made aware of the presence of reptiles and 15 mph speed limit on site.	No significant effect	N/A	Near certain

VER	Current Baseline Value	Nature of Operational Impact	Positive, Negative or Neutral and Impact Magnitude	Significance of pre-mitigation effect	Mitigation	Residual Significance of Effect	Duration and Reversibility	Confidence in Prediction
Great Crested Newts (GCN)	Local	Vehicle mortality	Low-level negative impact	No significant effect	Timing of site visits to coincide with likely absence of GCN. Maintenance engineers to be made aware of the presence of GCN and 15 mph speed limit on site.	No significant effect	N/A	Near certain
Terrestrial Invertebrates	Local	No impact	Negligible - no impact	No significant effect	N/A	No significant effect	N/A	Near certain

Generic Mitigation to Avoid Impacts

9.7.38 An Operational Environmental Management Plan (OEMP) will be implemented by an appointed contractor to illustrate how impacts on ecology will be managed throughout the operational phase of the development to cover dealing with the protected species found on site and habitat management.

9.8 Assessment of Impact on Valued Ecological Receptors during Decommissioning

Assessment of Decommissioning Effects

9.8.1 During decommissioning, the turbines will be removed at the base, with the foundations, crane pads, underground cables and access tracks anticipated to be left in situ. Potential impacts during decommissioning are largely the same as during construction (i.e. disturbance of vegetation and potential disturbance/harm of protected species) with no additional potential impacts anticipated.

9.8.2 Prior to decommissioning, the site will be resurveyed to evaluate the potential for impacts on protected species and the appropriate mitigation (and licensing if necessary) would be applied.

Biodiversity Enhancement

9.8.3 The proposed mitigation measures outlined below have the potential to provide additional ecological enhancement.

9.8.4 The Natural Environment and Rural Communities Act (NERC) (2006) requires planning authorities and statutory bodies to consider opportunities for biodiversity enhancement and the National Planning Policy Framework emphasises the need to achieve sustainable development, in part by moving from a net loss of bio-diversity to achieving net gains for nature. The detailed design of the measures proposed would be subject to consultation with the Local Planning Authority and statutory consultees prior to their implementation. Measures need to be carefully considered to ensure that enhancement measures do not attract species into the area that may subsequently be adversely affected by the operation of the development.

9.8.5 The gapping up and planting of new hedgerows and creation of wildlife strips and beetle banks in the margins of arable fields as detailed in the proposed mitigation for bats during the operational phase of the development would also enhance connectivity and increase the quality of foraging habitat within the site for badgers, small mammals, reptiles, great crested newts, and some bird species.

Assessment of Residual Effects

9.8.6 Following the implementation of the mitigation measures identified in this chapter it is considered that all significant construction phase and operational phase effects associated with the proposed development can be reduced to levels where they would not be significant above a neighbourhood level.

Assessment of Cumulative Effects

9.8.7 A review of proposed and consented developments in the area has been undertaken.

9.8.8 A two 80 kW turbine wind farm at Mount Pleasant Farm is being considered. The site is located approximately 1.5 km to the north of the Park Spring Road site.

9.8.9 The only VER likely to be negatively affected by the additional turbines at Mount Pleasant Farm would be bats, specifically high risk Noctule and Leisler's bat species for the duration of the operational phase of the two developments.

9.8.10 Due to the appropriate siting of Park Spring Wind Farm in combination with the low level of bat activity recorded within the survey area it is considered unlikely that the development would add significantly to the level of bat mortality in the local area.

9.8.11 Should monitoring show levels of bat mortality are higher than predicted during the operational phase of the wind farm appropriate additional mitigation measures will be implemented.

9.8.12 Within 20 km of the Park Spring site there are an additional two operational wind farms (with a total of 10 turbines), four under application for planning permission (total of 12 turbines) and two (total of five turbines) which are approved but not operational (one of the two is currently under construction). Of the eight potential wind farms two schemes (total of eight turbines) are located within 10 km of the Park Spring survey area, at Hampole and Marr, approximately 9.2 and 8.4 km from the Park Spring site respectively.

9.8.13 With the exception of Mount Pleasant Farm, due to the distance of these sites none of the above developments are considered likely to add to the cumulative effect on any of the VERs identified in this chapter.

9.9 Conclusion

9.9.1 The assessment has been informed through a suite of desk and field based surveys to inform the baseline conditions of the survey area. The VERs have been identified and provided a geographic value in consideration of their abundance and location.

9.9.2 The potential effects of the proposed development have been identified during construction, and operation and decommissioning and the potential significant effects to the VERs identified. Where significant adverse effects above neighbourhood level have been identified (as per the IEEM guidelines for assessment) appropriate mitigation has been prescribed, this ensures no net loss of habitats considered to be VERs and no significant detrimental effects to any of the local protected species populations. No cumulative effects have been identified.

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SECTION 10

ORNITHOLOGY

10 ORNITHOLOGY

10.1 Introduction

10.1.1 This section describes and evaluates the current ornithological baseline of the proposed Park Spring Wind Farm site (hereinafter referred to as 'the Development'), and its surrounds, and provides an assessment of the likely significant effects of the Development upon ornithology. The specific objectives of the ornithological assessment were to:

- Undertake breeding bird surveys of the proposed wind farm site and its surrounds, to determine the numbers of birds present, and approximate breeding locations.
- Undertake wintering bird studies to determine the birds that may be affected by the proposed development at that time of year.
- Undertake vantage point observations to quantify the rates of bird movement across the proposed wind farm site and its surrounds.
- Collate relevant additional information on the area's ornithological interests.
- Evaluate the ornithological importance of the study area, assess the likely effects of the development on the study area's ornithology and recommend mitigation measures if necessary.
- Evaluate the residual effects of the Development after mitigation measures are incorporated.

10.1.2 This assessment has been undertaken by Dr Steve Percival of Ecology Consulting. The fieldwork was carried out by Mike Hoit and Keith Langdon. A full description of the Development is given in Chapter 3 and shown on Figure 3.2. The main elements of the Development considered in this chapter are:

- Three wind turbines (tip height of up to 126.5m, hub height 80m, 92m rotor diameter).
- A control building.
- Internal access tracks linking the turbines.
- Underground electrical cables.
- A temporary construction compound.

10.1.3 The site is located approximately 7 km east of Barnsley in South Yorkshire. Baseline surveys followed the guidance on bird surveys for wind farm assessments produced by Scottish Natural Heritage [SNH] (Whitfield et al. 2010) and by Natural England [NE] (Drewitt 2010). The ornithological study areas were chosen to include areas within the potential zone of ornithological influence of the proposed wind farm. This included all the land that was being considered for locating wind turbines, plus a 500m buffer around this for the breeding bird surveys and a 1 km buffer for the wintering bird surveys. These distances were chosen to follow current guidance (Drewitt 2010). The breeding bird study area covered a total area of 4.1 km^2, the wintering bird survey area 8.7 km^2. The main habitat across both of these areas is predominantly arable farmland and grassland, with the Edderthorpe Flash wetland on

the western fringe. The site lies within the '*Coal Measures*' Natural England Natural Area.

10.2 Regulatory / Policy Framework

10.2.1 The following documents have been taken into account in this assessment:

- National Planning Policy Framework, which includes guidance on how government policies for conservation and enhancement of flora and fauna should be reflected in land use planning.
- Overarching National Policy Statement for Energy (EN-1).
- National Policy Statement for Renewable Energy Infrastructure (EN-3).
- EU Council Directive 79/409/EEC on the conservation of wild birds (the 'Birds Directive').
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (codified version).
- The Conservation of Habitats and Species Regulations 2010 which now constitutes the "Habitats Regulations." This supersedes the Conservation (Natural Habitats, etc.) Regulations 1994 and translates the Birds and Habitats Directives into UK Law.
- 'Managing Natura 2000 Sites' (European Communities 2000), which gives guidance on the implementation of the Birds and Habitats Directives;
- The Wildlife and Countryside Act 1981, as amended.
- The Countryside and Rights of Way Act 2000.
- The Natural Environment and Rural Communities Act 2007.
- The UK Biodiversity Action Plan.
- The Yorkshire Local Biodiversity Action Plan.

10.3 Assessment Methodology

10.3.1 This assessment has been carried out using the methodology developed by SNH and the British Wind Energy Association [BWEA] and updated by Percival (2007). This method first identifies the sensitivity (conservation importance; as defined in Table 10.1) of the receptors present in the study area, then determines the magnitude of the possible effect on those receptors (as described in Table 10.2).

10.3.2 The evaluation of the conservation importance of the ecological populations at the site has been undertaken with reference to guidelines given in Percival (2007). The conservation importance in numeric terms was assessed by reference to Table 10.1 and by using the standard 1% criterion method (Holt et al. 2012); >1% national population = nationally important, >1% international population = internationally important.

10.3.3 National (GB) and International wintering waterfowl baseline populations have been taken from the most recently published population figures (Holt et al. 2012) from the national Wetland Birds Survey. Other baseline populations were derived from Baker et al. (2006). For all of the assessment the 'region' was taken as the county of South Yorkshire. A further category of 'local importance' was used for species that did not reach regional importance but are still of ecological value. This included all species on

the red or amber lists of the RSPB' et al.'s 'Birds of Conservation Concern' (Eaton et al. 2009) that did not reach national or regional importance at the site.

Table 10.1: Sensitivity (conservation importance) of bird species

Sensitivity	Definitions
Very High	Cited interest of SPAs, SACs and SSSIs. Cited means mentioned in the citation text for those protected sites as a species for which the site is designated (SPAs/SACs) or notified (SSSIs).
High	Other species that contribute to the integrity of an SPA or SSSI. A local population of more than 1% of the national population of a species. Any ecologically sensitive species, e.g. large birds of prey or rare birds (<300 breeding pairs in the UK). EU Birds Directive Annex 1, EU Habitats Directive priority habitat/species and/or W&C Act Schedule 1 species (if not covered above). Other specially protected species.
Medium	Regionally important population of a species, either because of population size or distributional context. UK BAP priority species (if not covered above).
Low	Any other species of conservation interest, e.g. species listed on the Birds of Conservation Concern not covered above.

Table 10.2: Definition of terms relating to the magnitude of ecological effects

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

Magnitude	Definition
	Guide: <1% of population/habitat lost

10.3.4 The combined assessment of the magnitude of an effect and the sensitivity of the receptor has been used to determine whether or not an adverse effect is significant. These two criteria have been cross-tabulated to assess the overall significance of that effect (Table 10.3).

Table 10.3: Matrix of magnitude of effect and sensitivity used to test the significance of effects.

MAGNITUDE	SENSITIVITY			
	Very high	**High**	**Medium**	**Low**
Very high	Very high	Very high	High	Medium
High	Very high	Very high	Medium	Low
Medium	Very high	High	Low	Very low
Low	Medium	Low	Low	Very low
Negligible	Low	Very low	Very low	Very low

The significance category of each combination is shown in each cell. Shaded cells indicate potentially significant effects.

10.3.5 The interpretation of these significance categories is as follows:

- Very low and low are not normally of concern, though normal design care should be exercised to minimise adverse effects;
- Very high and high represent adverse effects on bird populations which are regarded as significant for the purposes of EIA;
- Medium represents a potentially significant adverse effect on which professional judgment has to be made.

10.4 Information gaps

10.4.1 No significant information gaps have been identified. Inevitably with any ecological survey it cannot be guaranteed to detect all target species/individuals and surveys cannot be fully representative of all conditions (e.g. severely reduced visibility). However in this case it was concluded that the baseline surveys provide a robust data set on which to carry out the assessment. None of the limitations are considered likely to have materially affected the conclusions of this assessment.

10.5 Baseline Methodology

Desk Study

10.5.1 The desk study aimed to provide information on the ornithological interest of the study area and its surrounds, including the locations of any relevant statutory protected sites. The following sources of information were used for the desk study exercise:

- Natural England website [www.naturalengland.org.uk] – statutory designated site boundaries, including Sites of Special Scientific Interest (SSSI) and SSSI citation details.
- Joint Nature Conservation Committee website [www.jncc.gov.uk] – European protected site boundaries and designations.
- National Biodiversity Network (NBN) website [www.nbn.org.uk] - records of species in the vicinity of the study area.
- Wetland Bird Survey annual reports (Holt et al. 2012).
- Data supplied by the council records centre.

Field Surveys: Breeding Birds

10.5.2 The main breeding bird survey method followed the standard principles of the Common Birds Census, a walkover survey mapping all of the birds encountered and recording their behaviour. Six surveys of the site were made at approximately fortnightly intervals through April, May and June. The dates of the surveys were; 12 and 26/27 April, 4 and 16/17 May and 2 and 20/21 June. The extent of the breeding bird survey area is shown in Figures 10.1-10.13. All bird locations and behaviour were mapped, using the standard British Trust for Ornithology (BTO) Common Birds Census notation. All species were recorded. Approximately 2 hours were spent surveying per square kilometre, to standardise the search effort per unit area. The survey route was plotted onto the survey map as it was carried out.

10.5.3 The surveys were carried out between daylight hours (starting at dawn), avoiding strong winds, heavy rain, fog and low cloud. Birds were located by walking, listening and scanning by eye and with binoculars. Standard BTO notation was used to record the birds' activities; singing, calling, carrying nest material, nests or young found, repetitively alarmed adults, disturbance displaying, carrying food or in territorial dispute.

10.5.4 The survey data were analysed to determine spatially distinct clusters of records, equivalent to breeding territories, with the number of such territories used to calculate the breeding population for each species (Gilbert et al. 1998). A record in potentially suitable breeding habitat on a single visit was considered sufficient to indicate a potential breeding attempt.

10.5.5 On the first survey visit the crop present in each field within the survey area was recorded, and any changes through the survey period were noted.

10.5.6 Vantage point (VP) surveys were carried out during the spring and summer to quantify flight activity over the wind farm site. The specific aim of the observations was to collect data on key species flight activity that will enable estimates to be made of:

- The time each species spends flying over the survey area.
- The relative use each species makes of different parts of the survey area.
- The proportion of flying time each species spends at different elevations above the ground.

The following species were recorded:

- All waders (including lapwing and golden plover).

- All ducks, geese, swans, cormorants, herons and grebes.
- All birds of prey and owls.
- All gulls.
- Large flocks (>100 birds) of other species (except woodpigeon and rook).
- Other species/sightings considered of note.

10.5.7 These surveys were carried out from April through to July (total 36 hours, with 9 hours each month and the survey times spread out to give even coverage of all daylight hours; all were additional to the breeding bird surveys). A vantage point (at SE423069) was selected to satisfy the following criteria:

- It gave a clear view across the proposed wind farm site (with all parts of the wind turbine envelope within 1km of the VP to follow the Natural England guidance, Drewitt 2010).
- The proposed wind turbine locations plus a 200m buffer (the SNH-recommended collision risk zone, Whitfield et al. 2005) could be observed by looking in a 180 degree arc forward from the vantage point (i.e. no need for the observer to look behind to cover the site).
- It was located outside the proposed wind turbine envelope itself.
- Vantage points were chosen parsimoniously in order to achieve maximum visibility with the minimum number of points (all of the collision risk zone could be observed clearly from a single vantage point).

10.5.8 All target birds were recorded, irrespective of their distance from the vantage point. Observations were carried out throughout daylight hours but not in periods of severely reduced visibility (<3 km).

10.5.9 During the observation periods all target species flights were mapped and cross-referenced to a standard recording form using a numbering system, and the flight height of each recorded. To estimate flight height as accurately as possible available reference structures (e.g. pylons, other power lines) were used. Heights were estimated as accurately as possible recorded as a raw estimate, rather than being summarised to height classes. Below 10 m estimates were made to 1m, between 10 and 20 m to 2 m, between 20 m and 50 m to 5 m, and above 50 m to 10 m. When birds were observed over an extended period, estimates of flight height were recorded every 30 seconds. The activity during each flight (e.g. striking prey, displaying or food passing) was also recorded. Particular attention was paid to any observations of birds at rotor height crossing the proposed wind farm site that would be at risk of collision. Details of all of the vantage point surveys are included in Appendix 10.1.

Field Surveys: Wintering Birds

10.5.10 The aim of the autumn/winter field survey work was to obtain data on the importance of the proposed wind farm site and its surrounds outside the breeding season, and on the flight lines and feeding areas of potentially sensitive species.

10.5.11 The surveys comprised (a) a field survey based on a simple ‘look-see’ method, counting the bird numbers within a pre-defined study area (Gilbert et al. 1998), and (b) a vantage point survey, monitoring bird flight activity to quantify movement rates across the study area.

Field counts

10.5.12 This survey work comprised regular counts of the birds within the wintering bird study area (covering the potential wind farm site and an additional buffer zone of 1km around that). Sixteen of these surveys were undertaken at approximately fortnightly intervals between August 2011 and March 2012. The counts were carried out as instantaneous counts, recording a snapshot of the birds present in each field at the time it was surveyed. One such count of each field was made each survey day, recording the numbers of all the key species present. Any additional records made outside this time were noted as supplementary records. These snapshot counts were organised to ensure that the full range of times of day were covered in each part of the study area. The same target species were recorded as for the breeding season VP surveys.

10.5.13 As well as counting each species, the behaviour of each flock was also recorded, e.g. feeding/roosting. Birds in flight over-flying the field during the snapshot were also recorded, together with an estimate their height and direction.

Vantage point surveys: autumn/winter

10.5.14 The autumn/winter vantage point surveys followed the same methodology as those undertaken in the breeding season. These surveys were carried out from August 2011 through to March 2012 (total 72 hours; 9 hours each month with the survey times spread out to give even coverage of all daylight hours to cover dawn/dusk roost flights as well as general daytime movements; all were additional to the field count surveys). The same vantage point was used as for the breeding season surveys. Details of all of the vantage point surveys are included in Appendix 10.1.

Habitat/crop mapping

10.5.15 Mapping of the habitats and crop types available in the study area was carried out during the first visit (in August 2011) and then again in November 2011 and lastly in March 2012 at the end of the survey period, so that habitat availability could be determined and any changes during the survey period taken into account.

Weather

10.5.16 Weather conditions during all observations were recorded, and visits were made to cover a representative range of visibilities, wind speeds and directions (though avoiding extreme conditions where visibility is severely limited i.e. fog, continuous heavy rain).

10.6 Baseline Conditions

Nature Conservation Designations relating to Ornithology

10.6.1 A desk search was made for statutory protected nature conservation sites within 5km of the proposed wind farm site. Only a single site was found in that zone:

- Carlton Main Brickworks SSSI: 700 m NNW from the nearest proposed wind turbine. This site is notified for its geological interest features.

10.6.2 A further wider search was made for Special Protection Areas (SPAs) within 20 km of the Development, where bird populations from those SPAs might use the development site. No SPAs were located within this zone.

10.6.3 It is clear therefore that the Development would not have any effect the ornithological interest features of any statutory protected site.

10.6.4 Edderthorpe Flash, which lies 300 m SW from the nearest proposed wind turbine at its nearest point, is part of the Dearne Valley RSPB reserve, which RSPB considers to be of national importance for birds and wildlife. Though Edderthorpe Flash now supports a range of wetland bird species through the year, it is not currently covered by any formal biodiversity designation. It is of particular importance for its wintering golden plover and lapwing populations, and for its breeding waterfowl. The Old Moor section of the Dearne Valley reserve lies 1km south from the nearest proposed wind turbine. Again this has no formal statutory designation.

10.6.5 The site lies within the Dearne Valley Green Heart Nature Improvement Area (NIA). Funding has recently been secured to restore the ecological functionality of the river, its floodplain and its link to habitats on surrounding sandstone and limestone hills as part of one of the government's new NIA schemes.

Desk Study Bird Records

10.6.6 Records of species of conservation interest obtained from the desk study included:

- Barn Owl – breeding within the 10x10km square in which the Development lies;
- Other species specially protected under Schedule 1 of the 1981 Wildlife and Countryside Act including quail, little ringed plover and kingfisher;
- A range of other farmland species listed as priority species on the UK BAP recorded within the 10x10km square in which the Development lies including grey partridge, lapwing, turtle dove, cuckoo, skylark, yellow wagtail, tree pipit, dunnock, song thrush, grasshopper warbler, spotted flycatcher, marsh tit, willow tit, starling, house sparrow, tree sparrow, bullfinch, linnet, lesser redpoll, yellowhammer, reed bunting and corn bunting;
- The Dearne Valley Wetland Bird Survey (WeBS) area supports a nationally important wintering population of golden plover, with the most recently published 5-year annual mean peak of 4,940 individuals (Holt et al. 2012).

Breeding Birds

10.6.7 The breeding bird populations within the survey area found during the 2011 surveys are summarised in Table 10.4 below. The breeding densities are also given in the Table.

Table 10.4: Breeding bird population estimates in the Park Spring breeding bird survey area, 2011

Species	Species code	Estimated number of breeding pairs	Density (pairs per km^2)
Mute Swan	MS	2	0.5
Greylag Goose	GJ	2	0.5
Canada Goose	CG	5	1.2
Shelduck	SU	1	0.2
Gadwall	GA	6	1.5

Species	Species code	Estimated number of breeding pairs	Density (pairs per km^2)
Teal	T	3	0.7
Mallard	MA	8	2.0
Garganey	GY	1	0.2
Shoveler	SV	4	1.0
Tufted Duck	TU	4	1.0
Red-legged Partridge	RL	6	1.5
Grey Partridge	P	3	0.7
Quail	Q	3	0.7
Pheasant	PH	13	3.2
Little Grebe	LG	1	0.2
Buzzard	BZ	2	0.5
Kestrel	K	1	0.2
Moorhen	MH	5	1.2
Coot	CO	5	1.2
Oystercatcher	OC	1	0.2
Avocet	AV	1	0.2
Little Ringed Plover	LP	2	0.5
Ringed Plover	RP	2	0.5
Lapwing	L	12	2.9
Snipe	SN	1	0.2
Redshank	RK	2	0.5
Stock Dove	SD	6	1.5
Woodpigeon	WP	210	51.2
Collared Dove	CD	11	2.7
Turtle Dove	TD	1	0.2
Cuckoo	CK	2	0.5
Swift	SI	3	0.7
Kingfisher	KF	1	0.2
Green Woodpecker	G	5	1.2
Great Spotted Woodpecker	GS	3	0.7
Skylark	S	21	5.1
Swallow	SL	8	2.0
House Martin	HM	15	3.7
Meadow Pipit	MP	22	5.4
Yellow Wagtail	YW	2	0.5
Pied Wagtail	PW	5	1.2
Wren	WR	41	10.0
Dunnock	D	27	6.6
Robin	R	53	12.9
Blackbird	B	57	13.9
Song Thrush	ST	12	2.9
Mistle Thrush	M	9	2.2
Sedge Warbler	SW	6	1.5

Species	Species code	Estimated number of breeding pairs	Density (pairs per km^2)
Reed Warbler	RW	1	0.2
Blackcap	BC	19	4.6
Garden Warbler	GW	7	1.7
Lesser Whitethroat	LW	3	0.7
Whitethroat	WH	41	10.0
Chiffchaff	CC	18	4.4
Willow Warbler	WW	91	22.2
Spotted Flycatcher	SF	1	0.2
Long-tailed Tit	LT	15	3.7
Blue Tit	BT	28	6.8
Great Tit	GT	27	6.6
Nuthatch	NH	1	0.2
Treecreeper	TC	4	1.0
Jay	J	5	1.2
Magpie	MG	20	4.9
Jackdaw	JD	2	0.5
Carrion Crow	C	8	2.0
Starling	SG	15	3.7
House Sparrow	HS	57	13.9
Chaffinch	CH	75	18.3
Greenfinch	GR	16	3.9
Goldfinch	GO	30	7.3
Linnet	LI	49	12.0
Bullfinch	BF	10	2.4
Yellowhammer	Y	35	8.5
Reed Bunting	RB	7	1.7

10.6.8 Other species recorded over-flying/using the study area but not breeding included wigeon (2 in early April), pochard (single in early April), black-necked grebe (single in late June), cormorant (single in late April), grey heron (peak 1), sparrowhawk (single sighting in early June), dunlin (peak 4), bar-tailed godwit (3 in early May), black-tailed godwit (4 in late May), ruff (single in early April), whimbrel (single in early May), greenshank (single in late April), common sandpiper (peak 3), green sandpiper (peak 2), wood sandpiper (2 in late May, single in early June), Mediterranean gull (singles in late May and late June), black-headed gull (peak 30), little gull (single in early May), lesser black-backed gull (peak 4), common tern (2 in late May), sand martin (peak 60), wheatear (2 in early April), ring ouzel (single in early April), rook (peak 15). The large majority of these additional non-breeding records were from Edderthorpe Flash.

10.6.9 The distributions of the breeding birds of conservation importance (i.e. of high, medium or low sensitivity) within the study area are shown on Figures 10.1 to 10.13.

Vantage Point Survey Results

10.6.10 The rates of bird flight movement observed across the study area during the vantage point observations are summarised in Table 10.5 below. This gives the mean over-flying rate per hour over the study period and the total number of birds recorded over-flying. Table 10.5 also gives the percentage of flocks of each species that were recorded at rotor height (taking rotor height conservatively as between 21m and 150m above ground level; the actual rotor height above the ground would be about 35-126.5m). The raw flight data are given in Appendix 10.1

10.5: Bird flight rates recorded over the Park Spring study area during April-July 2011 vantage point surveys.

Species	Flight rate (no/hr):	Total number of birds observed over-flying	% flocks at rotor height
Greylag Goose	0.36	13	80%
Canada Goose	0.58	21	100%
Gadwall	0.39	14	80%
Mallard	2.89	104	63%
Cormorant	0.17	6	67%
Little Egret	0.03	1	100%
Grey Heron	0.17	6	100%
Marsh Harrier	0.03	1	100%
Sparrowhawk	0.25	9	33%
Buzzard	0.22	8	75%
Osprey	0.03	1	100%
Kestrel	1.89	68	46%
Hobby	0.03	1	0%
Peregrine	0.19	7	100%
Oystercatcher	0.19	7	100%
Lapwing	6.64	239	38%
Curlew	0.03	1	100%
Redshank	0.11	4	100%
Common Gull	0.06	2	100%
Lesser Black-backed Gull	1.36	49	96%
Herring Gull	0.06	2	100%
Black-headed Gull	10.92	393	88%

N = 36 hours total observation from the single vantage point

Conservation Importance of Breeding Birds

10.6.11 The conservation importance of the breeding bird populations recorded at Park Spring in 2011 is summarised in Table 10.6. This Table includes all the species noted during the surveys. Additional species that were observed within the study area but showing no evidence of breeding are shown in Table 10.7.

Table 10.6: Conservation evaluation of the breeding bird populations in the Park Spring study area, 2011

Species	Peak no. of breeding pairs	>1% region-al popul-ation	EU Birds Directive Annex 1	W and C Act Sch 1	Red/ Amber List	UK BAP priority species	Sensitivity
Mute Swan	2						Nil
Greylag Goose	2				A		Low
Canada Goose	5						Nil
Shelduck	1				A		Low
Gadwall	6	✓			A		Medium
Teal	3	✓			A		Medium
Mallard	8				A		Low
Garganey	1	✓			A		Medium
Shoveler	4	✓			A		Medium
Tufted Duck	4				A		Low
Red-legged Partridge	6						Nil
Grey Partridge	3				R	✓	Medium
Quail	3			✓	A		High
Pheasant	13						Nil
Little Grebe	1				A		Low
Buzzard	2						Nil
Kestrel	1				A		Low
Moorhen	5						Nil
Coot	5						Nil
Oystercatcher	1				A		Low
Avocet	1	✓	✓	✓	A		High
Little Ringed Plover	2	✓		✓			High
Ringed Plover	2	✓			A		Medium
Lapwing	12				R	✓	Medium
Snipe	1				A		Low
Redshank	2				A		Low
Stock Dove	6				A		Low
Woodpigeon	210						Nil
Collared Dove	11						Nil
Turtle Dove	1				R	✓	Medium
Cuckoo	2				R	✓	Medium
Swift	3				A		Low
Kingfisher	1		✓	✓	A		High
Green Woodpecker	5				A		Low
Great Spotted Woodpecker	3						Nil
Skylark	21				R	✓	Medium
Swallow	8				A		Low
House Martin	15				A		Low
Meadow Pipit	22				A		Low
Yellow Wagtail	2				R	✓	Medium
Pied Wagtail	5						Nil
Wren	41						Nil
Dunnock	27				A	✓	Medium

Species	Peak no. of breeding pairs	>1% region-al popul-ation	EU Birds Directive Annex 1	W and C Act Sch 1	Red/ Amber List	UK BAP priority species	Sensitivity
Robin	53						Nil
Blackbird	57						Nil
Song Thrush	12				R	✓	Medium
Mistle Thrush	9				A		Low
Sedge Warbler	6						Nil
Reed Warbler	1						Nil
Blackcap	19						Nil
Garden Warbler	7						Nil
Lesser Whitethroat	3						Nil
Whitethroat	41				A		Low
Chiffchaff	18						Nil
Willow Warbler	91				A		Low
Spotted Flycatcher	1				R	✓	Medium
Long-tailed Tit	15						Nil
Blue Tit	28						Nil
Great Tit	27						Nil
Nuthatch	1						Nil
Treecreeper	4						Nil
Jay	5						Nil
Magpie	20						Nil
Jackdaw	2						Nil
Carrion Crow	8						Nil
Starling	15				R	✓	Medium
House Sparrow	57				R	✓	Medium
Chaffinch	75						Nil
Greenfinch	16						Nil
Goldfinch	30						Nil
Linnet	49				R	✓	Medium
Bullfinch	10				A	✓	Medium
Yellow-hammer	35				R	✓	Medium
Reed Bunting	7				A	✓	Medium

10.7: Conservation evaluation of the non-breeding bird populations in the Park Spring survey area seen during the 2011 breeding season

Species	Peak count	>1% regional popul-ation	EU Birds Directive Annex 1	W and C Act Sch 1	Red/ Amber List	UK BAP priority species	Sensitivity
Wigeon	2				A		Low
Pochard	1				A		Low
Black-necked Grebe	1	✓		✓	A		High
Cormorant	1						Nil
Grey Heron	1						Nil
Sparrowhawk	1						Nil

Species	Peak count	>1% regional popul-ation	EU Birds Directive Annex 1	W and C Act Sch 1	Red/ Amber List	UK BAP priority species	Sensitivity
Peregrine	1		✓	✓			High
Dunlin	4		✓		R		High
Ruff	1	✓	✓		R		High
Black-tailed Godwit	4	✓		✓	R	✓	High
Bar-tailed Godwit	3	✓	✓		A		High
Whimbrel	1	✓		✓	R		High
Common Sandpiper	3				A		Low
Green Sandpiper	2			✓	A		Low
Greenshank	1			✓			High
Wood Sandpiper	2	✓	✓		A		High
Mediterranean Gull	1	✓	✓	✓	A		High
Lesser Black-backed Gull	4				A		Low
Little Gull	1	✓	✓	✓	A		High
Black-headed Gull	30				A		Low
Common Tern	2		✓		A		High
Sand Martin	60				A		Low
Wheatear	2				A		Low
Rook	5						Nil

10.6.12 The breeding bird community included four high sensitivity species, quail, avocet, little ringed plover and kingfisher. All of these species are specially protected from disturbance during breeding under Schedule 1 of the Wildlife and Countryside Act, and avocet and kingfisher are also listed in Annex 1 of the EU Birds Directive. Given the site location and the habitat present it is also possible that other Schedule 1 species such as barn owl and hobby could breed there in the future.

10.6.13 Twenty breeding species were classed as medium sensitivity: teal, gadwall, garganey, shoveler, grey partridge, ringed plover, lapwing, turtle dove, cuckoo, skylark, yellow wagtail, dunnock, song thrush, spotted flycatcher, starling, house sparrow, linnet, bullfinch, yellowhammer and reed bunting. Teal, gadwall, garganey and shoveler were present in regionally important numbers, and the others are UK Biodiversity Action Plan [BAP] priority species. A further 18 breeding species were classed as low sensitivity, through their listing on RSPB et al.'s (Eaton et al. 2009) amber list of birds of conservation concern.

10.6.14 Twelve additional high sensitivity species were observed during the 2011 breeding season surveys (though showing no evidence of breeding); black-necked grebe, peregrine, dunlin, ruff, black-tailed godwit, bar-tailed godwit, whimbrel, greenshank, wood sandpiper, Mediterranean gull, little gull and common tern. All were seen on Edderthorpe Flash.

Wintering Birds

10.6.15 The target species populations recorded within the wintering bird study area during the winter 2011-12 field surveys are summarised in Table 10.8.

Table 10.8: Autumn/winter bird populations recorded in the Park Spring wintering bird study area during August 2011 – March 2012

Species	Mean count	Peak count	Frequency (% surveys recorded)
Mute Swan	2.9	16	44%
White-fronted Goose	1.8	28	6%
Greylag Goose	52.1	135	81%
Ross' Goose	0.1	1	13%
Canada Goose	69.6	260	81%
Shelduck	3.1	9	81%
Wigeon	41.6	125	81%
Gadwall	19.6	82	81%
Teal	123.4	254	100%
Mallard	158.8	243	100%
Garganey	0.1	1	6%
Shoveler	38.5	78	100%
Pochard	4.4	22	38%
Tufted Duck	9.7	48	75%
Goldeneye	0.1	1	6%
Goosander	2.6	18	38%
Little Grebe	0.1	1	13%
Cormorant	4.1	12	88%
Little Egret	0.1	1	6%
Grey Heron	2.8	5	100%
Sparrowhawk	0.4	1	38%
Buzzard	0.3	2	19%
Kestrel	1.4	3	88%
Hobby	0.1	1	6%
Peregrine	0.1	1	6%
Coot	16.7	66	69%
Oystercatcher	0.1	1	6%
Avocet	0.3	5	6%
Little Ringed Plover	0.6	7	13%
Ringed Plover	0.9	8	25%
Golden Plover	875.9	4682	75%
Grey Plover	0.1	2	6%
Lapwing	254.5	485	100%
Knot	0.1	1	13%
Little Stint	0.1	1	6%
Curlew Sandpiper	0.1	2	6%
Dunlin	4.4	16	69%
Ruff	0.9	8	31%
Snipe	1.3	5	44%
Woodcock	0.1	2	6%
Black-tailed Godwit	0.4	5	13%
Curlew	0.1	2	6%
Common Sandpiper	0.2	2	13%
Green Sandpiper	0.5	4	31%
Greenshank	0.3	3	13%

Species	Mean count	Peak count	Frequency (% surveys recorded)
Wood Sandpiper	0.1	1	6%
Redshank	1.8	14	31%
Common Gull	3.5	20	69%
Lesser Black-backed Gull	1.4	8	38%
Yellow-legged Gull	0.1	1	6%
Herring Gull	0.1	1	13%
Black-headed Gull	152.9	396	100%
Common Tern	0.8	7	13%

10.6.16 The observed bird flight rates over the survey area outside the main breeding season during the August 2011-March 2012 vantage point surveys are summarised in Table 10.9, with values given for the autumn (Aug-Nov) and winter (Dec-Mar) surveys. The table gives the mean over-flying rate per hour and the total number of individuals recorded over each period for all the target species flying over the application site and its surrounds.

10.6.17 Table 10.9 also gives the percentage of flocks of each species that were recorded at rotor height (taking rotor height conservatively as between 21m and 150m above ground level; the actual rotor height above the ground would be about 35-125m).

Table 10.9: Bird flight rates recorded over the Park Spring survey area during August 2011 – March 2012 vantage point surveys.

Species	Flight rate (no/hr):		Total number of birds observed over-flying		% flocks at rotor height
	Autumn	Winter	Autumn	Winter	
Mute Swan	0	0.4	0	16	75%
White-fronted Goose	2.2	0.4	78	13	100%
Greylag Goose	21.4	3.3	772	120	79%
Canada Goose	16.2	4.7	583	168	59%
Shelduck	0	0.1	0	3	100%
Wigeon	0.5	1.8	18	65	71%
Gadwall	0	0.5	0	19	67%
Teal	0	<0.1	0	1	100%
Mallard	4.8	5.6	173	202	60%
Shoveler	0	<0.1	0	1	100%
Tufted Duck	0	0.1	0	2	100%
Goldeneye	0	0.1	0	5	100%
Goosander	0	0.2	1	7	83%
Gannet	<0.1	0	1	0	100%
Cormorant	0.4	0.3	16	11	90%
Grey Heron	0.1	0.1	2	2	75%
Sparrowhawk	0.3	0.1	10	3	54%
Buzzard	0.2	0.3	8	11	75%
Kestrel	1.2	1.4	43	52	45%
Merlin	<0.1	0.1	1	4	20%
Peregrine	0.1	0.1	3	3	83%
Golden Plover	774.3	182.7	27,876	6,577	63%
Lapwing	79.8	58.3	2,871	2,099	76%
Dunlin	0.1	0	3	0	100%

Species	Flight rate (no/hr):		Total number of birds observed over-flying		% flocks at rotor height
	Autumn	Winter	Autumn	Winter	
Snipe	<0.1	0	1	0	100%
Black-tailed Godwit	0.1	0	4	0	100%
Curlew	<0.1	0	1	0	100%
Redshank	0	0.1	0	3	100%
Common Gull	3.0	13.8	107	498	77%
Lesser Black-backed Gull	1.0	0	36	1	100%
Herring Gull	0.2	1.0	7	36	100%
Great Black-backed Gull	<0.1	0.3	1	10	100%
Black-headed Gull	106.6	226.7	3,837	8,162	74%

N = 36 hours total observation from the single vantage point in autumn (Aug-Nov) and 36 hours in winter (Dec-Mar)

Conservation Importance of Autumn/Wintering Birds

10.6.18 The conservation value of the wintering bird populations observed in the Park Spring survey area during the autumn/winter bird surveys has been summarised in Table 10.10. This included 15 high sensitivity species that are EU Birds Directive Annex 1 and/or Wildlife and Countryside Act Schedule 1 species. Golden plover was additionally present in up to nationally important numbers (peak 4,682).

10.6.19 Fifteen species were classed as medium sensitivity species (present in regionally important numbers and/or UK BAP priority species), including a range of waterfowl species that were found primarily on Edderthorpe Flash.

Table 10.10: Conservation evaluation of the wintering bird populations in the Park Spring survey area 2011-12

Species	Peak count	>1% region-al popul-ation	EU Birds Directive Annex 1	W and C Act Sch 1	Red [R]/ Amber [A] List	BAP priority species	Sensitivity
Mute Swan	16						Nil
White-fronted Goose	28	✓				✓	Medium
Greylag Goose	135				A		Low
Ross' Goose	1						Nil
Canada Goose	260						Nil
Shelduck	9				A		Low
Wigeon	125	✓			A		Medium
Gadwall	82	✓			A		Medium
Teal	254	✓			A		Medium
Mallard	243	✓			A		Medium
Garganey	1				A		Low
Shoveler	78	✓			A		Medium
Pochard	22	✓			A		Medium
Tufted Duck	48	✓			A		Medium
Goldeneye	1			✓	A		High
Goosander	18	✓					Medium
Little Grebe	1				A		Low
Gannet	1				A		Low
Cormorant	12						Nil
Little Egret	1		✓		A		High

Species	Peak count	>1% region-al popul-ation	EU Birds Directive Annex 1	W and C Act Sch 1	Red [R]/ Amber [A] List	BAP priority species	Sensitivity
Grey Heron	5						Nil
Sparrowhawk	1						Nil
Buzzard	2						Nil
Kestrel	3				A		Low
Hobby	1			✓			High
Merlin	1	✓	✓	✓	A		High
Peregrine	1	✓	✓	✓			High
Coot	66	✓					Medium
Oystercatcher	1				A		Low
Avocet	5	✓	✓	✓	A		High
Little Ringed Plover	7	✓		✓			High
Ringed Plover	8	✓			A		Medium
Golden Plover	4,682	✓	✓		A		High
Grey Plover	2				A		Low
Lapwing	485	✓			R	✓	Medium
Knot	1				A		Low
Little Stint	1						Nil
Curlew Sandpiper	2						Nil
Dunlin	16	✓	✓		R		High
Ruff	8	✓	✓		R		High
Snipe	5				A		Low
Woodcock	2				A		Low
Black-tailed Godwit	5			✓	R	✓	High
Curlew	2				A	✓	Medium
Common Sandpiper	2				A		Low
Green Sandpiper	4			✓	A		High
Greenshank	3			✓			High
Wood Sandpiper	1		✓	✓	A		High
Redshank	14	✓			A		Medium
Common Gull	20				A		Low
Lesser Black-backed Gull	8				A		Low
Yellow-legged Gull	1				A		Low
Herring Gull	1				R	✓	Medium
Black-headed Gull	396				A		Low
Common Tern	7		✓		A		High

10.6.20 The main wintering bird species of interest identified during the surveys were wildfowl and waders associated with the Edderthorpe Flash. Peak numbers of golden plover were sufficient to be considered as nationally important, and a range of other species occurred there in regionally important numbers (see Table 10.10). The distributions and flight lines of the key species are shown on Figures 10.14 - 10.17). The raw flight data are given in Appendix 10.2.

10.7 Impact Assessment

Structure of the Impact Assessment

10.7.1 Direct and indirect environmental effects of the wind farm's construction, operational and decommissioning phases, based on the project description in Chapter 3, are evaluated for each aspect of the ornithological studies in the following paragraphs. Mitigation for identified negative effects is presented below.

Effects on birds

10.7.2 The main potential effects of wind farms on birds are considered to be direct loss of breeding or feeding habitat, potential collision risk and indirect loss of habitat from disturbance (either temporary during construction or permanent from operating turbines) (Percival 2005, Drewitt and Langston 2006). Each of these is considered in turn in the following sections.

Direct effects (1): loss of habitat

10.7.3 This would be an effect of low/negligible magnitude that would occur during the construction of the wind farm, with only a very small area taken up by the turbine bases and access tracks (see Chapter 3). The only habitats that would be affected are arable and improved grassland. Careful selection of routes for the access tracks and turbine locations and use of proven construction techniques would ensure that such effects on birds would be of negligible magnitude, and would not be significant.

Direct effects (2): collision risk

10.7.4 This potential effect would occur during the operation phase of the wind farm. There have been a number of wind farms that have caused bird mortalities through collision but their characteristics are very different to those at the proposed Park Spring site. Most notably, at Altamont Pass in California and Tarifa in southern Spain, large numbers of raptors have been killed (Orloff and Flannery 1992, Janss 1998, Thelander et al. 2003). Such problems have occurred where large numbers of sensitive species occur in close proximity to very large numbers (hundreds/thousands) of turbines, and usually also where the wind farm area provides a particularly attractive feeding resource. In wind farm sites in the UK, with similar bird densities to Park Spring, collision rates have generally been very low and are not considered to be significant (Meek et al. 1993, Tyler 1995, Dulas 1995, EAS 1997, Bioscan 2001, Percival et al. 2008, Percival et al. 2009, Percival et al. 2012).

Indirect effects: disturbance

10.7.5 Disturbance could potentially affect a rather greater area than direct habitat loss. The maximum distance that wind turbines have been shown to affect breeding birds is 800m (Percival 2005; Pearce-Higgins et al. 2009), though most reliable studies have not reported effects further than 600 m from turbines (Drewitt and Langston 2006) and displacement is usually partial rather than complete (i.e. a reduction in use not complete exclusion). Displacement has generally been more widely reported and over a greater distance outside the breeding season.

Construction

10.7.6 Disturbance is likely to be highest during construction owing to the activities being carried out. Pearce-Higgins et al. (2012) found that red grouse, snipe and curlew

densities all declined on wind farms during construction, though also that densities of skylark and stonechat increased. Construction also involves the presence of work personnel on site which itself can be an important source of potential disturbance. Even at this time displacement from a zone around the wind turbines is likely to only be partial. Pearce-Higgins et al. (2012) for example reported decreases in curlew density during construction of 40% and snipe by 53%. A worst-case approach has been adopted in this assessment for the construction disturbance assessment, that all breeding birds within 500m of the wind turbines could potentially be at risk of displacement, and a slightly wider zone (600m) for wintering birds (Percival 2005; Drewitt and Langston 2006).

Operation

10.7.7 Experience from existing UK wind farms has shown that many species are tolerant of the presence of operational wind turbines and not unduly disturbed by them. A recent study of wintering golden plover, lapwing and pink-footed geese, found no evidence of displacement of any of these species (Percival et al. 2008). All three species were observed feeding within 300 m of wind turbines in years when their preferred crop was present in that zone.

10.7.8 Some short-term displacement during wind farm operation of species such as curlew may occur following construction but populations have subsequently re-established themselves (Bullen Consultants 2002). Most species that have been studied have not been significantly affected (Meek et al. 1993, Phillips 1994, Dulas 1995, Thomas 1999, Gill 2004, Percival 2005, Percival et al. 2008, Devereux et al. 2009). A recent RSPB study has reported partial displacement of breeding upland birds around wind turbines up to 800m (Pearce-Higgins et al. 2009). This scale and pattern of displacement is similar to that reported for breeding waders in general by Hotker et al (2004), with most studies reporting only small scale (0-200m) displacement distances and a smaller number over a greater distance. For the purposes of this assessment it has been assumed that all breeding birds within 300m of the wind turbines could be at risk of disturbance during operation, with consideration also given to the breeding populations within a 500m buffer as well, and a 600m buffer outside the breeding season.

10.7.9 A further potential operational disturbance effect could be disruption to important flight lines (barrier effect). Birds may see the wind farm and change their route to fly around (rather than through) it. This would reduce the risk of collision but could possibly have other effects, for example potentially making important feeding areas less attractive (by acting as a barrier to the birds reaching them) and (if diversions were of a sufficient scale) resulting in increased energy consumption. The distance needed to divert around the Park Spring Wind Farm would be relatively small and would not be expected to act as a major barrier to movements. Accordingly, the ecological consequences of any such changes in flight lines would be of negligible magnitude and not significant.

Ornithological Impact Assessment Results

10.7.10 The first stage in the assessment has been to determine the numbers of each of the key species in the potential ‘risk zones’ for each of the two main possible impacts, collision and disturbance. For disturbance, the numbers within 300 m and 500 m have been determined (see Table 10.12 below), as the potential operational and construction phase displacement zones although it should be noted that only partial displacement within those zones would be expected, e.g. Pearce-Higgins et al. 2009.

For collision, this risk zone has been taken as the wind turbine envelope plus a 200m buffer (as recommended in current SNH guidance, Whitfield et al. 2010).

Bird Numbers at Risk of Disturbance: Breeding

10.7.11 The numbers of breeding birds recorded within 300m and 500m of the proposed wind turbine locations are summarised in Table 10.11 below. This gives the estimated number of breeding pairs of each species of low, medium or high sensitivity in each zone, and the importance of the population in that zone on the basis of the numbers recorded.

Table 10.11: Conservation importance of the breeding birds at Park Spring within 300m and 500m of the proposed turbine locations

Species	Total breeding pairs in 2011 within: 300m	500m	Importance of population in zone of possible disturbance effect (on basis of numbers)
Greylag Goose	0	0	Nil
Shelduck	0	0	Nil
Gadwall	0	2	Nil/Local
Teal	0	0	Nil
Mallard	0	3	Nil/Local
Garganey	0	0	Nil
Shoveler	0	0	Nil/
Tufted Duck	0	0	Nil
Grey Partridge	2	2	Local
Quail	0	0	Nil
Little Grebe	0	0	Nil
Kestrel	1	1	Local
Oystercatcher	0	0	Nil
Avocet	0	0	Nil
Little Ringed Plover	0	0	Nil
Ringed Plover	0	0	Nil
Lapwing	1	3	Local
Snipe	0	1	Nil/Local
Redshank	0	0	Nil
Stock Dove	2	4	Local
Turtle Dove	0	1	Nil/Local
Cuckoo	0	2	Nil/Local
Swift	0	3	Nil/Local
Kingfisher	0	0	Nil
Green Woodpecker	1	3	Local
Skylark	15	17	Local
Swallow	0	0	Nil
House Martin	0	0	Nil
Meadow Pipit	14	17	Local
Yellow Wagtail	0	0	Nil
Dunnock	4	8	Local
Song Thrush	0	3	Nil/Local
Mistle Thrush	1	4	Local
Whitethroat	14	23	Local
Willow Warbler	35	56	Local
Spotted Flycatcher	0	0	Nil
Starling	0	0	Nil
House Sparrow	0	0	Nil
Linnet	15	22	Local
Bullfinch	2	3	Local
Yellowhammer	17	27	Local

Species	Total breeding pairs in 2011 within: 300m	500m	Importance of population in zone of possible disturbance effect (on basis of numbers)
Reed Bunting	3	5	Local

Note: Table includes all species of low, medium or high sensitivity.

10.7.12 Generally the breeding bird numbers within both the construction and operational potential disturbance zones were low, with no species present in more than locally important numbers (on the basis of their population sizes). None of the high sensitivity species were found breeding within 500m of the proposed wind turbine locations.

Bird Numbers at Risk of Disturbance: Autumn/Winter

10.7.13 The wintering bird numbers recorded during the field surveys within a worst-case potential disturbance zone of 600 m from the wind turbines (for both construction and operation) are shown in Table 10.12. This distance is the one usually used in wind farm assessments as a reasonable worst case, reflecting the greatest distance at which any reliable studies have shown any measurable effect on wintering birds (Percival 2005; Drewitt and Langston 2006). This is not to say that all of the birds within this zone would be displaced, but rather that these numbers constitute the birds at risk of a possible disturbance effect.

10.7.14 Table 10.12 gives the mean and peak numbers recorded of each species of low or higher sensitivity, and the importance of the population in that zone on the basis of the numbers recorded.

Table 10.12: Conservation importance of the autumn/wintering birds at Park Spring within 600m of the proposed turbine locations in 2011-12

Species	Numbers in 2011-12 within 600m: Mean	Peak	Importance of population in zone of possible disturbance effect (on basis of numbers)
White-fronted Goose	1.2	20	Regional
Greylag Goose	16.1	85	Local
Shelduck	1.6	5	Local
Wigeon	20.5	78	Regional
Gadwall	7.9	30	Regional
Teal	47.8	127	Regional
Mallard	80.6	146	Regional
Garganey	0.01	1	Local
Shoveler	17.5	52	Regional
Pochard	2.4	15	Local
Tufted Duck	5.3	26	Local
Goldeneye	0.01	1	Local
Goosander	0.9	7	Local
Little Grebe	0.1	1	Local
Little Egret	0.01	1	Local
Kestrel	0.7	2	Local
Hobby	0.03	1	Local
Peregrine	0.01	1	Local
Coot	5.0	17	Local
Oystercatcher	0.01	1	Local
Avocet	0.2	3	Regional
Little Ringed Plover	0.1	1	Local
Ringed Plover	0.2	1	Local
Golden Plover	92.3	487	Regional

Species	Numbers in 2011-12 within 600m: Mean	Peak	Importance of population in zone of possible disturbance effect (on basis of numbers)
Grey Plover	0.1	1	Local
Lapwing	69.9	217	Regional
Knot	0.01	1	Local
Dunlin	0.5	2	Local
Ruff	0.4	3	Local
Snipe	0.4	3	Local
Woodcock	0.1	2	Local
Black-tailed Godwit	0.04	1	Local
Curlew	0.01	1	Local
Common Sandpiper	0.1	1	Local
Green Sandpiper	0.2	3	Local
Greenshank	0.1	1	Local
Wood Sandpiper	0.01	1	Local
Redshank	0.4	3	Local
Common Gull	0.5	3	Local
Lesser Black-backed Gull	0.1	1	Local
Yellow-legged Gull	0.01	1	Local
Herring Gull	0.01	1	Local
Black-headed Gull	22.6	58	Local
Common Tern	0.1	1	Local

Note: Table includes all species of low or higher sensitivity.

10.7.15 One species was recorded in the survey area in nationally important numbers, golden plover. Numbers of that species in the 600 m zone around the wind turbines were rather lower, with a peak of 487 (but still sufficient to be considered to be of regional importance). This species was largely found on Edderthorpe Flash outside the 600m zone. Eight other species were also present in this zone in regionally important numbers (on the basis of their peak count); white-fronted goose, wigeon, gadwall, teal, mallard, shoveler, avocet and lapwing.

Bird Numbers at Risk of Collision

10.7.16 The over-flying rates of the key target species within the potential collision risk zone (the wind farm plus a 200 m buffer, Whitfield et al. 2010) are shown in Table 10.13. Four species were observed flying through this zone at rotor height in sufficient numbers to possibly be at a significant risk of collision; peregrine, golden plover, lapwing and black-headed gull. All of these have been modelled to determine their collision risk.

Table 10.13: Over-flying rates of key target species within the potential collision risk zone (wind farm plus 200m buffer): flight rates for direct flights

Species	Flight rate though collision risk zone (number per hour)											
Peregrine	0.1	0.1	0	0	0.1	0	0	0	0	0	0	0
Golden Plover	0	70.3	194.4	11.3	0	0	0	0	0	0	0	0
Lapwing	0	8.3	60.7	0.1	2.0	1.6	3.9	2.0	0.4	0.4	1.8	0
Black-headed Gull	0.3	12.8	55.9	18.4	52.7	17.4	16.0	2.6	2.6	1.3	0.2	0.6

Collision Risk Modelling

10.7.17 In order to further inform the determination of the likelihood of potential adverse effects occurring, collision modelling has been carried out for all the key target species recorded over-flying the collision risk zone and at rotor height (i.e. the species listed in Tables 10.13 that were observed flying through the collision risk zone at rotor height).

10.7.18 The collision risk model used in this assessment is the one developed by SNH and BWEA (Percival et al. 1999, Band 2001, Band et al. 2007). Details of the model are given in these publications. The model runs as a two-stage process. Firstly the risk is calculated making the assumption that flight patterns are unaffected by the presence of the wind turbines, i.e. that no avoidance action is taken. This is essentially a mechanistic calculation, with the collision risk calculated as the product of (i) the probability of a bird flying through the rotor swept area, and (ii) the probability of a bird colliding if it does so. This probability is then multiplied by the estimated numbers of bird movements through the wind farm rotors at the risk height (i.e. the height of the rotating rotor blades) in order to estimate the theoretical numbers at risk of collision if they take no avoiding action.

10.7.19 The second stage then incorporates the probability that the birds, rather than flying blindly into the turbines, will actually take a degree of avoiding action, as has been shown to occur in all studies of birds at existing wind farms. SNH has recommended a precautionary approach, using a value of 99% as an avoidance rate for geese and several birds of prey and 98% for most other species (Urquhart 2010), and that approach has been adopted here. Actual avoidance rates measures at existing wind farms have typically been in excess of 99.9% (Fernley et al. 2006, Percival et al. 2008, Percival et al. 2009), so results for a range of possible avoidance rates is presented.

10.7.20 The collision model requires data on bird body size and flight speed. Body sizes and baseline mortality rates were taken from Robinson (2005), and flight speeds from Alerstam et al. (2007).

10.7.21 The magnitude of the additional collision mortality has been assessed against the baseline population, taken in this case as an estimate of the regional population of each species.

10.7.22 The model input data are summarised in Table 10.14. Table 10.14 gives the estimated annual number of flights through the turbine rotors (assuming no avoiding action), the background annual mortality rate, and an estimate of the baseline regional population size. Details of the collision risk calculations are given in Appendix 10.2.

Table 10.14: Collision risk model input data for the proposed Park Spring wind farm

Species	% flights at rotor height	Estimated no. of rotor passes/ year	Background annual mortality rate (ad/imm)	Estimated baseline regional population size
Peregrine	92%	32	20%/46%	100
Golden Plover	63%	36,556	27%/37%	10,000
Lapwing	74%	12,577	29%/40%	10,000

Species	% flights at rotor height	Estimated no. of rotor passes/ year	Background annual mortality rate (ad/imm)	Estimated baseline regional population size
Black-headed Gull	74%	12,390	10%/33%	20,000

10.7.23 Table 10.15 summarises the collision risk analysis for each of these species and gives the number of collisions predicted per year based on the precautionary SNH avoidance rate (from the collision risk model) and a range of other more likely rates, the percentage increases that these would represent over the baseline mortality and an assessment of whether such an effect would be significant.

Table 10.15: Collision risk modelling predictions for the proposed Park Spring wind farm

Species	Predicted number of collisions per year applying the following avoidance rates:			Percentage increase in baseline mortality applying the following avoidance rates:			Magnitude of effect	Likely significant effect?
	98%	99%	99.5%	98%	99%	99.5%		
Peregrine	0.04	0.02	0.01	0.15%	0.08%	0.04%	Negligible	No
Golden plover	41.4	20.7	10.3	1.38%	0.69%	0.34%	Low/ negligible	No
Lapwing	15.0	7.5	3.7	0.46%	0.23%	0.12%	Negligible	No
Black-headed Gull	16.2	8.1	4.0	0.48%	0.24%	0.12%	Negligible	No

Effects on High Sensitivity Species

10.7.24 **High sensitivity breeding species:** four high sensitivity species were found breeding within the survey area; quail, avocet, little ringed plover and kingfisher. None of these were breeding within 500 m of any of the proposed wind turbines and none were observed flying through the collision risk zone, so any effects on them would be of negligible magnitude and not significant. Pre-construction surveys would inform the need for further mitigation if construction were scheduled for the bird breeding season, ensuring that no significant effects on these species would occur.

10.7.25 **Golden Plover:** this was the only species recorded in the baseline surveys in nationally important numbers within the survey area. The collision risk to this species (41 birds per year using a precautionary 98% avoidance rate – see Table 10.15 above) would be of at most low magnitude (representing an increase of 1.4% over the existing regional baseline mortality) and not significant, particularly when it is considered that the actual collision risk would be likely to be much lower given the very low numbers of collisions recorded for this species at existing wind farms (Hotker et al. 2004) and the recognition by RSPB/BirdLife that waders as a group are not particularly vulnerable to collision (Langston and Pullan 2003). Disturbance to golden plover would be of negligible magnitude and not significant given the numbers (mean 92, peak 487) recorded within 600m of the proposed wind turbines during the baseline surveys and the fact that the actual displacement of this species would be likely to be only very limited given experience from other wind farms; Hotker et al. 2004, Percival 2005, Percival et al. 2008). The key area used by this species,

Edderthorpe Flash, is only partially within this worst-case displacement zone and outside the usual zone over which this species may be displaced (Hotker et al. 2004).

10.7.26 During consultation RSPB requested that further detail be provided on the spatial distribution of golden plover and lapwing in relation to distance from the wind turbines, and on their behaviour in these zones. All of the winter field count sightings were recorded to by field/sector so it is not possible to directly measure the distance from each bird/flock to the nearest wind turbine. Instead the distances from the turbines have been calculated to the midpoint of each field/sector.

10.7.27 The spatial distribution of golden plover in relation to distance from the wind turbines is summarised in Figure 10.18, where the peak numbers counted on the ground are shown in each 100 m band around the wind turbines. The Figure also shows the numbers feeding and roosting. All of the golden plover ground records were in the 500-699 m bands, reflecting that all records were from Edderthorpe Flash (and all except a single flock of 32 within the main part of the Flash, which formed a single count sector; it covered an area of 6.4 ha. and was 570 m from the closest wind turbine at its nearest point, and 860 m at its furthest point).

10.7.28 **Peregrine:** there were occasional sightings of this species during the baseline surveys through the year. The collision risk to this species (0.04 birds per year using a precautionary 98% avoidance rate – see Table 10.15 above) would be of negligible magnitude (representing an increase of 0.15% over the existing regional baseline mortality) and not significant, As the use of the potential disturbance zone was very low, any disturbance effect would be of negligible magnitude and not significant.

10.7.29 **Other scarce raptor species:** hobby and merlin. There were very occasional sightings of these species, hobby in summer/autumn and merlin in winter, but no evidence that the survey area was important for either. Hobby is a potential breeding species in the area, so given its conservation status (specially protected from disturbance during breeding under Schedule 1 of the 1981 Wildlife and Countryside Act), mitigation measures would need to be adopted to ensure that they were not disturbed during breeding, particularly during construction. Pre-construction surveys would inform the need for further mitigation if construction were scheduled for the bird breeding season, ensuring that no significant effects on this species (or any other Schedule 1 species that could breed there, such as barn owl) would occur.

10.7.30 **Other high sensitivity waterfowl species:** goldeneye, little egret, dunlin, ruff, black-tailed godwit, green sandpiper, greenshank and wood sandpiper – the combination of low numbers in the potential disturbance zone, low frequency of occurrence and lack of flight activity through collision risk zone means that any effects on these species would be of negligible magnitude and not significant,

Effects on Medium Sensitivity Species

10.7.31 **Lapwing:** this UK BAP priority species was present in the study area through much of the year in locally important numbers. Collision risk would be of negligible magnitude (15 birds per year using a precautionary 98% avoidance rate – see Table 10.15 above – equivalent to only 0.46% of the existing baseline regional mortality) and not significant. As noted above, waders are not considered as a group particularly vulnerable to collision (Langston and Pullan 2003). Disturbance to wintering lapwing would be of negligible magnitude and not significant given that the numbers (mean 70, peak 217) recorded within 600m of the proposed wind turbines during the baseline surveys and the fact that the actual displacement of this species would be likely to be only very limited given experience from other wind farms (Hotker et al.

2004). One pair was breeding within 300m of the wind turbines and three pairs within 500m. Recent work by Pearce-Higgins et al. (2009) suggests that displacement of this species would be unlikely, and even so, given the small numbers present in the potential disturbance zone, this would not be significant in any case.

10.7.32 The spatial distribution of wintering lapwing and golden plover in relation to distance from the wind turbines is summarised in Figure 10.19, where the peak numbers counted on the ground are shown in each 100 m band around the wind turbines. The Figure also shows the numbers feeding and roosting. All of the lapwing ground records were in the 500-699 m bands, reflecting that all records were from Edderthorpe Flash.

10.7.33 **Black-headed Gull:** this species was present in the study area in up to regionally important numbers. Collision risk would be of negligible magnitude (16 birds per year using a precautionary 98% avoidance rate – see Table 10.15 above – equivalent to only 0.48% of the existing baseline regional mortality) and not significant. Gull avoidance rates are actually likely to be considerably higher than 98%, with 99.5% representing a more reasonable estimate (Maclean et al. 2009). Disturbance to wintering black-headed gulls would be of negligible magnitude and not significant given that the numbers (mean 23, peak 58) recorded within 600m of the proposed wind turbines during the baseline surveys and the fact that the actual displacement of this species would be likely to be only very limited given experience from other wind farms (Hotker et al. 2004).

10.7.34 **Other wildfowl species:** teal, gadwall, garganey and shoveler were all breeding in the survey area in sufficient numbers to be considered of regional importance. None of these were breeding within 300 m of any of the proposed wind turbines and only one (gadwall) within 500 m. Any disturbance to breeding birds would be of at most low magnitude and not significant. Wintering wildfowl present in regionally important numbers within the survey area included white-fronted goose, wigeon, gadwall, teal, mallard, shoveler, pochard, tufted duck and goosander. Numbers of white-fronted goose, wigeon, gadwall, teal, mallard and shoveler within the worst-case 600m potential disturbance zone occasionally exceeded the threshold for regional importance, but there was very little suitable habitat for any of these species within 300m of the wind turbines. The key area used by this species, Edderthorpe Flash, is only partially within this worst-case displacement zone and outside the usual zone over which this species may be displaced (Hotker et al. 2004). As a result any displacement would be of at most low magnitude and not significant. The numbers of flights of all of these species observed through the collision risk zone were so low that any collision risk to these species would be of negligible magnitude and not significant.

10.7.35 Numbers of the other medium sensitivity bird species within the potential impact zone were low, only reaching local importance. None would be likely to be particularly affected by such a development, given experience from other wind farms (Meek et al. 1993, Phillips 1994, Thomas 1999, Percival 2005, Devereux et al. 2008) and their relatively large UK population sizes. Effects would be of at most low magnitude (more likely negligible) and not significant.

Effects on Low Sensitivity Species

10.7.36 The low sensitivity species are of lesser concern, as a high magnitude impact would be necessary in order for a significant effect to occur. As these species are generally at low density within the study area, such a magnitude impact would be very unlikely. No significant effects are predicted for any low sensitivity bird species.

Effects on designated sites

10.7.37 Given that there are no SPAs within 20 km of the proposed wind farm site, none would be affected by this Development.

10.7.38 The only SSSI within 5 km of the site is the Carlton Main Brickworks SSSI, a site of geological interest with no notified ornithological features. No ornithological interest features on any SSSIs would therefore be affected by the proposed development.

10.7.39 No significant effects on the ornithological interest features of any other statutory protected sites would be likely to occur either.

Effects on other ornithological sites

10.7.40 Edderthorpe Flash lies 300m SW from the nearest proposed wind turbine at its nearest point and is part of the Dearne Valley RSPB reserve, which RSPB considers to be of national importance for birds and wildlife. The results of the baseline surveys support this conclusion.

10.7.41 Most of the Flash's bird populations of conservation interest were found outside even a worst-case potential impact zone of the wind farm. When the key species' distributions and flight lines are considered, with most of those lying outside any area that could possibly be affected by the development, there would not be any likely significant effect on this area's bird populations.

Effects of the Decommissioning Phase

10.7.42 The ornithological effects that are likely to occur during decommissioning will be similar to those during construction, though given the reduced time required, and the presence of existing infrastructure, they would be of a lower magnitude. Significant effects are not likely but precautionary mitigation measures will be implemented to ensure this, as detailed below, to deliver a net benefit to the NIA.

10.8 Design, Mitigation and Enhancement measures

10.8.1 The proposed wind farm development is not likely to result in any significant ornithological effects. However, the best practice measures described below would be followed throughout all of the proposed works.

Mitigation of the Construction Phase

10.8.2 Designated working areas, storage areas and access routes would be identified at the commencement of the construction phase. The proposed works will be phased so that access tracks are constructed early in the construction programme. Vehicular access would be restricted to designated routes throughout construction and operation as far as possible, thereby minimising potential disturbance of birds.

10.8.3 Four species specially protected under Schedule 1 of the Wildlife and Countryside Act from disturbance during breeding were found during the surveys, quail, avocet, little ringed plover and kingfisher, and it is possible that others such as hobby and barn owl could breed there in the future. It will be important to ensure that no Schedule 1 species are disturbed during the breeding season, particularly during the construction phase of the wind farm. Further surveys for these and any other Schedule 1 species will therefore be undertaken immediately prior to construction, if construction were planned for the main bird breeding season (March-August). If any were found then

potentially disturbing activities would be suspended for the breeding season within an appropriate zone (dependent on the location of the birds and the species involved) to be agreed with Natural England.

10.8.4 All birds' nests are protected from malicious destruction under the Wildlife and Countryside Act, so it will be necessary to ensure that this does not occur. If any construction works are scheduled for the main bird breeding season (March-August), then nest searches will be undertaken of any areas that would be affected and any active nests found avoided until the breeding attempt had been completed. Any hedgerow removal would be scheduled to take place outside the bird breeding season.

Mitigation of the Operational Phase

10.8.5 No specific mitigation during the operational phase is considered necessary but if major maintenance were necessary during the bird breeding season that involved ground or vegetation clearance, then the same mitigation measures as described above for the construction phase would be implemented.

Mitigation of the Decommissioning Phase

10.8.6 In order to ensure that none of the decommissioning effects on the Site's ornithological interest are significant, the same mitigation measures will be implemented as for the construction phase of the development.

Enhancement of Wildlife Value

10.8.7 Though no significant effects would be likely on the breeding or wintering bird community, given the range of BAP species present, and the fact that the site lies within the Dearne Valley NIA, a habitat enhancement programme will be implemented to ensure that the project delivers a net local conservation gain (following the guidance given in the NPPF). This could include enhancement of field margins, hedgerow restoration and the provision of barn owl nest-boxes to encourage nesting but at distances exceeding 300m from the wind turbine locations.

10.9 Ornithological Monitoring

10.9.1 An ornithological monitoring programme will be implemented to provide detailed information about the effects of the wind farm on the local bird populations and on the habitat enhancement programme. The baseline surveys will provide a baseline for a post-construction monitoring programme. This work will continue when the wind farm has been commissioned, to determine the effects that the wind farm does (or does not) have on the local bird populations. The following will be undertaken for the bird monitoring programme:

- a standard Common Birds Census method breeding bird survey, with six visits per season (as carried out for the baseline surveys) would be undertaken. The Study Area for this survey will include the same area as that covered during the baseline studies. The survey would be undertaken annually for the first three years after commissioning.
- wintering bird surveys (field counts and vantage point surveys) will be carried out following the same methodology as the baseline studies for the first three years after commissioning.

10.10 Residual Impacts

10.10.1 Following mitigation, the residual effects of the development will be a loss of a small amount of agricultural habitat to turbine bases and tracks, and a non-significant risk of disturbance and collision. Using evidence from existing wind farms it is considered unlikely that this will have any long term impact on the integrity of the study area's ornithological features or the conservation status of the species found here. The implementation of the proposed wildlife enhancement measures would deliver a net gain to the area's bird populations.

10.11 Cumulative effects

10.11.1 Given the low level of ornithological impact that would result from the Park Spring wind farm, it is not considered that it would be likely to contribute to any significant cumulative ornithological impact.

10.11.2 Notwithstanding this, consideration has been given to the potential cumulative impacts of other schemes in the vicinity of Park Spring, including Marr (4 x 2MW turbines operational 9 km to the SE of Park Spring, Hampole (9 km E - 4 x 2MW turbines, consented and currently in construction) and Mount Pleasant (1.6 km E – 2 x WES80 80kW turbines). This has confirmed that the Park Spring wind farm is not likely to contribute to any significant cumulative ornithological impact. None of these projects identified any significant ornithological effects that would be likely to arise from each, either alone or in combination. The predicted ornithological impacts from the Park Spring wind farm would similarly not be significant and would also not be sufficient for there to be any possible significant impact in combination with either of these two other wind farms.

10.12 Summary and Conclusions

10.12.1 The assessment of the potential effects of the proposed wind farm on the features of ornithological interest are summarised in Table 10.16 below.

10.12.2 Overall, there are not likely to be any significant impacts on ornithology as a result of the Development assuming that the mitigation measures referred to in this chapter are adopted. In addition, no effects would result in any breach of the Habitats Regulations.

Table 10.16: Summary of effects of the Park Spring wind farm on birds

Project Phase	Summary of effect	Value	Nature of effect			Mitigation Measure	Residual significance
			Positive/ negative	Permanent/ temporary	Reversible/ irreversible		
Construction	Habitat loss: construction of turbine bases and access tracks	Low/ negligible	Negative	Temporary	Reversible		Not significant
	Disturbance to Schedule 1 breeding species	High	Negative	Temporary	Reversible	Pre-construction survey; if present avoid disturbing activity in proximity.	Not significant
	Disturbance to breeding lapwing	Medium	Negative	Temporary	Reversible	Pre-construction survey and active nests avoided.	Not significant
	Disturbance to other breeding species	Up to medium	Negative	Temporary	Reversible	Pre-construction survey and active nests avoided.	Not significant
	Disturbance to wintering birds	Up to high	Negative	Temporary	Reversible		Not significant

Project Phase	Summary of effect	Value	Nature of effect			Mitigation Measure	Residual significance
			Positive/ negative	Permanent/ temporary	Reversible/ irreversible		
Operation	Mortality through bird collision with wind turbines	Up to high	Negative	Temporary	Reversible		Not significant
	Displacement of birds from zone around wind turbines	Up to high	Negative	Temporary	Reversible		Not significant
Decommissioning	Disturbance to Schedule 1 breeding species	High	Negative	Temporary	Reversible	Check again pre-decommissioning; if present avoid disturbing activity in proximity.	Not significant
	Disturbance to other breeding species	Up to medium	Negative	Temporary	Reversible	Pre-decommissioning survey and active nests avoided.	Not significant
	Disturbance to wintering birds	Up to high	Negative	Temporary	Reversible	Avoid areas with important bird populations in design process	Not significant
	Restoration works	Low/ negligible	Positive	Permanent	Reversible		Not significant

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SECTION 11

SOCIO-ECONOMIC IMPACTS

11 SOCIO-ECONOMIC IMPACTS

11.1 Introduction

11.1.1 This chapter assesses the potential impacts of the proposed Development on the economy of the area and social factors such as local tourism and recreation.

11.1.2 A range of socio-economic impacts may occur as a result of the proposed Development, these include:

- Direct effects on employment.
- Indirect effects on economic activity, e.g. construction workers using local facilities such as bed and breakfast accommodation.
- Indirect effects on tourism and recreation, principally due to perception of visitors to the area. Visual impacts are assessed in Chapter 6, Landscape and Visual Impact Assessment, and safety issues in respect of Public Rights of Way (PRoW) are considered in Chapter 14, Technical Issues.

11.1.3 Potential impacts are assessed during the construction, operation and decommissioning phases.

11.1.4 It is important to note that the proposed Development will make a contribution towards alleviating the impacts of climate change and the increase in the security of energy supply through the production of renewable energy generation. Such benefits are not easily identified at a local scale, however it is considered that the generation of renewable energy is considered to be a significant national benefit.

11.2 Guidance

11.2.1 An overview of UK and local guidance is provided in Chapter 4, Planning Policy. There is no specific guidance within the National Planning Policy Framework (NPPF) in relation to specific socio-economic impacts, although of relevance is the presumption in favour of sustainable development.

11.2.2 The Overarching National Policy Statement for Energy (EN-1) includes guidance on the assessment of socio-economic impacts. EN-1 states that assessments should consider:

- *The creation of jobs and training opportunities.*
- *Provision of additional local services and improvements to local infrastructure, including the provision of educational and visitor facilities.*
- *Effects on tourism.*
- *The impact of changing influx of workers during the different construction, operation and decommissioning phases of the energy infrastructure.*
- *Cumulative effects.*

11.2.3 The adopted Core Strategy for Barnsley sets out the spatial strategy for the Barnsley area, including the Council's hopes and aims for the people who live, work, run businesses and enjoy leisure in Barnsley. To that aim, the Core Strategy includes

policies to tackle climate change, encourage employment, and protect and encourage tourism in the region.

11.2.4 Of particular relevance is Core Strategy Policy CSP 20, Promoting Tourism and encouraging Cultural Provision. This policy aims to promote tourism and encourage the growth and development of cultural provision. New tourist related development is to be focused within existing centres and existing tourist related development in rural areas protected and encouraged in order to support and diversify the local economy.

11.3 Assessment methodology

11.3.1 There is no standard methodology for the assessment of socio-economic impacts. This assessment has therefore been carried out by determining the baseline through a desk-based exercise and then assessing the potential impacts of the proposed Development upon this baseline through professional judgement and prior knowledge of onshore wind development.

Economics

11.3.2 This socio-economic assessment considers the direct impact on employment, indirect economic impacts within the supply chain and induced economic impacts arising from expenditure in the local economy from those directly employed during construction, operation and decommissioning of the Development.

11.3.3 The assessment is based on the experience of EDF ER in constructing and operating wind farm developments in the UK, and recent studies on the economic impacts of wind farm development.

Tourism and Recreation

11.3.4 The assessment of tourism and recreation impacts considers the potential of the Development to impact upon local visitor attractions within approximately 20 km i.e the landscape and visual study area. It also considers the potential impact on public rights of way in the vicinity of the Development and other recreational facilities used by local residents.

11.3.5 As the tourism and recreation value of outdoor visitor attractions derives, in part, from their landscape character and visual amenity, the assessment of the potential impacts draws upon the conclusions of Chapter 6 – Landscape and Visual Impact.

11.3.6 The assessment of tourism and recreation impacts has been informed by a broad body of research with reference to well known and documented studies, and recent planning appeal decisions which are identified in the relevant sub-sections.

11.4 Assessment criteria

11.4.1 The significance of any potential impacts is difficult to define due to their often qualitative and subjective nature. However, the assessment criteria outlined below have been applied to this assessment in an attempt to quantify any potential impacts identified.

11.4.2 The potential impacts will be identified as being either: positive; adverse; or, negligible. The significance of the positive / adverse impacts will be defined as either:

- **Negligible Impacts** are considered to be no detectable change or a change which is unlikely to be perceivable on either a local, wider or national scale.
- **Minor Impacts** are considered to be a detectable but not-material change which may affect the local community.
- **Moderate Impacts** are considered to be material but non-fundamental changes those which may affect the local community.
- **Major Impacts** are considered to be a fundamental change or impacts which affect the wider community or are of a national scale.

11.5 Consultation

Table 11.1 - Consultation Responses

Barnsley Metropolitan Borough Council (BMBC) – The Scoping Report received from BMBC (dated 14th September 2011) stated that the potential impacts upon socio-economics including tourism, recreation, bridleways and footpaths should be one of the main issues on which the ES should focus.
BMBC Public Rights of Way (PRoW) – Email dated 12th March 2013. BMBC PRoW Officer provided a plan showing the PRoW on the site and in the vicinity of the site. The consultation response requested consideration of the dedication of the permissive paths and to improve the network for pedestrians and horse riders.

11.6 Baseline conditions

Economics

11.6.1 This sub-section establishes the current baseline by which to assess the impacts of Park Spring Wind Farm with regards to the following characteristics:

- Population.
- Skills and Education.
- Labour Force and Employment.
- Occupational Profile.
- House Prices.

Population[33]

11.6.2 The population of Barnsley is approximately 231,900 (2011 estimate). Over the ten year period 2001 to 2011, the population increased by 6.3 per cent.

Skills and Education

11.6.3 In Barnsley approximately 43.7 per cent of people are qualified to at least National Vocational Qualification (NVQ) Level 3 and approximately 13 per cent of the population hold no qualifications.

[33] http://www.nomisweb.co.uk/reports/lmp/la/1946157120/report.aspx

11.6.4 This information is shown in Table 11.2 below (based on Jan 2012 - Dec 2012 estimates).

Table 11.2: Qualifications in Barnsley

Qualifications	*Barnsley*	
	Number	*%*
NVQ4 and Above	31,000	21.3
NVQ3 and Above	63,500	43.7
NVQ2 and Above	90,200	62.1
NVQ1 and Above	110,800	76.3
Other Qualifications	15,500	10.7
No Qualifications	18,900	13.0

Labour Force and Employment

11.6.5 In 2011, the working age population (16 to 64 year olds) of Barnsley was approximately 148,600. Of this population in 2012, 113,400 (76.9 per cent) were economically active[34]. Of the economically active population, approximately 100,800 (68.2 per cent of the working age population) were in employment.

Occupational Profile

11.6.6 The breakdown of these workforces in terms of industries in both Barnsley and also Yorkshire and the Humber is shown in Table 11.3 below.

Table 11.3 - Breakdown of Workforce in Barnsley, Yorkshire and the Humber

Sector		**Barnsley**		**Yorkshire and the Humber**
		Number	**%**	**%**
Manufacturing		11,400	16.4	13.0
Construction		4,200	6.0	5.2
Services		53,400	76.9	80.4
	Distribution, hotels and restaurants	15,100	21.7	23.5
	Transport and Communications	3,000	4.4	5.5
	Finance, IT, other business activities	9,600	13.8	18.4
	Public admin, education and health	22,900	33.0	28.6
	Other services	2,800	4.1	4.4

[34] *The economically active population is defined as being the population of people within the working age population who are either employed or unemployed.*

Tourism related	5,500	8.0	7.7

House prices[35]

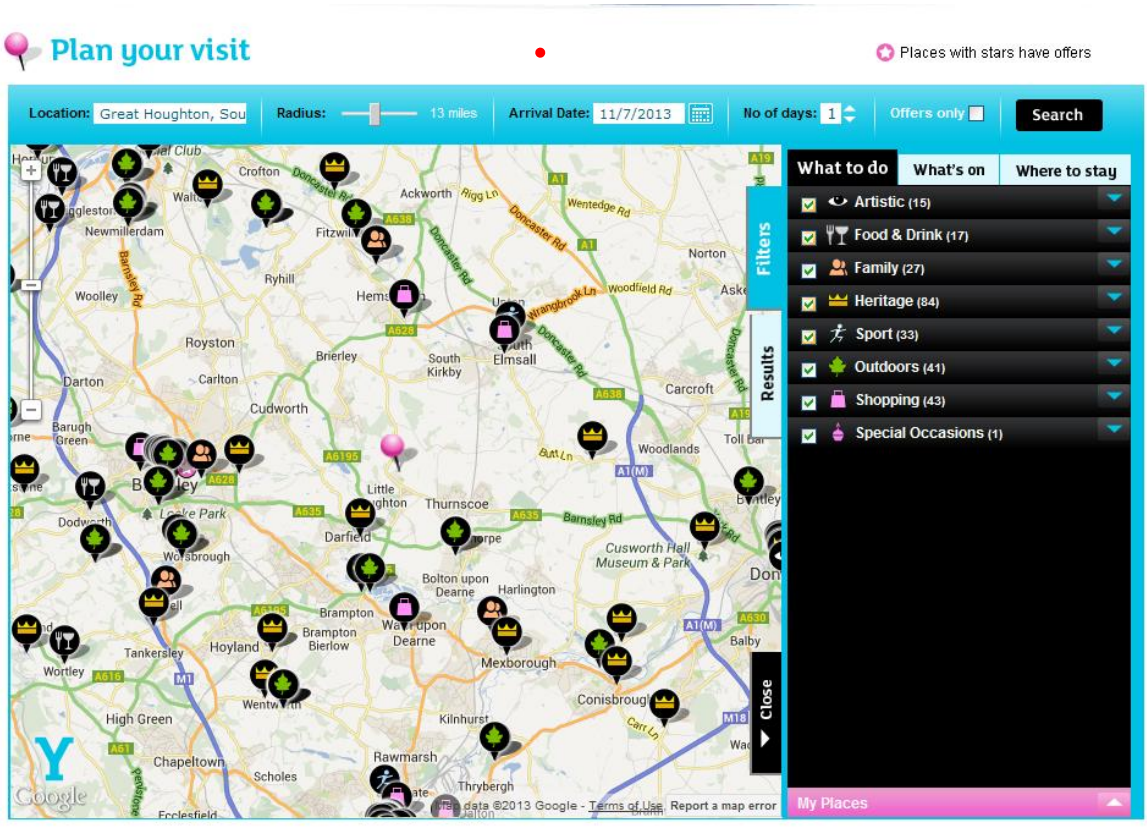
11.6.7 House prices in Barnsley are lower than in the Yorkshire and Humber Region and the national average. The average house price in Barnsley in January 2013 was £86,612 compared to £114,946 and £162,029 respectively for the county and national averages.

Tourism and Recreation

11.6.8 Based on the information in Table 11.3 above, employment within the tourist industry in Barnsley accounts for approximately 8 per cent of the workforce and within Yorkshire and the Humber 7.7 per cent of the workforce.

11.6.9 Figure 11.1 below shows the distribution of tourist destinations within an approximate 20 km radius of the Development site.

Figure 11.1: Interactive Destination Map[36]



11.6.10 From the Yorkshire.com map displayed above the closest tourism/recreation attractions listed are:

[35] http://www.landregistry.gov.uk/public/house-prices-and-sales/search-the-index
[36] http://www.yorkshire.com/discover/what-to-do/all/Barnsley,%20South%20Yorkshire

- Maurice Dobson Museum and Heritage Centre, Darfield, 2.5 km south.
- Monk Bretton Priory, 4.5 km west.
- Halycon Walking Holidays, Goldthorpe, 4.6 km south-east.
- Hemsworth Market, 5.4 km north-east.
- South Elmsall Market, 6.6 km north-east.
- Minsthorpe Swimming Pool, 7 km north-east.
- Brodsworth Hall and Gardens, 8.5km east.

11.6.11 The tourism and recreation attractions within the 20km landscape and visual study area include:

- The Peak District National Park - 18 km south west.
- Locke Park - 7.5 km west.
- Brodsworth Hall - 8.5 km east.
- Wentworth Woodhouse - 9.5 km south west.
- Wentworth Castle 9.6 km west.
- Transpennine Trail - 3.9 km south west.
- Barnsley Boundary Walk - 12 km north west.
- Dearne Way - 1 km south west.
- Rotherham Round Walk - 8 km south.
- Dove Valley Trail - 3.8 km south west.
- National Cycle Network 62 and 67.
- Fitzwilliam County Park - 8.5 km north.
- Howell Wood County Park - 3 km north east.
- Worsbrough Mill County Park - 8.5 km west.
- Anglers County Park - 8 km north, north west.
- Phoenix Park - 4.5 km north east.

11.6.12 With regards to recreation on the site itself there are a number of footpaths and bridleways which cross the site, these are illustrated on Figure 11.1. There are also several permissive paths across the site, these are also illustrated on Figure 11.1.

11.7 Socio-economic Impacts

Economics

Construction

11.7.1 A recent report produced by BiGGAR Economics on behalf of RenewableUK and the Department of Energy and Climate Change (DECC)[37] based upon 18 wind farm case studies across the UK found that:

- 98% of development expenditure, 45% of construction expenditure and 90% of operation and maintenance expenditure currently occurs in the UK.
- Total direct and supply chain impact was 8,600 jobs and £548 million in Gross Value Added (GVA) across the UK, of which 1,100 jobs and £84 million GVA arose at the local level (local authority area).
- Opportunities exist for a wide range of business further down the supply chain –
  - Income effects - £85 million GVA and 2,400 jobs in business where employees spend their wages.
  - Impacts on land owners – generation of additional revenue and the diversification of income for landowners.
  - Community ownership.
  - Community benefit funds.
  - Business and tourism effects, spend on food and accommodation during construction is estimated to contribute £11 million to the UK economy, supporting 300 jobs.
  - Other tourism effects, e.g. provision of visitor facilities.
  - Wildlife and habitat management.
  - Investment in local infrastructure.

11.7.2 Direct employment impacts will likely be realised as a result of the contract for the supply, the construction, and the commissioning of the Park Spring wind turbines which will be awarded through a procurement procedure to one or more contractors who may in turn appoint specialist subcontractors.

11.7.3 Approximately 30 construction workers will be directly employed and it is anticipated that where possible these workers will be based locally, however specialised skills required for certain construction tasks including turbine erection and testing may have to be recruited from a wider area.

11.7.4 Where specialised skills cannot be recruited locally indirect minor positive impacts will arise as a result of increased expenditure. These members of staff will commute or seek temporary accommodation in local accommodation. Furthermore, it is likely that businesses including cafes, restaurants and bars will benefit from increased spending in the area.

11.7.5 The decision to use local labour and materials will be made by the selected contractor(s). However, the tender specification documents will request information on where the contractor(s) will source labour and sub-contractors, and EDF ER will encourage tenderers to use local contractors wherever possible.

11.7.6 In addition, the construction of the Development will result in indirect positive minor economic benefits being realised by local businesses that are included in the supply chain, such as local quarries supplying aggregate and concrete for the access roads.

[37] Onshore Wind, Direct and Wider Economic Impacts, BiGGAR Economics on behalf of RenewableUK and DECC, May 2012

This in turn will assist in maintaining local employment and induced expenditure elsewhere in the local economy.

11.7.7 It is considered that the impact of the proposed Development upon the economic baseline during the construction phase is Moderate Positive.

Operation

11.7.8 There will be a reduced impact upon direct employment during the operational phase as the Development will be unmanned.

11.7.9 The need for maintenance engineers is envisaged, the number of which would be dependent upon the manufacturer selected during the tendering process. The maintenance engineers would be employed part-time at the Development as it is expected that they would also operate and maintain a number of other wind projects. These maintenance engineers will have a background appropriate to their discipline and will be trained in the operation of the Development.

11.7.10 It is anticipated that there would be continuing opportunities in the supply chain during the operational phase, for example spend in the local economy by visiting personnel, revenue for landowners, wildlife and habitat management and the potential for investment in local infrastructure.

11.7.11 Once the wind farm is operational, a dedicated community fund based on an agreed annual contribution from EDF ER will be set up to support a range of local activities and community projects.

11.7.12 The potential impact of any development upon nearby house prices is not a material planning consideration, as set out in The Planning System: General Principles (ODPM, 2005). A report - What is the impact of wind farm on house prices? (RICS, 2007) concluded that there in no clear relationship between houses prices and proximity to a wind farm development.

11.7.13 It is considered that impact of the proposed Development upon the economic baseline during the operation phase is Moderate Positive.

Decommissioning

11.7.14 During decommissioning, the impacts on socio-economics are expected to be similar to those during construction, and will involve the creation of opportunities for local contractors to be involved in aspects of the decommissioning work.

11.7.15 It is considered that impact of the proposed Development upon the economic baseline during the operation phase is Moderate Positive.

Tourism and Recreation

Construction

11.7.16 The tourism industry in Barnsley and Yorkshire and the Humber accounts for approximately 8 and 7.7 per cent of the total workforce respectively. There are important visitor attractions in the area such as the Peak District National Park. These attractions are largely based on visual amenity and are discussed in greater detail in Chapter 6. The landscape and visual assessment concluded that there were

no unacceptable adverse impacts as a result of the Development, including during the construction phase.

11.7.17 There is expected to be a Negligible impact on the tourism industry as a result of the Development including the additional noise and traffic generated by the Development. Please refer to Chapter 5 Noise and Chapter 13 Transport.

11.7.18 With regards to recreation there is anticipated to be a temporary negative impact on the permissive paths and bridleways which cross the site. Sections of the permissive paths and a short section of a bridleway that cross the site will be required to provide site access, therefore temporary closure of these paths is requested. In addition, it is proposed that two sections of footpaths are temporarily closed during the construction phase to ensure safety is maintained on the site. Due to the interlinking nature of the PRoW across in the locality it is considered that members of the public will be able to use other routes for example Bridleway 5 between Great Houghton and Grimethorpe which passes along Park Lane will not be affected.

11.7.19 It is considered that the Development would have a Moderate Adverse impact on recreation in the area during the temporary construction phase.

Operation

11.7.20 Numerous studies into public attitudes regarding onshore wind development have been carried out, a recent example of which was undertaken by DECC in 2012 as part of its Public Attitudes Tracker.[38] This found:

- 77% of the British public want electricity from renewable sources.
- 73% of people support development of onshore wind, 66% offshore.
- 74% are concerned that the UK is too dependent on energy from other countries.

11.7.21 It is anticipated that operation of the wind turbines will have positive impacts on local public attitudes to wind farms and renewable energy. Residents living in close proximity to wind farm sites have been regularly consulted regarding their attitudes towards wind farms and documentary evidence indicates that during operation a statistically significant change in attitude is observed. A survey by researchers at Edinburgh University observed a significant decrease in the number of residents who were unable to identify a positive impact of wind turbines, an increase in residents finding them visually attractive and an increase in residents considering them a secure form of energy.[39]

11.7.22 Wind turbines have the potential to impact on tourist attractions by impacting on their visual amenity and many of the tourist attraction in the region are based around their visual attractiveness including the Peak District National Park. Chapter 6 Landscape and Visual Assessment assesses the impacts that the turbines will have on these attractions in more detail and concludes that there will not be an unacceptable impact.

[38] http://www.decc.gov.uk/assets/decc/11/stats/6410-decc-public-att-track-surv-wave2-summary.pdf

[39] Eltham, D.C., Harrison, G.P. & Allen, S.J., 2008. Changes in public attitudes towards a Cornish Wind Farm: implications for planning. Energy Policy. Vol 36, pp.23-33.

11.7.23 Furthermore, there is an increasing body of research that suggests that wind farms have very little impact on tourism. A comprehensive study released in 2008 by the Moffat Centre for Scottish Government concluded that the impacts on wind farms on tourism are very small, such that the aims of reaching renewable energy targets and meeting tourism targets can be compatible.[40] It stated that there is no overall evidence to suggest a negative economic impact of wind farms on tourism.

11.7.24 A recent study by Visit Scotland found that the presence of wind farms had no influence on the decision making of the vast majority of tourists.[41]

11.7.25 Several planning inspector's decisions have reported on the impacts of wind farm developments upon tourism. For example a decision was made to grant planning permission for Carsington Pastures Wind Farm in Derbyshire (ref: APP/P1045/A/07/2054080); a four turbine development 2 km from the Peak District National Park.

11.7.26 In granting consent for that development the Inspector stated that *"so far as tourism is concerned, research into what has happened, not happened or might happen in other areas seems to provide a reasonable guide to what would be likely to follow here"* (Paragraph 75). The Inspector went on to say: "*the various studies cited by the Appellant and not challenged by the Council show no clear evidence of wind turbines having had a significant effect and lasting adverse effect on visitor numbers or the visitor economy; and the most recent such publication, the Moffat Centre's report on the Economic Impacts of Wind Farms on Scottish Tourism (March 2008) concludes that even on a worse case scenario adverse economic impact would be very small and in three or four (admittedly extensive) study areas, hardly noticeable"* (Paragraph 76).

11.7.27 Wind farms have themselves become tourism attractions. The following wind farms incorporate visitors centres and encourage visitors to attend the site:

- Ecotech Centre in Norfolk – attracted 17,000 visitors in 2009.
- Whitelee Wind Farm and Visitors Centre – attracted 25,000 visitors in the first 2 months.
- Scroby Sands Visitors Centre in Norfolk – attracts 35,000 visitors each year.

11.7.28 With regards to recreation there will be a Minor Positive impact on the bridleways, footpaths and permissive paths which cross the site during the operation of the wind farm. All paths will be reopened to the public following construction, with the possible exception of temporary closure for maintenance activities.

11.7.29 The permissive paths and a short section of a bridleway that are required for the access tracks will be upgraded during construction. Tracks will be upgraded with compacted stone such that they are suitable to accommodate construction traffic. These upgraded and improved paths will be reopened for use following construction.

11.7.30 In the consultation response from the PRoW Officer at BMBC it was requested that EDF ER consider the dedication of permissive paths on the site to the PRoW network. After discussion with the landowner, the land agent and members of the public it is evident that a key concern in the area is the misuse of these paths by motorbikes and

[40] The economic impacts of wind farms on Scottish Tourism. Available at http://www.scotland.gov.uk/Resource/Doc/214910/0057316.pdf

[41] Visit Scotland, Windfarm Consumer Research, April 2012

similar. Rather than the creation of new paths or dedication of permissive paths, which could encourage further misuse of the site, it is considered that the provision of bollards, gapping up hedgerows etc. as appropriate would improve the area for pedestrians and horse riders.

11.7.31 There are a number of examples of wind turbines built close to footpaths and / or bridleways including:

- Eastman Wind Farm in Cumbria, operated by Wind Direct, where a public footpath passes within approximately 50 m of a turbine base.
- Harehill Wind Farm near Sunderland, operated by E.ON, where one turbine lies immediately adjacent to a bridleway.
- E.ON's Holmside Hall site in County Durham, where a public footpath passes within feet of a turbine base.

11.7.32 At the above wind farms there has been no evidence of conflict between the users of local public rights of way and the turbines (e.g. complaints of disturbance to recreational activity).

11.7.33 It is considered that impact of the proposed Development upon the tourism and recreation baseline during the operation phase is Minor Positive.

Decommissioning

11.7.34 During decommissioning, the impacts the local economy are expected to be Moderate Positive as they are similar to those realised during construction.

11.7.35 During decommissioning, the impacts on tourism and recreation are expected to be Moderate Adverse as they are similar to those realised during construction.

11.7.36 The access tracks will be upgraded from compacted earth to crushed compacted stone which will remain in place post decommissioning.

SECTION 12

SHADOW FLICKER

12 SHADOW FLICKER

12.1 Introduction

12.1.1 This section assesses the potential for the three wind turbines at the proposed Park Spring Wind Farm site to produce shadow flicker effects, resulting from moving shadows cast by rotating wind turbine blades. Also included are discussions on glinting and photosensitive epilepsy.

12.1.2 Shadow flicker is the effect caused when wind turbine blades periodically cast shadows over nearby properties as they rotate. In a closed space, for example in a room with a window facing the wind turbines, these effects may be intensified, and for a stationary person in the space, such shadows can result in a momentary reduction in the intensity of the available natural light. If the regular changes in light intensity levels are sufficiently great, then nuisance may be caused.

12.1.3 The magnitude of the shadow flicker effect varies both spatially and temporally and depends on a number of environmental conditions coinciding at any particular point in time, including, the position and height of the sun, wind speed, direction, cloud cover and position of the turbine to a sensitive receptor.

12.1.4 National Policy Statement for Renewable Energy Infrastructure (EN-3) states that shadow flicker is unlikely to be of a significant impact at distances greater than 10 rotor diameters from a turbine. EN-3 lists the factors which influence the potential significance of shadow flicker impacts, these include:

- The location of the relevant building relative to the path of the sun and the turbines.
- The distance of turbines from such buildings; the size of the window apertures and their location in the building relative to the turbines.
- The turbine height and rotor diameter.
- The presence of intervening topography, buildings or vegetation.
- The frequency of bright sun and cloudless skies.
- The time of year.
- The prevailing wind direction and hence usual rotor orientation.

12.1.5 In addition, EN-3 lists the factors which influence the occurrence and duration of shadow flicker, these include:

- Wind speed - wind speed will determine its frequency.
- Wind direction - must allow the rotor to be perpendicular to the dwelling for a shadow flicker effect to take place.
- Cloud cover - must be sufficiently thin to allow the sun to shine brightly enough for shadow flicker to occur.

12.1.6 Nordrhein-Westfalen (2002) set out criteria for shadow flicker worst case scenario. German guidance sets two limits on the levels of acceptable shadow flicker effect:

- Worst case scenario limited to a maximum of 30 hours per year or 30 minutes on the worst affected day.
- A realistic scenario including meteorological parameters limited to a maximum of 8 hours per year.

12.1.7 These limits have been widely accepted across Europe and are recommended in guidance such as that undertaken by Predac in European Actions for Renewable Energies.

12.1.8 EN-3 is clear that in cases where shadow flicker has the potential to occur but a wind turbine has been fitted with a mechanism to inhibit shadow flicker, the impacts should be judged to be of negligible significance.

12.1.9 Numerical and qualitative analyses of the impact of shadow flicker at buildings in the vicinity of the proposed wind turbines have been undertaken. A computer model containing the relative position of the sun in the sky, from any point on the earth's surface, and at any time during a day and year, was used. From this model it was possible to accurately quantify the theoretical temporal and spatial shadow flicker effects. The prevalence and impact of such effects is dependant upon a number of other factors, discussed in turn in paragraphs 12.2.3 – 12.1.17.

12.2 Assessment methodology

12.2.1 WindPro 2.6 was used to model shadow flicker effects on potential receptors within 10 rotor diameters of the proposed Park Spring Wind Farm. WindPro calculates how often and in which intervals a specific receptor will be affected by one or more wind turbines. The calculations were based on worst case scenarios.

12.2.2 Nordrhein-Westfalen (2002) *"(worst case) is the theoretical time when the sun is during the entire period between sunrise and sunset passing through a cloudless sky and the rotor surface is perpendicular to the solar radiation, and the wind turbine is in operation".*

12.2.3 The position of each proposed wind turbine was entered into the WindPro model, along with the hub height and rotor diameter dimensions of the proposed Park Spring wind turbines. The position of each identified potential receptor was also entered into the model. For each receptor a single window, 1 m x 1 m and orientated to directly face the wind farm was used to simulate a worst case scenario. Based on this information the model is able to use spatial data for the position of the sun relative to the turbines over the course of a year. The model assumes that the turbine rotor is a disc with a shadow occurring when the centre of the sun passes behind any part of the rotor and that it always faces the sun. Any shadow generated by this disc is classed as an impact, however the intensity of any potential flickering was not considered by the model.

<u>Factors considered by numerical modelling</u>

12.2.4 The following issues were considered by the numerical modelling:

Site position

12.2.5 One of the key factors relating to shadow flicker is the latitude of a proposed wind farm site. This influences the shape of the potentially affected area, which is characteristically a 'butterfly' or 'kidney' shape centred on each turbine.

12.2.6 Planning Practice Guidance for Renewable and Low Carbon Energy notes that "*Only properties within 130 degrees either side of north, relative to the turbines can be affected at these latitudes in the UK - turbines do not cast long shadows on their southern side"*. Despite this, the assessment of the potential impact of the proposed Park Spring Wind Farm has not been limited in this regard to demonstrate the comprehensive nature of the assessment.

12.2.7 The areas at greatest risk of being affected by any wind turbines can be summarised depending on the season:

- During the winter - principally to the north-west and north-east and to the west and east.
- During the summer - principally to the south-west and south-east.

12.2.8 The assessment of shadow flicker effects has therefore focused on residences within these areas; however, potential receptor locations all around the proposed Park Spring Wind Farm were studied.

Wind turbine - potential receptor separation distance

12.2.9 An area equivalent to 10 rotor diameters is widely accepted as an appropriate assessment area. This is due to the potential for shadow flicker impacts at distances greater than 10 rotor diameters to be very low. For the proposed Park Spring Wind Farm this would give a distance of 920 m.

12.2.10 EN-3, "*Research and computer modelling on flicker effects has demonstrated that there is unlikely to be a significant impact at distances greater than ten rotor diameters from a turbine."*

12.2.11 A Case of Shadow Flicker (Clarke A.D. 1991) "*The minimum separation distance for wind turbines from habitations should be approximately 10 blade diameters. This is emerging from experience and research as a standard guideline, in order to reduce problems of visual impact, noise, shadow disturbance, and safety".*

12.2.12 Shadow intensity decreases exponentially with separation distance, and the influence of varying light levels on sight, discussed below. It is to be noted that there are residential properties within the 920 m of the proposed wind turbines.

Wind turbine size and number

12.2.13 A wind turbine's size is broadly defined by its hub height and rotor diameter. The Danish Wind Industry Associates website (2010) stated that hub height was of minor importance for shadow from the rotor. For wind turbines with an increased hub height, the same shadow is spread over a larger area, so in the vicinity of the turbine the number of minutes per year when shadows are experienced will actually decrease. Although shadows cast further away from a turbine are of less significance, due to the influence of the increased separation distance; shadows cast close to a turbine will be more intense and therefore more likely to be of a concern. The rotor diameter determines the size of shadow cast, and the theoretical shadow

flicker exposure times close to a wind turbine are proportional to rotor diameter. A larger rotor diameter would increase the area that could have potential impact. The number of turbines would not intensify any flicker effects in a cumulative manner. Shadow flicker effects on receptors are relative to individual turbines and the position of the sun.

Cloud cover

12.2.14 Cloud cover is a key consideration because of the influence on ambient light levels, and therefore the intensity of shadows. All calculations assumed the metrological worst case; clear skies. However in reality cloud cover would vary daily as well as seasonally. Cloud cover can dramatically reduce the number of shadow hours per year. The national guidelines on acceptable shadow flicker levels for Germany are 30 hours per year, calculated with a clear sky. As for Denmark average cloud cover is taken into account resulting in an acceptable level of 10 hours per year.

Horizon diffusion

12.2.15 The sunlight's angle varies with the latitude and time of day. The greater the latitude of the site, the lower the sunlight's angle will be, and so the more important shadow flickering becomes. Moreover, it has been considered that an angle above horizon of less than 3° has no shadow influence. This assumption is considered reasonable due to the significant increase in light diffusion that occurs at low solar altitudes.

Shielding

12.2.16 Another key factor influencing whether or not shadow flicker occurs, is the visibility of a wind turbine's 'rotor disc' (i.e. the area swept by the blades) at a particular receptor location. If only partially visible, or not visible at all, then the impact will be reduced, or eliminated altogether. Shielding can be provided by the topography between the wind turbines and a potential receptor location and also by trees and buildings. The modelling undertaken for the project has only considered topography and therefore represents a worst case outcome.

Wind speed and availability

12.2.17 The wind speed on a site and availability of wind turbines determines whether or not the turbine would operate. If wind speeds are either too low or too high, only static shadows are cast. The worst case scenario used in this study assumes all turbines are operational for the duration of year at all times of the day. The wind turbines were also assumed to be facing directly towards each of the shadow receptors, regardless of the time of day and year. This again represents a worst case outcome.

Window size/viewing area and orientation

12.2.18 The orientation of the windows of a property is relevant. Unless shadows fall over most of the area of the window(s) providing a light source to a room, the proportion of natural light entering the room will not be reduced sufficiently for shadow flicker effects to be experienced. If the window(s) does not directly face the wind farm the potential for shadow flicker will be reduced. The orientation of each shadow receptor has been defined in the model according to the shape of the buildings. The larger a window is, or the more windows there are, to allow natural light into a room, the less significant the potential impact of any moving shadows cast by a wind turbine. The size of each shadow receptor has been defined as a 1 m x 1 m rectangle, at a height of 1 m above ground level (AGL) for the lower side.

12.3 Assessment results

12.3.1 There are a number of properties within 10 rotor diameters (920 m) of the proposed Development that may be affected by shadow flicker. The properties are all located within Great Houghton and as such are grouped together, a single receptor has been chosen, closest to the turbines from each residential street. The analysis of these properties has been compiled and is given in Table 12.1 below.

Table 12.1 - Properties within 10 rotor diameters of Park Spring

ID	Property name	Distance to nearest turbine
A	1 Crabtree Drive	760 m
B	34 Park Lane	775 m
C	63 High Street	828 m
D	14 Pear Tree Close	864 m
E	Crabtree Grange Farm	849 m
F	1 Ashwood Grove	872 m
G	20 Milton Street	886 m

12.3.2 Please refer to Figure 12.1.

12.3.3 A summary of the results of the shadow flicker modelling are included in Table 12.2 below.

Table 12.2 - Summary of shadow flicker results

Receptor	Max shadow hours per year	Months affected	Potential flicker times	Turbine	Worst affected day (minutes of shadow flicker)
A	30:29	February	16:24 - 16:52	T3	00:29
		March	17:32 - 18:48	T2	00:25
		April	19:36 - 19:59	T1	00:23
		May	19:36 - 19:59	T1	00:23
		August	19:44 - 20:08	T1	00:23
		September	18:17 - 18:44	T2	00:25
		October	16:54 - 17:23	T3	00:29
		November	15:59 - 16:04	T3	00:05
B	28:29	February	16:32 - 17:00	T3	00:28
		March	16:39 - 16:50 / 17:38 - 18:58	T3/T2	00:11 / 00:24
		April	19:39 - 20:01	T1	00:22
		May	19:39 - 20:02	T1	00:22
		August	19:47 - 20:10	T1	00:23
		September	18:23 - 18:50	T2	00:24
		October	16:03 - 17:29	T3	00:28

Receptor	Max shadow hours per year	Months affected	Potential flicker times	Turbine	Worst affected day (minutes of shadow flicker)
C	21:58	March	17:05 - 17:29 / 19:02 - 19:11	T3/T2	00:25 / 00:09
		April	19:00 - 19:22 / 20:00 - 20:03	T2/T1	00:21/ 00:03
		May	19:54 - 20:15	T1	00:20
		July	20:07 - 20:22	T1	00:15
		August	20:05 - 20:25	T1	00:20
		September	18:54 - 19:18 / 17:48 - 18:04	T2/T3	00:21 / 00:16
		October	17:41 - 18:07	T3	00:25
D	19:54	March	18:37 - 18:56	T3	00:24
		April	19:26 - 19:45	T2	00:18
		May	20:15 - 20:34	T1	00:18
		July	20:26 - 20:44	T1	00:18
		August	20:28 - 20:31 / 19:28 - 19:49	T1/T2	00:04 / 00:18
		September	18:23 - 18:48	T3	00:23
E	25:48	January	16:07 - 16:13	T3	00:06
		February	16:05 - 16:30	T3	00:25
		March	17:12 - 36	T2	00:23
		April	19:15 - 19:38	T1	00:22
		August	19:18 - 19:41	T1	00:22
		September	19:21 - 19:29 / 17:54 - 18:14	T1/T2	00:08 / 00:21
		October	17:49 - 18:15 / 15:36 - 16:00	T2/T3	00:23 / 00:24
		November	15:35 - 16:01	T3	00:26
F	22:46	February	16:17 - 16:43	T3	00:24
		March	17:20 - 17:43	T2	00:22
		April	19:20 - 19:41	T1	00:21
		August	19:23 - 19:45	T1	00:22
		September	18:00 - 18:22	T2	00:22
		October	17:59 - 18:16 / 15:46 - 17:09	T2/T3	00:17 / 00:24
		November	15:47 - 16:04	T3	00:17

Receptor	Max shadow hours per year	Months affected	Potential flicker times	Turbine	Worst affected day (minutes of shadow flicker)
G	19:41	March	17:51 - 19:11	T3	00:23
		April	18:52 - 19:11 / 19:35 - 19:54	T3/T2	00:22 / 00:17
		May	20:22 - 20:40	T1	00:18
		June	20:27 - 20:37	T1	00:10
		July	20:32 - 20:49	T1	00:17
		August	19:39 - 19:59	T2	00:17
		September	18:39 - 19:03	T3	00:23

12.3.4 Receptors A to G are representative of properties in Great Houghton that lie within 10 rotor diameters of the proposed Park Spring Wind Farm. Each receptor is the closest property of a street or cluster of properties and as such representative of a worst case scenario.

12.3.5 Maximum theoretical shadow flicker of 30 hours within a year is exceeded at receptor A by 29 minutes. It is however considered unlikely that such levels of shadow flicker will be experienced in reality due to the worst case assumptions used in the model.

12.4 Mitigation

12.4.1 Although there is no national planning policy or guidance in England relating to acceptable shadow flicker impacts, it is considered that the levels discussed above of 30 hours a year or 30 minutes a day are considered to be appropriate.

12.4.2 Based on the best practice limits, receptor A would need to be mitigated with the number of shadow hours per year exceeding 30 hours. It should be stated that the limits at receptor A are only exceeded by 29 minutes over the year based upon a worst case modelling scenario. The property is orientated north west and may benefit from additional screening. The assessment has not taken screening into account and is based upon worst-case assumptions, it is therefore considered that shadow flicker impacts in reality would be lower than 30 hours a year.

12.4.3 If required, a potential mitigation measure would be to provide additional screening at affected properties. Subject to agreement with the relevant property owner, planting trees to obscure the wind turbine from view or installing blinds to prevent the flicker becoming a nuisance at EDF ER's cost could be undertaken. If the wind turbines are not visible then there can be no impact from shadow flicker.

12.4.4 An alternative would be to apply technical measures to mitigate the effects of shadow flicker on neighbouring properties. Turbines can be switched off during the times when there would be an impact. This would be determined based on calculations from the model used in this study. An automated switching unit, with radiation or illumination sensors would also allow for the turbine to be regulated for shadow flicker. The automated approach would allow for real-time shadows to be effectively mitigated.

12.5 Glinting

12.5.1 Glinting is associated with the reflection of sunlight off wind turbine blades as they rotate, and the sun moves through the sky.

12.5.2 In practice however, similar issues that apply to shadow flicker also apply to glinting; meteorological conditions, turbine geometry such as hub height and rotor diameter and surrounding topography. In addition, careful selection of a wind turbine's colour and surface finish will minimise the potential for glinting, and its general visual impact. The turbine towers would be painted white or light grey, as these colours minimise any contrasts with the prevailing sky conditions. It is also common practice for wind turbine blades to be provided with a semi-matt finish. In combination with a light grey colour, the reflectivity of wind turbine blades and the potential impact of glinting are therefore minimised. Overall, this issue is not considered to be significant.

12.5.3 The surface treatment of the wind turbines will be agreed with the local planning authority, through a planning condition.

12.6 Photosensitive epilepsy

12.6.1 Photosensitive epilepsy is a condition brought on by strong flashing or flickering lights or images. Around 2 per cent of the population suffer from epilepsy, 5 per cent of people with epilepsy have shown anomalous EEG (electroencephalogram) reactions to flickers in the range of 2.5 to 3 Hz.

12.6.2 Turbines such as those proposed at Park Spring do not have the potential to trigger seizures due to the low speed at which the blades rotate and therefore frequency of passing blades. The factors influencing the onset of a seizure include the frequency and intensity of flickering, and the proportion of the field of view exposed. The frequency required to trigger seizures varies individually, but is generally between 5 to 30 Hz. Whilst some people are sensitive to higher frequencies, it is relatively unusual for people to be sensitive to frequencies below 5 Hz. Of photosensitive epileptics, less than 5 per cent are sensitive to the lowest frequencies of 2.5 to 3 Hz. The wind turbine models under consideration with regard to the proposed wind farm have operating speeds of approximately 15 to 20 rpm and because they are all three-bladed, the flicker frequency will be equivalent to three times the wind turbine's operating speed, or between 0.75 to 1.0 Hz. This is well below the range that would trigger a photosensitive epileptic seizure.

12.7 Conclusion

12.7.1 Potential shadow flicker effects have been assessed at nearby residential receptors using industry standard techniques and best practice.

12.7.2 There is theoretical potentially for shadow flicker to exceed best practice levels of shadow flicker of 30 hours over the course of a year at properties on Crabtree Drive, Great Houghton by 29 minutes. However, once climatic conditions are taken into account the actual likelihood of the nearby residential properties experiencing shadow flicker effects above recognised best practice limits is considered to be very low.

12.7.3 Should shadow flicker levels exceed the limits, mitigation options are available to reduce impacts to a negligible level.

12.7.4 The effects of Glinting are minimised through the visual appearance of the turbines and not considered to be significant.

12.7.5 The frequency of the rotating blades is lower than the required range to trigger photosensitive epileptic seizures.

SECTION 13

TRANSPORT AND TRAFFIC

13 TRANSPORT AND TRAFFIC

13.1 Introduction

13.1.1 This chapter presents an assessment of the potential impacts of the proposed Development on the local transport network.

13.1.2 A description and assessment of the proposed access route to site for normal project traffic and abnormal load deliveries (i.e. turbine components) is included.

13.1.3 This assessment describes both the volume and composition of the traffic that will be generated by the Development during construction, operation and decommissioning of the three wind turbines and associated site facilities and compares this to the existing use of the local transport network.

13.2 Legislation and guidance

13.2.1 This chapter of the ES has been completed with relevance to the following legislation and guidance:

- National Planning Policy Framework (NPPF) (March, 2012);
- Overarching National Policy Statement for Energy (EN-1) (July, 2011);
- National Policy Statement for Renewable Energy Infrastructure (EN-3) (July, 2011);
- Guidelines for the Environmental Assessment of Road Traffic (Institute of Environmental Assessment (IEA), 1993);
- The third South Yorkshire Local Transport Plan: 2011 – 2026.

13.2.2 The Local Transport Plan for South Yorkshire is a statutory planning document and details the region's visions, strategies and policies for transport.

13.3 Consultation

13.3.1 Table 13.1 below summarises the consultation responses received regarding the proposed access route to site and the associated potential impacts.

13.3.2 Consultation was undertaken in the first instance through the formal Scoping process. BMBC Highways Authority, Highways Agency and the Department for Transport were consulted at the Scoping stage.

13.3.3 Consultation with Barnsley Metropolitan Borough Council (BMBC) Highways Authority continued during the development process. BMBC Highways Authority were consulted regarding the proposed access route suitability, a summary of comments received is included within Table 13.1 below.

13.3.4 In addition to consultation with statutory consultees, feedback on the access proposal was received as part of the public consultation process. As a result of the local feedback from the public exhibitions, the initial proposed access route (through Great Houghton) was revised due to local residents concerns. See the Statement of

Community Involvement which accompanies this document to form the planning application for further details.

Table 13.1: Consultation summary

Consultee	Response	Comment
Highways Agency	29th July 2011	Highways Agency considers three criteria when assessing wind farm sites: 1. Turbines should be located such that there is no risk to the Strategic Road Network (SRN) (height of the turbine plus 50 m separation distance). The Highways Authority stated for this proposal this was not considered to be an issue. 2. Consideration of whether infrastructure and turbine components can be transported safely to site and that short term impacts on the operation of the network can be appropriately managed. This is assessed within this ES chapter. 3. Visual impact upon the SRN should be considered. The Highways Agency stated that for the Park Spring proposal this is unlikely to be a concern.
Department for Transport	Received copy of Scoping Report	No comments
BMBC Highways and Engineering	Received copy of Scoping Report	No comments
	11th June 2013	Comments provided on the proposed access route, and the EIA: The proposed access route is part of the Barnsley strategic road network, with heavy traffic use and high speed traffic. There have been a number of serious/ fatal accidents. However BMBC stated that they consider this route would be much more appropriate for the amount, and type of vehicular traffic proposed [than an access route through Great Houghton]. The site entrance point from A6195 would require upgrading. The slip roads are within the adopted highway limits but not formally metalled and unlikely to be able to accommodate the weight of HGV/abnormal load vehicles. The slip roads appear to meet the highway at a shallow enough angle to be easily negotiated by larger vehicles. The turn from the slip road onto the on-site access track may need some accommodation works. The detail of the traffic management for the abnormal loads can be agreed at a later stage, e.g. traffic control or temporary closure. For the EIA BMBC require details regarding the size and frequency of vehicles proposed, and the junctions to be tracked.

Consultee	Response	Comment
		Hours of movement can be the subject of a detailed discussion at a later stage, however BMBC would expect peak times to be avoided and this traffic movement to be coordinated with other developments happening in the vicinity at the same time. BMBC request that prior to any works commencing on site, a condition survey of the highways is carried out. Future maintenance requirements for access should be included in the ES.

13.4 Assessment methodology and significance

Methodology

13.4.2 The traffic and transportation assessment has been undertaken in accordance with the IEA (1993) guidelines. The IEA is now recognised as the Institute of Environmental Management and Assessment (IEMA).

13.4.3 The IEA guidelines states that to assess the environmental impact of the potential Development upon the transportation network, the following first need to be considered as the baseline for the assessment:

- The existing volume of traffic.
- The existing highway characteristics.
- The existing traffic composition.

13.4.4 The assessment therefore began by identifying the roads in the vicinity of the proposed site most likely to be affected by the Development. The proposed access route to site was assessed by investigating the likely port of entry for turbine components and then the motorways and A-roads from the port to the site. Consultation with BMBC Highways Authority and consultation responses from members of the public also fed into the access route design.

13.4.5 The baseline traffic counts for the assessment have been taken from the Department for Transport Annual Average Daily Traffic (AADT) estimates for roads in the vicinity of the proposed Park Spring Wind Farm and the Highways Agency Traffic Flow Data System (TRADS2) for the determination of hourly flow profiles, as appropriate.

13.4.6 The baseline is then compared to the potential impacts of the development by analysing:

- The proposed access route to site.
- The proposed vehicle generation caused as a result of the Development.
- The proposed construction timetable.

13.4.7 When assessing the preferred access routes to site it was determined that there was potential for some tight bends and narrow lanes to constrain the preferred route to

site, and as such a swept path analysis of the potential constraint corners has been undertaken. Further detail can be found in Appendix 13.1.

13.4.8 The volume of traffic likely to be generated by the proposed Development was calculated. These figures were then added to the baseline flows in order to provide an estimate of the impact on traffic flows within the study area.

13.4.9 The assessment of the impact of the proposed Park Spring Wind Farm on the local traffic and infrastructure network has been based on worst case assumptions of the vehicle trip generation of the Development.

13.4.10 These desk based studies were complimented by site visits to help identify issues not immediately obvious from the maps available such as street furniture, overhanging wires, and to determine the suitability of the site entrance point.

Significance Criteria

13.4.11 IEMA guidance suggests that significant traffic related environmental impacts may occur if:

- Traffic generated by the development increases baseline traffic flows by more than 30 percent (or where the number of heavy goods vehicles is predicted to increase by more than 30%).
- Traffic generated by the development increases baseline traffic flows by more than 10 percent in close proximity to sensitive receptors.

13.4.12 Sensitivity of the receptor can be defined by the user group. For this assessment sensitivity has been defined as outlined in Table 13.2.

Table 13.2: Receptor sensitivity

Receptor Sensitivity	Receptor Type
Major	Receptors of greatest sensitivity to traffic flow: schools, colleges, playgrounds, accident black sports, retirement homes, urban / residential roads without footways that are used by pedestrians.
Moderate	Traffic flow sensitive receptors including: congested junctions, doctors' surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, un-segregated cycle-ways, community centres, parks, recreation facilities.
Minor	Receptors with some sensitivity to traffic flow: places of worship, public open space, nature conservation areas, listed buildings, tourist attractions and residential areas with adequate footway provision.
Negligible	Receptors with low sensitivity to traffic flows and those sufficiently distant from affected roads and junctions.

13.5 Baseline conditions and receptors

Access route

13.5.2 The proposed route to site is shown on Figure 13.1. It is anticipated that the main turbine components will be brought to the site from the motorway network. From the A1(M) (Junction 37) vehicles would travel along the A635 westbound through Hickleton and along the outskirts of Goldthorpe, before turning right onto the A6195

(Rotherham Road), and left onto A6195 (Park Spring Road). The proposed Development will be accessed from the A6195 (Park Spring Road).

Site entrance and internal access tracks

13.5.3 The proposed site entrance will be at approximate grid reference SK 773 840. At the proposed site entrance point, there are existing slip roads from the A6195 to the on-site tracks currently in place. These slip roads would be used as part of the access route, and therefore upgrading would be required.

13.5.4 Park Spring Road is a 60 mph national speed limit road, it is recommended that the speed limit along a section of this road in the vicinity of the site entrance and site exit is reduced to 40 mph for the duration of the construction works to more readily accommodate safe turning in and out. This would be managed in discussion with BMBC Highways Authority.

13.5.5 The purpose built junction will be constructed to provide a visibility splay in accordance with the standards suggested by the Design Manual for Roads and Bridges.

13.5.6 The exit point from the A6195 (Park Spring Road) varies for normal and abnormal load deliveries. Using traffic management such as temporary traffic lights, the small number of abnormal load deliveries will exit the A6195 when heading northbound, onto the existing slip road. This would be managed in discussion with BMBC Highways Authority.

13.5.7 Normal load deliveries will continue northbound along the A6195 before doubling back at the Grimethorpe Colliery Roundabout, travelling southbound along the A6195 and turning onto the slip road.

13.5.8 The proposed access tracks for the Park Spring Wind Farm are shown on Figure 3.2. Approximately 900 m of new track will be built and 550 m of existing tracks will be upgraded, totalling 1.45 km of total access tracks on-site.

Receptor sensitivity

13.5.9 The proposed access route from the A1 (M) to site passes through the villages of Marr, Hickleton and Billingley Green. These residential areas are 'residential areas with adequate footway provision', as per the sensitivity table (Table 13.2) these are classed as receptors of Minor sensitivity, and therefore the threshold for sensitivity (as suggested by the IEA guidelines) of 30% is applicable in this assessment.

Traffic Count

13.5.10 The AADT flow data for the access route, together with other major roads in the area, are presented in Table 13.3.

Table 13.3: Traffic Data (Two Way) 2011

Road	Day		
	All Traffic	% HGV	Total HGV
A1(M) around Junction 37 (Count points 6066 and 26068)	67,551 – 74,829	17.7 – 18.7	11,972 – 13,977

A635 (Count points 57483, 37454, and 73009)	12,604 – 16,319	8.5 – 8.9	1,116 - 1,384
A6195 (Count point 80863)	8,967	5.6	503

13.6 Vehicle Trip Generation

Construction

The Construction Programme

13.6.2 The construction of the proposed wind farm is likely to comprise the following elements:

- Site set-up – preparation of the site for construction staff.
- Road and hard standings – construction of site access and necessary hard standings for construction vehicles within the site.
- Foundation construction – construction of foundations for the wind turbines.
- Control building construction – delivery of control building components and construction of the control building on site.
- Turbine erection – delivery of turbine components and erection of the turbines.
- Cable installation – delivery and laying of electric cables.
- Landscaping – removal of construction materials and clearing of the site.

13.6.3 The construction programme and traffic generation estimates assume a worst case scenario (i.e. shortest) of a 6 month construction programme which increases the number of vehicles per day arriving at site during the peak of the construction phase.

13.6.4 The exact programme for each phase is yet to be determined, although the above phases are expected to occur broadly chronologically.

13.6.5 Daily construction at the site is anticipated to commence at 07:30 and finish at 19.00, and a maximum of 30 construction staff are expected on-site at any one time. For the purposes of estimating traffic generation, 10 people are expected to be on site on average over the construction period. The worst case scenario will be for all vehicles to arrive during the morning peak hour and leave during the evening peak hour. However, appointed contractors will be encouraged to promote the use of car sharing and / or the use of 'gang' mini-buses to reduce these flows.

Construction Equipment

13.6.6 The construction equipment is anticipated to consist of excavators, bulldozers, compactors, dump trucks and trenchers, and will be brought to site by low loader. Additional site vehicles may be required in order to expedite the construction phase. It is anticipated that of the order of 110 vehicles would be required to deliver the majority of the construction equipment, and for site set-up.

13.6.7 The installation team would require two cranes to travel to site and another 8 vehicles to bring the associated counterweights. It is expected that two mobile cranes, (800 tonnes and 120 tonnes capacity) will be required.

13.6.8 The majority of the construction equipment will be brought to site in the first few weeks of the construction phase with the exception of the cranes which would arrive later in the construction phase.

Access Road Construction

13.6.9 Standard 20 tonne tipper trucks will be used for the delivery of aggregate for the construction of the access tracks, crane hardstanding and the site compound area. Approximately 256 lorry loads of stone aggregate will be required in total, spread over a period of around 8 weeks. There are a number of quarries locally that may be able to supply the necessary materials. Recycled materials could be considered if suitable quality is available locally.

Foundations

13.6.10 Each wind turbine will require a concrete foundation that is anticipated to be constructed from poured concrete up to 600 m^3 per turbine. The concrete will likely be brought to site in conventional concrete mixer trucks, each with a capacity of 6 m^3 of pre-mixed concrete.

13.6.11 Approximately 278 mixer trucks are expected to bring the concrete to site over a period of around 8 weeks.

Control building

13.6.12 The construction materials for the site control building will require of the order of 5 HGV deliveries over a period of between 4 to 8 weeks.

Cabling

13.6.13 The proposed wind turbines will be connected to the site control building via underground cables. The cables are buried in sand and laid at a depth of at least 1 m below ground level. Around 9 HGVs would visit the site to deliver and install the cabling.

Traffic Generation

13.6.14 Table 13.4 summarises the anticipated requirements for all vehicle movements for the project as a whole, over the construction period. Each journey is considered to be a round journey to and from the site. The estimates have been derived from consideration of the likely works to be undertaken, and the likely material needed to be transported to and from the site.

Table 13.4: Estimated Traffic Generation

Phase	Purpose	Vehicle	Total estimated number of journeys
Site Set Up	Portacabin delivery	Low loader	3
	Skip delivery	Low loader	52
	Generator delivery	Low loader	3
	Water and fuel tank delivery	Low loader	26

Phase	Purpose	Vehicle	Total estimated number of journeys
Road and hard standings	Stone for road	Tipper trucks	162
	Stone for crane hardstanding	Tipper trucks	49
	Stone for construction compound	Tipper trucks	45
Foundation construction	Excavator delivery	Low loader	2
	Misc works	Backhoe loader	1
	Concrete delivery	Mixer trucks	278
	Concrete Pump	Concrete Pump	3
	Steel delivery	Flat bed	9
	Foundation bolts or steel	Flat bed	9
	Place foundation bolt cage or steel insert	30t to 50t crane	3
Turbine Erection	Tool Container Delivery	Low loader	3
	Top section delivery	Extendible trailer	3
	Middle section delivery	Extendible trailer	3
	Base section delivery	Extendible trailer	3
	Blade delivery	Extendible Trailer	9
	Nacelle	Low loader	6
	Hub and spinner	Low loader	3
	Turbine erection	1000t crane	1
	Turbine erection	150t to 200t crane	1
Cable installation	Cable delivery	Flat bed or Hiab	6
	Excavator delivery	Low loader	1
	Cable laying	Telescopic handler	2
Control building construction	Concrete delivery	Mixer trucks	2
	Brick delivery	Flat bed	1
	Switchgear	Flat Bed	1
	Misc Electrical Equipment	Flat bed	1

Phase	Purpose	Vehicle	Total estimated number of journeys
Misc		Vans, cars (staff)	1300
		Telescopic Handler	1
		Light goods van	26
Total			2021

Abnormal Loads

13.6.15 A total of nine articulated low loader lorries would be expected to bring each prefabricated turbine to site. The tower will arrive in three sections and each blade will travel separately as will the nacelle and hub. Each nacelle may be brought in one or two sections. All such traffic movements would constitute abnormal loads.

13.6.16 The likely abnormal loads for the entire project are detailed in Table 13.5.

Table 13.5 – Abnormal Loads

	Number of Loads	Approximate Length (m)	Approximate Unit Weight (tonnes)
Tower Sections	9	27	70 (max)
Blades	9	46	8
Hub	3	5 (diameter)	17
Nacelles (assuming 2 parts)	6	10	71
Total	**27**		

Operation

13.6.17 During the operation phase, only infrequent maintenance traffic is expected to visit the site. Due to the high reliability of the turbine equipment, requirements for maintenance will be low thus limiting the number of site visits necessary by maintenance staff. Twice yearly visits by staff in a single vehicle are expected for servicing and once-monthly visits by staff in a single vehicle for routine inspection. Servicing would require staff on site for up to a week. This will involve very few vehicle movements comprising up to 5 light commercial vehicles such as transit vans and pick-ups.

13.6.18 Parking for the operational phase will be on the on-site access tracks or adjacent to the turbine bases.

Decommissioning

13.6.19 Decommissioning will require access for heavy goods vehicles to visit site to remove all items of plant, including the turbines and associated infrastructure. The number of

vehicles will be considerably less than those during the construction phase as the foundations below one metre depth will remain in situ. As such, of the 2,201 vehicles anticipated for construction, decommissioning will not require the removal of aggregate or concrete and steel subject to agreement with the local authority. Therefore the total decommissioning traffic is expected to be only of the order of 300 vehicles over the entire decommissioning period.

13.7 Potential Impacts

Construction

Vehicle Generation

13.7.2 Traffic generation estimates show that the construction phase is likely to require of the order of 2021 vehicle movements over an estimated 6 month period. This amounts to an average of approximately 15 vehicle movements per working day (assuming an average 22 working days per month average).

13.7.3 Peak traffic generation is likely to occur whilst the delivery of the aggregate necessary for the construction of the access tracks takes place, and during the construction of the turbine foundations. This will result in a worst-case figure of approximately 50 vehicle movements per day spread throughout each day. During the construction period, the heavy goods vehicle movements are likely to be considerably fewer, in the range of a maximum of 10-15 vehicle movements per day. This is a minimal increment to the existing peak traffic levels within the study area.

13.7.4 The stretch of road along the A6195 around the proposed site entrance is considered to be the most sensitive receptor as it has the lowest traffic count data along the access route, although the A635 and A1(M) will also be affected. The daily average of 15 additional vehicles using Park Spring Road would represent an increase of 0.17% total in traffic levels. Given the potential for a maximum of approximately 50 additional vehicle movements per day out of total traffic volumes in excess of 8,967 per day, the impact of the construction traffic associated with Park Spring Wind Farm would produce an insignificant increase (0.6 %) over the existing traffic volumes according to the IEMA guidelines. An increase of 50 HGV along Park Spring Road in comparison to 503 HGV currently using park Spring Road would represent an increase of 9.94% in HGV movements.

13.7.5 The roads along the proposed access route to site are not understood to be currently operating above, or close to, the thresholds for satisfactory operation.

13.7.6 An increase of 0.17% - 0.6% total traffic along Park Spring Road is not considered likely to cause any driver delay impacts.

13.7.7 The overall impact of the construction phase of the proposed Development on traffic flows on the local highway network is predicted to be insignificant.

Abnormal Loads

13.7.8 The location of the turbine manufacturer will not be known until receipt of planning permission and the contract award. It is likely that the majority of components will be brought by sea from abroad and it is anticipated that the main turbine components will be brought to the site via the motorway network from the chosen port.

13.7.9 It is anticipated that the transportation of each turbine will require nine visits to site (i.e. 27 in total). The turbines will be delivered over a 5 to 6 week period (i.e. an average of between 1 and 2 movements from the Port to site per day). The transportation of abnormal loads may lead to temporary delays and cause inconvenience to other road users.

13.7.10 Routes and timings of the transportation of abnormal loads will be discussed with the relevant authorities in order to minimise disruption. A police escort may also be used if necessary.

13.7.11 The movement of abnormal loads represents a different kind of effect on the road network to that of the daily construction traffic. The size and weight of the turbine parts, and multiple axle vehicles used in this process, means that time and care must be taken to ensure safe passage along the prescribed routes and prevent/minimise potential delays and damage to road surfaces.

13.7.12 The effects of driver delay would be most apparent during the delivery of the abnormal loads due to the slow nature of these movements and the requirements for traffic control on the A6195. It is considered that due to the temporary nature of these effects (27 deliveries over a short timeframe), and the mitigation measures as described in section 13.8, impacts will be insignificant.

Swept Path Analysis

13.7.13 An assessment of the proposed route to site for the delivery of the wind turbine components has been completed to determine any potential constraints to abnormal load movements. The assessment considered both the worst case length and widths of the various turbine components in identifying the potential constraints.

13.7.14 A survey of the proposed route identified a number of key sections that required assessment to determine any impacts associated with the delivery of the wind turbine components:

- Pinch Point (PP) 1 – turning from the A1(M) onto the A635.
- PP2 – A635 in Marr village.
- PP3 and PP4 – A635 through Hickleton village.
- PP5 – roundabout on the A635 to the north of Goldthorpe.
- PP6 – roundabout on the A635 to the north-west of Goldthorpe.
- PP7 – right turn (3rd exit) at the roundabout between the A635 and the A6195.
- PP8 – left turn (1st exit) at the roundabout on the A6195.
- PP9 – roundabout on the A6195.
- PP10 – site entrance point slip road on the A6195.

13.7.15 All of the above locations have been subject to a Swept Path Analysis, the results of which are presented in Appendix 13.1.

13.7.16 All of the above locations can be negotiated with minor temporary works such as the temporary removal of street furniture, such as road signs and lamp posts and / or the blade overhanging the verge.

Traffic noise

13.7.17 An assessment of the potential noise impact as a result of traffic generated due to the Development and proposed upgrading works likely to be required is included within Chapter 5 Noise.

Operation

Vehicle generation

13.7.18 The proposed Park Spring Wind Farm will be designed and constructed for a high reliability and therefore will require little in the way of maintenance. Monthly inspection visits will require one four wheel drive vehicle.

13.7.19 Any maintenance to the turbines that is required will be of a minor nature and will require only a small number of light commercial vehicles such as transits and pickups and work is expected to last for no more than a week.

13.7.20 In the event that unscheduled maintenance is required on the turbine, such as gearbox or generator replacement, access is generally restricted to a single crane, in addition to the required replacement component on a standard fixed or articulated HGV. Hydraulic cranes of this capacity are generally regarded as normal loads able to negotiate public highways with relative ease. In the highly unlikely event of a blade replacement, transport requirements to site will be identical to those identified for the construction phase together with the necessary mitigation works.

13.7.21 Impacts on the local road network and traffic flows during the operation phase are therefore predicted to be insignificant.

Driver distraction

13.7.22 Guidance on driver distraction was included within the Companion Guide to PPS22 which although now cancelled this statement is still considered to be of relevance:

"Concern is often expressed over the effects of wind turbines on car drivers, who may be distracted by the turbines and the movement of the blades. Drivers are faced with a number of varied and competing distractions during any normal journey, including advertisement hoardings, which are deliberately designed to attract attention. At all times drivers are required to take care to ensure their own and others' safety. Wind turbines should therefore not be treated any differently from any other distractions a driver must face and should not be considered particularly hazardous. There are now a large number of wind farms adjoining or close to road networks and there has been no history of accidents at any of them."

13.7.23 Department for Transport guidance[42] recommends that a set-back distance of at least turbine tip height is achieved. A6195 (Park Spring Road) at 188 m from the nearest turbine position comfortably achieves this recommended set-back distance.

Decommissioning

13.7.24 Current practice in decommissioning wind turbines comprises of the same operations and procedures used during the construction phase but in reverse order. Therefore,

[42] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/73173/strategic-road-network-policy.pdf

similar road alignments and mitigation measures must be provided at the end of the turbine's operational life.

13.7.25 If the resale value of turbine components is negligible, the size of blades and tower sections may be reduced on site to aid transport requirements and ultimately negate the need for abnormal loads. Should resale values be high, turbine components will be removed from site intact. At this time, it is not possible to identify where resale turbine components of this site will be transported to. However, the proposed access route will likely be used, and in its present condition, poses no additional constraints to those identified in the construction sub-section above. It is considered that a transport survey will be conducted immediately prior to decommissioning works in order that any restrictions are identified on the proposed route from site.

13.7.26 Decommissioning will require access for heavy goods vehicles to visit site to remove all items of plant, including turbines and associated infrastructure. The traffic generated by decommissioning of the wind farm will be considerably less than those during the construction phase as vehicles will only be required to remove the turbines and the control room. During decommissioning, only the top 1 m of the turbine foundations and crane pads will be removed, with the ground above the remainder of the concrete returned to its original condition. Therefore, the removal of the concrete and steel reinforcement will generate significantly less traffic than the construction period. In total, around 300 vehicles will be required over approximately 3 months.

13.7.27 The impacts during decommissioning will be temporary in nature and would be insignificant in relation to local traffic and infrastructure.

13.8 Mitigation and management methods

Construction Phase

13.8.2 It is proposed that all vehicle movements associated with the construction of the proposed Park Spring Wind Farm will operate under a Transport Management Plan (TMP) to be submitted to the Local Planning Authority for approval prior to any development commencing. The purpose of the TMP will be to actively manage all potential issues resulting from the increased demand on the local transport infrastructure to ensure that all impacts are minimised or eliminated. The TMP is intended to operate as a working document that will evolve throughout the construction phase. The Transport Manager will ensure that all proposed modifications to the Plan will be discussed and agreed with BMBC and the HA, in advance and as necessary.

13.8.3 A Transport Manager will be identified to co-ordinate all aspects of transport associated with the construction of the proposed wind farm and be responsible for the effective implementation of the TMP. The agreed route will be enforced by formal instructions in the construction contract and through the use of road signs locally. The main contractor will also be responsible for surveying all routes to ensure that abnormal loads can be transported to their required destination. The contractor will be required to select transportation plant appropriate to the routes to site.

13.8.4 Targets and objectives will be set with regard to issues including traffic volumes and the scheduling of deliveries to the site and appropriate procedures and control methods will be established in full consultation with BMBC and the Highways Agency (HA). Such targets will include the periods during which deliveries may be made to site.

13.8.5 The level of on-site personnel, volumes and timings of vehicles travelling to and from site and the adherence to timetables throughout the construction phase of the project will be monitored.

13.8.6 The results of the monitoring will be regularly assessed to evaluate the effectiveness of all strategies defined within the TMP and to anticipate any variance from the targets or key dates within the construction programme.

13.8.7 Regular updates will be provided to BMBC as to the performance of the TMP and any issues identified as a result of the review and monitoring.

13.8.8 The appointed contractors will be required to promote sustainable travel arrangements amongst their staff. Obligations negotiated at the tender and contractual stages of the development will ensure that measures such as the use of public transport, car-sharing and the use of mini buses will be actively encouraged to increase the person to car ratio as far as possible.

13.8.9 Cleanliness of the existing roads will be maintained at all times. Temporary wheel and chassis washing facilities will be provided close to the site entrance to minimise the deposition of construction materials on the public highway.

13.8.10 It may be necessary to temporarily remove street furniture to allow the long loads to pass. Warning signs would be erected for other road users and full communication with local residents will be undertaken informing them of the proposed times of abnormal load delivery.

13.8.11 'Before and after' surveys would be commissioned by EDF ER to identify the condition of the road infrastructure and appropriate measures to ensure that there is no damage to the existing road network as a result of the construction of the project.

13.8.12 The impacts associated with the operation of the proposed Development are predicted to be insignificant. Therefore, no further formal mitigation and management methods are considered necessary.

13.9 Residual impacts

13.9.1 It is predicted that through implementation of the mitigation measures outlined above the residual impacts of the movement of the construction vehicles to / from the site on traffic flows / highway capacity will be insignificant.

13.10 Assessment of cumulative effects

13.10.1 A review of proposed and consented developments in the area has been undertaken. Of most relevance are the operational wind turbines at Marr Wind Farm, located approximately 9 km from Park Spring Wind Farm, and the Mount Pleasant application for two 35 m to tip wind turbines approximately 1.5 km to the east of Park Spring Wind Farm.

13.10.2 The Marr access route to site is via the A1(M) Junction 37, before turning onto the A635 towards Marr for around a mile, before going onto site. Because the Marr Wind Farm is already constructed, it is considered that the cumulative impact of the two wind projects on the route to site would be insignificant.

13.10.3 The Mount Pleasant application is currently in the appeal process. Due to the scale of the development it is not considered that the cumulative vehicle generation would

exceed the 30% increase in traffic threshold, and therefore cumulative impacts are considered to be insignificant.

SECTION 14

TECHNICAL ISSUES

14 TECHNICAL ISSUES

14.1 Aviation

14.1.1 Wind turbines have the potential to impact on aircraft in two ways: as a physical obstruction because of their height; and, also because they can be detected by radar, again due, in some part, to height but particularly due to interference caused by the rotating blades.

14.1.2 Both wind power and aviation are important to the UK's national interests and it is important that they coexist in a safe manner.

14.1.3 In June 2008 (Refreshed 2011) a Memorandum of Understanding (MOU) was signed by the BWEA (British Wind Energy Association, now RenewableUK), BERR (Department for Business, Enterprise and Regulatory Reform, now the Department for Business, Innovation and Skills), DfT (Department for Transport), MOD (Ministry of Defence), NATS (National Air Traffic Services) and the CAA (Civil Aviation Authority) to demonstrate a shared commitment to remove aviation and radar barriers in wind farm development.

14.1.4 EDF ER has consulted the relevant authorities with respect to the proposed Park Spring wind farm development, summarised in Table 14.1.

Consultation

Table 14.1: Consultation

Consultee	Response	Comment
CAA	16th August 2011	CAA recommended consultation with NATS En Route Ltd, the MOD, and Robin Hood Airport Doncaster Sheffield. CAA did not identify any other aerodromes in the vicinity. Provided advice on lighting and mapping.
Ministry of Defence (MOD)	4th November 2010, DE reference number: 10650	MOD confirmed that they have no concerns with the proposal. An initial assessment did not identify any Line of Sight Issues to any RAF ATC (Air Traffic Control) Radar and therefore the MOD expects to have no concerns (pending assessment of full planning application)

Consultee	Response	Comment
	Parsons Brinckerhoff consulted MOD based upon final site layout in May 2013. No response received.	
NATS	28th July 2011	Pre-planning letter received from NATS advising of consultancy services.
Robin Hood Airport Doncaster - Sheffield (RHADS)	2nd December 2010	RHADS advise that the development is unlikely to affect operations at RHADS, and therefore they have no objection.
Leeds - Bradford International Airport	October 2010	No objection received from Leeds – Bradford International Airport with regard to an initial 5 turbine layout.

CAA

14.1.5 The CAA recommended consultation with NATS En Route Ltd, the MOD, and Robin Hood Airport Doncaster Sheffield. The CAA did not identify any other aerodromes in the vicinity which could be impacted by the Development. The CAA commented that obstacles below 150m in height are not generally required to be lit however other aviation stakeholders may have other requirements, and that objects over 91.4m in height are required to be marked on aeronautical charts. The proposed turbines are 126.5 m to tip, and therefore it is anticipated that if consented the Park Spring wind turbines will need to be charted but that aviation lighting will not be required.

MOD

14.1.6 The MOD issued a letter of No Objection with regards to the Park Spring Wind Farm development on the 4th November 2010 (DE/C/SUT/43/10/1/10650). This response stated that *"An initial assessment has not identified any Line of Sight issues to any RAF ATC Radar. MOD expects to have no concerns (pending assessment of a full planning application should this proposal progress)".*

14.1.7 This MOD response was based upon an earlier, although similar, turbine site layout. Following the finalisation of the site layout, the MOD was reconsulted with the amended turbine coordinates and dimensions. No response to this reconsultation was received.

14.1.8 An assessment of the potential impact of the proposed development has found:

- It is unlikely that any ASACS (Air Defence radar) will be affected by the proposed wind turbines;
- No military aerodromes are likely to be affected by the proposed wind turbines;
- The site is within an area with no military low flying concerns.

14.1.9 It is therefore considered that the MoD no objection to this scheme is still applicable.

NATS

14.1.10 A response from NATS was received on the 28th July 2011 containing generic advice outlining NATS responsibilities and advisory services.

14.1.11 NATS self assessment maps for Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR), air/ground communications, navigation aids and NATS safeguarding have been considered. The following table (Table 14.2) shows information on the affected National Air Traffic Services (NATS) radar infrastructure highlighted by the maps.

Table 14.2: NATS radar coverage

PSR 60m AGL coverage	Partial Coverage - 20%
PSR 80m AGL coverage	Partial Coverage - 60%
PSR 100m AGL coverage	Full Coverage.
PSR 120m AGL coverage	Full Coverage.
PSR 140m AGL coverage	Full Coverage.
SSR coverage	No Coverage.
Air-ground-air coverage	No Coverage.
Navigational aid coverage	No Coverage.

14.1.12 The NATS self assessment maps show that the Park Spring wind turbines at 126.5m to tip height are likely to be visible to NATS PSR radar. No visibility of SSR, Air-ground-air or navigational aid radar systems is anticipated.

14.1.13 A more detailed assessment of the NATS PSR coverage shows that the proposed turbines are likely to be within radar line of sight to NATS Claxby PSR. However, located at a distance of 71 km from the Development, is considered that the wind turbines will not have a significant impact upon NATS operations.

Robin Hood Airport Doncaster - Sheffield

14.1.14 RHADS issued a letter of no objection to the Park Spring scheme on the 2nd December 2010. This letter stated *"After careful consideration, we write to advise that this development is unlikely to affect operations at RHADS, therefore we have no objection".*

14.1.15 This response was based upon an earlier, similar (3 turbine) layout. It is considered that the no objection response is still applicable as the turbine locations and dimensions are similar to the proposed Development.

Leeds - Bradford International Airport

14.1.16 Leeds – Bradford International Airport issued a letter of no objection to the Park Spring scheme on the 14th October 2010.

14.1.17 This response was based upon an earlier, larger (5 turbine) development, and as such it is considered that the no objection response is still applicable.

14.2 Electromagnetic Interference (EMI)

14.2.1 This section provides an assessment of the potential impacts that the proposed wind farm may have on existing communication systems, in the vicinity of the development site. Potential impacts upon fixed point to point microwave communications links, UHF radio telemetry links and television reception are considered.

14.2.2 Wind turbines, as with any large structure, can potentially interfere with electromagnetic signals; these interference mechanisms may be classified as Reflections, Shielding or Emissions. This can affect television reception, and fixed radio communications links used in many telecommunications networks.

- Reflections - Wind turbines are large structures, consisting of a static tower, a nacelle and rotating blades. Radio signals may be reflected from these components, as they are reflected from other structures and terrain. In the case of a wind turbine these effects are sometimes noticeable, due to turbine size, the motion of the blades and the combined effects from multiple turbines.
- Shielding - Radio signals can be blocked by terrain and structures. Wind turbine towers can block radio signals. In practice signals are not blocked entirely but are only weakened due to diffraction affects. This affect can be termed shielding, shadowing or blocking.
- Emissions - Most electrical equipment emits radio signals at a range of frequencies. Most equipment is designed to appropriate standards which limit such emissions to negligible levels. Wind turbines are designed to such standards and emissions are consequently negligible.

14.2.3 Telecommunications operators have been consulted and communications links in the vicinity of the site have been surveyed.

Consultation

14.2.4 Ofcom, the UK radio communications regulator, and individual link operators have been consulted regarding this development.

14.2.5 The Ofcom consultation identified five links in the area around the proposed Park Spring Wind Farm site. The link details and operators are summarised in Table 14.3 below.

14.2.6 Based on the response from Ofcom, the following telecommunication operators were subsequently consulted:

- BT;

- Everything Everywhere Limited;
- Mobile Broadband Network Limited as Agent of Everything Everywhere and Hutchison 3G UK Limited;
- Northern Powergrid (Yorkshire) Plc.

14.2.7 Additional coordination is also necessary with the band managers for the water, electricity and utilities industries which operate in the frequency ranges 457-458 MHz paired with 463-464 MHz band, therefore the following were also consulted;

- Atkins Ltd; and
- The Joint Radio Company (JRC).

Table 14.3: Ofcom consultation details

Links	Company	Contact	Email
0933846/1	BT	Dale Aitkenhead	radionetworkprotection@bt.com
0451256/1	Everything Everywhere Limited	Windfarm Enquiries	tech.services-tx@ericsson.com
0937070/1	Mobile Broadband Network Limited as Agent of Everything Everywhere and Hutchison 3G UK Limited	Windfarm Enquiries	tech.services-tx@ericsson.com
0937384/1	Mobile Broadband Network Limited as Agent of Everything Everywhere and Hutchison 3G UK Limited	Windfarm Enquiries	tech.services-tx@ericsson.com
0512498/4	Northern Powergrid (Yorkshire) Plc	Phillip Green	phil.green@yedl.com
Multiple	JRC	Windfarm Team	Keith.brogden@jrc.co.uk
-	Atkins Ltd	Windfarm Enquiries	windfarms@atkinsglobal.com

14.2.8 The link details and information on the formal consultation process and outcomes is detailed below. In addition, please refer to Figure 14.2.

BT

14.2.9 Ofcom identified one BT operated link crossing the site – the link ID number is 0933846/1.

14.2.10 Parsons Brinckerhoff consulted with BT in April 2013.

14.2.11 BT confirmed in April 2013 that they do operate a link that passes through the Park Spring site boundary. In their consultation response, BT provided the location details of the link end points, and requested that for links a buffer of ± 100m from blade tip to link path should be used. The stated frequency of the link in question is 18 GHz.

14.2.12 The BT link is shown in Figure 14.2. The closest turbine is located 183 m from the fixed link, maintaining a separation distance exceeding 100m between blade tip and link path.

14.2.13 Due to the separation distance between the proposed turbines and the existing link path no impact on the BT link is anticipated.

Everything Everywhere Limited

14.2.14 Ofcom identified one Everything Everywhere Ltd operated link in the vicinity of the Park Spring site – the link ID number is 0451256/1.

14.2.15 PB consulted with Everything Everywhere in April 2013. No response to this consultation has been received.

14.2.16 The frequency of Link 0451256/1 is 7.5 GHz. The minimum turbine to microwave clearance distance used for links with a frequency of 7.5 GHz and above is 100m plus blade radius. The link is 459 m from the nearest Park Spring wind turbine, and therefore the required clearance distance is met.

Mobile Broadband Network Limited as Agent of Everything Everywhere and Hutchison 3G UK Limited

14.2.17 Ofcom identified two links within 2 km of the site – the link ID numbers are 0937070/1 and 0937384/1.

14.2.18 PB consulted with Mobile Broadband Network Limited in April, May and July 2013. No response has been received.

Northern Powergrid (Yorkshire) Plc.

14.2.19 Ofcom identified one link in the vicinity of the site – the link ID number was 0512498/4.

14.2.20 JRC provided details on the YEDL link 0512498/4 (102468). It is unknown at what frequency this microwave point to point link operates, however at a distance of 964 m from the nearest Park Spring wind turbine there will be no impacts.

Atkins Ltd

14.2.21 Atkins Limited is responsible for providing Wind Farm/Turbine support services to the Telecommunications Association of the UK Water Industry (TAUWI). Parsons Brinckerhoff consulted with Atkins Ltd in April 2013.

14.2.22 Atkins Ltd provided a consultation response in April 2013, stating that the Park Spring application had been examined in relation to UHF Radio Scanning Telemetry communications used by their clients in the region and confirmed that they have no objection to the Park Spring proposal.

The Joint Radio Company

14.2.23 The Joint Radio Company (JRC) analyses proposals for wind energy developments on behalf of the UK Energy Industry. The JRC assesses the potential of such developments to interfere with radio systems operated by Energy Industry companies in support of their regulatory operational requirements.

14.2.24 The JRC confirmed that parts of the Park Spring Wind Farm site are located within 1km of link sites. The JRC has objected to the proposed development on behalf of Northern Gas Networks and itself.

14.2.25 The EM field along the path of a link can be considered to consist of a number of 3 dimensional concentric zones, known as Fresnel zones, each shaped like an elongated rugby ball. The radius of a Fresnel zone at any point along the path of a link is related to the link's overall length and operating frequency. Guidance published by Ofcom in 2002 recommends that due to the varying geometry of a wind turbine a conservative approach to avoiding interference should be taken. The guidance advises keeping the second Fresnel zone clear of obstructions to minimize the risk of interference.

14.2.26 The closest JRC link (JEYIS1 – JEYI01) is 553m away from turbine T3, this is outside of the 2nd Fresnel zone, and there is therefore no direct impact predicted. Due to the distances involved, no reflection impacts are anticipated.

14.3 Television Reception

14.3.1 The assessment of the potential impact of the proposed wind development on television reception has considered both analogue and digital broadcasting services.

14.3.2 Television interference is assessed by considering the strength of the carrier signal in comparison to the reflected or interfering signal. To achieve a good television reception an aerial must receive a strong carrier signal and weak interference signals. The methodology for assessing interference has been developed for the assessment of interference in relation to analogue services, however it is considered that interference mechanisms for digital services are similar to those for analogue services.

14.3.3 The potential impact of the development on television services has been assessed in the first instance through the use of the BBC's online assessment tool and secondly with as assessment undertaken by Pager Power, Appendix 14.1. The online assessment tool provides details of the number of properties which would be affected by the proposed wind turbines based on the location. It then provides estimates of the number of any affected properties which have access to an alternate signal and those which do not.

14.3.4 The BBC online consultation tool has identified transmitters which provide television services to the locality as 'Emley Moor CH5', 'Sheffield CH5', 'Belmont', and 'Emley Moor'. The results therefore suggest that homes in the vicinity of the proposed wind development are able to receive terrestrial television from a number of different transmitters.

14.3.5 The BBC tool calculated that 0 homes may be affected for whom there is no alternative off-air service, and 13,145 homes may be affected for whom there may be an alternative off-air service.

14.3.6 The detailed television assessment found that television services in the vicinity of the Development are likely to be provided by Emley Moor Transmitter, which provides television services for most of Yorkshire. The digital switchover of the Emley Moor Transmitter and its relays have been completed.

14.3.7 Medium interference on either side of Great Houghton and isolated points to the north and north-west of the turbine locations were modelled, it is considered unlikely that this would cause interference in homes in the area. Isolated points of medium and high interference were modelled to the east of Darfield, these points of interference are not in populated areas and are not considered likely to cause interference in homes.

14.3.8 The BBC online tool has determined that the development is unlikely to affect all available transmitters at any home. The detailed assessment determined that detrimental impacts to television reception in homes are unlikely to occur. If effects attributable to the Development were to occur, suitable mitigation measures such as the upgrading of the receiving equipment or installation of satellite TV would be investigated and implemented.

14.4 Safety

14.4.1 A construction Health and Safety Plan will be developed to manage safety during the construction, operation and decommissioning of the wind farm. Wind turbines are designed to operate to very high standards of safety and are extensively tested prior to commercial operation. Full Health and Safety / Risk Assessments will be carried out for the design, construction and operational phases of the Development and all recommended actions will be undertaken. Suitable training in the associated risks will be given to all construction and operation personnel.

14.4.2 Renewable UK has produced Wind Turbine Safety Rules (WTSR) to formalise a safe system of work for wind turbines, the WTSR was published in 2005 and has been used extensively across the UK and Ireland.

14.4.3 Renewable UK considers that the WTSR, when implemented correctly and appropriately will:

- *represent industry good practice for safeguarding employees from the inherent dangers that exist from installed electrical and mechanical equipment in wind turbines;*
- *assist in the development and application of safe systems of work in a consistent manner;*
- *provide a robust approach to demonstrating legal compliance with relevant health and safety regulations.*

<u>Construction, Operation and Decommissioning activities</u>

Construction

14.4.4 All site work will comply with all relevant legislation such as the Health and Safety Act 1974, the Construction (Design and Management) Regulations 2007 approved code of practice and all activity specific legislation and guidance such as the Work at Heights Regulations 2005 as appropriate.

14.4.5 The wind turbines will be designed and manufactured by an experienced company to meet international engineering design and manufacturing safety standards. There is an international quality control assurance program for turbines, and a number of relevant safety and design standards, including the British Standard BS EN 61400-1:1995 "Wind Turbine Generator Systems – Safety Requirements.

14.4.6 Individual components manufactured by subcontractors will also adhere to the appropriate recognised standards.

14.4.7 The wind turbines to be used at the site will be generic machines in wide use and will already be type tested and certified by the manufacturer in order to ensure compliance with all appropriate safety guidelines.

14.4.8 Road access to the Project site will comply with Highway Authority Guidelines. All traffic movements will be adequately controlled and supervised in accordance with a Transport Management Plan. Further details are provided in Chapter 13.

14.4.9 Site security during construction will be strictly controlled. Temporary fencing will be installed around any excavations. The type of fencing used will be agreed with the local planning authority. A compound or container for the temporary storage of equipment or materials will be provided. This will be locked with restricted access. The working area will be fenced to prevent unauthorised access. If appropriate, security staff will be utilised at night and weekends, and during non-working periods.

14.4.10 All storage tanks will be bunded to prevent the release of potentially hazardous materials. However only very small quantities of oil will be held on site and these will not cause a risk to health or safety.

Operation

14.4.11 An important component of wind turbine safety philosophy is redundancy or the use of back-up systems or components. Modern turbine control and monitoring systems have several layers of redundancy to protect the turbines from damage in addition to protecting the safety of the personnel working on the Development and the general public in the vicinity.

14.4.12 Wind turbines stop automatically in case of malfunction of a critical component. The turbines are monitored constantly by internal computers and incorporate two independent fail-safe breaking mechanisms. The fail-safe breaking mechanisms aim to stop the turbine in a couple of blade rotations. Over-speed protection sensors will also be fitted.

14.4.13 If any type of operational benchmark mismatch or error occurs, the wind turbine will be shut down. Depending on the type of error, the turbine will undertake a self-test, restart, or send an error message to the control centre in order for a service team to take further steps. There are various procedures to shut down the wind turbine. If severe errors occur, a brake-activated emergency shutdown will be performed.

14.4.14 Concerning electrical safety, wind turbines have an electrical protection system which is part of the overall turbine control system. The electrical protection system monitors the internal and external electrical parameters and reports to the overall turbine control system if any deviations of accepted ranges occur. For instance, the loss of grid voltage (external problem) would be a severe electrical error, upon which the turbine would perform an emergency shutdown. Surge protection will be supplied for the protection of electrical components.

14.4.15 The Control Building and turbine towers will be sturdy and resilient to vandalism and be fitted with high security locks.

14.4.16 The Control Building will be designed and constructed with systems that will protect any operational personnel and minimise potential risks associated with accidental exposure to high voltage electrical equipment. A robust earthing grid will be installed which would divert stray surges and faults. This will comprise a heavy gauge bare copper conductor buried in a grid fashion and welded to a series of multiple underground earthing rods.

Public safety

14.4.17 Although now cancelled, Companion guide to PPS 22, stated: *"experience indicates that properly designed and maintained wind turbines are a safe technology. The very few accidents that have occurred involving injury to humans have been caused by failure to observe manufacturers' and operators' instructions for the operation of the machines. There has been no example of injury to a member of the public".* In addition, PPS 22 stated *"the minimum desirable distance between wind turbines and occupied buildings calculated on the basis of expected noise levels and visual impact will often be greater than that necessary to meet safety requirements".*

14.4.18 Statistics held by the HSE show that no member of the public has ever been injured by a wind turbine. A report to the HSE Board in 2012 (Paper HSE/12/48 – paragraph 14) did not highlight any underlying levels of serious injury or harm for persons at work in the wind sector. In addition, the findings of an independent report commissioned by the HSE made a clear statement and conclusion that the safety risk associated with wind turbines is well below all other comparable societal risks.

14.4.19 Public safety will be maintained throughout the construction of the Development with all necessary steps taken to ensure the safety of the public using the rights of way on the site.

14.4.20 Driver distraction is often raised as a concern by local residents prior to the installation of a wind turbine. Companion guide to PPS 22 (now cancelled) noted *"drivers are faced with a number of varied and competing distractions during any normal journey, including advertising hoardings, which are deliberately designed to attract attention. At all times drivers are required to take reasonable care to ensure their own and others' safety. Wind turbines should therefore not be treated any differently from other distractions a driver must face and should not be considered particularly hazardous. There are now a large number of wind farms adjoining or close to road networks and there has been no history of accidents at any of them".*

14.4.21 Department for Transport guidance recommends that a set-back distance of at least turbine tip height is achieved. A6195 (Park Spring Road) at 188 m from the nearest turbine position comfortably achieves this recommended set-back distance.

14.4.22 There are a number of footpaths, permissive footpaths and a bridleway within the Development site boundary, as illustrated on Figure 13.1. There is no Open Access land within the immediate vicinity of the site.

14.4.23 The Development will also comply with the British Horse Society's recommended minimum separation distance of 200 m between wind turbines and Bridleways. This distance is not a statutory requirement but is recommended within the British Horse Society guidance.

14.4.24 Although recently cancelled, Companion Guide to PPS22 suggested that the topple distance of a turbine from public footpaths is an acceptable arrangement and that as a minimum turbine blades should not oversail a public right of way. All turbines except turbine T3 are separated from Public Right of Way (PRoW) by a greater distance than the turbine topple distance. Turbine T3 is located at a distance of 100m from a footpath which travels from Park Spring Road around the ASOS industrial unit. This distance (100m) complies with the minimum recommended distance of blade oversail.

Extreme weather

14.4.25 Modern wind turbines are designed to withstand storms, local weather conditions and, more importantly, extreme gust magnitudes which could possibly be expected at a specific wind farm site. Wind turbines are also programmed to stop at high wind speeds by the high speed cut out limit controller. This is set to trigger when the wind speed approaches approximately 24 metres per second. Wind turbines are robust in their design and manufacture so as to allow for the buffeting they endure at these higher speeds without suffering structural damage.

14.4.26 Lightning protection will be installed in the turbines to prevent damage in the event of a strike. The blade protection system comprises two major components: the receptors on the surface of the blade; and, a conductive cable system leading down the inside of blade itself. When lightning strikes, the receptors intercept the lightning and the cable system conducts the charge through the blade to the tower and then down to the earth.

14.4.27 Under freezing conditions there is the possibility that exposed parts of the wind turbine will experience a build-up of ice. Ice throw occurs as stationary turbine blades begin to rotate. Turbines can continue to operate if a thin build up of snow or ice occurs, but will shut down if ice builds up to cause aerodynamic or physical imbalance of the rotor assembly. There are monitoring systems in place to ensure that turbines that have been stationary during icing condition are restarted in a controlled manner. The Companion Guide to PPS 22 (now cancelled) stated *"the build-up of ice on turbine blades is unlikely to present problems on the majority of sites in England. For ice to build up on wind turbines particular weather conditions are required, that in England occur for less than 1 day per year".* The embedded site design mitigation, set-back distances from roads, public rights of ways and residential properties, further reduces any potential impacts.