Table of Contents

Chapter No.		Page No.
	Abbreviations	**vii**
Chapter 1	**Introduction**	
	Introduction	1-1
	Site Location	1-1
	Purpose of the ES	1-1
	Other Planning Documents	1-1
	EIA Process	1-1
	Commenting on the ES	1-3
Chapter 2	**Project Description**	
	Introduction	2-1
	Site layout and Flexibility	2-1
	Project Description	2-2
	Description of Access	2-4
	Typical Construction Activities	2-5
	Operation, Management and Maintenance	2-8
	Decommissioning	2-8
	Construction and Decommissioning Management	2-9
Chapter 3	**Design Evolution and Alternatives**	
	Introduction	3-1
	Site Selection Considerations	3-1
	Current Land Use and Site Context	3-1
	Key Issues and Constraints	3-1
	Consultation	3-2
	Alternatives	3-3
	Turbine Design Evolution	3-3
	Infrastructure Design Evolution	3-5
	Residual Design Considerations	3-6
	Issues Remaining for Impact Assessment	3-10
Chapter 4	**Landscape and Visual**	
	Introduction	4-1
	Legislation and Policy Context	4-1
	Consultation	4-5
	Method of Assessment	4-9
	Assessment of Significance	4-10
	Baseline Conditions	4-12
	Visual Receptors	4-14
	Analysis of Baseline Appraisal	4-18
	Potential Sources of Significant Effects	4-18
	Mitigation	4-19
	Residual Effects	4-21
	Theoretical Visibility	4-21
	Residual Effects	4-23
		4-36
Chapter 5	**Ecology**	
	Introduction	5-1
	Study Area Description	5-1
	Assessment Structure	5-1
	Legislation and Policy	5-2
	Issues Identified During Consultation	5-2
	Assessment Methodology	5-5
	Limitations	5-8
	Baseline Conditions	5-8
	Future Baseline - The 'Do Nothing' Scenario	5-13
	Design Mitigation	5-14
	Potential Impacts	5-14
	Mitigation	5-18
	Assessment of Residual Effects	5-19
	Cumulative Effects	5-19
	Summary	5-20

Chapter 6 Ornithology
Introduction 6-1
Assessment Methodology 6-1
Baseline Conditions 6-6
Design Mitigation 6-8
Effects Assessment 6-8
Cumulative Effects 6-15
Pre-Construction Surveys 6-18
Summary of Effects 6-18

Chapter 7 Cultural Heritage and Archaeology
Introduction 7-1
Legislation, Policy and Guidance 7-1
Assessment Methodology and Significance Criteria 7-2
Baseline Conditions 7-6
Assessment of Potential Effects 7-11
Mitigation and Residual Effects 7-19
Cumulative Effect Assessment 7-19
Summary of Effects 7-21
Statement of Significance 7-22

Chapter 8 Geology, Hydrology and Hydrogeology
Introduction 8-1
Legislation, Policy and Guidance 8-1
Assessment Methodology and Significance Criteria 8-2
Baseline Conditions 8-9
Assessment of Potential Effects 8-16
Mitigation and Residual Effects 8-21
Cumulative Effect Assessment 8-21
Summary of Effects 8-22
Statement of Significance 8-22
Potential Effect on the River Tweed SAC 8-22

Chapter 9 Noise
Introduction 9-1
Scope of Assessment 9-2
Legislative Framework & Guidance 9-2
Consultation 9-3
Methodology 9-3
Baseline Conditions 9-5
Potential Impacts 9-6
Mitigation 9-16
Residual Effects 9-16
Cumulative Effects 9-16
Summary 9-17

Chapter 10 Forestry
Introduction 10-1
Legislation and Planning Policy Guidance 10-1
Forestry Study Area 10-2
Development of the Wind Farm Forest Plan 10-3
Baseline Conditions 10-4
Wind Farm Forest Plan 10-5
Forestry Management Practices 10-7
Summary 10-8

Chapter 11 Traffic and Transport
Introduction 11-1
Methodology 11-1
Assessment Methodology and Significance Criteria 11-2
Baseline Conditions 11-4
Assessment of Potential Construction Phase Effects 11-5
Predicted Traffic Generation 11-6
Other Effects 11-7
Mitigation 11-9
Residual Effects 11-10
Assessment of Cumulative Effects 11-10
Statement of significance 11-10

Table of Figures

Figure No.

1.1 Site Location & Planning Application Boundary
1.2 Turbine Layout

2.1 Infrastructure Layout
2.2 Typical Wind Turbine Elevations (176 m)
2.3 Typical Wind Turbine Foundation
2.4 Typical Crane Hardstanding General Arrangement
2.5 Typical Masts
2.6 Access Track Typical Details
2.7 Substation Building and Compound Layout Plan
2.8 Substation Building and Compound Layout Elevations
2.9 Cable Trenches Typical Details
2.10 Typical Drainage Details
2.11 Typical Site Track Water Crossing with Mammal Crossing
2.12 Site Entrance
2.13 Temporary Construction Compound – Layout and Elevation
2.14a Borrow Pit A Detail
2.14b Borrow Pit B Detail
2.14c Borrow Pit C Detail
2.14d Borrow Pit D Detail
2.14e Borrow Pit E Detail

3.1 Combined Constraints
3.2 RES Site Selection Results
3.3 Turbine Layout Evolution
3.4 Comparitive ZTV – Final layout vrs 150 m and 130 m Turbines

5.1 Ecological Designated Sites within 5 km
5.2a-c Phase 1 Habitat Survey Results
5.3a-e NVC Survey Results
5.4a-e Groundwater Dependent Terrestrial Ecosystems (GWDTE) Survey Results
5.5 Protected Species Survey Results
5.6 Confidential Badger Survey Results [CONFIDENTIAL ANNEX ONLY}
5.7 Great Crested Newt Pond Survey Locations 2012
5.8 Bat Survey Locations 2012
5.9 Bat Spatial Survey Results 2012
5.11 Bat Survey Locations 2013
5.12 Bat Spatial Survey Results 2013
5.13 Bat Temporal Survey Results 2013
5.14 Bat Target Note Locations
5.15 Bat Buffer Zones From Turbines
5.16a-c Site Location and Sampling Grid
5.17a-d Interpolated Peat Depth
5.18 Sphagnum Abundance and Distribution
5.19 Non-Sphagnum Abundance and Distribution
5.20 Calluna Vulgaris Abundance and Distribution
5.21 Eriophorum Vaginatum Abundance and Distribution
5.22 Molinia Abundance and Distribution
5.23 Other Grasses, Bracken and Rushes Abundance and Distribution
5.24 Bare Ground/Conifer Needle Abundance and Distribution
5.25 Peat Erosion
5.26 Drain Activity

6.1 Proposed Wind Farm Boundary and Study Areas
6.2 Designated Sites: Ornithology within 20 km"
6.3 Vantage Points and Viewsheds 2011 - 2012
6.4 Vantage Points and Viewsheds 2012 - 2013
6.5 Flight Activity Non-Breeding Season 2011 - 2012
6.6 Flight Activity Breeding Season 2012
6.7 Flight Activity Breeding Season 2013
6.8 Confidential Historic Black Grouse Records [CONFIDENTIAL ANNEX ONLY]
6.9 Confidential Schedule 1 Species Records [CONFIDENTIAL ANNEX ONLY]
6.10 Breeding Wader Territories 2012 and 2013
6.11 Cumulative Developments

7.1 Site location with heritage features considered within 1 km Study Area
7.2a Cultural Heritage Designations within 5 km
7.2b Cultural Heritage Features Assessed within 15 km and ZTV
7.3 Cultural Heritage Viewpoint 2: Southdean Church (wireline over photo)
7.4 Cultural Heritage Viewpoint 3: Southdean Hill Fort (wireline over photo)
7.5 Cultural Heritage Viewpoint 4: Bonchester Hill Fort (wireline over photo)
7.6 Cultural Heritage Viewpoint 7: Tamshiel Rig Settlement (wireline over photo)
7.7 Cultural Heritage Viewpoint 1: Dykeraw Tower (wireline)

7.8 Cultural Heritage Viewpoint 2: Southdean Church (wireline)
7.9 Cultural Heritage Viewpoint 3: Southdean Hill Fort (wireline)
7.10 Cultural Heritage Viewpoint 4: Bonchester Hill Fort (wireline)
7.11 Cultural Heritage Viewpoint 5: Rubers Law Hill Fort (wireline)
7.12 Cultural Heritage Viewpoint 6: Penchrise Pen Fort and Settlement (wireline)
7.13 Cultural Heritage Viewpoint 7: Tamshiel Rig Settlement (wireline)
7.14 Cultural Heritage Viewpoint 8: Steele Knowe Settlement (wireline)
7.15 Cultural Heritage Viewpoint 9: Shaw Craigs Fort (wireline)
7.16 Cultural Heritage Viewpoint 10: Five Stanes (Circle) (wireline)
7.17 Cultural Heritage Viewpoint 11: Woden Law Fort (wireline)
7.18 Cultural Heritage Viewpoint 12: Cunzierton Fort (wireline)

8.1 Hydrology Study Areas;
8.2 Solid Geology;
8.3 Superficial Geology; and
8.4 Hydrological Catchments

9.1 Predicted Noise Footprint

10.1 Forestry Study Area
10.2 Baseline Age Class Structure
10.3 Baseline Species Composition
10.4 Baseline Felling Plan
10.5 Baseline Restock Plan
10.6 Wind Farm Felling Plan
10.7 Wind Farm Restock Plan

11.1 Location of Traffic Survey Counters

Abbreviations

The following is a list of abbreviations commonly used throughout this Environmental Statement

AOD	Above Ordnance Datum
BAP	Biodiversity Action Plan
BGS	British Geological Society
BoCC	Birds of Conservation Concern
BS	British Standard
BT	Blade Tip
CAA	Civil Aviation Authority
CAR	The Water Environment (Controlled Activities) (Scotland) Regulations 2005
CIRIA	Construction Industry Research and Information Association
CLVIA	Cumulative Landscape and Visual Impact Assessment
CMS	Construction Method Statement
CO_2	Carbon Dioxide
dB	Decibels – The logarithmic measure of sound
dB(A)	Decibels – Weighted to reflect the range of human hearing
DEFRA	Department for Environment, Farming and Rural Affairs
DfT	Department for Transport
DIO	Defence Infrastructure Organisation
DMRB	Design Manual for Roads and Bridges
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ES	Environmental Statement
ETSU	Energy Technology Support Unit
GCN	Great Crested Newts
GDL	Gardens and Designed Landscapes
GHG	Greenhouse Gas
GIS	Geographical Information Systems
GLVIA	Guidelines for Landscape and Visual Impact Assessment, Second Edition (Landscape Institute and IEMA, 2002)
GWDTE	Ground Water Dependent Terrestrial Ecosystem
HER	Historic Environment Record
HES	Historic Environment Scotland
HGVs	Heavy Goods Vehicles
HH	Hub Height
HRA	Habitats Regulations Appraisal
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment
IHT	Institution of Highways and Transportation
JNCC	Joint Nature Conservation Committee
JRC	Joint Radio Company
Kv	Kilovolts
LA90	The “A weighted” noise level exceeded for 90 per cent of the specified measurement period
Laeq	The equivalent continuous sound level
LCA	Landscape Character Areas
LDP	Local Development Plan
LDR	Long Distance Route
LCA	Landscape Character Areas
LCT	Landscape Character Type
LNR	Local Nature Reserve
LPA	Local Planning Authority
LVIA	Landscape and Visual Impact Assessment
MoD	Ministry of Defence
MW	Megawatts
NATS	National Air Traffic Services
NCA	National Character Area
NCC	Northumberland County Council
NERL	NATS En Route Limited
NHZ	Natural Heritage Zone
NGR	National Grid Reference
NMR	National Monument Record
NNP	Northumberland National Park
NNR	National Nature Reserve
NSA	National Scenic Area

NTS	Non Technical Summary
OS	Ordnance Survey
PAC	Pre-Application Consultation
PAN	Planning Advice Note
PCBs	Polychlorinated Biphenyls
PIA	Personal Injury Accidents
pLBS	Potential Local Biodiversity Site
PPG	Planning Policy Guidance
PPG	Pollution Prevention Guidelines
PRoW	Public Rights of Way
RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland
RD	Rotor Diameter
RES	RES Ltd
RSPB	Royal Society for the Protection of Birds
SAAR	Seasonally Adjusted Annual Rate
SAC	Special Area of Conservation
SBC	Scottish Borders Council
SCADA	Supervisory Control and Data Acquisition
SCC	Southdean Community Council
Schedule 1	Birds listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended)
SEPA	Scottish Environment Protection Agency
SFS	Scottish Forest Strategy
SHEP	Scottish Historic Environment Policy
SLA	Special Landscape Area
SM	Scheduled Monument
SMR	Sites and Monuments Record
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SPD	Supplementary Planning Document
SPG	Supplementary Planning Guidance
SPP	Scottish Planning Policy
SPP	Species Protection Plan
SPR	Standard Run Off
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TMP	Traffic Management Plan
VP	Vantage point
WEWS	Water Environment and Water Services (Scotland) Act 2003
WFD	The EU Water Framework Directive (2000/60/EC)
ZTV	Zone of Theoretical Visibility

1. Introduction

Introduction

1.1 This Environmental Statement (ES) has been prepared by Renewable Energy Systems Limited (RES) in accordance with the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (as amended), in support of an application to Scottish Borders Council (hereafter, the Council) for planning permission to construct a wind farm comprising 13 wind turbines at Highlee Hill, Chesters, Scottish Borders (Figure 1.1).

1.2 The ES comprises four volumes:

- Volume 1: Non-Technical Summary (NTS);
- Volume 2: Main Report;
- Volume 3: Landscape & Visual Figures; and
- Volume 4: Technical Appendices

Site Location

1.3 The proposed wind farm is located near the village of Chesters in the Scottish Borders with the closest turbine located just over 3 km from the village edge. Further afield Hawick is located 12.5 km to the north-west and Jedburgh 12.6 km to the north. The Scotland-England border is 2.5 km from the site boundary (5.5 km from Carter Bar). The centre point of the proposed wind farm site is grid reference E362049, N606846.

1.4 The site itself comprises two land holdings, the first is a large area of commercial forestry and the second is mixed use agricultural land. Twelve of the turbines are located within the commercial forest and one on open land.

1.5 The turbines are located in an area classified as Southern Uplands Forest Covered. The lowest turbine is located at 219 m AOD (Turbine 8) and the highest at 298 m (Turbine 2).

Purpose of the ES

1.6 This ES reports on the Environmental Impact Assessment (EIA) process undertaken to date for the proposed Highlee Hill Wind Farm. EIA is required where a development is '*likely to have significant effects on the environment by virtue of factors such as its nature, size or location*'[1]. The ES provides a clear and concise summary of the proposed development and its likely significant environmental effects on the natural, built and human environments.

Other Planning Documents

1.7 Additional documentation that will be submitted with this application includes:

- Planning Statement
- Design and Access Statement;
- Pre-Application Consultation Report; and
- Confidential Annex.

EIA Process

Screening

1.8 RES (the Applicant) has not requested a formal screening opinion from the Council on the need for EIA. Given the nature and scale of the proposed Highlee Hill Wind Farm and the potential for significant environmental effects, the Applicant considers that an EIA is required as set out in Schedule 2 to the EIA Regulations.

Scoping

1.9 RES originally proposed a project of up to 111 MW comprising 37 turbines of up to 150 m which constituted a Section 36 application under the Electricity Act. RES submitted a Scoping Report (Doc Ref: 02836-000440) to the Scottish Government Energy Consents Unit in January 2014. After further design the proposed capacity dropped below 50 MW resulting in the project falling under the Town and Country Planning Regulations administered by the Council. Given the increase in turbine height and change in consenting authority it was considered appropriate to issue a fresh Scoping Report to the Council in November 2015. The Scoping Report and subsequent Scoping Opinion are available on the Council's eplanning portal.

1.10 Further detail on the key issues identified through the scoping and consultation process are described in **Chapter 3: Design Evolution and Alternatives.**

Baseline Characterisation

1.11 The purpose of EIA is to predict how environmental conditions may change as a result of a proposed development. This requires that the environmental conditions now and in the future, assuming no development on the site, are established. These conditions are referred to as 'the baseline' and are usually established through a combination of desk based research, site survey, and empirical studies and projections. Together these describe the current and future character of the site and surroundings, and the value and vulnerability of key environmental resources and receptors.

1.12 Making predictions about how parameters such as land use, landscape, views and the wider community may change in the future relies heavily on assumptions about future development and environmental trends and is at risk of being wholly hypothetical and subjective. For this reason where development is not currently proposed in the vicinity of the proposed development, to allow for a future baseline to be addressed, the baseline adopted for EIA is normally taken as the current character and condition of the site and surrounds, and the likely

[1] Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (as amended)

significant environmental impacts of the development are then assessed in the context of the current conditions alone.

EIA Methodology

1.13 Good practice in EIA is defined in a number of sources (Hakes P, 2007[2]; Carroll B et al, 2003[3]; DCLG, 2006a[4] & b[5]; IEMA, 2004[6] and 2008[7]; Lee et al (1999)[8], European Commission 2001[9]; PAN 1/2013, Circular 3/2011). The methods followed in this EIA have drawn on these documents to generate a robust assessment. In line with guidance provided in the EIA Regulations and EIA good practice guides, the EIA process has involved the following:

- consultation and scoping with statutory consultees, non-statutory consultees and the local community to identify the key issues on which the EIA should focus;
- establishing baseline environmental conditions through desktop research and site surveys;
- identifying potential impacts of the proposed wind farm;
- determining how impacts could be avoided or reduced through design evolution or additional mitigation measures;
- assessing the significance of residual environmental impacts on the identified receptors against recognised or defined criteria;
- describing how likely significant future impacts would be monitored (e.g. through conditions attached to a planning consent); and
- reporting the process, results and conclusions of the EIA in an ES.

Mitigation by Design

1.14 In the hierarchy of mitigation, likely significant adverse effects should in the first instance be avoided altogether, then reduced and finally, where possible, offset (IEMA 2004).

1.15 Adverse effects are best avoided through the design, and the iterative nature of EIA can help inform the development of the design process. In this case, the EIA and the design processes have been combined in order to minimise potential impacts through mitigation by design.

1.16 An explanation of mitigation by design is provided in **Chapter 3: Design Evolution and Alternatives**.

1.17 In addition to employing the tenet of mitigation by design, the following design principles have been employed when making design decisions:

- mitigation by design should be the principal method of reducing potential environmental impacts;
- existing infrastructure should be used whenever possible to avoid unnecessary development;
- use of site won rock is preferred to reduce traffic generation; and
- all site infrastructure should be designed as efficiently as possible to reduce the overall extent of development.

Consideration of Alternatives

1.18 Both the EIA Directive and the EIA Regulations require that, as part of the information to be provided in an ES, an outline of the main alternatives studied by the developer and an indication of the main reasons for their choice, taking into account the environmental impacts, should be provided. However, there is no requirement in the regulations for the applicant of a wind farm to demonstrate that there are no alternative sites which would have lesser environmental effects.

1.19 Good practice on EIA (DCLG, 20063) clarifies this point. It explains that the EIA Regulations do not require applicants to 'invent' an alternative where none has been considered, although the lack of alternatives should be explained. It goes on to accept that alternatives would be constrained by economic and operational reasons, and that the competent authority should consider an application on its merits and not on the merits of potential alternatives (although for some applications, the existence or otherwise of feasible alternatives might be a material consideration). **Chapter 3: Design Evolution and Alternatives** therefore summarises the alternatives to the proposed wind farm considered by the design team, including the site selection process and the consideration of alternative designs through design evolution.

Identification of Impacts

1.20 Each technical chapter contains a section that identifies the likely significant effects on the environment that may arise as a result of the construction and/or operation of the proposed wind farm. Impacts may be direct, indirect, primary, secondary or cumulative. Within these categories, they may also be short, medium or long-term, permanent or temporary, positive or negative. Direct (or 'Primary') impacts are changes to the baseline arising directly from activities that form part of the development, for example a localised increase in noise during construction. Indirect (or 'Secondary') impacts are those that arise as a result of a direct impact, for example deterioration of water quality in a watercourse due to a discharge could have secondary impacts on aquatic biodiversity. Cumulative impacts occur when a receptor is subject to multiple impacts, either of the same nature from different developments, or of different types but caused by the same development. Cumulative impacts are discussed further below. In this report the terms impacts and effects are used interchangeably.

Phasing

1.21 In relation to phasing, the likely significant effects arising from construction, operation and decommissioning have been assessed individually in each chapter, where appropriate. **Chapter 2: The Proposed Development** provides a detailed breakdown of project phasing.

[2] Hakes P (2007) The Essex Guide to Environmental Impact Assessment
[3] Carroll B and T Turpin (2003) Environmental Impact Assessment Handbook: A Practical Guide for Planners, Developers and Communities
[4] Department for Communities and Local Government (2006a) Environmental Impact Assessment: A Guide to Good Practice (Consultation Paper)
[5] Department for Communities and Local Government (DCLG) (2006b) Amended Circular on Environmental Impact Assessment (Consultation Paper)
[6] Institute of Environmental Management and Assessment (2004) Guidelines for Environmental Impact Assessment
[7] Institute of Environmental Management and Assessment (2008) ES Review Criteria
[8] Lee N, R Colley, J Blonde and J Simpson (1999) EIS Review - Reviewing the quality of Environmental Statements and Environmental Appraisals
[9] European Commission (2001) Guidance on EIA

Cumulative Impacts

1.22 In accordance with the web-based renewable energy guidance[10] which has been replaced PAN 45[11], likely cumulative impacts have been defined as the likely impacts that the proposed wind farm may have in combination with developments which are at the application stage, consented, under construction or operational. However, it should be noted that the specific developments which are included within the cumulative impact assessment varies from one technical discipline to another according to the particular impacts which are under consideration – for example all of the cumulative schemes are included within **Chapter 4: Landscape and Visual**, however this approach is not appropriate for e.g. **Chapter 5: Ecology** due to the potential ecological receptors being much more localised. The rationale for the cumulative developments included in the assessments is explained within each technical chapter.

1.23 Due to the nature and scale of the proposed wind farm, cumulative landscape and visual impacts, ecological and ornithological impacts, historic environment impacts, hydrological impacts, noise impacts, and impacts from traffic and access arising from other wind farms in the vicinity of the site have all been considered in the respective assessments. No other potentially significant cumulative impacts have been identified and therefore only the aforementioned cumulative impacts are assessed in this ES.

Commenting on the ES

1.24 Further information is available on the project website (http://www.highleehill-windfarm.co.uk/) and hard copies of the ES and other documentation can be viewed at the following locations:

Scottish Borders Council
Planning & Regulatory Services
Newton St Boswells
Melrose
TD6 0SA

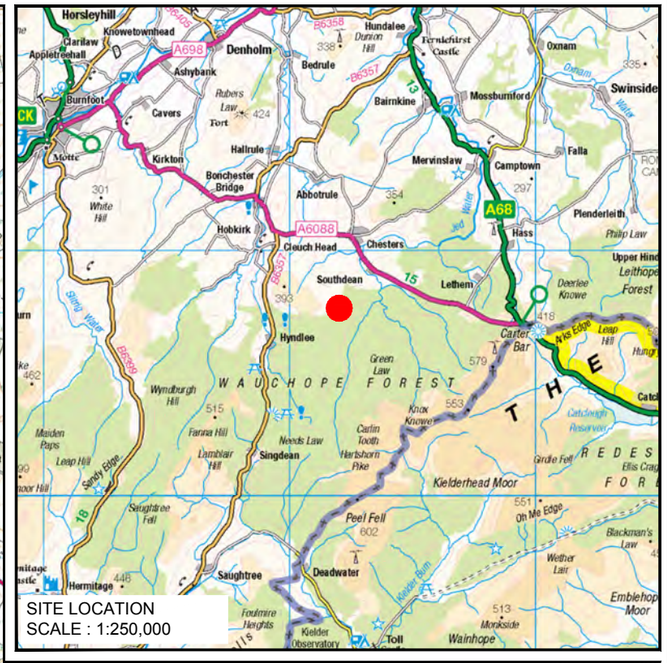
Southdean Hall
Chesters
TD9 8TH

Hawick Library
North Bridge Street
Hawick
TD9 9QT

1.25 This document is available in hard copy format for a cost of £150 (Volume 2), £675 (Volume 3) and £130 (Volume 4) (including postage and packaging) or on CD-ROM (price £10). A Non-Technical Summary of the Environmental Statement is available free of charge. Copies can be obtained from RES at the address below on request.

RES Limited
STV Building
Pacific Quay
Glasgow
G51 1PQ

[10] Scottish Government – Online Renewables Planning Advice - http://www.gov.scot/Resource/0045/00451413.pdf
[11] Scottish Government (2002) Planning Advice Note 45: Renewable Energy Technologies



HIGHLEE HILL WIND FARM

FIGURE 1.1

SITE LOCATION & PLANNING APPLICATION BOUNDARY

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673 .

KEY

SITE BOUNDARY

SITE LOCATION - NOT TO SCALE

LAYOUT DWG N/A	T-LAYOUT NO. N/A
DRAWING NUMBER 02836D2219-01	
SCALE - 1:25,000	
ENVIRONMENTAL STATEMENT 2016	

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIGURE 1.2

TURBINE LAYOUT

Site Boundary

Turbine Location

Turbine ID	Easting	Northing
T1	361706	605510
T2	361276	605923
T3	362105	606015
T4	361736	606280
T5	361647	606885
T6	361837	607484
T7	362300	607186
T8	362613	606794
T9	362941	606443
T10	363186	607023
T11	363442	606548
T12	363248	606022
T13	363692	605723

LAYOUT DWG N/A

T-LAYOUT NO. PSCOhhi041

DRAWING NUMBER 02836D0002-13

SCALE - 1 : 25,000

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

2. Proposed Development

Introduction

2.1 The proposed wind farm comprises 13 horizontal axis wind turbines, two with a tip height of 150 m and 11 with a tip height of 176 m. Key elements of the proposed wind farm include associated underground cabling, access tracks and turning heads, crane hardstandings, control building and substation compound, temporary and permanent free-standing wind monitoring (anemometer) masts. During construction and commissioning there would be a number of temporary works including construction compounds, borrow pits and welfare facilities.

2.2 A detailed plan of the proposed wind farm showing the position of the turbines is shown in Figure 1.2 and associated infrastructure shown in Figure 2.1.

2.3 This chapter provides a description of the physical characteristics of the proposed wind farm for the purpose of identifying and assessing the main environmental impacts of the proposal.

2.4 Planning permission is being sought for the proposed wind farm comprising the following:

- 13 three-bladed horizontal axis wind turbines. Turbine 6 & 7 at 150 m and the others at 176 m tip-height,
- turbine foundations,
- hardstanding areas at each turbine location for use by cranes erecting and maintaining the turbine,
- access tracks,
- 4 temporary, guyed lattice work meteorological ('met') masts,
- a wind farm compound containing a control building,
- an on-site electrical and control network of underground (buried) cables,
- a temporary construction compound,
- a temporary enabling works/gatehouse compound,
- 1 10 m communications mast,
- borrow pits,
- drainage works including a SuDs system,
- associated ancillary works,
- engineering operations,
- forestry felling,
- a connection from the control building to the local grid network (not part of the wind farm planning application).

Site layout and Flexibility

2.5 A plan of the proposed wind farm showing the proposed positions of the turbines, met masts, access tracks, control building/substation compound, borrow pit search areas and other infrastructure is shown in Figure 2.1.

2.6 Although the design process to date has sought to optimise environmental and economic requirements, the Applicant would nevertheless wish some flexibility, where necessary, in micrositing the exact positions of the turbines and routes of on-site access tracks and associated infrastructure (50 m deviation in plan from the indicative design). This reflects possible variations in ground conditions across the site, which would only be confirmed once trial pits and boreholes for detailed site investigations are dug during the detailed infrastructure design, prior to the commencement of construction. Any repositioning would not encroach into environmentally constrained areas. Therefore, 50 m flexibility in turbine and infrastructure positioning would help mitigate any potential environmental effects e.g. avoidance of archaeological features not apparent from current records.

Development Area

2.7 The turbines have a requirement to be spaced apart, so as not to interfere aerodynamically with one another (thus avoiding array losses). The actual land developed is limited to the substation, wind turbine plinths and paths, permanent crane hardstandings and the access tracks, which account collectively for about 0.8% of the total area within the site boundary.

2.8 The turbine foundation is made up of a central excavation of up to approximately 30 m diameter and an approximate depth of 3 - 5 m subject to prevailing ground conditions, but with sloping batters which would increase the excavated area to ground level to approximately 35 m diameter, possibly greater where poor ground conditions are encountered.

2.9 Each turbine requires a crane hardstanding to facilitate construction and maintenance. At each turbine there will be a 1800 m^2 permanent hardstanding with an additional 930 m^2 temporary hardstanding during the construction phase. The excavation area around each turbine is temporary. Ancillary excavation works and material storage around other parts of the development, such as those for cable trenching, would have a negligible impact on environmental receptors due to the very minor scale of the excavation or duration of the works and are not considered further in the ES.

2.10 Following completion of the turbine installation, the total permanent hardstanding would be approximately 2,000 m^2 at each turbine site, which includes the crane hardstanding, the concrete plinth to which the steel tower is attached and a 5 m wide maintenance track/path around the base of the turbine (Figure 2.3). The completed foundation is covered with soil approximately 2.0 m deep, leaving only the concrete plinth exposed at ground level to which the steel tower is attached.

2.11 The temporary calibration met masts will have a foundation base measuring approximately 9 m x 9 m (Figure 2.5). There would be a temporary crane pad of 800 m^2 (20 m x 40 m) to facilitate the erection and removal of the masts.

2.12 The proposed wind farm would result in the construction of approximately 5.5 km of new track and a further 7.7 km of existing track will also be upgraded. The running width of the track would be 5 m on straight sections, with 0.25 m wide shoulders on each side. Tracks will be

wider on bends. The total permanent hardstanding area for the new track would be approximately 39,142 m^2, 15,102 m^2 of hardstanding area added to the existing track plus 3,693 m^2 of hardstanding area for turning heads.

2.13 The external compound would take up an area of approximately 1,435 m^2 and the control building approximately 450 m^2. This would give a total area of 1,885 m^2 within the control building compound.

2.14 The temporary construction compound would require a hardstanding area of approximately 3,000 m^2 (60 x 50 m). This area would be re-vegetated after construction is complete.

2.15 The temporary enabling works/gatehouse compound would require a hardstanding area of approximately 3,000 m^2 (60 x 50 m). This area would be re-vegetated after construction is complete.

Table 2.1 : Summary of Temporary and Permanent Hardstanding

Wind Farm Element	Temporary hardstanding1	Permanent Hardstanding2
Construction Compound	3,000 m^2	N/A
Temporary Welfare Compound	3,000 m^2	N/A
Turbines	N/A	2210m^2
Crane Pads and laydown areas	12,480 m^2	23,400 m^2
Substation and Control Buildings	N/A	1,885 m^2
On-site access tracks (New)	1800 m^2	39,142 m^2
On-site access tracks (Turning Head)	N/A	3,693 m^2
On-site access tracks (Upgrade)	N/A	15,102 m^2
On-site access tracks (Passing Place)	N/A	1,225 m^2
Temporary Met Masts and Crane Pad	1600 m^2	36 m^2
Total Hardstanding (m^2)	20,680 m^2	86,693 m^2
Total Hardstanding (ha)	2.07 ha	8.67 ha
Total Hardstanding (as % of total area within the wind farm site) Boundary (10,973,500 m^2) (1,097ha).	0.2 %	0.8 %

2.16 Thus, in summary, the proposed wind farm would require approximately 8.67 ha of hardstanding during the life of the project. An estimated further 2.07 ha would be occupied by hardstanding on a temporary basis during the construction phase.

[1] Temporary hardstanding: this refers to ground which will be occupied by hardstanding / built structures during the construction of the proposed wind farm. However, once the proposed wind farm has been constructed this land will be reinstated and available for grazing.
[2] Permanent hardstanding: this refers to ground which will be occupied by hardstanding / built structures throughout the lifetime of the proposed wind farm.

Project Description

Wind Turbines

2.17 The wind turbine industry is constantly evolving. Designs continue to improve technically and economically. The most suitable turbine model for a particular location can change with time and therefore a final choice of machine for the proposed wind farm has not yet been made. The most suitable machine would be chosen before construction, with an overall height limit of up to 150 or 176 m as assessed in this ES.

2.18 For visual and acoustic assessment purposes, the most suitable candidate turbine available in the market place (currently of 3.45 MW nominal capacity and with an overall height to blade tip of 150 m or 176 m) has been assumed. Most of the dominant wind turbine manufacturers are now producing turbines that are classed as suitable for the wind regimes typical of Scotland and many are also producing turbines that match the proposed tip heights being suggested for the proposed wind farm. Exact tower and blade dimensions vary marginally between manufacturers, but suitable turbines are produced by Senvion, Nordex and Vestas amongst others. A diagram of a typical 176 m tip height turbine is given in Figure 2.2. The colour and finish of the wind turbine blades, nacelles and towers would be agreed with the Council. A significant amount of research has been undertaken in relation to turbine colour and finish. Siting and Designing wind farms in the Landscape (Version 1) SNH, December 2009 states:

"Selecting the most appropriate colour for a turbine(s) is an important part of a detailed wind farm design and mitigation. It has previously been assumed that wind turbines could be painted a colour that would camouflage them against their background. However, experience has shown that no single colour of wind turbine would consistently blend with its background and it is more important to choose a colour that would relate positively to a range of backdrops seen within different views and in different weather conditions."

2.19 The publication goes onto state that as a rule for most rural areas of Scotland:

- a single colour of turbine is generally preferable;
- a light grey colour generally achieves the best balance between minimising visibility and visual impacts when seen against the sky;
- the use of coloured turbines (such as green, browns or ochres) in an attempt to disguise wind turbines against a backcloth is usually unsuccessful; and
- paint reflection should be minimised.

2.20 Whilst often backclothed in views by topography, the turbines would be seen above the horizon at a number of key viewpoints both in close proximity to the site and from more distant views. In cognisance of the preceding guidance, a simple pale grey colour with a semi-matt finish is suggested for the turbines at the proposed wind farm.

2.21 Turbines normally rotate clockwise when viewed from the front, although this can vary between models. The computerised control system incorporated into each turbine continuously monitors the wind direction and instructs the turbine to turn (yaw) to face into the wind to maximise the amount of energy that is captured.

2.22 Turbines begin generating automatically at a wind speed of around 3 to 4 metres per second (m/s) and have a shut down wind speed of about 25 m/s.

2.23 Specific details of the aviation lighting likely to be required are not yet confirmed. The Applicant is currently in discussions with the Civil Aviation Authority (CAA) and the Ministry of Defence (MoD) to agree a lighting scheme which is acceptable to both parties. The CAA standard procedures require any structure over 150 m in height to have visible lighting. Renewable UK, an industry body representing renewable energy companies, is currently in consultation with the CAA to develop guidelines for specific lighting plans which will distinguish wind turbines from other tall structures. This consultation is unlikely to have been concluded by the time this application has been submitted however RES will continue work with the CAA and MOD to agree a lighting plan which can be secured by planning condition. For the purposes of this EIA RES has assessed the visible lighting plan which is currently before the CAA for consideration.

2.24 Each turbine would have a transformer and switchgear. The transformer will either be housed inside the turbine (within the tower or nacelle) or it will be located alongside the base of the turbine. The transformer's function is to raise the generation voltage from approximately 690 volts to the higher transmission level of 33 kV that is required to transport the electricity around the proposed wind farm and then onto the grid.

2.25 Every year, the proposed wind farm is likely to generate electrical energy equivalent to the average annual demand of approximately 30,000 homes, approximately 57% of the homes in the Scottish Borders area (refer to **Technical Appendix 2.2**).

Temporary Wind Monitoring Masts

2.26 Temporary guyed lattice met masts, known as power performance masts or calibration masts, of up to 116.5 m height will be erected to confirm the detailed wind flow of the proposed wind farm site. These masts are raised prior to turbine erection and the data they gather is used in the acceptance tests on the turbines. Figure 2.5 shows an example of a calibration mast.

2.27 Two pairs of masts (total four masts) are expected to be required. One mast of each pair will be erected at the turbine location and the paired mast will be approximately 200 m upwind. The mast locations can be seen on Figure 2.1.

2.28 The masts will be raised around the same time as the turbine foundations are poured, approximately 6 months before the turbine are erected. All the masts will remain in place during the turbine commissioning period. After approximately three months once the mast pairs have been calibrated against each other, the masts at the turbine locations are removed. The remaining two masts will be removed 6-24 months into the wind farm operation, once sufficient data across the full range of wind conditions is gathered to prove the performance of the turbine.

Foundations and Hard Standing

2.29 The wind turbines would be erected on steel reinforced concrete foundations. It is anticipated that the foundations would be of gravity base design. Final base designs would be determined after a full geotechnical evaluation of each turbine location. Figure 2.3 provides an illustration of a typical gravity base wind turbine foundation construction.

2.30 During the erection of the turbines, crane hardstanding areas would be required at each turbine base. Typically, these consist of one main permanent area of 1,800 m^2 (Figure 2.4) adjacent to the turbine position where the main turbine erection crane would be located. The other areas, totalling 930m^2, would be temporary and would be used to assist turbine erection. The hardstanding would be constructed using the same method as the excavated access tracks. This involves the topsoil being excavated and replaced with an engineered layer, typically crushed rock, to near the original ground level.

2.31 After construction operations are complete, the temporary crane pad areas, shown on Figure 2.4, would be reinstated. There would be a requirement to use cranes on occasion during the operational phase of the proposed wind farm, so the main crane hardstanding would be retained to ease maintenance activities. This approach complies with current best practice guidance[3] which recommends crane hardstandings are left uncovered for the lifetime of the proposed wind farm.

Timber Felling

2.32 The majority of the wind farm infrastructure is located within the Dykeraw forest plantation. In order to install and freely operate the wind turbines, areas of the existing forestry will be felled.

2.33 Phased felling and replanting operations have been taking place at Dykeraw since 2004. The forest now consists of a mix of young and mature timber.

2.34 The existing Forest Management Plan states that the remaining areas of mature forest are to be felled within the 2018-2022 timeframe. This coincides with the predicted start of the wind farm construction (currently programmed for 2019). Several forest 'coupes' which are identified to be felled in that timeframe contain the wind farm infrastructure. Depending on when the wind farm construction begins these areas will have already been felled or they will be felled as part of the wind farm construction. For the purposes of this ES we have assumed that 29.98 ha of conifer forest will be felled as part of the wind farm construction.

2.35 The remaining wind farm infrastructure to be located in areas of younger forest will only require keyhole felling which is unlikely to produce any timber of marketable quality.

2.36 The timing of any timber felling operations will be tightly co-ordinated with the civils works to minimise traffic impacts and to ensure on site operations are not taking place in the same area for reasons of health and safety.

2.37 Further information on the impacts on the forestry can be found in **Chapter 10: Forestry**.

Borrow Pits

2.38 Borrow pits are proposed as a potential source of site won rock for use primarily in the construction of new tracks and hardstandings. The location of the borrow pit areas of search are shown on Figure 2.1. These areas of search are shown as the maximum potential area of borrow pit extraction, but it is not anticipated that these areas would be fully exploited.

2.39 Areas of search are shown as the nature and quality of the underlying geology will not be defined until the results of detailed pre-construction ground investigation are known. At this point, the exact extent of borrow pit extraction cannot be defined. Indicative borrow pit drawings for all of the proposed borrow pit search areas are shown on Figures 2.14a-2.14e. It is

[3] SNH, Scottish Renewables, SEPA and the Forestry Commission Scotland (2013) "*Good Practice during Wind Farm Construction*"

not expected that all of the search areas would be utilised providing that sufficient volume and quality of suitable material can be found from the most optimal locations.

Site Tracks

2.40 The on-site access track layout has been designed to minimise environmental disturbance and land take by utilising the existing forest tracks where possible, and keeping the length of track commensurate with the minimum required for operational safety. The track route also takes cognisance of the various identified environmental constraints. New tracks totalling approximately 5.5 km in length are proposed to access the various turbine locations.

2.41 Typical access track designs are shown in Figure 2.6. This Figure shows floating and excavated track types. It is expected 100% of the on-site tracks would be constructed as excavated track as little or no peat is expected to be found on site.

2.42 Two new watercourse crossings would be required as part of the track layout with a further 14 existing crossings requiring upgrade or replacement. These crossings would be designed to ensure that mammal movement is not restricted, and sized to ensure flood flows are not restricted. An example of the watercourse crossing design is shown in Figure 2.11. All water crossings will be in accordance with the CAR Regulations.

Electrical Connection

2.43 Each turbine would be connected to the substation by underground cable (Figure 2.9).

2.44 The point of connection into the grid system is proposed to be at Hawick substation. The grid connection route is expected to consist of a mixture of overhead line and underground cable.

2.45 The grid connection route is not yet known. The precise route would be subject to a separate Section 37 application by the relevant network operator under the Electricity Act 1989 after further detailed surveys and assessments.

RES Control Building

2.46 The onsite substation is proposed to be located within the forest between Turbine 5 and 7, as shown in Figure 2.1.

2.47 The substation compound would contain electrical equipment, including auxiliary transformers. The control building required at the substation would accommodate metering equipment, switchgear, the central computer system and electrical control panels. A store room, toilet and wash basin along with a kitchenette would also be located in the control building. The building will be staffed by maintenance personnel on a regular basis. There is no requirement for any other permanent buildings within the proposed wind farm.

2.48 A communications mast, may be required. Typically this would be a 10 m high freestanding mast located adjacent to the substation compound and a typical elevation is shown in Figure 2.5.

2.49 There is a preference to source a ground water supply for the building subject to local availability. Alternatively water supply could be sourced from a rain water harvesting system. This would collect rain water from the roof of the control building via a modified drain pipe system and feed into a storage tank either within roof space of the building or an external buried tank. An overflow from the tank would drain to the outside of the building into a rainwater soakaway. The storage tank would supply untreated rainwater to the toilet and rainwater via a UV filter to the hand basin.

2.50 If an extended period of low rainfall occurs, water would be transported to the site in small tanks, as required.

2.51 Following an assessment of foul treatment options through a review of Pollution Prevention Guidelines 4, it was determined that both the toilet, wash hand basin and sink should drain to a small package treatment plant located adjacent to the control building, which would follow the Controlled Activities Regulations (CAR) guidelines and be constructed and located in accordance with the relevant Building Standards and agreed with the Council.

2.52 A permanent external environmental waste storage area will be provided with a minimum of 5 m clearance from the buildings. The area will consist of a concrete plinth typically 7 x 7 m surrounded with a palisade fence and double gate.

Description of Access

2.53 It is anticipated that the port of entry for turbine delivery would be the Port of Blyth. From there the turbine deliveries would proceed around the north periphery of Newcastle before joining the A696 and travelling north-west until joining the A68. Shortly after crossing the Scottish Border the turbine deliveries turn off onto the A6088 which takes them to the site entrance at Southdean.

2.54 Deliveries will be possible with upgrades to sections of the route and by agreeing access to third party land owners to accommodate abnormal load vehicles. Three areas along the access route will require additional areas of hardstanding to allow the turbine delivery vehicles to pass. All these areas are outwith the boundaries of Scottish Borders Council and as such will be subject to a separate planning application. More information can be found in **Chapter 11 Traffic and Transport**.

Typical Construction Activities

Timber Felling

2.55 In order to install and freely operate the wind turbines existing forestry will be felled. The following corridors and buffers will be felled as part of the wind farm construction:

- Site tracks – a 30 m corridor will be felled along the site access tracks. This will allow sufficient space to allow the construction of the track, drainage, cable trenches and spoil bunds while also maintaining an appropriate buffer to prevent any falling trees from blocking the track during the wind farm operational phase.
- Turbine hardstandings – a 50m buffer will be felled around the turbine hardstandings to allow sufficient working space during turbine construction. Following the construction phase the buffer will be reduced to 5 m and the construction areas replanted.
- Turbine bases – a 50 m buffer will be felled around the turbine base in order to accommodate the turbine hardstanding and also sufficient space to carry out the turbine lifting operations. This buffer will remain in place during the lifetime of the wind farm in order to protect the turbine from falling trees, protect wind resource and also to ensure potential bat flight paths are not obstructed by turbines.

Access Tracks

2.56 In areas where the peat and topsoil are consistently less than 1 m thick, the vegetation and soil would typically be stripped to a suitable subsoil layer. This excavation would include a cut slope. The cut batter would have an angle of 30^{o} where peat is deeper than 1 m, and the track cannot be floated. The track (approx 300-500 mm thick) would be constructed on the subsoil or bedrock. Although likely degraded by historic forestry ploughing, where possible, the upper topsoil layer, together with any turf, would be stored separately from the rest of the subsoil in piles adjacent to, or near to, the tracks, where appropriate, for later reinstatement.

2.57 Once the soil has been removed, as described above, to a suitable founding layer, the road and running surface would be constructed by placing and compacting aggregate to the required shape and thickness. Cross sections of the final road profile following reinstatement of the roadside slopes by replacing the layers of excavated material in the correct order, are presented in Figure 2.6.

2.58 The site has rolling slopes, generally ranging from 0 to 11%,with some steeper sections present particularly to the west of the site. Some short sections of track will cross slopes but typically will avoid gradients in excess of 11%. Wherever possible the down-slope side would follow the existing slope rather than rising back up as shown in the section, to avoid the need for cutting the slope.

2.59 In the unlikely event the track is required to cross an area of peat and topsoil greater than 1 m thick over an appreciable distance, a '*floating road'* construction would be used where possible. A layer of geotextile reinforcement would be placed directly onto the route of the track. The track would then be built up on the geotextile by placing and compacting stone up to a thickness of approximately 500 – 1000 mm, the exact depth being dependent on ground conditions (see Figure 2.6). The use of '*floating roads'* in areas of deep peat eliminates the need for excavation and minimises effects on ecology and disruption to existing water paths and allows for some filtration. Given that only very limited pockets of peat at a depth greater than 1 m were found during was found on site investigation works it is unlikely any of the track would be of '*floating road'* construction.

Construction of Compound

2.60 A temporary construction compound of approximately 3,000 m^2 (e.g. 50 m x 60 m) would be established. The compound would include:

- temporary portable buildings to be used as site offices, security monitoring and welfare facilities;
- toilet facilities;
- containerised storage areas for tools, small plant and parts;
- parking for construction vehicles;
- a receiving area for incoming vehicles;
- a generator; and
- a bunded area for storage of fuels and greases.

2.61 Figure 2.13 shows a typical layout for the construction compound, the exact layout may be different in practice.

2.62 It is proposed that a waterless wheel washing facility would be established to ensure vehicles do not deposit material on public roads after leaving the site.

2.63 The compound area would be constructed by topsoil excavation in a similar manner to the access tracks. Aggregate would be laid over a geotextile membrane to avoid mixing of materials and enable the formation of a sound structural base. Following construction of the proposed wind farm, the temporary facilities would be removed and soil and vegetation reinstated over the construction compound area.

2.64 During construction, temporary fencing would be erected, as required, around the construction compound, areas under restoration and, if necessary, areas identified as ecologically or archaeologically sensitive.

SuDs

2.65 The site tracks, shown in Figure 2.1, cross various tributaries of the Jed Water including West Shiels Burn, Rough Sike, Pedan's Cleugh and Well Cleugh. The design of the new watercourse crossings would be agreed with SEPA prior to construction and would ensure the continued safe passage of mammals where appropriate. These water crossings would require registration under The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR). The typical watercourse crossing used in upland sites on watercourses of this size is shown on Figure 2.11.

2.66 The access tracks would be designed to allow the efficient drainage of rainwater. The maintenance of the hydrological connectivity and water quality will be maintained through the appropriate design of the SuDS system around the tracks.

2.67 Where tracks cross contours conveyance of existing surface flows would be maintained by diverting flow under the tracks through appropriately sized drainage pipes. Where appropriate, a lateral drainage swale would be cut along the uphill side of the track to intercept the natural runoff. This lateral swale would be drained under the track at regular intervals through correctly sized cross drains. In these cases, the cross drainage pipes would outfall into a drainage swale cut directly downhill at minimum slope until the bottom of the swale reaches ground level. Water would then flow out of the end of the swale onto the hillside, through a soakaway or settlement pond, thereby transferring the natural runoff through the track.

2.68 Where appropriate, a second lateral drainage swale on the other side of the road would catch runoff from the track itself. This swale would also outfall into the drainage swales cut directly downhill from the cross drains. Any material washed off the track surface would be removed through natural filtration or settlement pond before reaching any watercourse.

2.69 In cases where the tracks must run significantly downhill, transverse drains would be constructed, where appropriate, in the surface of the tracks to divert any runoff down the track into the drainage swale.

2.70 Floating tracks will not require drainage swales, their construction will allow for runoff in a distributed manner and continued drainage will be allowed across the track either through constructing the sub-base with coarse granular material, or by constructing sub-surface drains through the peat at regular points along the length of the track.

2.71 The SuDs design will specify measures to adequately control any runoff associated with borrow pit operations and will be agreed prior to commencement of construction.

Water Crossings

2.72 The design of the new watercourse crossings would be agreed with SEPA prior to construction and would be dealt with by registration under the CAR Regulations.

2.73 Guidance on the size, scale, design and construction of the crossings would be taken from the Construction Industry Research and Information Association (CIRIA) Culvert design and operation guide (C689). The crossings would be designed to ensure that they do not disconnect the watercourses at times of low flow and that they have appropriate flood capacity.

2.74 The crossings would be designed to ensure that fish and mammal movement is not restricted.

Borrow Pits

2.75 The daily operation and management of the borrow pits will be the joint responsibility of RES and the Contractor. The general methodology set out below for careful management of the borrow pit will be adhered to in order to minimise potential environmental impact.

2.76 A Borrow Pit Method Statement will be agreed with SEPA and the Council prior to the commencement of construction. Provisions for the control of surface run-off during and post construction (SuDs) and the re-vegetating of working faces post construction will be included.

2.77 It is anticipated that blasting would likely occur 1-3 times per week during the first 6 months of civil works (although this could be as frequent as up to 5 times per week) before tapering off and becoming less frequent.

2.78 Appropriate dust suppression at the borrow pits and any materials storage areas will be provided as required.

2.79 Once operations are sufficiently underway, restoration will take place progressively behind the working area to encourage re-vegetation or replanting with trees where appropriate. This will minimise any impact to the surrounding environment by minimising the working area at any point.

Crane Hardstanding Construction

2.80 During the erection of the turbines, crane hardstanding areas are required at each turbine base. Typically, these consist of one main area adjacent to the turbine position where the main turbine erection crane would be located and other smaller temporary areas would be used during the assembly of the main crane jib. Figure 2.4 shows the hardstanding layout configuration in plan. The hardstanding would be constructed using the same method as the excavated access tracks. This involves the topsoil/subsoil being replaced with structurally designed stone to ground level. The final position of the hardstanding would be decided shortly before the time of construction based on a number of considerations, including; size of crane required, depth of excavation required, hydrological/ecological features in the vicinity, local topography (it is preferable to position the crane hardstanding on the same level, or higher level to the turbine foundation level since this eases lifting operations).

2.81 After construction operations are complete, the temporary areas shown on Figure 2.4 would be reinstated. There would be a need to use cranes from time to time during the operational phase of the proposed wind farm. The '*Good Practice during Wind Farm Construction*'[4] guide recommends that crane hardstanding areas are not covered with peat or topsoil. Therefore, the crane pads would be left uncovered, which would ease maintenance activities and comply with best practice guidance.

Turbine Foundation Construction

2.82 It is anticipated that the foundations for the turbine (Figure 2.3) would be of gravity base design.

2.83 For a typical 176 m machine the foundation would characteristically comprise around 550 m^3 of concrete reinforced by 80 tonnes of steel bars, in a tapered octagonal block of approximately 25 m diameter and from 1.5 – 3.5 m depth, (Figure 2.3). Each turbine base would require about 90 concrete deliveries (based on 6 m^3 of concrete in a truck), which would be delivered from a local batching plant. The final design of the turbine foundations will be subject to ground conditions on site.

2.84 The foundation surface lies approximately 2 m below the normal ground surface and is back filled with soil and reinstated. The foundation plinth would protrude from the ground by approximately 0.5 m. Approximately 2,950m^3 of material would be excavated for each turbine base. Excavated material is placed back around the foundation and any required structural fill with any excess peat layered into the contours of the existing topography and re-seeded, if required.

2.85 The exact quantities of concrete, reinforcement, diameters and depths would vary depending on the actual make of the turbine used. Different turbine foundations may also be considered for different turbine locations depending on the local ground conditions. In the development of the foundation, geo-technical tests would be undertaken to determine the strength of the soil layers beneath the turbines and the soil behaviour under loading over time. This information is used to produce the foundation design into which are also incorporated factors of safety.

2.86 The code of practice for concrete design[5], gives specifications for the required resistance of concrete to sulphate attack. This ensures that when constructing in areas of acidic groundwater, the concrete mix is designed to withstand sulphate attack. It is therefore likely that the rate of alkaline leaching would be low and would not be expected to have significant effect on the local soil or groundwater conditions. The concrete used would be specified for Class 2 sulphate conditions[6], as this is appropriate for mildly acidic groundwater.

Wind Turbine Erection

2.87 Wind turbine towers, nacelles and turbine blades would be transported to the site as abnormal loads. The tower sections and other turbine components would be stored at each turbine hardstanding until lifted into position.

[4] http://www.snh.gov.uk/planning-and-development/renewable-energy/onshore-wind/good-practice-during-windfarm-const/

[5] BS EN206:1: 2000 Concrete Part 1: Specification, performance, production and conformity and BS 8500 – 1: 2006 Concrete – Complementary British Standard to BS EN 206 – 1 Part 1: Method of specifying and guidance for the specifier

[6] BS EN206:1: 2000 Concrete Part 1: Specification, performance, production and conformity and BS 8500 – 1: 2006 Concrete – Complementary British Standard to BS EN 206 – 1 Part 1: Method of specifying and guidance for the specifier

2.88 The components would be lifted by adequately sized cranes and constructed in a modular fashion. Assembly, in general, requires only fixing of bolts, torqueing of nuts and electrical and hydraulic connections.

2.89 Following erection of the turbines, there is a period of commissioning works prior to the commencement of generation.

Met Mast Erection

2.90 The location of the temporary met masts is shown on Figure 2.1. The met masts are a steel lattice structure that is erected on a concrete foundation and supported by guy wires as shown in Figure 2.5. The concrete foundation is constructed in a similar manner to the turbine foundation, but on a far smaller scale.

Cabling, Substation and Control Building

2.91 The location of the control building compound is shown in Figure 2.1; layout and elevation drawings are presented in Figure 2.7 and 2.8. All cabling between the turbines and the control building on the site would be laid in underground trenches. Where excavated, the top layer of soil would be removed and used to reinstate the excavation following the installation of the cables. Where cables are being laid in areas of peat, the catotelmic and acrotelmic layers would be separated and replaced appropriately. Cabling would generally run parallel to the adjacent site tracks. Figure 2.9 presents a typical underground cable cross-section.

Re-Instatement

2.92 A programme of reinstatement would be implemented upon completion of construction. This would relate to the construction compound, crane hardstandings, cable trenches and track shoulders where appropriate. After construction operations are complete the temporary hardstanding areas associated with the crane hardstanding would be reinstated. There would be a need to use cranes from time to time during the operational phase of the proposed wind farm, so the main crane hardstanding would be left uncovered to enable maintenance activities.

2.93 It is essential that the access track width is retained during the operation of the proposed wind farm to allow occasional crane access if required, hence no works to reduce the track width, post turbine erection, are proposed.

2.94 Cable trenches would be similarly reinstated. Where practicable, vegetation over the width of the cable trenches would be lifted as turves and replaced after trenching operations to reduce disturbance.

Construction Programme

2.95 It is anticipated that the construction would take 18 - 24 months. The following indicative construction programme shows the anticipated scheduling of construction activities.

Indicative Construction Programme

	Month																					
Activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Forestry Works																						
Site Set-Up																						
Tracks & Hardstandings																						
Foundation Construction																						
Met Mast																						
Turbine Erection																						
Cable Installation																						
Substation																						
Reinstatement																						
Site Demobilisation																						
Site Staff																						
Miscellaneous Deliveries																						

Hours of Work

2.96 It is envisaged that the construction hours of work will be Monday to Saturday 07.00 to 19.00. There will be no working on a Sunday.

Construction Traffic and Plant

2.97 In addition to staff transport movements, construction traffic would consist of heavy goods vehicles (HGVs) and abnormal load deliveries.

2.98 As outlined in **Chapter 11: Access, Traffic and Transport**, taking into account forecast vehicle numbers from construction activities (12,986 trips) and forecast staff vehicle numbers (13,678 private car, mini bus or 4x4 vehicle trips). This equates to an average of circa 73 journeys per day based on a 6 day week assuming a 22 month construction period. Out of the forecast 73 return trips to and from the site per day, around 40 of these would generally be normal sized loads (car, mini bus, land rover or van).

2.99 Approximately 154 abnormal load deliveries would be generated for the turbine erection stage which would typically result in three deliveries per day. However, the actual number would be determined in the development of the Traffic Management Plan (TMP) which would be written in consultation with the Council, post-consent.

2.100 Turbine components would be supervised during their transportation and would use appropriate steerable hydraulic and modular trailer equipment where this is required. Axle loads would be appropriate to the roads and access tracks to be used. The transportation of turbine components would be conducted in agreement with the relevant roads authorities and local police. RES would notify the police authorities of the movement of abnormal length (e.g. turbine blade delivery) and abnormal weight (e.g. crane) vehicles and obtain authorisation prior to any abnormal vehicle movements.

2.101 Police escorts would be used where necessary and the appropriate permits obtained for the transport of abnormal loads to ensure that other traffic is aware of the presence of large, slow

moving vehicles. Where long vehicles would have to use the wrong side of the carriageway, or need to swing into the path of oncoming vehicles, a lead warning vehicle would be used and escort vehicles would drive ahead and stop oncoming traffic. Vehicles would also be marked as long/abnormal loads. For return journeys, the extendible low loaders used for wind turbine delivery would be retracted to ensure they leave the site with a trailer length of no more than 16 m.

Construction and Decommissioning Management

2.102 A Construction Method Statement (CMS) will be agreed prior to construction commencing. This will be agreed with the Council and relevant statutory consultees. The CMS will, as a minimum, include details of:

- schedule of mitigation;
- construction methodologies;
- pollution prevention measures;
- public liaison provision;
- control of contamination/pollution prevention;
- drainage management;
- water quality monitoring;
- management of construction traffic;
- control of noise and vibration; and
- control of dust and other emissions to air.

2.103 In addition to the CMS, details of an archaeological clerk of works/watching brief and details of ecology and protection of biodiversity will be agreed prior to the commencement of construction as required.

Operation, Management and Maintenance

2.104 Wind turbines and wind farms are designed to operate largely unattended. Each turbine at the proposed wind farm would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. Sometimes the turbines would re-start automatically (if the shut-down had been for high winds, or if the grid voltage had fluctuated out of range), but other shut-downs (e.g. generator over temperature) would require investigation and manual restart.

2.105 The proposed wind farm itself would have a sophisticated overall Supervisory Control and Data Acquisition system (SCADA) that would continually interrogate each of the turbines and the high voltage (HV) connection. If a fault were to develop which required an operator to intervene then the SCADA system would make contact with duty staff via a mobile messaging system. The supervisory control system can be interrogated remotely. The SCADA system would have a feature to allow a remote operator to shut down one or all of the wind turbines.

2.106 An operator would be employed to monitor the turbines, largely through remote routine interrogation of the SCADA system. The operator would also look after the day-to-day logistical supervision of the proposed wind farm and would be on-site intermittently.

2.107 Routine maintenance of the turbines would be undertaken approximately twice yearly. This would not involve any large vehicles or machinery.

2.108 If a fault should occur, the operator would diagnose the cause. If the repair warranted the proposed wind farm being disconnected from the grid then the operator would make contact with ScottishPower. However, this is a highly unlikely occurrence as most fault repairs can be rectified without reference to the network utility. If the fault was in the electrical system then the faulty part or the entirety of the proposed wind farm would be automatically disconnected.

2.109 A sign would be placed on the proposed wind farm giving details of emergency contacts. This information would also be made available to the local police station and ScottishPower.

Decommissioning

2.110 The expected operational life of the proposed wind farm is 30 years from the date of commissioning. Towards the end of this period a decision would be made as whether to refurbish, remove, or replace the turbines. If refurbishment or replacement were to be chosen, relevant planning applications would be made. If a decision was taken to decommission the proposed wind farm, this would require the removal of all the turbine components, transformers, the substation and associated buildings. Cables would be cut away below ground level and sealed. Some of the access tracks could be left on site to ensure the continued benefit of improved site access for the landowner, or they could be reinstated. It is not currently usual to remove the concrete foundations from the site as this would cause more damage to the environment. The exposed concrete plinth would be removed to a depth of 1 m below the ground surface and the entire foundation would be graded over with soil and would be replanted if appropriate. This follows SNH Report No. 591 Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms and advice given in former Planning Advice Note: PAN 45 (Revised 2002) (which advised in paragraph 33 that "*Concrete foundations may be best left in place and covered over*") and as reiterated in the Scottish Government's web-based renewable advice which has replaced PAN 45. Such advice is similarly contained in the '*Good Practice During Wind Farm Construction*'[7]. This approach also follows advice given in the SNH Report No. 591, which states that "*noise, ground disturbance and cost (excavation /breaking /processing /transporting) along with associated carbon emissions, may create a larger environmental impact than leaving such concrete in situ*."

2.111 If the proposed wind farm obtains planning permission it is expected that an agreement would be put in place to allow for the establishment of a decommissioning bond or fund to be set aside for when the proposed wind farm is decommissioned after its operational life. Prior to decommissioning of the proposed wind farm, a method statement would be prepared and agreed with the Council.

2.112 Unlike most other forms of electricity production, wind farms are able to be decommissioned with comparative ease. Plant can readily be dismantled and removed from the site. Site restoration is relatively straight forward and after restoration there would be no significant visible trace of the wind farm's prior existence and no legacy of pollution.

[7] SNH, SEPA, Scottish Renewables, HES & FCS (2015) Good Practice during Windfarm Construction

Construction and Decommissioning Management

2.113 This section details the environmental management controls that would be implemented by RES and its contractors during the construction of the proposed wind farm to ensure that potential significant adverse effects on the environment are, wherever practicable, prevented, reduced, and where possible offset.

2.114 It would be a requirement that the appointed contractor complies with the CMS that will be produced and agreed with the Council and relevant statutory consultees prior to construction commencing.

Site Induction

2.115 The principal contractor would ensure that all employees, sub-contractors, suppliers and other visitors to the site are made aware of the content of the CMS and its applicability to them. Accordingly, environmental specific induction training would be prepared and presented to all categories of personnel working on and visiting the site.

2.116 As a minimum, the following information would be provided to all inductees:

- Identification of specific environmental risks associated with the work to be undertaken on site by the inductee;
- Summary of the main environmental aspects of concern at the site as identified in the CMS; and
- Environmental Incident and Emergency Response Procedures (including specific Environmental Communication Plan requirements).

2.117 A conveniently sized copy of an Environmental Risk Map or equivalent would be provided to all inductees showing all of the sensitive areas, exclusion zones and designated washout areas. The map would be updated and reissued as required. Any updates to the map would be communicated to all inductees through a tool box talk given by specialist environmental personnel. Regular tool box talks would be provided during construction to provide ongoing reinforcement and awareness of environmental issues.

Pollution Prevention, Water Quality Monitoring and Emergency Response Plan

2.118 The CMS will detail a number of measures to deal with pollution prevention, including RES' 'Environmental Requirements of Contractors', 'Water Quality Monitoring Procedure' and 'Procedure in the Event of a Contaminant Spill'.

2.119 SEPA has produced Pollution Preventions Guidelines (PPG) 5 for Works in, near or Liable to Affect Watercourses and PPG 6 for Working at Construction and Demolition Sites for civil engineering contractors. The proposed wind farm would be constructed using best practice in conformance with these requirements.

2.120 Contractors and sub-contractors would be required to follow Pollution Prevention Guidance published by SEPA, and the following pollution control measures will be incorporated into the CMS:

- equipment shall be provided to contain and clean up any spills in order to minimise the risk of pollutants entering watercourses, waterbodies or flush areas;
- trenching or excavation activities in open land shall be restricted during periods of intense rainfall and temporary landscaping shall be provided as required to reduce the risk of oil or chemical spills to the natural drainage system;
- sulphate-resistant concrete[8] shall be used for the construction of turbine bases to withstand sulphate attack and the resultant alkaline leaching into groundwater;
- all refuelling will be undertaken at designated refuelling points. There will be no refuelling within catchments contributing to water supply points;
- equipment, materials and chemicals shall not be stored within or near a watercourse. At storage sites, fuels, lubricants and chemicals shall be contained within an area bunded to 110%. All filling points shall be within the bund or have secondary containment. Associated pipework shall be located above ground and protected from accidental damage;
- concrete shall be batched on site and any on-site wash-out shall occur in allocated bunded areas;
- drip trays shall be placed under machinery left standing for prolonged periods;
- all solid and liquid waste materials shall be properly disposed of at appropriate off site facilities;
- routine maintenance of vehicles shall be undertaken outwith the site;
- there shall be no unapproved discharge of foul or contaminated drainage from the proposed wind farm either to groundwater or any surface waters, whether direct or via soakaway;
- sanitary facilities shall be provided and methods of disposal of all waste shall be in accordance with SEPA guidance;
- a programme of surface water quality monitoring would be undertaken during the construction phase to provide assurances as to the absence of water quality impacts; and
- RES has a policy that no wind turbines, auxiliary and electrical equipment would contain askarels or Polychlorinated biphenyls (PCBs).

2.121 In the unlikely event of an environmental pollution incident, there will be an emergency response procedure to address any accidental pollution incident. For example, this requires the use of spill kits to contain the material and procedures to ensure SEPA is notified immediately.

General Drainage Design

2.122 As set out in **Chapter 8: Geology, Hydrology and Hydrogeology**, buffers to watercourses have taken account of, and the proposed wind farm's infrastructure designed in accordance with, best practice guidance. Where localised encroachment into buffers has been unavoidable, specific mitigation measures will be implemented.

2.123 The potential impact of preferential routing of drainage and associated erosion and sediment wash-off within the sub-catchments draining the site would be mitigated through measures to be incorporated into the SuDS Design. Standard mitigation measures to address these issues are included in Technical Appendix 2.1

[8] BS EN206:1 : 2000 Concrete Part 1: Specification, performance, production and conformity and BS 8500 – 1 : 2006 Concrete – Complementary British Standard to BS EN 206 – 1 Part 1: Method of specifying and guidance for the specifier

Runoff and Sediment Control Measures

2.124 The following measures would be used to mitigate any potential impacts on the water quality of the sub-catchments through peat erosion, stream acidification and metals leaching during construction. These shall be incorporated into the CMS:

- appropriate sediment control measures (silt fences, attenuation ponds, etc.) would be used in the vicinity of watercourses, springs or drains where natural features (e.g. hollows) do not provide adequate protection;
- sediment control measures (e.g. checkdams, silt fences etc.) would be employed within the existing artificial drainage network during construction. These would be regularly checked and maintained during construction and for an appropriate period following completion. Consideration would be given to the permanent infilling of any major drains;
- watercourses would be monitored throughout the construction period by the ECoW to identify any enhanced scouring of the catchment surface. If sediment is excessively mobilised through the minor channels network these would be mitigated by temporary sediment control measures (e.g. geotextiles /straw/bales/brash);
- the extent of all excavations would be kept to a minimum and during construction activities and surface water flows shall be captured through a series of cut-off drains to prevent water entering excavations or eroding exposed surfaces. If dewatering of excavations is required, pumped discharges would be passed through attenuation ponds and silt fences to capture sediments before release to the surrounding land;
- where there is a permanent relocation of peat, the ground would be reinstated with vegetation as soon as practicable;
- where practicable, vegetation over the width of the cable trenches would be lifted as turfs and replaced after trenching operations to reduce disturbance;
- the movement of construction traffic would be controlled to minimise soil compaction and disturbance. Vehicle movements outside the defined tracks and hardstandings would be avoided;
- trenching or excavation activities in open land would be restricted during periods of intense rainfall and temporary landscaping would be provided, as required, to reduce the risk of sediment transport to the natural drainage system;
- construction of the track and cable crossings would take place only during dry weather conditions if reasonably practicable. If necessary, upstream of the crossing would be dammed and water pumped around the construction zone. The construction period would be minimised as far as practicable; and
- temporary peat stockpiles would be stored on a geotextile membrane and covered. Stored peat would be placed accordingly to minimise the potential for erosion. Peat would be stored in smaller stockpiles distributed in flat areas away from watercourses.

Traffic Management Plan

2.125 As detailed in **Chapter 11: Access, Traffic and Transport**, a Traffic Management Plan (TMP) would be developed to ensure road safety for all users during transit of development loads. The TMP would outline measures for managing the convoy and would set out procedures for liaising with the emergency services to ensure that police, fire and ambulance vehicles are not impeded by the loads. The TMP would be developed in consultation with the Council, the police, highways authorities and the local community and agreed before deliveries to the proposed wind farm commence.

Species Protection Plan

2.126 An Species Protection Plan (SPP) would be prepared and implemented through the CMS to set out the measures required to protect ecology at the proposed wind farm during the construction phase and will include pre-construction surveys and management measures during construction and decommissioning phases. The detail of the SPP would be prepared and agreed with SNH and the Council prior to commencement of construction.

2.127 An ECoW would be present during the construction period to ensure that ecological impacts are appropriately mitigated in accordance with the EMP.

Potential Construction and Decommissioning Phase Environmental Impacts

2.128 Construction is predominantly in two phases, forestry felling followed by civil engineering operations and would be phased over an approximate 18-24 month period. The construction phase would begin with forestry felling activities. Construction of tracks and foundations would be progressive, minimising the number of simultaneously active locations and ensuring that traffic density is kept low. Erection would span approximately 9 weeks toward the end of the work programme.

2.129 A programme of site reinstatement would be put in place to minimise the visual and ecological impacts on the land.

2.130 The proposed wind farm would operate for 30 years and would require only limited maintenance and inspection visits.

2.131 A restoration plan would be prepared and agreed with the relevant authorities towards the end of the proposed wind farm's operational life.

HIGHLEE HILL WIND FARM

FIGURE 2.1

INFRASTRUCTURE LAYOUT

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

KEY

- WIND TURBINE LOCATION
- SITE BOUNDARY
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- TEMPORARY SITE TRACKS & TURNING HEADS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMANENT HARDSTANDING AREA
- POWER PERFORMANCE MASTS
- BORROW PIT SEARCH AREA
- SITE ENTRANCE LOCATION

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

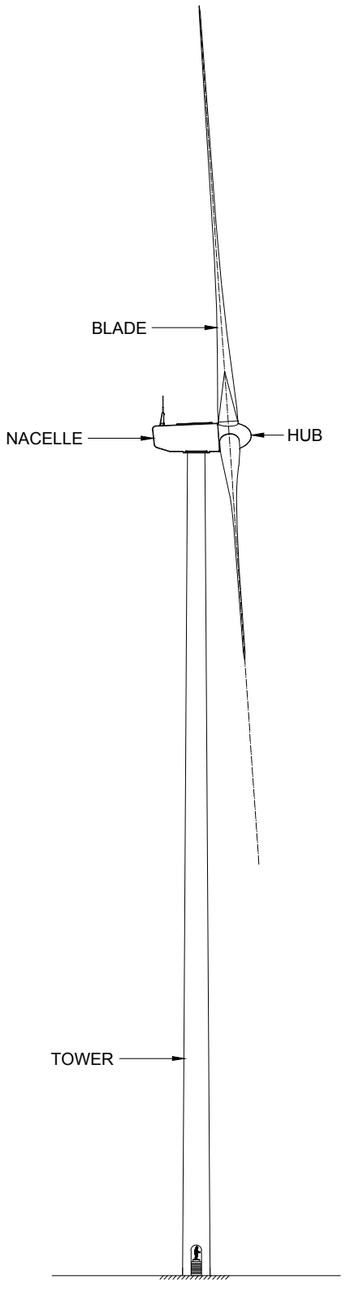
DRAWING NUMBER

02836D1001-03

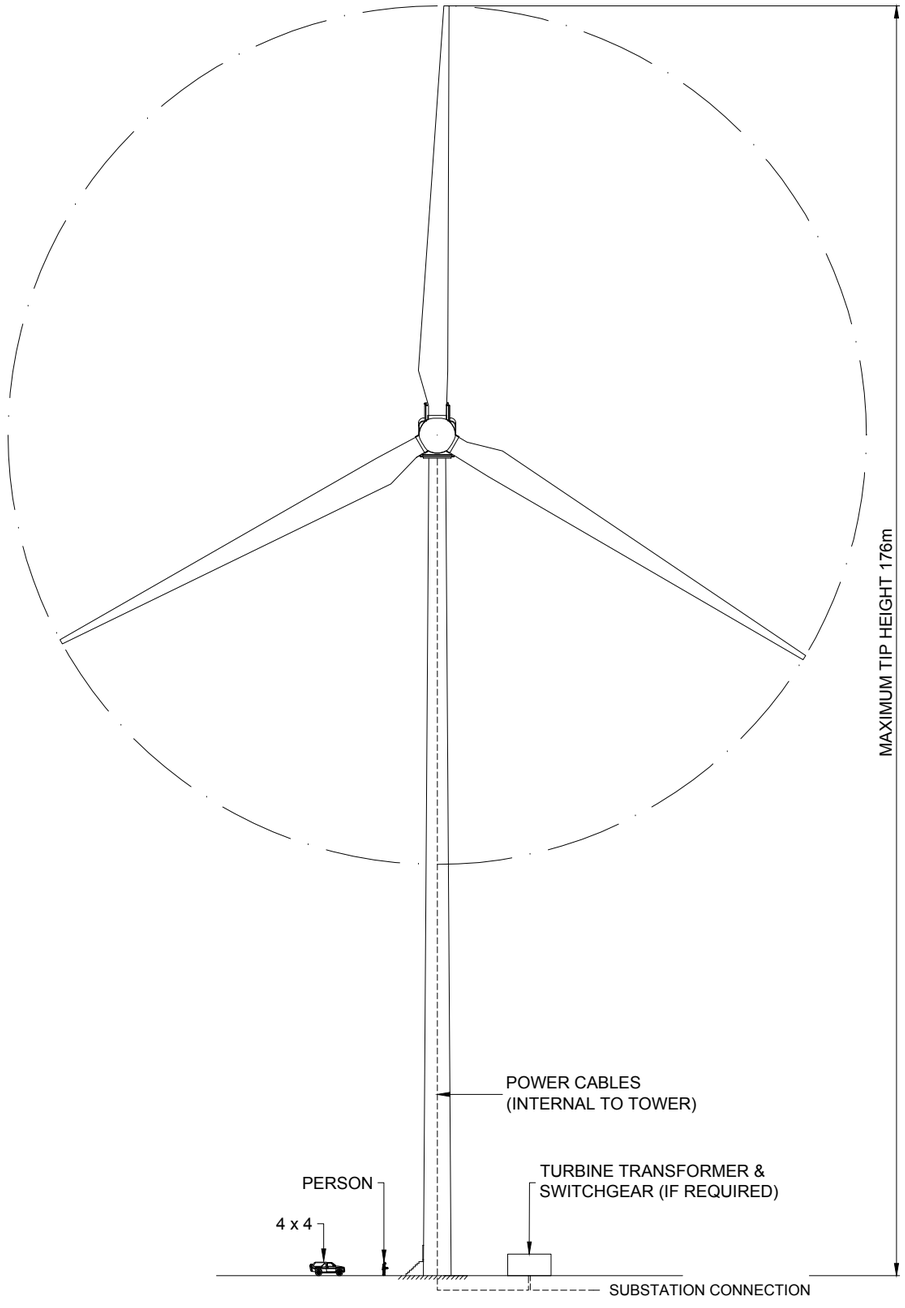
SCALE - 1:20,000

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



SIDE VIEW



FRONT VIEW

PHOTOGRAPH OF TYPICAL TURBINE

HIGHLEE HILL
WIND FARM

FIGURE 2.2

ELEVATIONS OF A
TYPICAL WIND TURBINE

LAYOUT DWG N/A

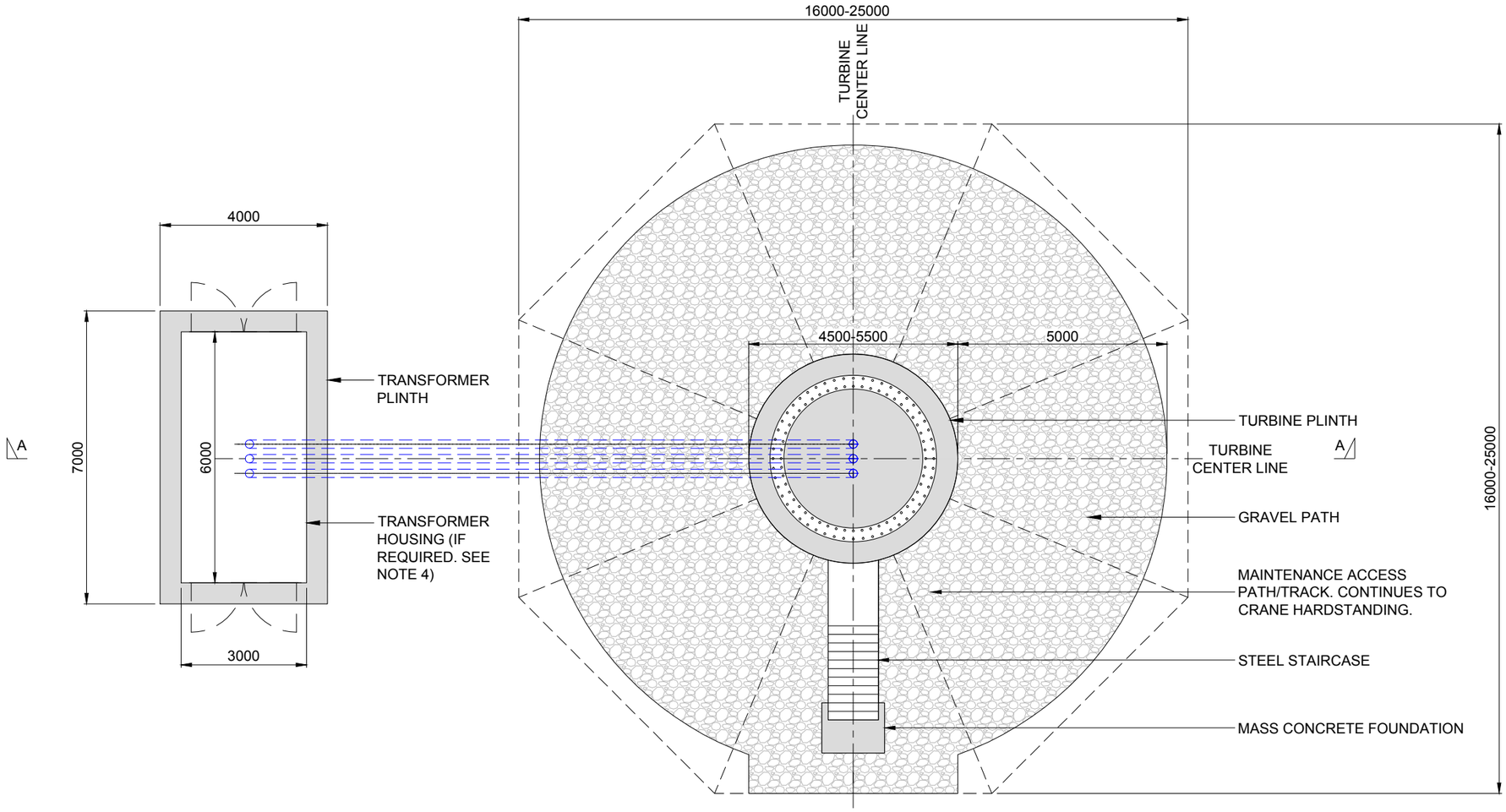
T-LAYOUT NO. N/A

DRAWING NUMBER
02836D2905-01

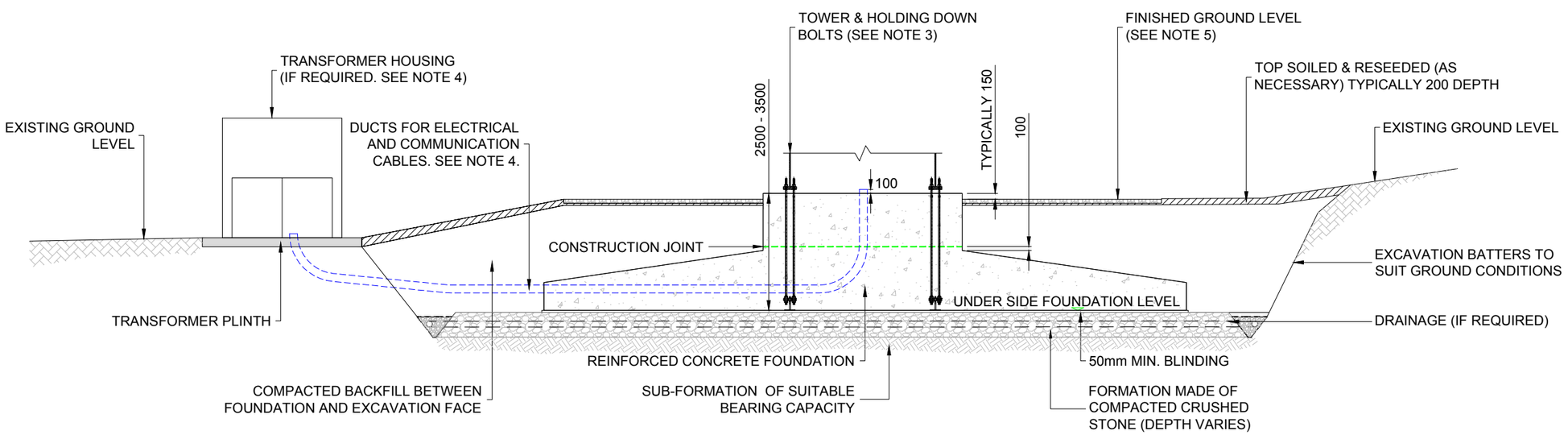
SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



PLAN



SECTION A-A

HIGHLEE HILL WIND FARM

FIGURE 2.3

WIND TURBINE FOUNDATION

NOTES

1. DIMENSIONS AND DETAILS ARE INDICATIVE ONLY AND MAY VARY DUE TO SPECIFIC TURBINE OR GROUND CONDITIONS.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED
3. THE HOLDING DOWN BOLT ARRANGEMENT SHOWN ON THIS DRAWING IS TYPICAL. HOWEVER ALTERNATIVE CAST IN ARRANGEMENTS ARE AVAILABLE AND MAY BE SUBSTITUTED DEPENDING ON ACTUAL TURBINE SELECTION.
4. EXTERNAL TRANSFORMER NOT REQUIRED FOR ALL TURBINES AND NEED FOR TRANSFORMER HOUSING WILL DEPEND ON THE TURBINE SELECTED DURING DETAILED DESIGN.
5. MATERIALS ARISING FROM EXCAVATIONS TO BE SEGREGATED AND PLACED IN AGREED LOCATIONS ADJACENT TO THE WORKING AREA FOR RE-USE. REINSTATEMENT AND /OR PEAT MANAGEMENT PLANS WILL BE DEVELOPED DURING THE DETAILED DESIGN OF SITE INFRASTRUCTURE, IN LINE WITH CURRENT BEST PRACTICE.

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

DRAWING NUMBER

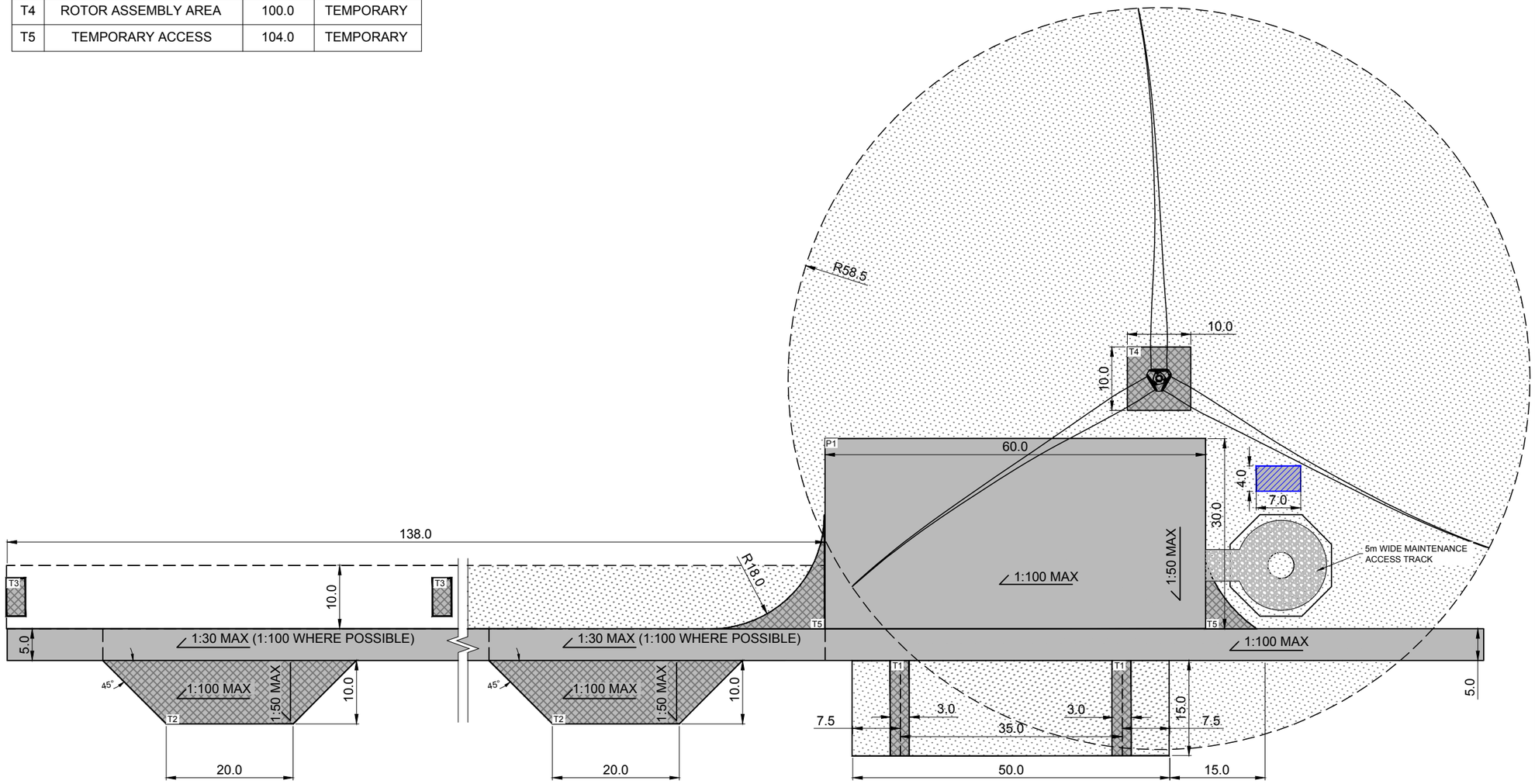
02836D2302-01

SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

REF	DESCRIPTION	AREA (m²)	MAINTENANCE
P1	MAIN HARDSTANDING	1800.0	PERMANENT
T1	BLADE LAYDOWN SUPPORTS	90.0	TEMPORARY
T2	ASSIST CRANE AREA	600.0	TEMPORARY
T3	BOOM SUPPORT	36.0	TEMPORARY
T4	ROTOR ASSEMBLY AREA	100.0	TEMPORARY
T5	TEMPORARY ACCESS	104.0	TEMPORARY



HIGHLEE HILL WIND FARM

FIGURE 2.4

CRANE HARDSTANDING GENERAL ARRANGEMENT (HH>100m)

KEY

- PERMANENT WORKS
- TEMPORARY WORKS
- EXTERNAL TRANSFORMER AND SWITCHGEAR ENCLOSURE
- AREA TO BE FREE FROM TOPOGRAPHICAL AND ECOLOGICAL CONSTRAINTS
- MAINTENANCE ACCESS TRACK

NOTES

1. ALL DIMENSIONS IN METRES.
2. HARDSTANDING ARRANGEMENT SUBJECT TO CHANGE DEPENDENT ON SPECIFIC WIND TURBINE MODEL SELECTED FOR CONSTRUCTION.
3. ALL HARDSTANDINGS TO BE CONSTRUCTED ON SUITABLE FOUNDATION MATERIAL.
4. ALL HARDSTANDINGS TO BE FINISHED WITH CRUSHED ROCK, FORMING A FREE DRAINING SURFACE.
5. TRACK ADJACENT TO CRANE HARDSTANDING TO BE DESIGNED TO ACCEPT CRANE OUTRIGGER LOADING.
6. THE PRELIMINARY CRANE HARDSTANDING LAYOUT HAS BEEN DEVELOPED TO ACCOMMODATE EITHER A SINGLE BLADE LIFT OR FULL ROTOR LIFT.

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

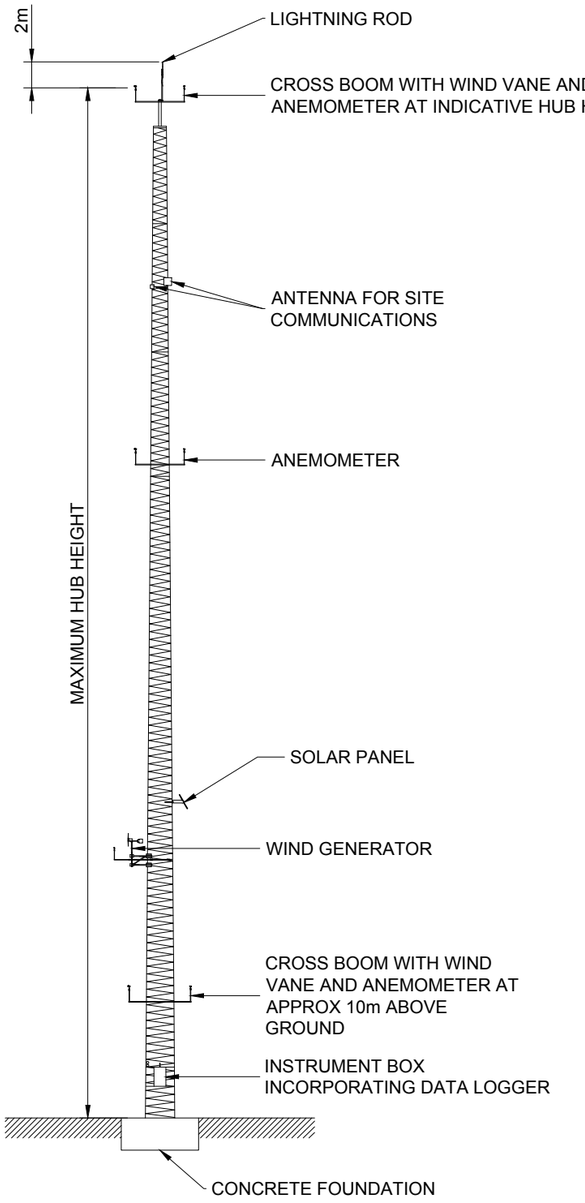
DRAWING NUMBER

02836D2303-02

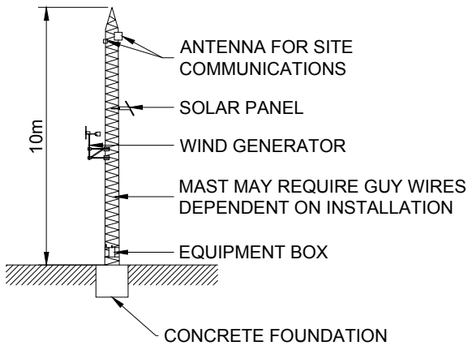
SCALE - 1:750

ENVIRONMENTAL STATEMENT 2016

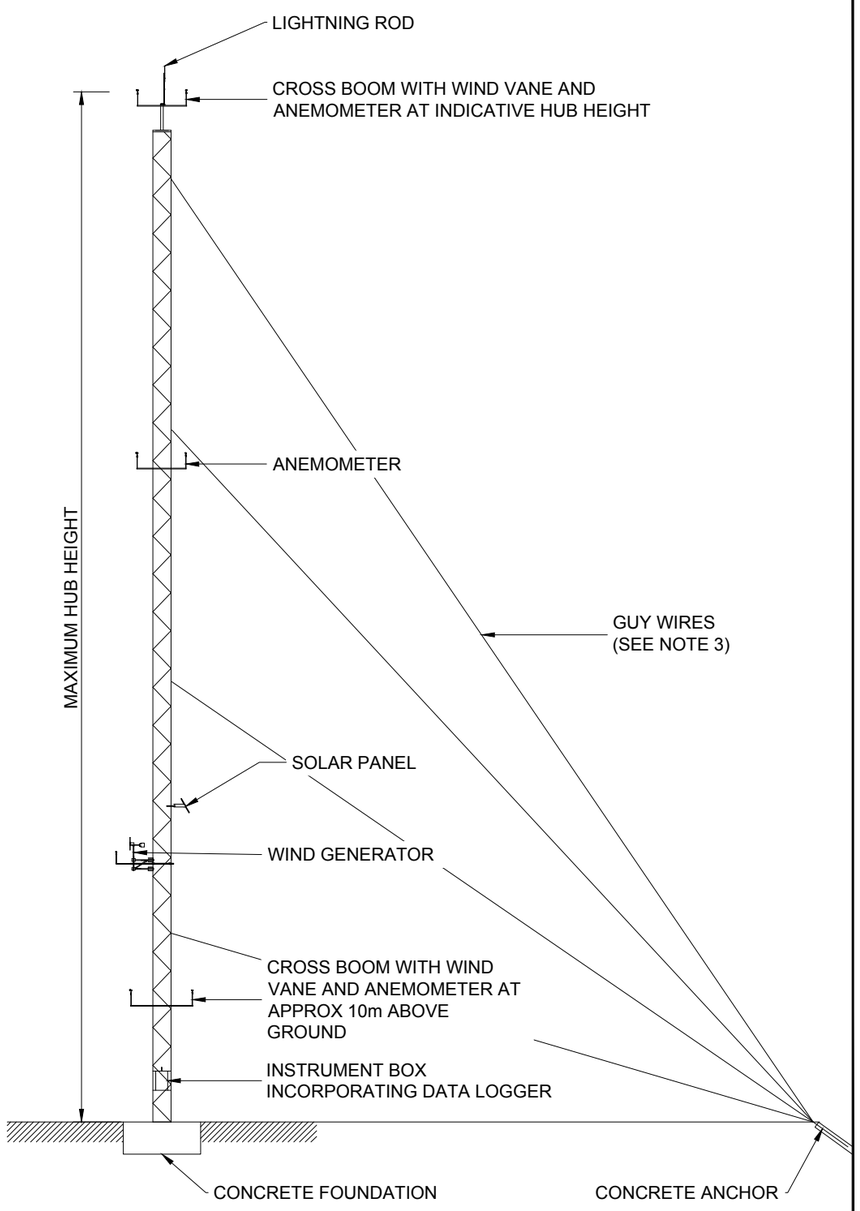
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



PERMANENT METEOROLOGICAL MAST



TELECOMMUNICATIONS MAST



TEMPORARY AND
SITE CALIBRATION METEOROLOGICAL MAST

HIGHLEE HILL WIND FARM

FIGURE 2.5

MASTS

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL INSTRUMENTATION SHOWN TO PROVIDE INDICATION OF TYPES AND NUMBERS REQUIRED. ACTUAL REQUIREMENTS TO BE CONFIRMED DURING DEVELOPMENT OF DETAILED DESIGN.
3. NUMBER AND LOCATION OF GUY WIRES ARE INDICATIVE ONLY, ALL REQUIRED WIRES NOT SHOWN FOR CLARITY.
4. ALL GUY WIRES TO EXTEND TO AND BE ANCHORED AT GROUND LEVEL.

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

DRAWING NUMBER
02836D2214-01

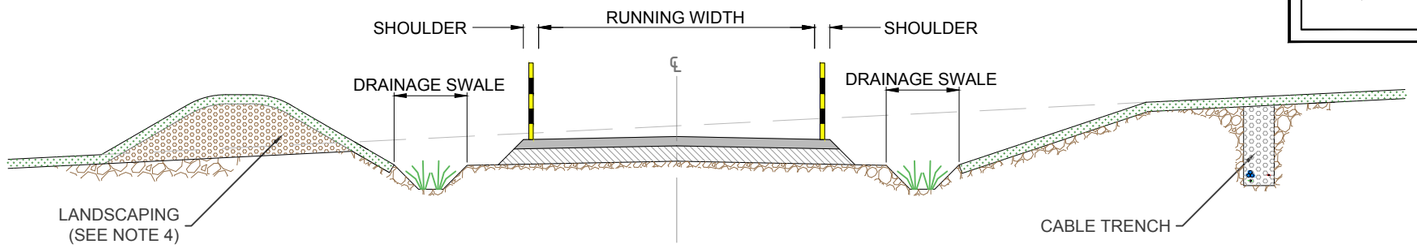
SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT
2016

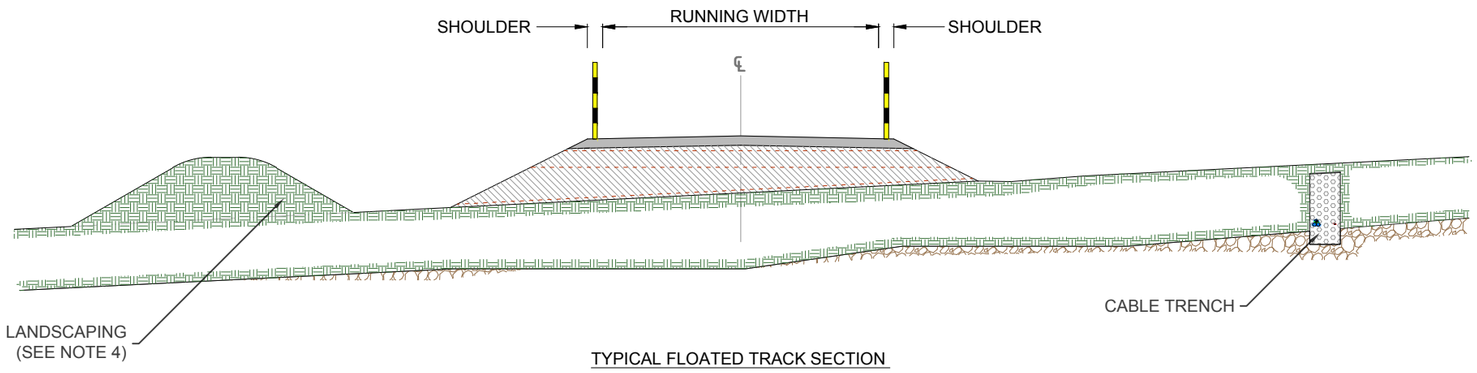
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

KEY

- RUNNING SURFACE
- BASE/CAPPING LAYER
- TOPSOIL
- SUBGRADE
- PEAT LAYER/SOFT GROUND
- GEOGRID
- EXISTING GROUND LEVEL
- SNOW POLES (WHERE REQUIRED)



TYPICAL TRACK SECTION



TYPICAL FLOATED TRACK SECTION

HIGHLEE HILL WIND FARM

FIGURE 2.6

ACCESS TRACK TYPICAL DETAILS

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. TRACK WIDTH TO INCREASE ON BENDS AND PASSING PLACES.
3. ALL EMBANKMENT SLOPES TO BE PROVIDED AT A STABLE ANGLE BASED ON THE PROPERTIES OF THE MATERIAL ENCOUNTERED ON SITE.
4. EXCAVATED MATERIAL WILL BE PLACED IN AGREED LOCATIONS. REINSTATEMENT AND/OR SPOIL MANAGEMENT PLANS WILL BE DEVELOPED IN LINE WITH CURRENT BEST PRACTICE.
5. TRACK CONSTRUCTION TYPE TO BE DETERMINED DURING DETAILED DESIGN. LAYOUT OF DRAINAGE, CABLE TRENCHES AND STORAGE BUNDS MAY VARY.
6. RUNNING SURFACE AND BASE/CAPPING LAYER TO BE FORMED FROM SUITABLE MATERIALS COMPACTED IN LAYERS.
7. GEOSYNTHETIC REINFORCEMENT OR SOIL STABILISATION MAY BE USED TO REDUCE THE DEPTH OF TRACK CONSTRUCTION. REQUIREMENT TO BE DETERMINED DURING DETAILED DESIGN.

LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

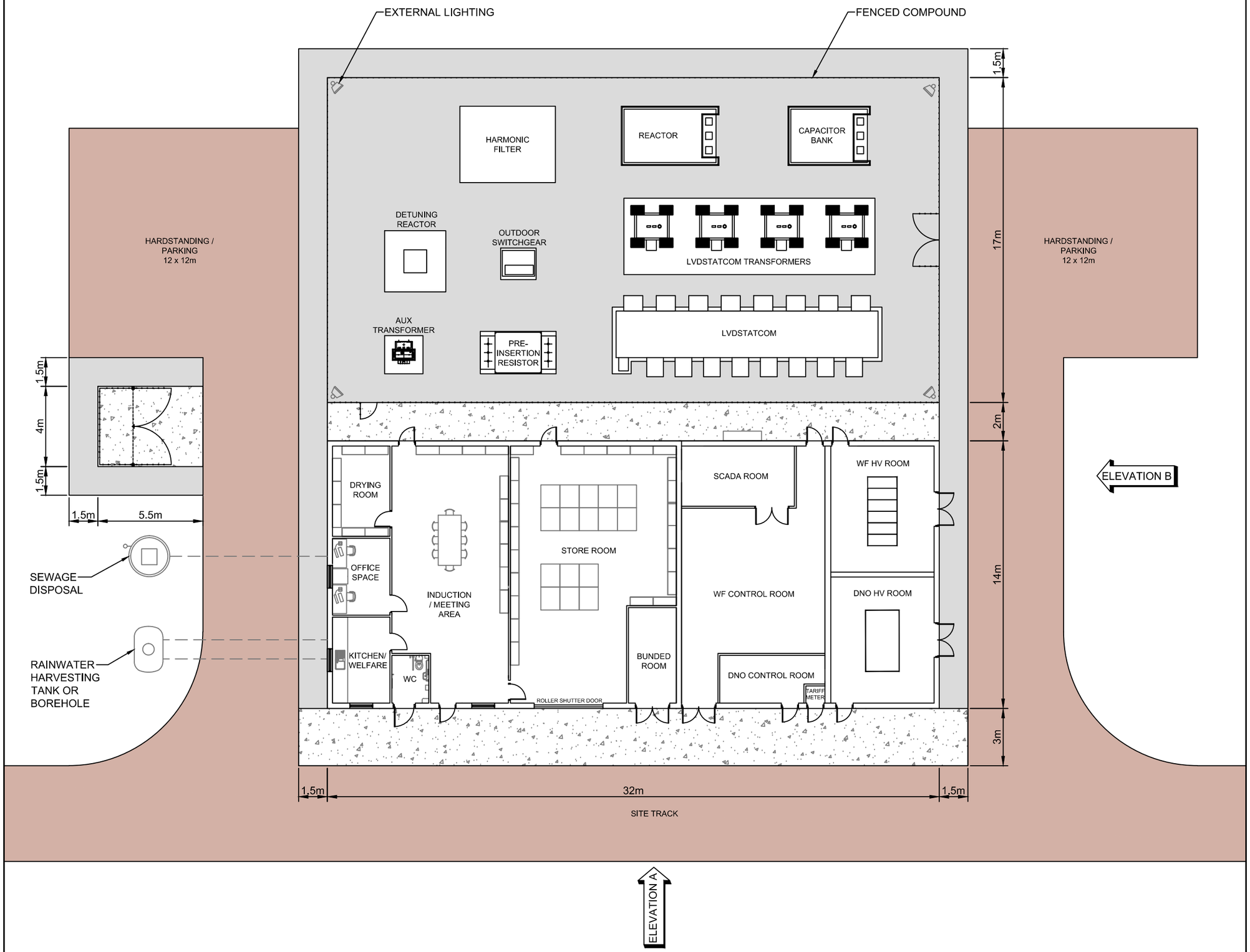
DRAWING NUMBER

02836D2215-01

SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIGURE 2.7

SUBSTATION BUILDING AND COMPOUND LAYOUT PLAN

NOTES

1. ROOM DESCRIPTIONS AND POSITIONS OF INTERNAL WALLS, DOORS, EXTERNAL EQUIPMENT, LIGHTS AND GATES ARE INDICATIVE ONLY AND ARE SUBJECT TO THE REQUIREMENTS OF THE TURBINE SUPPLIER AND ELECTRICITY DISTRIBUTION NETWORK OPERATOR.
2. WORST CASE ELECTRICAL EQUIPMENT REQUIREMENTS SHOWN. ACTUAL COMPOUND DIMENSIONS MAY BE LESS THAN THOSE SHOWN.
3. SEWERAGE DISPOSAL WILL BE IN ACCORDANCE WITH BUILDING REGULATIONS AND RELEVANT AGENCY REQUIREMENTS.
4. GRAVEL AND CONCRETE SURROUNDING SUBSTATION MAY BE REPLACED WITH ASPHALT IF REQUIRED FOR ELECTRICAL EARTHING REASONS.

KEY

- TRACKS AND HARDSTANDINGS
- GRAVEL PATH (SEE NOTE 4)
- CONCRETE PLATFORM (SEE NOTE 4)

SHEET 1 OF 2

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

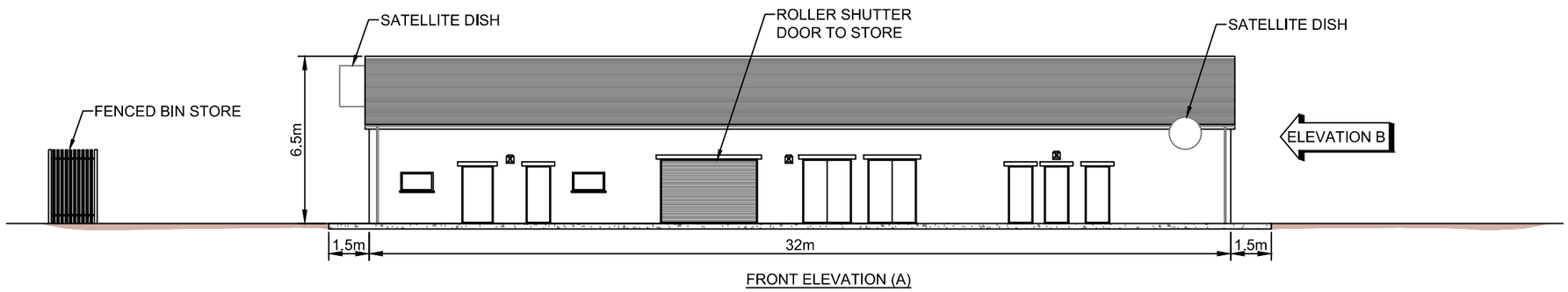
DRAWING NUMBER

02836D2216-01

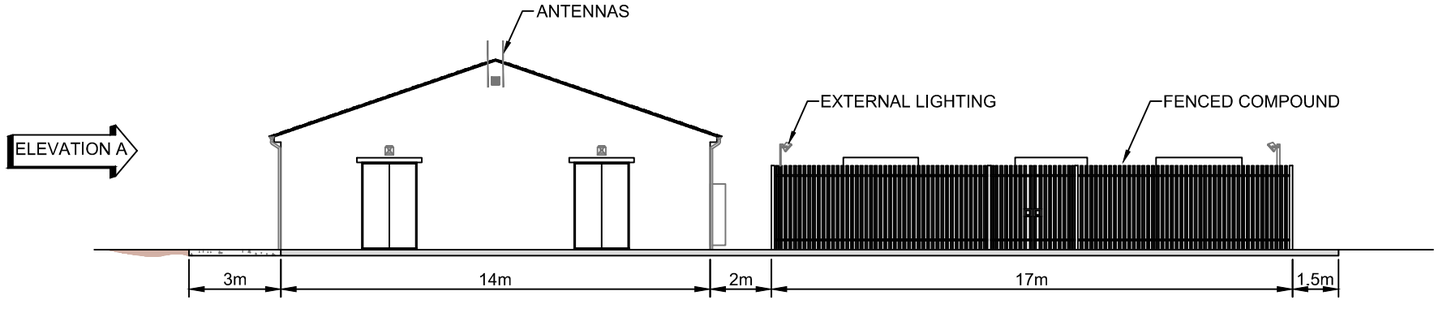
SCALE - 1:200

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



FRONT ELEVATION (A)



SIDE ELEVATION (B)

HIGHLEE HILL WIND FARM

FIGURE 2.8

SUBSTATION BUILDING AND COMPOUND FRONT & SIDE ELEVATIONS

NOTES

1. POSITIONS OF DOORS, EXTERNAL EQUIPMENT, LIGHTS AND GATES ARE INDICATIVE ONLY AND ARE SUBJECT TO THE REQUIREMENTS OF THE TURBINE SUPPLIER AND ELECTRICITY DISTRIBUTION NETWORK OPERATOR.
2. WORST CASE ELECTRICAL EQUIPMENT REQUIREMENTS SHOWN. ACTUAL COMPOUND DIMENSIONS MAY BE LESS THAN THOSE SHOWN.
3. GRAVEL AND CONCRETE SURROUNDING SUBSTATION MAY BE REPLACED WITH ASPHALT IF REQUIRED FOR ELECTRICAL EARTHING REASONS.

KEY

- TRACKS AND HARDSTANDINGS
- GRAVEL PATH (SEE NOTE 3)
- CONCRETE PLATFORM (SEE NOTE 3)
- PIR LIGHTING

SHEET 2 OF 2

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

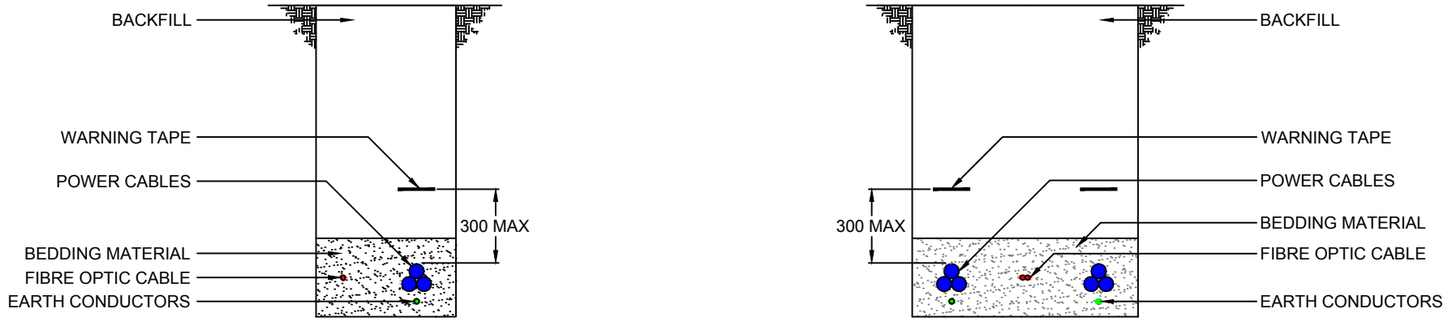
DRAWING NUMBER

02836D2216-01

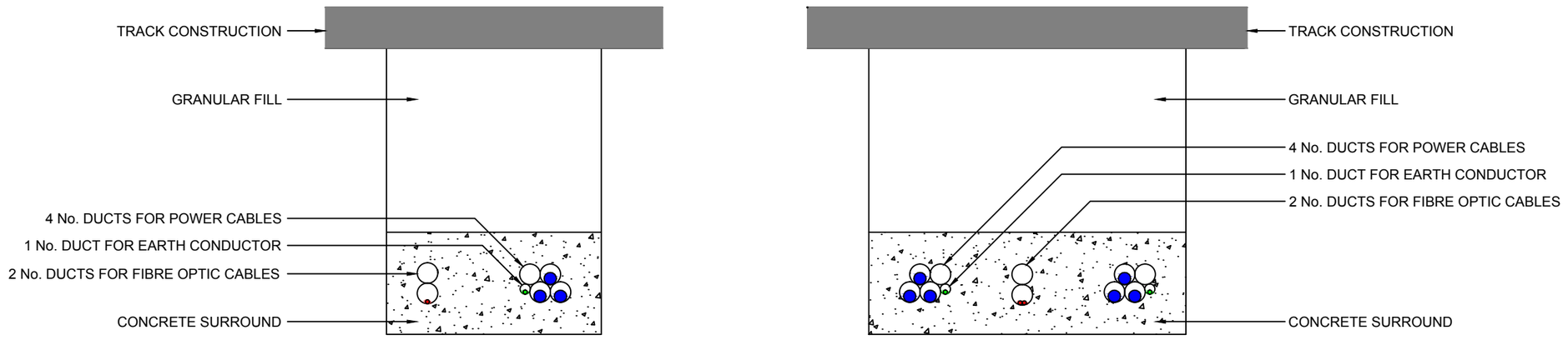
SCALE - 1:200

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



TYPICAL CABLE TRENCHES



TYPICAL TRACK CROSSINGS

HIGHLEE HILL WIND FARM

FIGURE 2.9

CABLE TRENCH TYPICAL DETAILS

NOTES

1. THIS DRAWING IS INDICATIVE ONLY AND IS SUBJECT TO CHANGE AT THE DETAILED DESIGN STAGE.
2. ALL DIMENSIONS IN mm.
3. CABLES MAY BE INSTALLED BY CABLE PLOUGH FOR DISTANCES GREATER THAN 1km.

LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

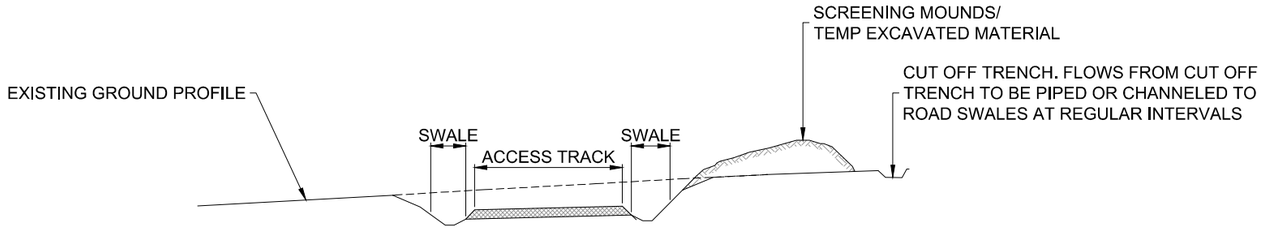
DRAWING NUMBER

02836D2304-01

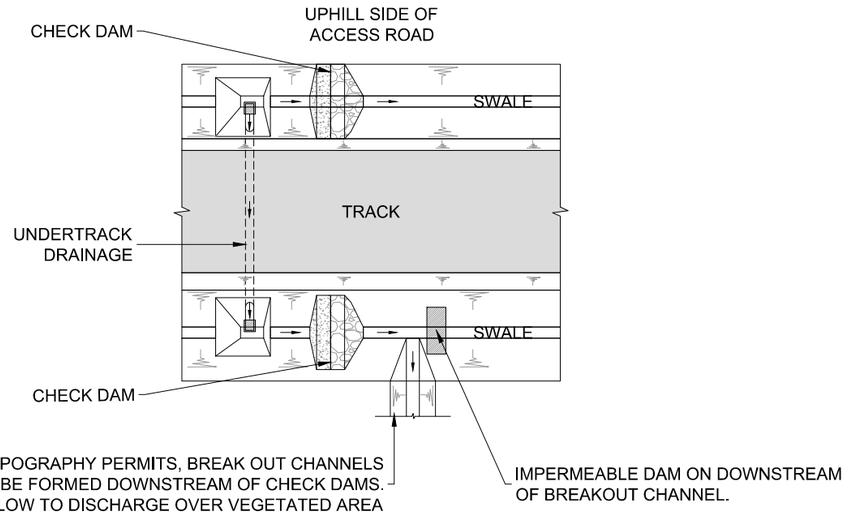
SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT 2016

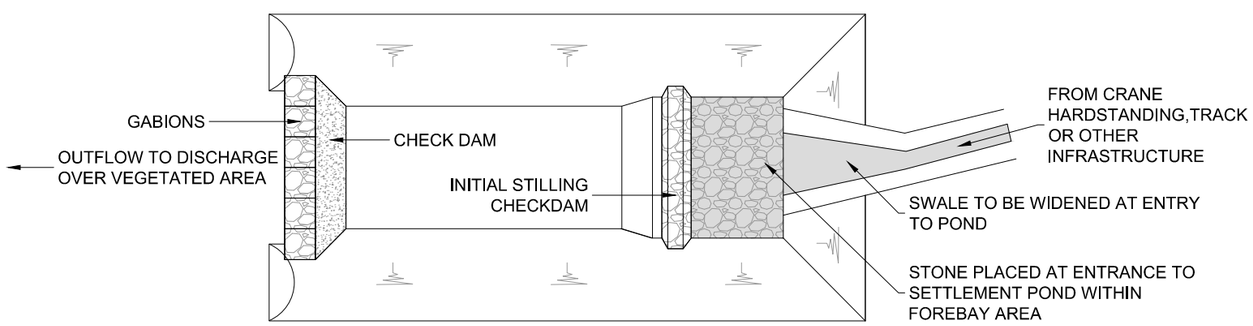
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



TYPICAL TRACK SECTION



TYPICAL TRACK PLAN



TYPICAL SETTLEMENT POND

TYPICAL UNDER TRACK DRAINAGE

TYPICAL CHECK DAM

TYPICAL SETTLEMENT POND

HIGHLEE HILL WIND FARM

FIGURE 2.10

TYPICAL DRAINAGE DETAILS

NOTES

1. SUDS SYSTEM TO BE CONSTRUCTED PRIOR TO, OR AT THE SAME TIME AS THE ACCESS ROAD.

2. SUSTAINABLE PREVENTION MEASURES SHOULD BE IN PLACE AT ALL TIMES TO PREVENT THE CONVEYANCE OF SILTS TO RECEIVING WATERCOURSE.

3. DRAINAGE SWALES TO BE EXCAVATED ADJACENT TO THE ACCESS TRACK. REGULAR CROSS DRAINS TO BE LOCATED ALONG ACCESS TRACKS TO PREVENT EXCESSIVE VOLUMES OF WATER COLLECTING IN THE SWALES.

4. ROADSIDE SWALES TO BE SHALLOW WITH MODERATE GRADIENTS TO PREVENT SCOURING. IN STEEP AREAS CHECK DAMS WILL BE DESIGNED TO REDUCE FLOW RATE AND PROVIDE SOURCE CONTROL SILT CONTAINMENT. WHERE NECESSARY THESE WILL BE DESIGNED IN CONJUNCTION WITH SETTLEMENT PONDS AND/OR CROSS DRAINS.

5. BUILD UP OF SILT LEVELS AT CHECK DAMS TO BE REMOVED AND DISPOSED OF APPROPRIATELY. SILT LEVELS AT CHECK DAMS TO BE VISUALLY INSPECTED AS PART OF AN ONGOING MAINTENANCE PROGRAMME.

6. SPACING AND FREQUENCY OF CHECK DAMS WILL BE DEPENDENT UPON LONGITUDINAL GRADIENT OF SWALE.

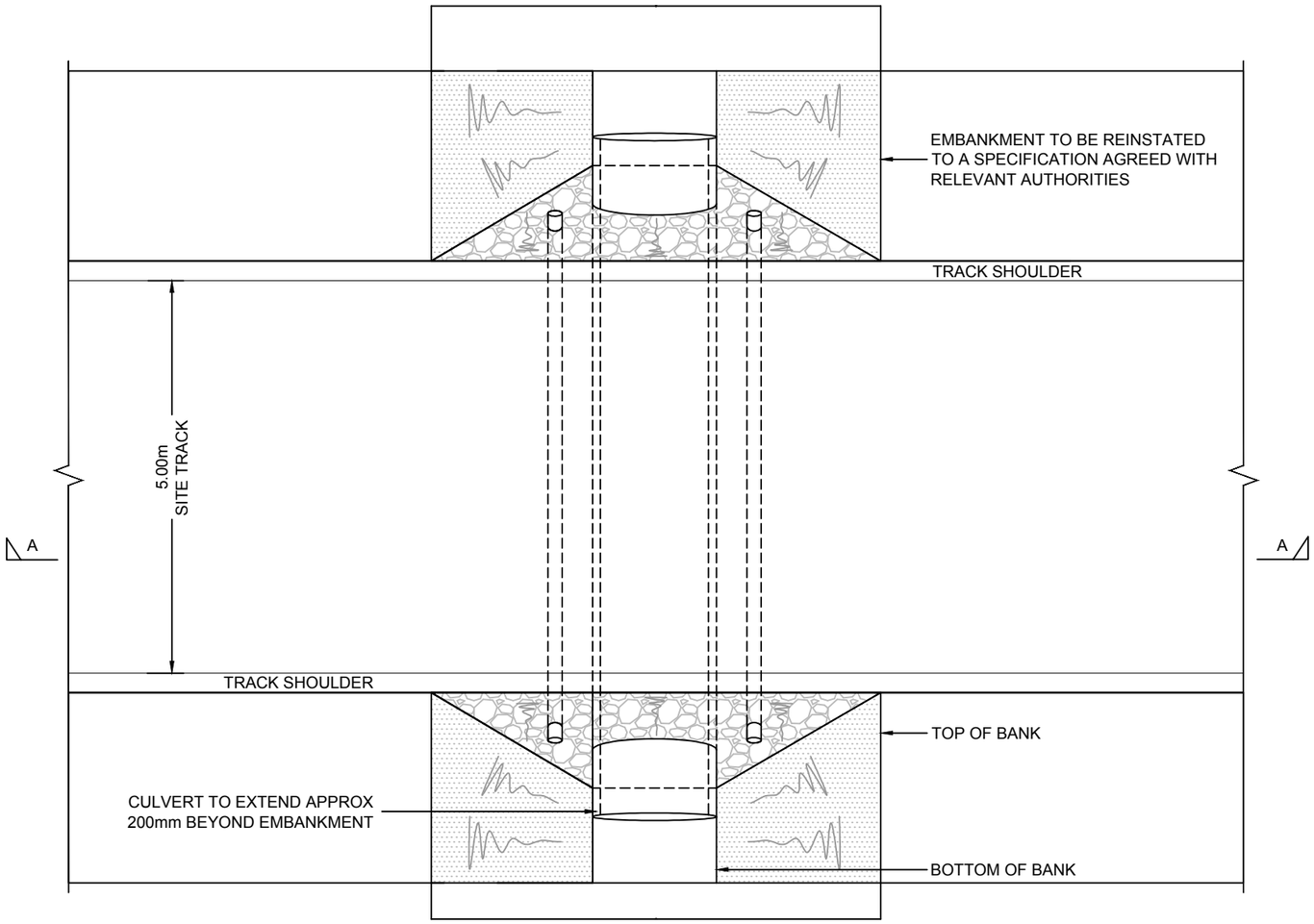
LAYOUT DWG N/A	T-LAYOUT NO. N/A

DRAWING NUMBER
02836D2305-01

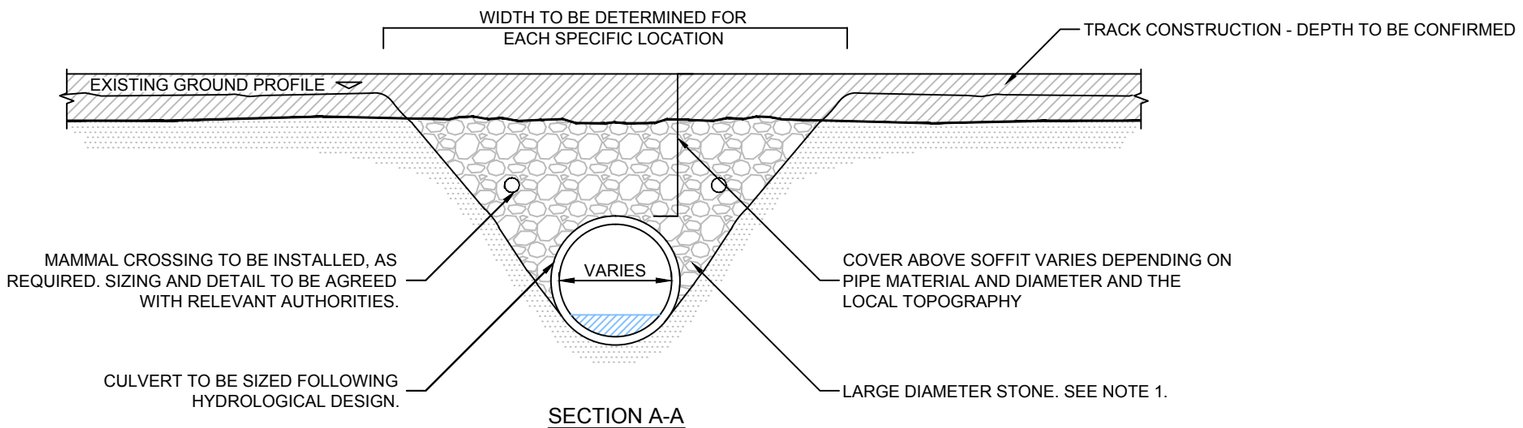
SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



PLAN



SECTION A-A

HIGHLEE HILL WIND FARM

FIGURE 2.11

TYPICAL SITE TRACK WATER CROSSING WITH MAMMAL CROSSING

NOTES

1. FINAL SPECIFICATION AND INSTALLATION METHOD TO BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE RELEVANT AUTHORITIES.
2. CULVERT TYPE AND SIZING TO BE DEFINED DURING DESIGN OF ON-SITE DRAINAGE SYSTEMS.
3. INFILL MATERIAL TO BE CLEAN CRUSHED ROCK.

LAYOUT DWG N/A

T-LAYOUT NO. N/A

DRAWING NUMBER

02836D2217-01

SCALE - NOT TO SCALE

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

PHOTO A - TOWARDS DUNS

PHOTO B - TOWARDS CARTER BAR

PHOTO C - VEGETATION TO BE CLEARED FOR VISIBILITY

215.0m

215.0m

ENVELOPE OF VISIBILITY

4.5m

A

B

C

OHL

BT OVERHEAD LINE TO BE RE-ROUTED OR UNDERGROUNDED AS REQUIRED FOLLOWING CONSULATION WITH UTILITY OWNER

FENCING TO BE REMOVED OR RELOCATED TO ACCOMMODATE ABNORMAL LOAD OVERSAIL AT THE TIME OF DELIVERIES.

PROPOSED 10m WIDE ACCESS GATE & STOCK PROOF FENCING

DETAILS OF TIE-IN BETWEEN EXISTING PRIVATE ACCESS ROAD AND PROPOSED TRACK TO BE AGREED WITH LANDOWNER

PRIVATE FARMHOUSE ENTRANCE

DETAIL 1

HIGHLEE HILL WIND FARM

FIGURE 2.12

SITE ENTRANCE

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

KEY

- EXISTING ROAD
- WIND FARM ACCESS TRACK
- PROPOSED SITE ENTRANCE
- PROPOSED ABNORMAL LOADS OVERUN AREA GRASSCRETE OR SIMILARLY APPROVED
- TEMPORARY FENCING
- OHL BT OVERHEAD LINE
- WATERCOURSE
- FILL
- CUT

NOTES

1. PROPOSED ABNORMAL LOADS OVERRUN AREA TO BE FENCED OFF FOLLOWING COMPLETION OF DELIVERIES.

- DETAILS OF THE ACCESS TO BE AGREED WITH THE COUNCIL ALONG WITH ANY REQUIRED SIGNAGE. THE CONSTRUCTION OF THE ACCESS IS LIKELY TO BE 40 HRA, 60 DBM, 100 DBM, 250 TYPE 1
- MINIMUM FALL FROM ENTRANCE GATE TO PUBLIC ROAD 1:100.
- EXISTENCE OF SERVICES TO BE CHECKED WITH RELEVANT AUTHORITIES.

- MINIMUM REQUIREMENTS FOR VISIBILITY IN ACCORDANCE WITH THE DESIGN MANUAL FOR ROADS AND BRIDGES.
- VEGETATION TO BE CUT AS NECESSARY.
- AREA TO BE LEVELLED TO BETWEEN 150mm AND 250mm ABOVE THE LEVEL OF THE CARRIAGEWAY.

DETAIL 1
SHEET 1 OF 2

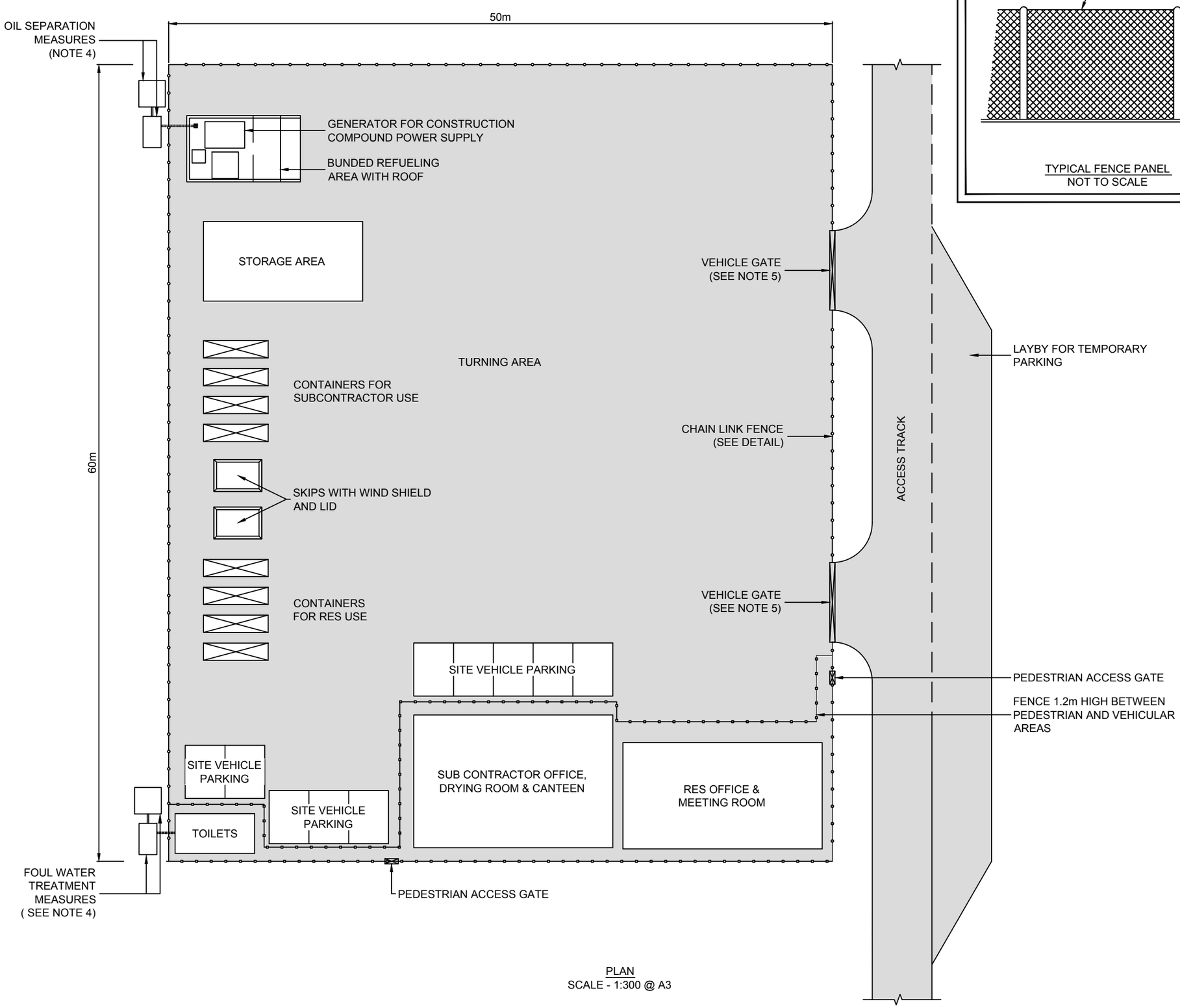
LAYOUT DWG	N/A	T-LAYOUT NO.	N/A

DRAWING NUMBER
02836D2301-02

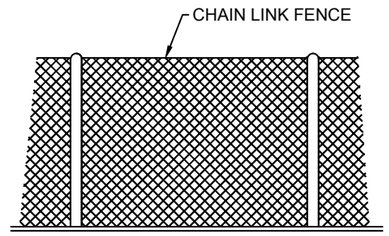
SCALE - AS SHOWN

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



PLAN
SCALE - 1:300 @ A3



TYPICAL FENCE PANEL
NOT TO SCALE

HIGHLEE HILL WIND FARM

FIGURE 2.13

TEMPORARY CONSTRUCTION COMPOUND LAYOUT & ELEVATION

NOTES

1. SIZE, NUMBER AND LOCATION OF COMPOUND EQUIPMENT AND FACILITIES ARE INDICATIVE ONLY
2. STRUCTURE TO BE TEMPORARY AND TO BE REMOVED AFTER CONSTRUCTION.
3. COMPOUND HARDSTANDING CONSISTING OF COMPACTED STONE OVER A LAYER OF GEOTEXTILE TO PROVIDE A CLEAN, FIRM, LEVEL AND FREE DRAINING SURFACE SUITABLE FOR CABINS AND HEAVY TRAFFIC.
4. APPROPRIATE MEASURES FOR SEPARATION OF OILS AND TREATMENT OF FOUL WATER TO BE AGREED WITH THE RELEVANT AUTHORITIES.
5. VEHICULAR GATES TO BE 6m WIDE CONSISTING OF 2 x 3m LEAVES

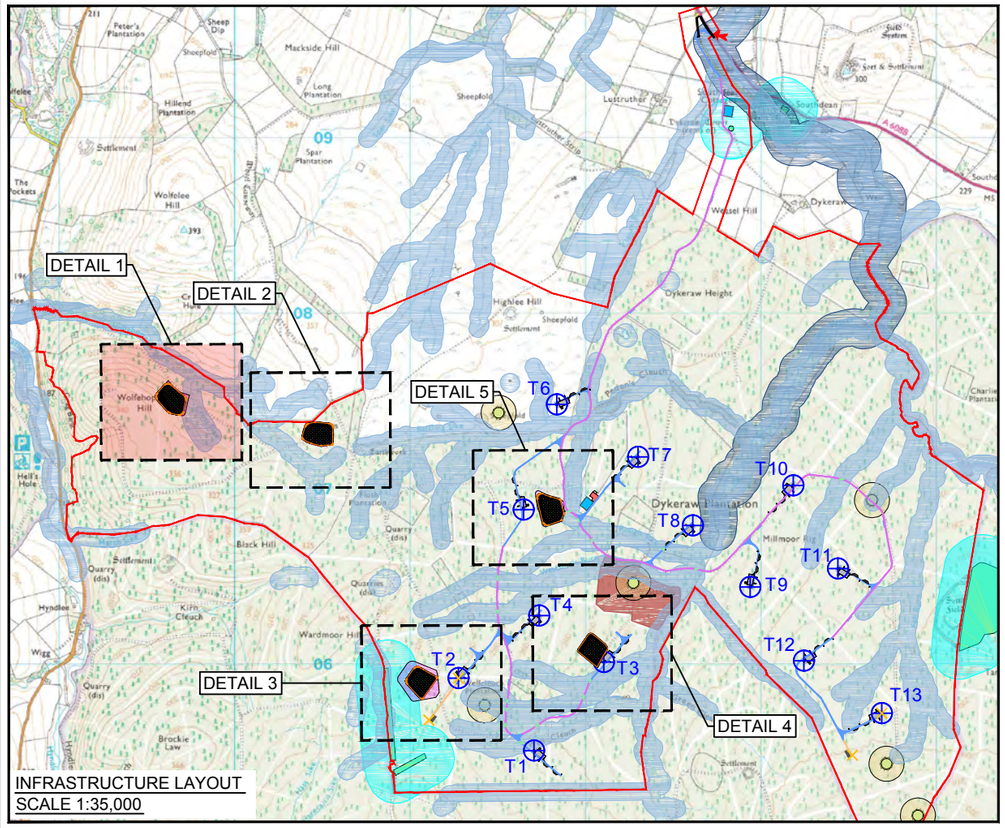
LAYOUT DWG	T-LAYOUT NO.
N/A	N/A

DRAWING NUMBER
02836D2218-01

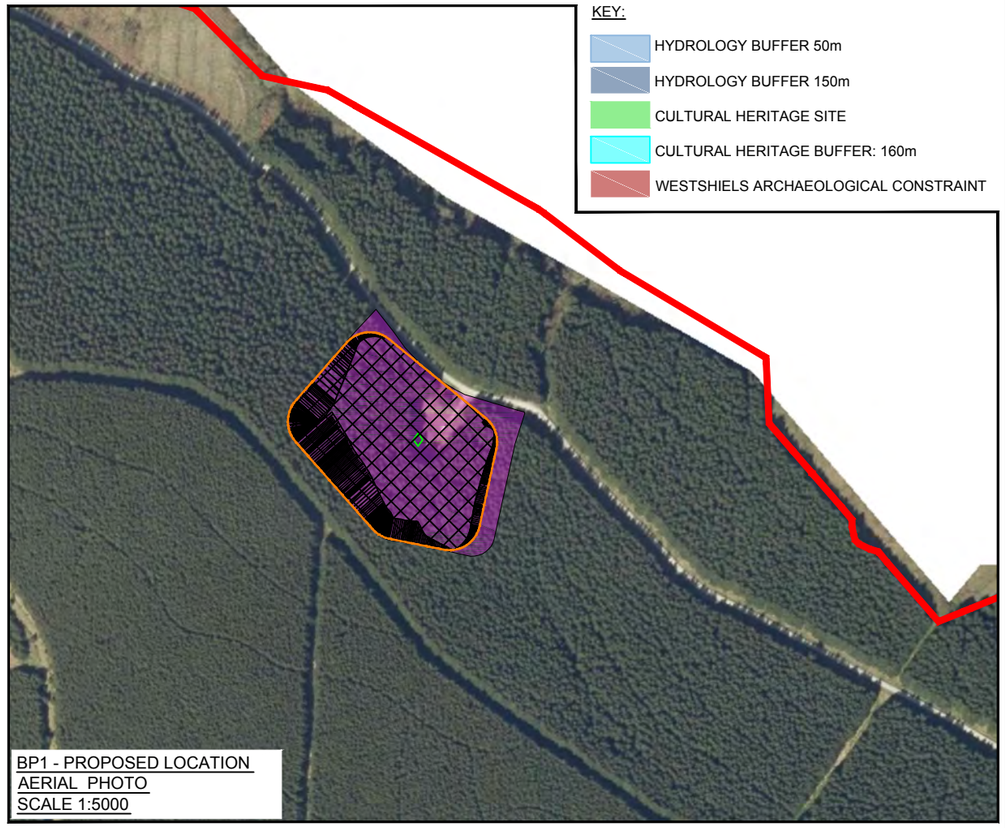
SCALE - AS SHOWN

ENVIRONMENTAL STATEMENT
2016

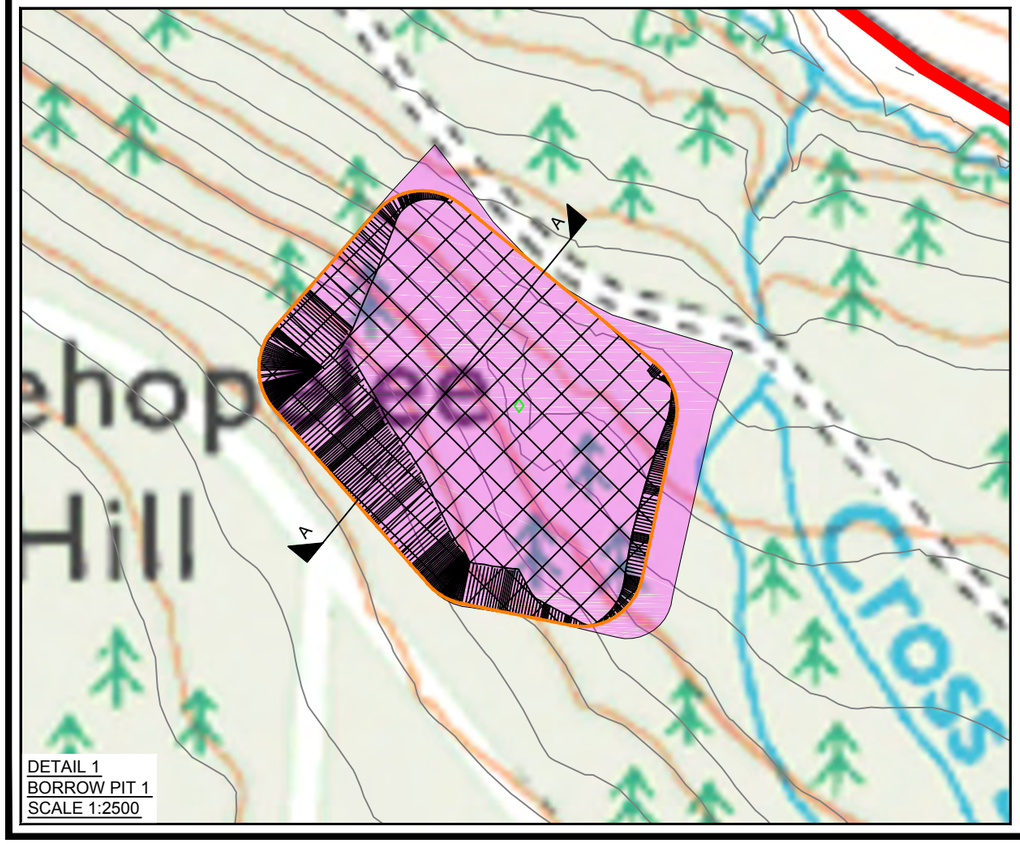
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



INFRASTRUCTURE LAYOUT
SCALE 1:35,000

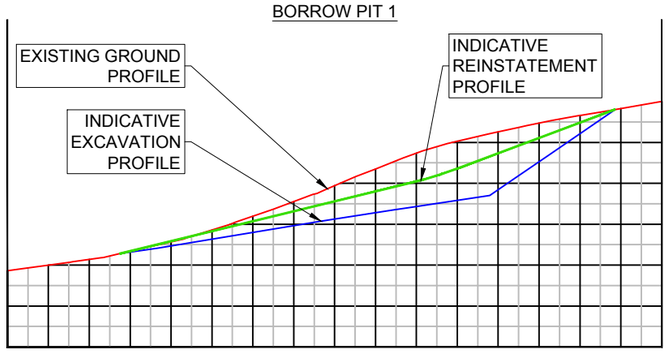


BP1 - PROPOSED LOCATION
AERIAL PHOTO
SCALE 1:5000



DETAIL 1
BORROW PIT 1
SCALE 1:2500

BORROW PIT 1



SECTION A-A

CROSS SECTION A-A
BORROW PIT 1

HIGHLEE HILL WIND FARM

FIGURE 2.14a

PROPOSED BORROW PITS GENERAL ARRANGEMENT

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

KEY

- WIND TURBINE LOCATION
- SITE BOUNDARY
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- TEMPORARY SITE TRACKS & TURNING HEADS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMANENT HARDSTANDING AREA
- POWER PERFORMANCE MASTS
- SITE ENTRANCE LOCATION

KEY - BORROW PIT

- BORROW PIT SEARCH AREA
- INDICATIVE BORROW PIT LOCATION
- TEMPORARY ACCESS TRACK

NOTE
DRAINAGE AND SPOIL ARRANGEMENTS TO BE DETAILED SEPARATELY.

BORROW PIT 1
SHEET 1 OF 5

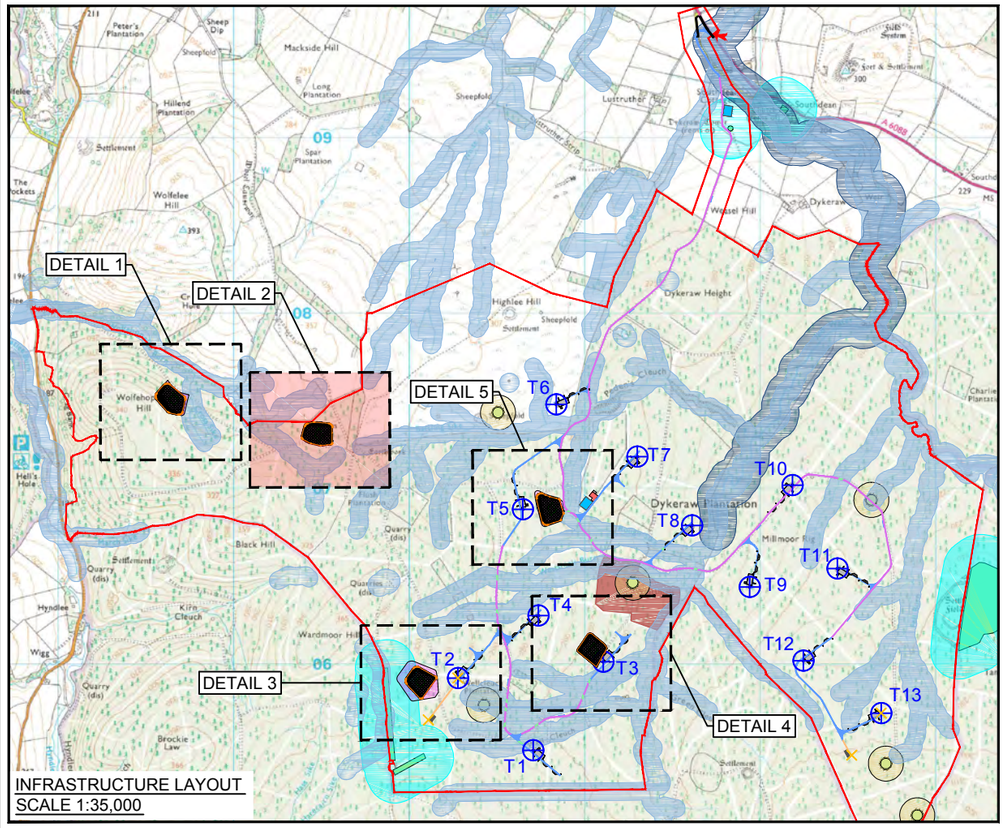
LAYOUT DWG	T-LAYOUT NO.
02836D0002-13	PSCOhhi041

DRAWING NUMBER
02836D2220-01

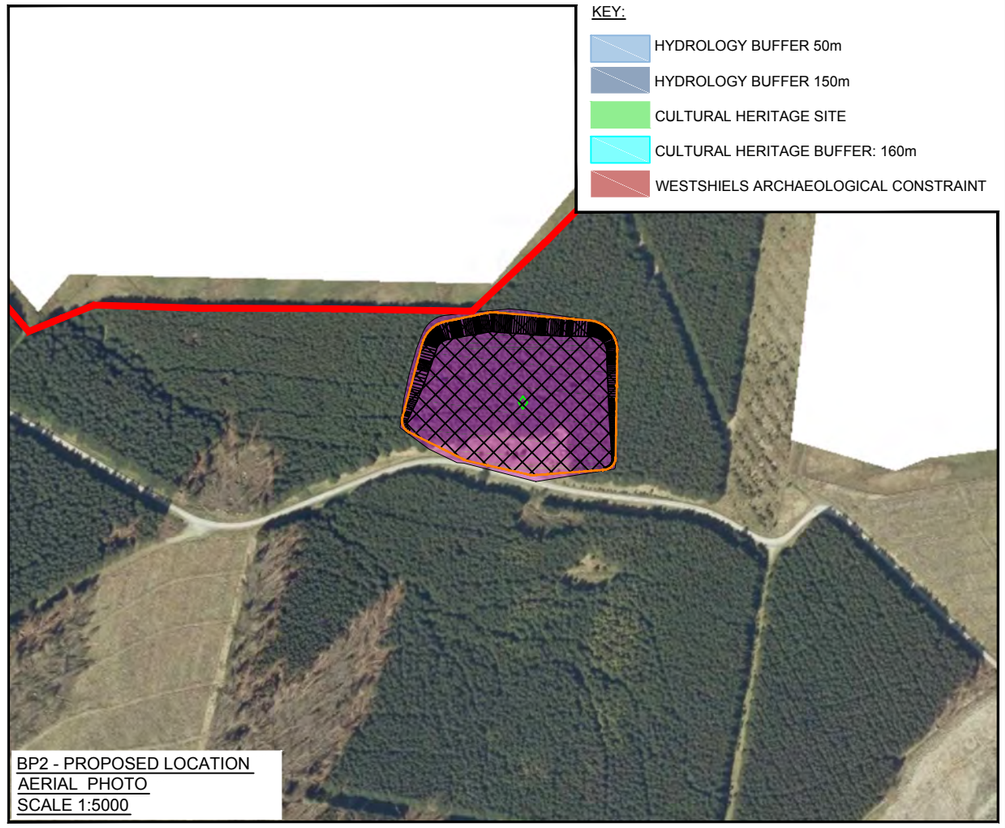
SCALE - AS SHOWN

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



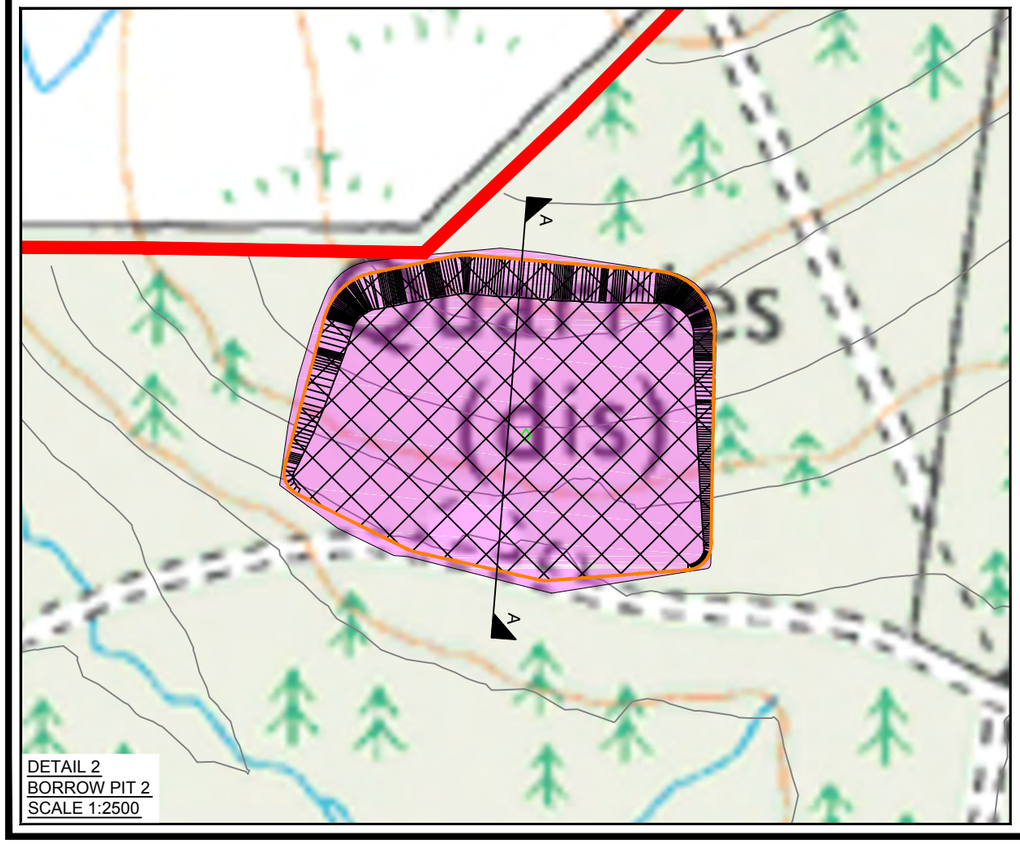
INFRASTRUCTURE LAYOUT
SCALE 1:35,000



KEY:

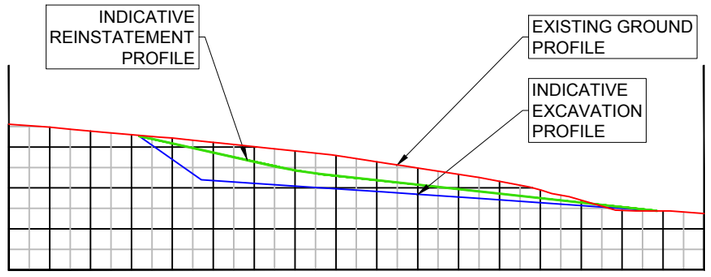
- HYDROLOGY BUFFER 50m
- HYDROLOGY BUFFER 150m
- CULTURAL HERITAGE SITE
- CULTURAL HERITAGE BUFFER: 160m
- WESTSHIELS ARCHAEOLOGICAL CONSTRAINT

BP2 - PROPOSED LOCATION
AERIAL PHOTO
SCALE 1:5000



DETAIL 2
BORROW PIT 2
SCALE 1:2500

BORROW PIT 2



SECTION A-A

CROSS SECTION A-A
BORROW PIT 2

HIGHLEE HILL WIND FARM

FIGURE 2.14b

PROPOSED BORROW PITS GENERAL ARRANGEMENT

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

KEY

- WIND TURBINE LOCATION
- SITE BOUNDARY
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- TEMPORARY SITE TRACKS & TURNING HEADS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMANENT HARDSTANDING AREA
- POWER PERFORMANCE MASTS
- SITE ENTRANCE LOCATION

KEY - BORROW PIT

- BORROW PIT SEARCH AREA
- INDICATIVE BORROW PIT LOCATION
- TEMPORARY ACCESS TRACK

NOTE
DRAINAGE AND SPOIL ARRANGEMENTS TO BE DETAILED SEPARATELY.

BORROW PIT 2
SHEET 2 OF 5

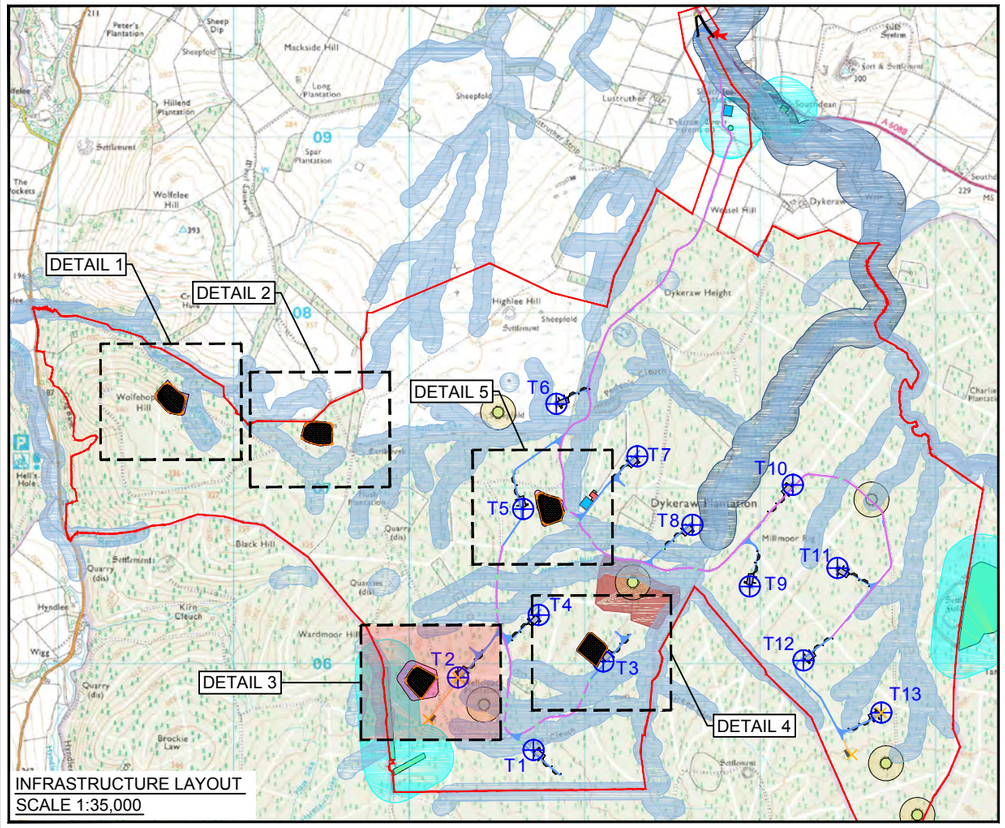
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
02836D2220-01

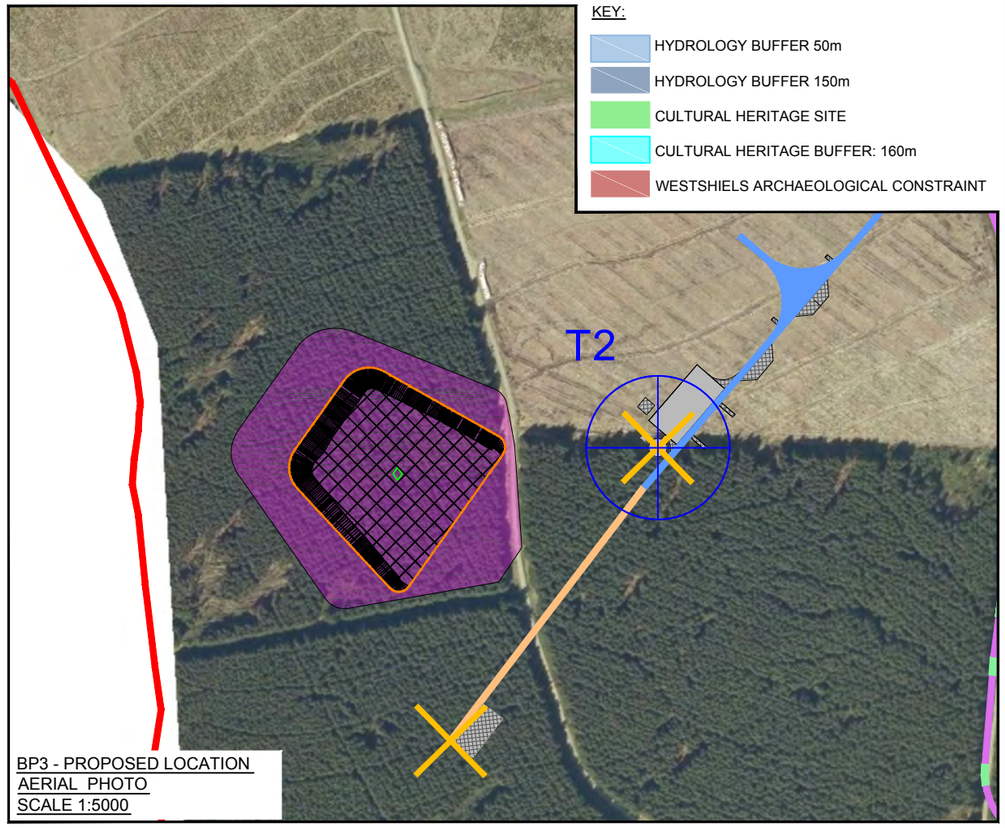
SCALE - AS SHOWN

ENVIRONMENTAL STATEMENT 2016

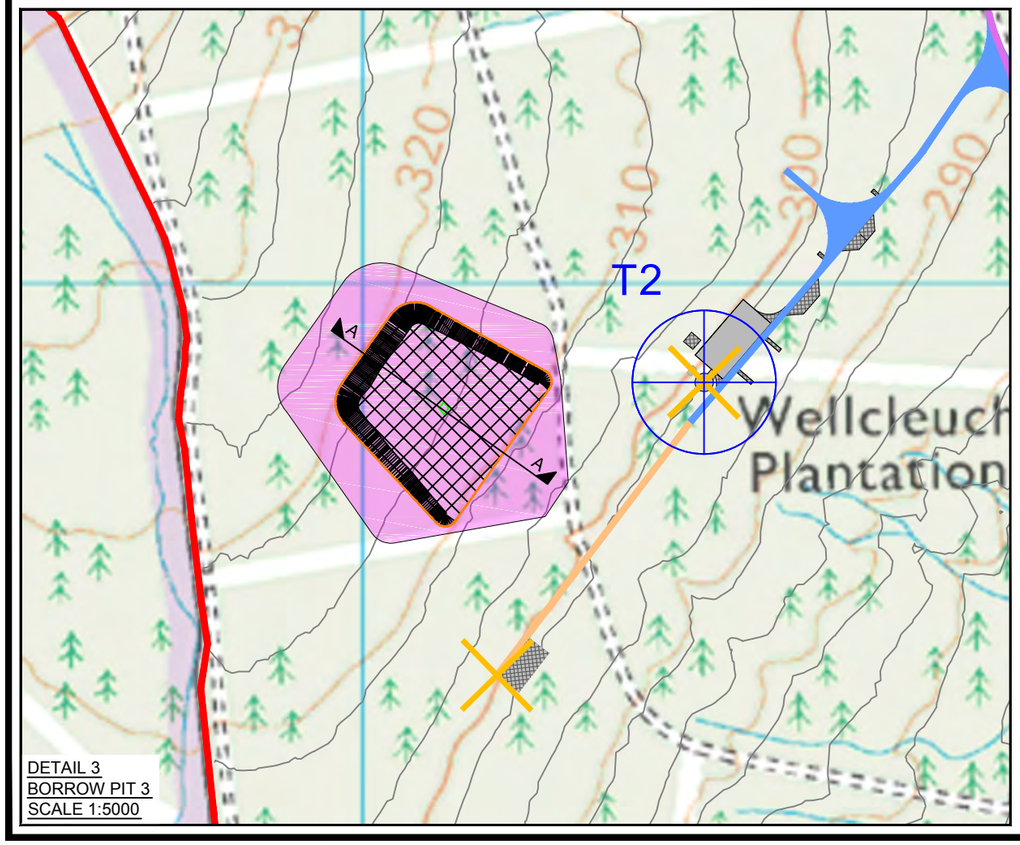
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



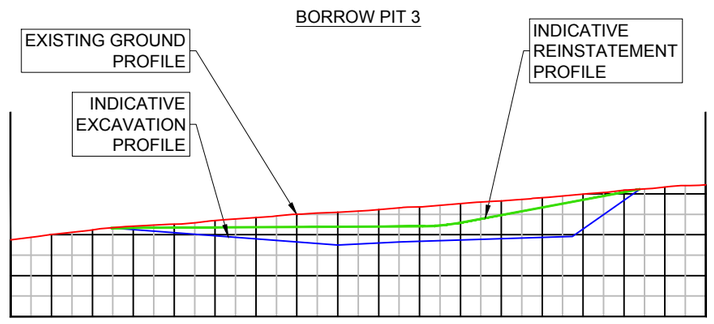
INFRASTRUCTURE LAYOUT
SCALE 1:35,000



BP3 - PROPOSED LOCATION
AERIAL PHOTO
SCALE 1:5000



DETAIL 3
BORROW PIT 3
SCALE 1:5000



SECTION A-A

CROSS SECTION A-A
BORROW PIT 3

HIGHLEE HILL WIND FARM

FIGURE 2.14c

PROPOSED BORROW PITS GENERAL ARRANGEMENT

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

KEY

- WIND TURBINE LOCATION
- SITE BOUNDARY
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- TEMPORARY SITE TRACKS & TURNING HEADS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMANENT HARDSTANDING AREA
- POWER PERFORMANCE MASTS
- SITE ENTRANCE LOCATION

KEY - BORROW PIT

- BORROW PIT SEARCH AREA
- INDICATIVE BORROW PIT LOCATION
- TEMPORARY ACCESS TRACK

NOTE
DRAINAGE AND SPOIL ARRANGEMENTS TO BE DETAILED SEPARATELY.

BORROW PIT 3
SHEET 3 OF 5

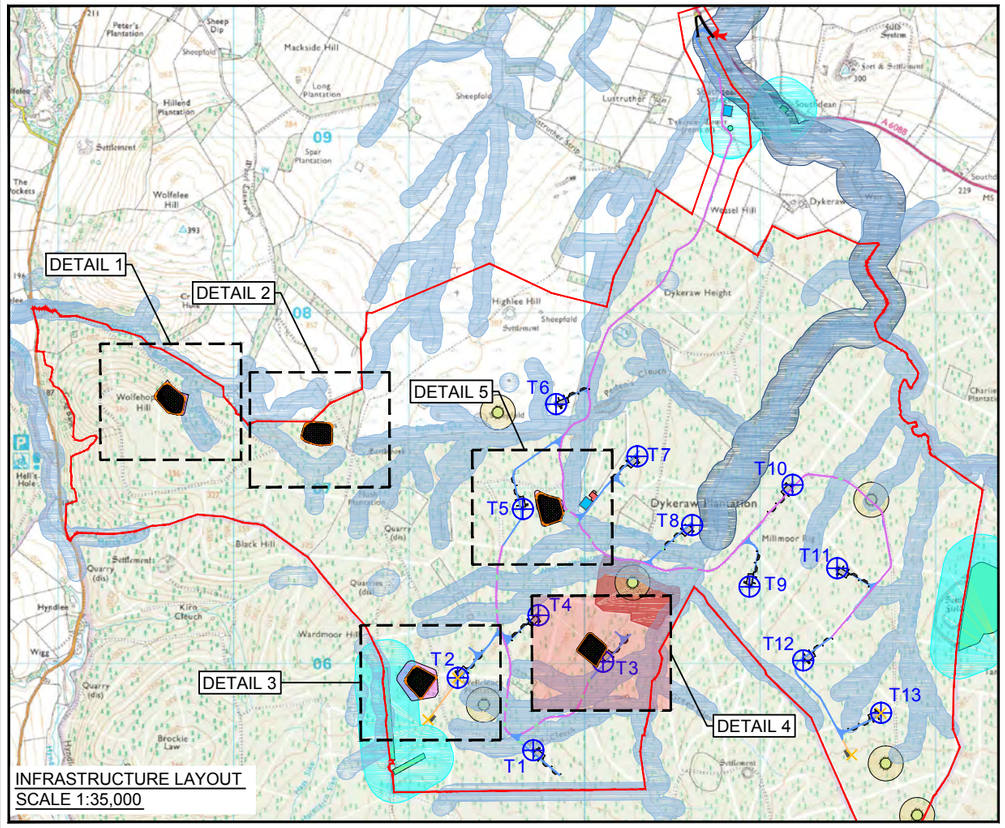
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
02836D2220-01

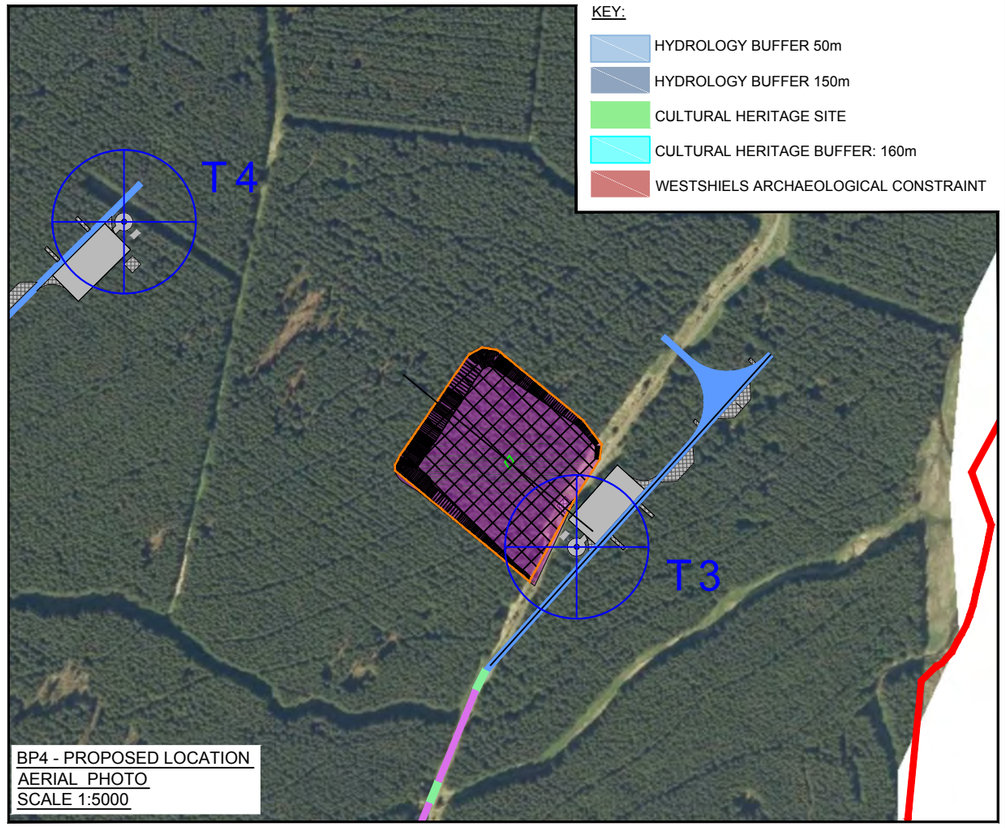
SCALE - AS SHOWN

ENVIRONMENTAL STATEMENT
2016

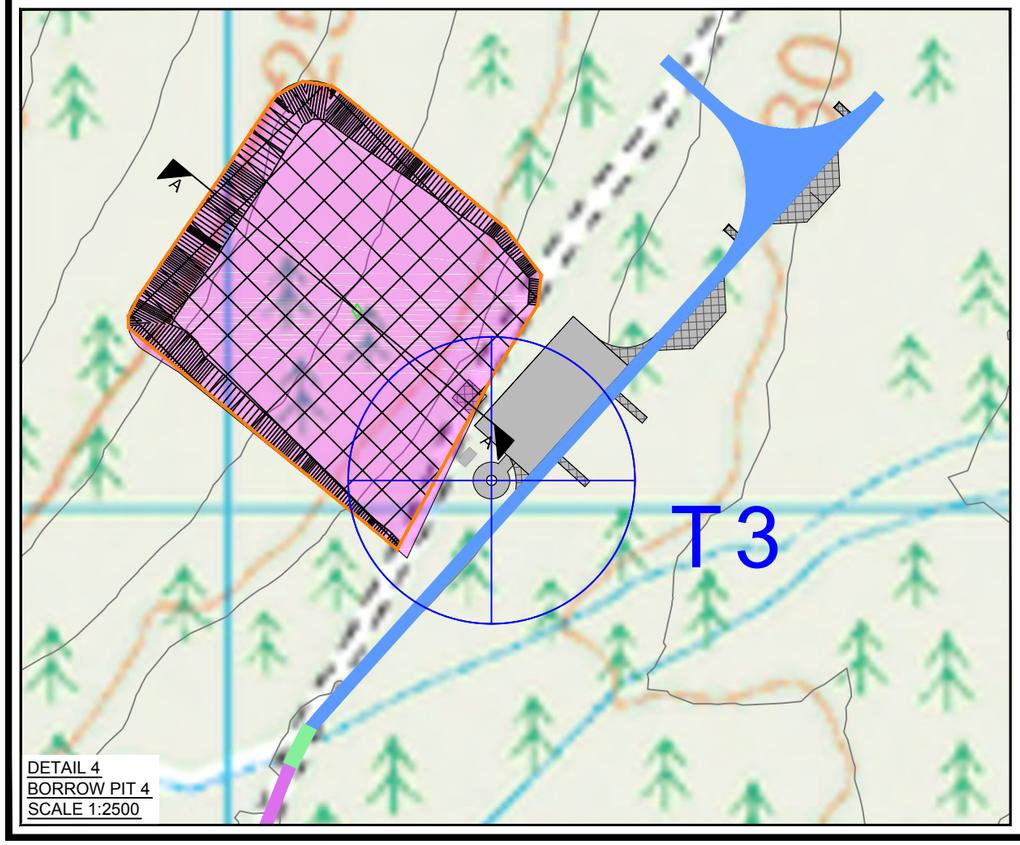
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



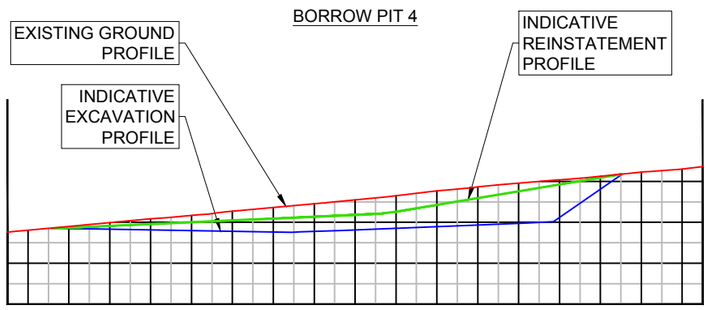
INFRASTRUCTURE LAYOUT
SCALE 1:35,000



BP4 - PROPOSED LOCATION
AERIAL PHOTO
SCALE 1:5000



DETAIL 4
BORROW PIT 4
SCALE 1:2500



SECTION A-A

CROSS SECTION A-A
BORROW PIT 4

HIGHLEE HILL WIND FARM

FIGURE 2.14d

PROPOSED BORROW PITS GENERAL ARRANGEMENT

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

KEY

- WIND TURBINE LOCATION
- SITE BOUNDARY
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- TEMPORARY SITE TRACKS & TURNING HEADS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMANENT HARDSTANDING AREA
- POWER PERFORMANCE MASTS
- SITE ENTRANCE LOCATION

KEY - BORROW PIT

- BORROW PIT SEARCH AREA
- INDICATIVE BORROW PIT LOCATION
- TEMPORARY ACCESS TRACK

NOTE
DRAINAGE AND SPOIL ARRANGEMENTS TO BE DETAILED SEPARATELY.

BORROW PIT 4
SHEET 4 OF 5

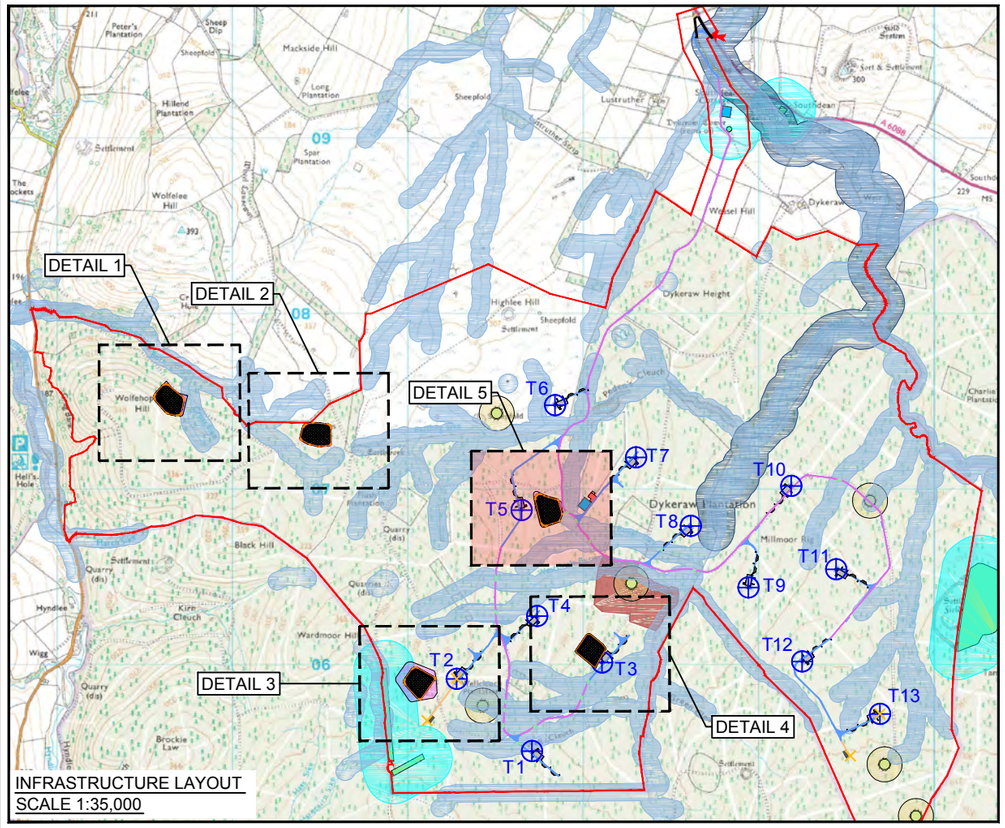
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
02836D2220-01

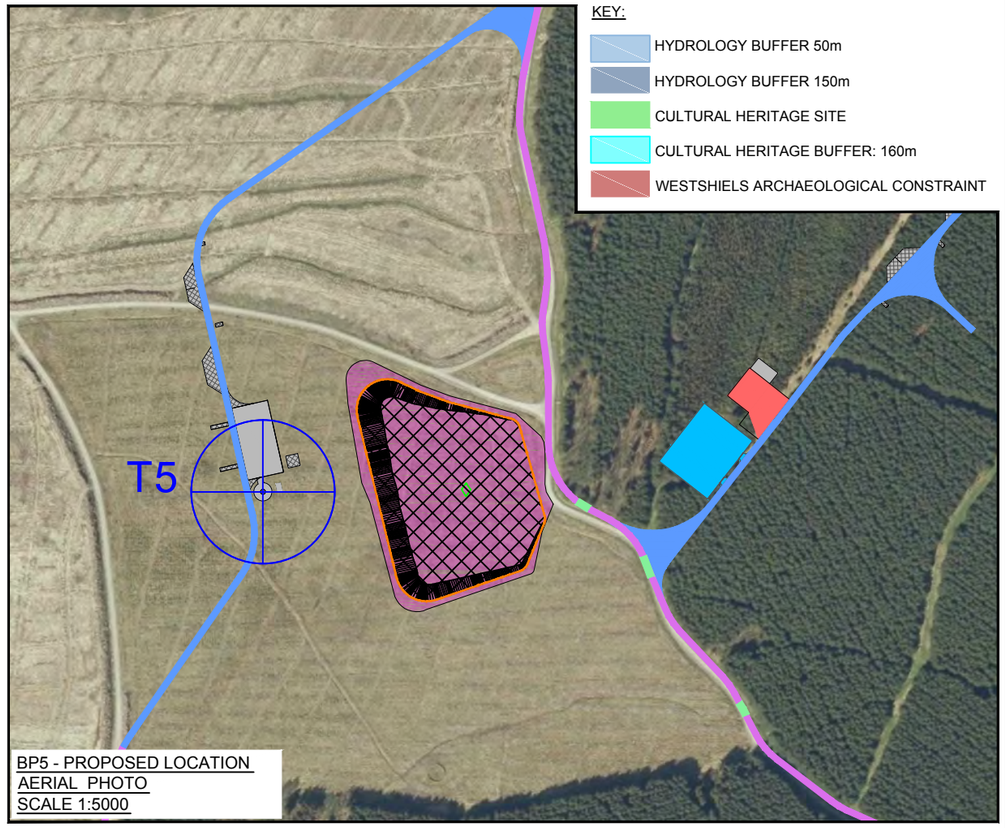
SCALE - AS SHOWN

ENVIRONMENTAL STATEMENT
2016

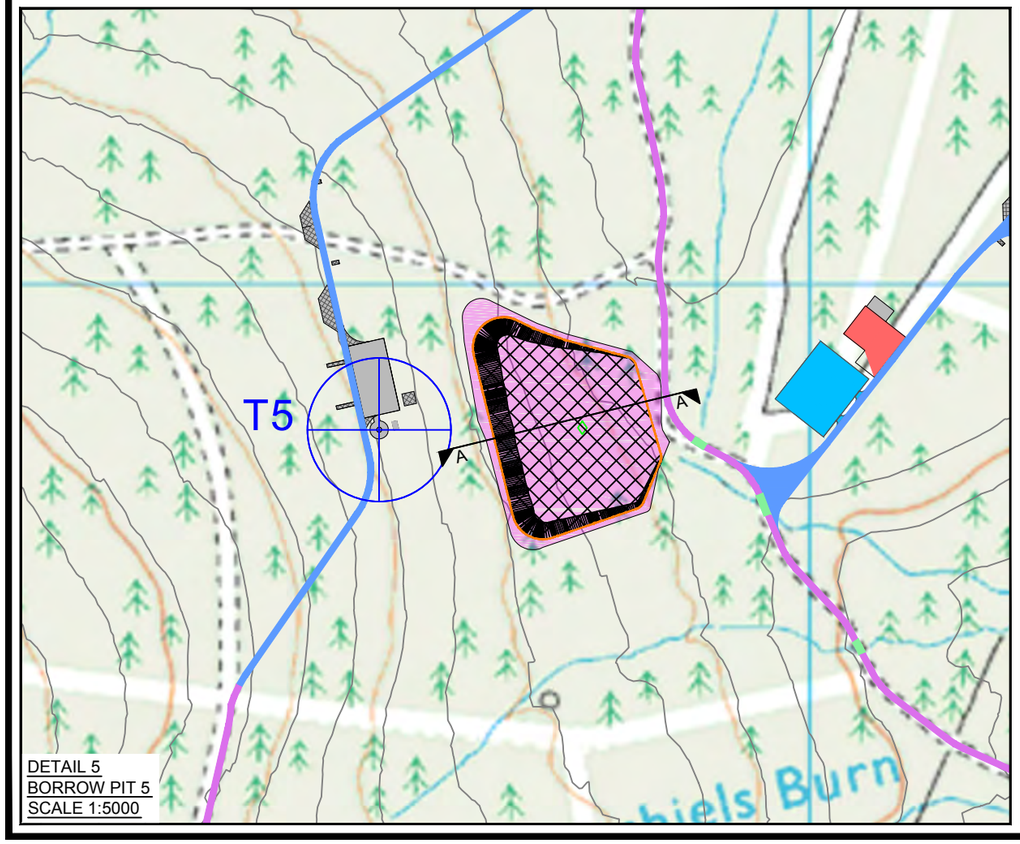
THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



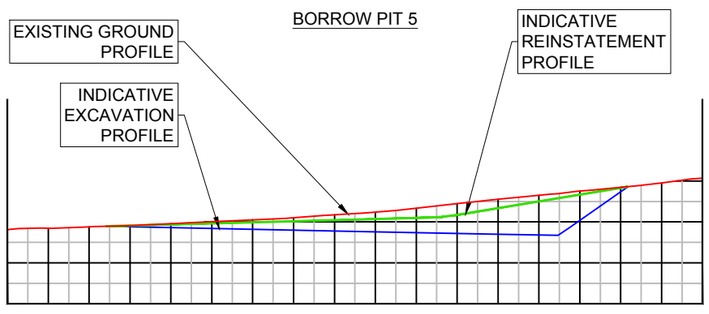
INFRASTRUCTURE LAYOUT
SCALE 1:35,000



BP5 - PROPOSED LOCATION
AERIAL PHOTO
SCALE 1:5000



DETAIL 5
BORROW PIT 5
SCALE 1:5000



SECTION A-A

CROSS SECTION A-A
BORROW PIT 5

HIGHLEE HILL WIND FARM

FIGURE 2.14e

PROPOSED BORROW PITS GENERAL ARRANGEMENT

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

KEY

- WIND TURBINE LOCATION
- SITE BOUNDARY
- NEW SITE TRACKS
- UPGRADED SITE TRACKS
- TEMPORARY SITE TRACKS & TURNING HEADS
- WATERCOURSE CROSSING
- CRANE HARDSTANDING AREA
  - PERMANENT
  - TEMPORARY
- TEMPORARY CONSTRUCTION COMPOUND
- CONTROL BUILDING & SUBSTATION COMPOUND WITH PERMANENT HARDSTANDING AREA
- POWER PERFORMANCE MASTS
- SITE ENTRANCE LOCATION

KEY - BORROW PIT

- BORROW PIT SEARCH AREA
- INDICATIVE BORROW PIT LOCATION
- TEMPORARY ACCESS TRACK

NOTE
DRAINAGE AND SPOIL ARRANGEMENTS TO BE DETAILED SEPARATELY.

BORROW PIT 5
SHEET 5 OF 5

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
02836D2220-01

SCALE - AS SHOWN

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

3 Design Evolution Considerations and Alternatives

Introduction

3.1 In this chapter, a description is given of the site selection process and design strategies that were adopted in arriving at the proposed wind farm described in **Chapter 2: Proposed Development**. First, the general design principles adopted by RES are outlined and the design objectives for the proposed wind farm are confirmed. Thereafter, an overview of the turbine layout of the proposed wind farm is given with identified / adopted design constraints that influenced the turbine layout changes between conception and this application. Finally, the design considerations and decisions for the proposed wind farm's infrastructure are explained.

Site Selection Considerations

3.2 RES use a Geographical Information System (GIS) to confirm suitability of potential wind farm sites. The RES GIS has confirmed that the Highlee Hill Wind Farm site exhibits several attributes that would make it an excellent site for a wind farm. These attributes include:

- sufficient wind speeds;
- the site can be easily accessed from the trunk road network;
- very few ecological constraints;
- in large scale evolving landscape dominated by commercial forestry;
- a relatively limited cumulative development context;
- the absence of nationally important landscape designations or classifications within, or in the vicinity of, the proposed Development site; and
- a position within the large scale uplands landscape where it is enclosed by topography, and where there is potential to limit the extent of its visibility, and the prominence of turbines in views from external receptor locations.

3.3 The GIS model was used to identify potential constraints that could restrict development or would need to be addressed in the design process.

Current Land Use and Site Context

3.4 The site is located just over 3 km from the village of Chesters in the Scottish Borders, approximately 1.8 km from the Scotland – England border (Figure 1.2). The site spans two land ownerships, one comprising a mix of rough grazing and arable fields while the other area is used for commercial conifer forestry. The majority of the wind farm infrastructure is located within the forestry section of the site.

Key Issues and Constraints

3.5 There are a number of ways in which a wind farm can be designed, but all approaches involve balancing the potentially conflicting interests of:

- technical/ economic requirements (high energy production from the turbines and low inter-turbine distortion of the wind flow);
- landscape character and visual amenity; and
- constraints concerning natural and built heritage such as ecological, hydrological and archaeological interests; underground utility services such as pipelines; and radio communications links.

3.6 The apportioning of weight to each element is a site-dependent consideration and results in bespoke design approaches and strategies for each site. However, typical design approaches include:

- establishing and mapping constraints related to the natural and built heritage, developing a layout that best satisfies technological and economic requirements and thereafter adjusting the design to improve the visual appearance. This is the traditional wind farm design approach that was adopted almost universally until more recently when there has been a shift towards adopting a specific design strategy for a site that addresses aesthetic and technical targets and thereafter identifying whether the impacts on other non-visual environmental interests are sufficiently severe to warrant compromising the visual design (this is an approach advocated by Architecture and Design Scotland). In establishing this design the strategy guidance contained in the "Siting and Designing windfarms in the landscape"[1] was referred to; and
- establishing and mapping natural and built heritage constraints as per the first approach, but then developing a layout which best minimises visual impact from key viewpoints, thereafter only altering the layout if essential engineering requirements are compromised, e.g. if the fatigue loading on a turbine would be beyond the classification that turbines are designed to withstand (this approach lends itself well to wind farms in the worked and working rural environment where they could become a prominent feature of everyday life for the local population).

3.7 The upland nature of the development site creates a number of sensitivities that need to be carefully addressed through appropriate design of the wind farm. The following sections identify potential issues, outline how these have been addressed through appropriate mitigation by design and presents areas that will be assessed in the following technical chapters.

3.8 The basis of the design process is the evaluation of the various constraints that have been identified through the environmental surveys that were undertaken between 2011 and 2015. Appropriate buffers resulting from these surveys and other technical constraints are presented in Figure 3.1.

Potentially Significant Issues

3.9 Following consultation and baseline characterisation of the site, the following key environmental issues have been identified:

- landscape and visual
- cultural heritage
- ornithology
- terrestrial ecology
- transport and traffic
- gorestry
- aviation

[1] "Siting and Designing windfarms in the landscape. Version 2 (Scottish Natural Heritage (SNH) December 2014)

- noise; and
- geology, hydrology and hydrogeology.

3.10 The issues listed above have been considered through design with the aim of '*designing out'* significant effects. Where it is not possible to mitigate by design, the issues are considered further as part of the EIA.

Non-Significant Issues

3.11 There are a number of issues that have been discounted as not being likely to have significant effects in the context of the proposed development. These include:

- air quality;
- Human health and climate change will require to be considered when the latest EIA Directive is transposed to UK legislation, and therefore does not apply at this time. Nonetheless, potential effects on human health are considered where appropriate throughout this ES although there is not a chapter specifically for this topic; and
- Climate change is also not allocated its own chapter but the ability of the project to mitigate climate change is a key driver for the need for this development and the potential carbon emissions savings are set out at XXXXXX. The location of the development means it will unlikely be affected by climate change beyond potential changes in hydrology which are considered in **Chapter 8**.

Consultation

3.12 Prior to and during the production of this Environmental Statement (ES), RES have consulted with various stakeholders and where appropriate incorporated the outcome of those consultations into the ES.

3.13 Throughout the EIA process, continual scoping has occurred to ensure that the ES fully, but concisely, addresses all potentially significant issues.

3.14 A summary of the consultation is provided in Table 3.1. Further detail on consultee response can be found in the relevant chapters.

Table 3.1: Summary of Consultation

Consultee	Date of Consultation	Nature and Purpose of Consultation
Scottish Borders Council	15/1/15	Meeting with SNH and RES to discuss viewpoint selection for landscape and visual assessment
	8/12/15	Provided formal response to reissued Scoping Report
	12/11/15	Feedback on Proposal of Application Notice
	3/2/2014 – 4/3/14	Provided formal response to Scoping Report
SNH	27/11/15	Provided formal response to reissued Scoping Report
	12/2/14	Provided formal response to Scoping Report
SEPA	10/11/15	Provided formal response to reissued Scoping Report
	6/2/14	Provided formal response to Scoping Report.
	15/10/13	Pre Scoping advice
Historic Environment Scotland (previously Historic Scotland)	11/2/16	Provided formal response to reissued Scoping Report
	24/3/14	Provided formal response to Scoping Report.
Forestry Commission Scotland	9/11/15	Provided formal response to reissued Scoping Report
	24/3/14	Provided formal response to Scoping Report.
Marine Scotland	24/3/14	Provided formal response to Scoping Report.
Transport Scotland	19/11/15	Provided formal response to reissued Scoping Report
	24/3/14	Provided formal response to Scoping Report
Northumberland National Park	11/2/16	Provided formal response to reissued Scoping Report
Northumberland Council	-	No response to 2014 Scoping Request
Environment Agency	23/1/14	Provided formal response to Scoping Report.
Natural England	12/11/15	Provided formal response to reissued Scoping Report
	19/2/14	Provided formal response to Scoping Report.
Historic England	26/11/15	Provided formal response to reissued Scoping Report
English Heritage	22/1/14	Provided formal response to Scoping Report.
NATS En Route	6/11/15	Provided formal response to reissued Scoping Report
	24/3/14	Provided formal response to Scoping Report.
	February 2012	Consultation on NERL interests, in particular Lowther Hill.
Ministry of Defence	02/11/15	Consultation on MOD interests, in particular Threat Radars, Low Flying and Eskdalemuir.
	24/3/16	Provided a formal response to Scoping Report
Civil Aviation Authority	12/11/15	Provided formal response to reissued Scoping Report
	19/04/16	Consultation on lighting above 150 metres.
	24/3/16	Provided a formal response to Scoping Report
RSPB	8/2/16	Provided formal response to reissued Scoping Report
	21/2/14	Provided formal response to Scoping Report.
Scottish Wildlife Trust	14/2/14	Provided formal response to Scoping Report.
Scotways	3/12/15	Provided formal response to reissued Scoping Report
	4/3/14	Provided formal response to Scoping Report.
John Muir Trust	8/2/16	Provided formal response to reissued Scoping Report
	24/3/14	Provided formal response to Scoping Report.
Mountaineering Council of Scotland	24/1/14	Provided formal response to Scoping Report.
Southdean Community Council	26/11/15	Provided formal response to reissued Scoping Report
	4/2/14	Provided formal response to Scoping Report.
Hobkirk Community Council	24/3/14	Provided formal response to Scoping Report.
Scottish Water	10/2/14	Provided formal response to Scoping Report.
Visit Scotland	16/11/15	Provided formal response to reissued Scoping Report
	24/3/14	Provided formal response to Scoping Report.
British Horse Society	13/2/14	Provided formal response to Scoping Report.

Consultee	Date of Consultation	Nature and Purpose of Consultation
Scottish Ornithologists Club	13/2/14	Provided formal response to Scoping Report.
OFCOM		Provided formal response to Scoping Report.
BT	6/11/15	Provided formal response to reissued Scoping Report
	24/3/14	Provided a formal response to Scoping Report
Arqiva	25/2/15	Provided a response regarding operated microwave links within the vicinity of the Proposed Development. Arqiva had no issues with the Proposed Development.
Ericsson	5/11/15	Provided response regarding operated MBNL and EE microwave links in the vicinity of the Proposed Development. A link was identified traversing the Proposed Development however turbine layout designed to have no impact on this.
JRC	13/2/14	Provided formal response to Scoping Report.
R4 Telecom	20/10/15	Provided a response regarding operated Airwaves microwave links in the vicinity of the Proposed Development. Commissioned an Analysis Report showing the Proposed Development will not present a problem to Airwave Microwave Links.
Atkins	12/8/15	Provided a response regarding operated microwave links in the vicinity of the Proposed Development. Atkins had no concerns with the Proposed Development.

Alternatives

3.15 RES consider a range of potential options when selecting and designing wind farm sites. The following sections outline the broad design alternatives that have been considered in terms of the EIA Regulations.

Do-Nothing

3.16 The "do nothing" scenario is a hypothetical alternative considered as a basis for comparing the potential significant effects of the development proposal.

3.17 In the case of Highlee Hill, the "do nothing" scenario would be to have the development site continue to be used for commercial forestry and farming activities.

Alternative Sites

3.18 RES has a robust site selection methodology which is employed when selecting new development sites. The RES GIS Site Selection Model allows an objective and consistent treatment of potential sites in Scotland and the rest of the UK, and Highlee Hill has been confirmed as being appropriate based on having a good site suitability score on the GIS Site Selection Model. The overall suitable score is the result of the combination of different scored criteria. All input data is scored on a range of 0-1 where 0 represents land that is unsuitable (and is therefore removed from the final preferability layer) and 1 (or 100%) represents land that is entirely suitable or has no conflicting issues.

3.19 Potential sites are scored on the following criteria: wind speed, natural heritage, slope constraint and proximity to dwellings.

3.20 Taking these criteria into consideration and also the attributes described in para 3.2, the site score for the majority of the Site scored higher in excess of 86% which confirmed it as being suitable for a wind farm. The scoring results for the site are also shown on Figure 3.2.

Alternative Layout Designs

3.21 There have been several iterations of the turbine and infrastructure layout. The finalised turbine and infrastructure design can be seen in Figure 2.1

3.22 From the outset the following design principles have been employed when making design decisions:

- mitigation by design should be the principle method of reducing potential environmental impacts;
- existing infrastructure should be used whenever possible to avoid unnecessary development;
- turbines to be 'hidden' from radar installations at Spadeadam and Lowther Hill.
- minimise visual impact when viewing from Carter Bar and other sensitive landscape features
- all site infrastructure should be designed as efficiently as possible to reduce the overall extent of development whilst maximising the renewable energy generation potential; and
- inclusion of borrow pit search areas to identify rock on site which would enable a reduction in construction vehicle movements.

3.23 A key tool in the design process is the combined constraints drawing which integrates all potential constraints that need to be considered in the design process.

3.24 The combined constraints drawing is iteratively updated as new information from surveys and site visits is received as well as feedback from consultees. The finalised combined constraints map is shown as Figure 3.1.

Turbine Design Evolution

Key Layout Stages

3.25 The following turbine layout design stages are shown on Figure 3.3.

Layout 1 – Scoping January 2014

3.26 At the beginning of the development process, an initial layout was produced to show the maximum potential extent of development within the space available and in accordance with the design principles. This layout was based only on the general design principles and preliminary constraint information and was not informed by any significant amount of baseline environmental information.

3.27 This initial layout showed the potential for up to 37 turbines at up to 150 m tip height (a mix of 125 m and 150 m). A site of this size would be expected to exceed 50 MW in capacity and as such fell under the remit of the Scottish Government Energy Consents and Deployment Unit (ECDU).

3.28 This 37 turbine layout was used in the initial Scoping Report submitted to ECDU in January 2014.

3.29 The key drivers at this stage of the turbine layout evolution were

- aviation;
- physical constraints (water courses, gradient);
- housing buffers; and
- international and national designations (landscape, ecological and archaeological).

Aviation

3.30 There are both civil and military radar installations in the south of Scotland. The initial turbine layout was designed to ensure that the turbines would be terrain shielded from the radars in the area by locating them on the lower slopes rather than the highest points on the site. This approach also minimised the visibility of the turbines.

Physical Constraints

3.31 A 70 m buffer was placed around all water courses found on a 1:25,000 scale OS Map. This would protect water courses from impacts mainly during the construction and decommissioning phases.

3.32 Terrain with slope of over 12% or 15%+ was marked on the constraints map as it was likely to be unsuitable for turbines.

Housing Buffers

3.33 A buffer of 10x rotor diameter was applied to all residential properties. The candidate turbine being considered had a rotor diameter of 100 m resulting in a buffer of 1,000 m.

National and International Designations.

3.34 Areas which have been recognised for their international/national importance are allocated designated status and are protected accordingly. Designated sites within the development boundary included a Special Area of Conservation (SAC), Scheduled Monuments (SM), Site of Special Scientific Interest and Ancient Woodland. These were all identified on the constraints map.

Layout 2 – refined 150 m tip height design

3.35 Following the receipt of initial baseline environmental data, consultation feedback and early landscape design the site was reduced to 20 turbines at up to 150 m tip height. The reduction in turbines was done primarily to mitigate potential effects on:

- Landscape and Visual;
- Cultural Heritage;
- Hydrology;
- Ornithology;
- Ecology; and
- Electromagnetic Interference (EMI)

Landscape and Visual

3.36 **Chapter 4: Landscape and Visual** sets out the landscape and visual baseline context of the proposed Development, identifies the key sources of potentially significant landscape and visual effects and proposes a number of general and site specific design and mitigation measures relating to the construction, operational and decommissioning stages of the proposed Development.

3.37 The key design objectives identified in the LVIA include:

- Avoidance of smaller scale enclosed landscapes, including locations within the farmland adjoining the A6088 corridor;
- The application of a suitable 'set back' from settlements and key transportation and recreational routes in order to minimise significant visual effects at these receptor locations;
- Location of the proposed turbines and key infrastructure within a low to medium sensitivity large scale upland landscape which is dominated by large scale coniferous plantations, and which already contains suitable infrastructure and borrow pits;
- Avoidance of locating turbines on prominent elevated locations at the southern end of the site where they are likely to be most visible from locations south of the Scottish/English border, the Northumberland National Park, and could be seen from Carter Bar vantage point;
- The application of a set back from more enclosed landscapes such as river valleys and enclosed farmland landscapes to reduce the visibility and prominence of the proposed Development and avoid the potential for turbines to tower over such landscapes;
- The avoidance of prominent ridgelines and summits, especially where such summits form focal points in the landscape (e.g. Rubers Law and Cheviots);
- Preferential positioning of turbines in a part of the application site that is enclosed on three sides by topography; and
- The achievement of a balanced and cohesive array in the majority of views of the proposed Development, but with particular emphasis upon views from key settlements in the vicinity.

Cultural Heritage

3.38 The buffer around heritage features within the Development boundary was increased to 100 m in order to protect from any direct impacts and the undesignated Westshiels Farmhouse was added to the protected list.

Hydrology

3.39 A 70 m buffer was already in place around watercourses within the site boundary. This was increased to 100 m along the Jed Water due to its designated status as a Special Area of Conservation (SAC).

Ornithology

3.40 Breeding bird surveys showed evidence of Goshawk nesting sites within the Development boundary. Although these sites were likely to be disturbed over time with the existing forestry felling operations a 500 m buffer was placed around known nest sites.

Ecology

3.41 As part of the baseline assessment, the following ecological surveys were carried out: Extended Phase 1 habitat, NVC, protected species, bat surveys and fisheries survey. The results of the protected species survey provided evidence of active bat roosts as well as the presence of badgers

EMI

3.42 A microwave link was identified crossing the site following consultation with telecoms providers. The link along with a 100 m buffer to the turbine blade tip was added to the constraints map.

Layout 3 – Scoping November 2015

3.43 Following the 2015 general election the new government announced changes to the support mechanism which applied to wind farms. Following a review of the project economics the decision was made to explore the possibility of using higher capacity taller turbines in order to maximise the amount of energy which could be produced from the site. Following a review of available turbines within the marketplace it was found that turbines in the region of 176 m tip height would be appropriate.

3.44 A new layout design was developed using the taller turbines and the number of turbines was reduced from 20 to 13.

3.45 In order to maintain the terrain shielding required to avoid detection on nearby radar installations the turbines were moved further down slope so the tip heights remained substantively unchanged in terms of height above sea level (AOD).

3.46 The increased tip height also has the benefit of further separating the turbines from the forest below. This will allow the existing commercial forest operations to continue without affecting the turbines' performance excessively.

Layout 4 – Final Layout

3.47 Further design iterations reduced the tip height of the two turbines closest to the village of Chesters.

3.48 The increase in size of eleven of the proposed turbines was applied selectively to those turbines set back from prominent ridges and the edges of the Southern Uplands, so as to take advantage of the topographical enclosure of the site.

3.49 The potential increase in visual impacts of the increased turbine height is tested in the comparative ZTV found in Figure 3.4. The figure shows how the ZTV changes if using a 130 m, 150 m and 176 m turbine assuming the same final turbine layout.

3.50 As can been seen from the figure the prominent ridges and the edges of the Southern Uplands continue to give the advantage of topographical enclosure even at the tallest 176 m.

3.51 A number of turbines were moved slightly following a final engineering site visit. This included Turbine 6 as the original location was found to have unfavourable ground conditions, the area was heavily saturated with a number of watercourses present, and more suitable ground was identified to the east.

3.52 The final layout is considered to represent the best environmental fit within environmental, technical and commercial constraints, operating efficiently and making a meaningful contribution to renewable energy generation targets.

Infrastructure Design Evolution

Initial Infrastructure Design

3.53 The defining principle of the infrastructure design was to minimise land take by using the existing track network wherever possible. Other design principles which were followed include:

- minimise number of new water crossings;
- avoiding identified constraints;
- limiting visibility of infrastructure elements such as control building and borrow pits;
- avoidance of cut and fill through appropriate routing of infrastructure;
- avoidance of forestry felling through appropriate routing of infrastructure

Final Infrastructure Design

3.54 The final infrastructure design was completed after additional on-site reviews. The changes made are detailed in paragraphs 3.55-3.64.

Engineering

3.55 The site entrance was re aligned to minimise the impact on the local road network and road users. The site access track now runs alongside the public road in adjacent property where possible to minimise disturbance the road users.

3.56 A temporary construction compound was located close to the site entrance to facilitate the construction of the access track towards the main wind farm site.

3.57 The direction of crane hardstand layouts at Turbine 1 and Turbine 3 were reversed to accommodate reversing manoeuvres to avoid additional cut and fill.

3.58 Turning heads were incorporated to avoid the need for circular routes and reduce the amount of track required overall.

3.59 Due to the taller hub heights proposed on this site a revision of the crane pads used to date was required. The need for a larger main hardstand was identified and also the requirements for an additional crane assist area. This is as a result of the larger cranes required for erecting turbines to a hub height greater than 100 m, in line with specifications from current turbine suppliers.

3.60 As a result of longer crane pads the following changes occurred at these locations:

- Turbine 8 approach was realigned to avoid the nearby water course Rough Sike.
- Turbine 9 approach track was re-aligned to accommodate the local terrain and ensure a suitable gradient on approach to the turbine for delivery vehicles thus minimising the requirement for cut and fill.
- Turbine 13 approach track was realigned to avoid a nearby water course to the east. This also resulted in the removal of a turning head which had previously existed to accommodate delivery vehicles this can now be accommodated by the newly created junction.
- Additional, minor refinements where made at other turbine locations to ensure the most suitable alignments where achieved for safe access and reduced cut and fill works.

3.61 Nine potential borrow pit search areas were consider with five taken forward following suitability assessments. The borrow pit search areas locations shown in Figures 2.14a-e. These areas were assessed and identified as having the most potential for supplying stone to construct the onsite infrastructure. These areas will be included in site investigation going forward, and following consent and further detailed design the most appropriate areas will be used.

Hydrology

3.62 The temporary compound at the site entrance was relocated to a position outside the flood risk area identified along the Jed Water.

3.63 Crane hardstand layouts at Turbine 1 and Turbine 3 were reversed to avoid water crossings.

Landscape and Visual

3.64 The LVIA sets out specific proposals for the location and design of key ancillary elements during the construction, operation and decommissioning phases of the proposed Development, including:

- the preferential use of existing forest and farm tracks and minimisation of the length of any additional tracks required;
- the location of the site control building and substation in an enclosed area towards the centre of the proposed Development site, to reduce the visibility of these elements;
- location of crane pads and laydown areas in forested areas to reduce their visibility from external receptor locations;

- location of potential borrow pits to avoid prominent elevated topography which may be visible from external receptor locations.

Residual Design Considerations

Shadow Flicker

3.65 Shadow flicker is a phenomenon caused by the moving shadow of the turbine rotor being cast over a narrow opening, such as a window or open door. The likelihood of disturbance from shadow flicker is dependent on the distance from turbines, turbine orientation, the time and day of the year and the weather conditions.

3.66 The Scottish Government web-based renewable advice[2] recommends that a separation between turbines and dwellings beyond 10 rotor diameters should avoid nuisance and annoyance to nearby residents. The advice quotes:

"In most cases however, where separation is provided between wind turbines and nearby dwellings (as a general rule 10 rotor diameters), "shadow flicker" should not be a problem."

3.67 For the proposed development the nearest turbine to a dwelling is located over 1.5 km away (approximately 13 rotor diameters) and therefore no significant shadow flicker is expected to occur.

Electromagnetic Interference / TV

3.68 Wind turbines can potentially interfere with communication systems that use electromagnetic waves as the transmission medium (e.g. television, radio or microwave links). Wind turbines therefore may cause interference to television reception in the proximity of a wind farm, primarily for receptors in the '*shadow*' of the turbines with aerials pointing through the wind farm, causing loss of picture detail, loss of colour or loss of audio. Microwave links can also be affected by the reflection, scattering, diffracting and blocking of the electromagnetic signal caused by wind turbines.

3.69 If the proposed development is consented, RES would agree a scheme of assessment and mitigation with the Council to be implemented in the case of complaints associated with television reception. Should interference to reception occur as a result of the proposed development, a range of viable mitigation measures can be considered, with the most suitable method chosen on a case by case basis. Any necessary work would be undertaken in a timely manner following receipt of a valid complaint, and would be funded by the wind farm operator.

3.70 The applicant has consulted with organisations and systems operators of microwave links which could be affected by the proposed development and these are listed in Table 3.1. The proposed development is not predicted to cause any interference to microwave links.

Aviation

3.71 Wind turbines can potentially interfere with aviation operators by either physically affecting the safeguarding of an aerodrome by the close proximity of the turbines or through interference with the Air Traffic Control (ATC) radars that direct aircraft in flight. The applicant has consulted with all relevant organisations which could be affected by the proposed development.

3.72 The Defence Infrastructure Organisation (DIO) safeguards all Ministry of Defence (MoD) infrastructure that may be impacted by the presence of wind turbines. The DIO were consulted in November 2015 using the proforma agreed with RenewableUK (RUK). The DIO responded highlighting some potential concerns regarding the proposed development, including impacts on threat radars, low flying operations and Eskdalemuir. The applicant will continue to discuss these concerns with the DIO to ensure a mutually acceptable way forward. The DIO has requested, and it is the Applicants intention to fully comply, that infra-red aviation lighting be fitted on all turbines at the highest practicable point.

3.73 NATS En Route (NERL) supplies air traffic service to all en route aircraft navigating UK airspace. The applicant has consulted the published NATS self-assessment maps which have been produced to indicate if a wind farm development will impact NERL infrastructure. The proposed development lies largely outside the safeguarding areas which identify need for further consultation with NERL. Accordingly, the applicant commissioned a Technical and Operational Assessment from NATS in early 2012. NATS responded in March 2012 to report that they had no concerns.

3.74 The UK Met Office safeguard their weather radars out to a distance of 20 km. The proposed development lies outside any of these safeguarding areas which identify need for further consultation with the Met Office and therefore the proposed development will have no impact on the Met Office operations.

3.75 As the proposed development includes turbines of above 150 m, the applicant consulted with the Civil Aviation Authority (CAA) in April 2016. The current UK legislation, the Air Navigation Order, Article 219, states that the obstacles over 150 m should have visible lighting as close as possible to the top. There is ongoing dialogue between RUK and the CAA regarding how this should be interpreted for turbines. The applicant is fully engaged with these discussions.

Ice Throw

3.76 Under certain climatic conditions, ice can build up on turbine blades which may be thrown from the blades during blade rotation or fall when blades are stationary.

3.77 To mitigate the risk of ice being thrown large distances, modern turbines may be fitted with ice detection sensors that will automatically shut down turbines when ice is detected. Risk from ice throw would therefore be limited to only a small area around each turbine.

3.78 To further mitigate the risk of ice throw, appropriate Health and Safety protocol can be implemented to ensure that operations staff are not in the vicinity during potential ice throw conditions. Notices at access points and warning signs around turbines can alert members of the public to the possible risk of ice throw under certain weather conditions.

3.79 These measures and the remote nature of the site, result in the potential for ice throw at this site to be considered low.

Tourism

3.80 In their 2014 scoping response submitted to the ECDU, Visit Scotland commented that given the role of tourism in Scotland's economic and cultural wellbeing, and in particular the importance of scenery and natural environment to tourism, that an application for a renewable development such as that proposed at Highlee Hill should consider the Scottish Government's 2007 research on the impact of wind farms on tourism (Moffat Report 2008) and further suggested that the applicant also consider the inclusion of a Tourist Impact Assessment as part of any subsequent Environmental Impact Assessment.

3.81 The findings of the report referred to by Visit Scotland confirmed that wind farms do not have an adverse impact on tourism in Scotland. These findings have subsequently been confirmed in further

[2] Scottish Government – Online Renewables Planning Advice - http://www.gov.scot/Resource/0045/00451413.pdf

studies into tourist attitudes to wind farms such as the recent report by the James Hutton Institute on behalf of ClimateXchange 'The Impact of Wind Farms on Scottish Tourism'[3], the findings of the 2012 Scottish Parliament's Economy, Energy and Tourism Committee, VisitScotland's 2011 Wind Farm Consumer Research4[4] and a recent YouGov Poll undertaken by Scottish Renewables[5].

3.82 Given the findings of the various studies undertaken into tourist attitudes of wind farms and that the final proposed layout has reduced the potential visibility to key sensitive receptors such as Carter Bar, the proposed wind farm is not considered to have a significant effect on this receptor. Therefore a Tourist Impact Assessment is not considered necessary. Potential effects on hill walkers and recreational routes are assessed in **Chapter 4: Landscape and Visual** and also **Chapter 5: Cultural Heritage and Archaeology**.

[3] http://www.climatexchange.org.uk/reducing-emissions/impact-wind-farms-scottish-tourism/

[4] http://www.visitscotland.org/pdf/Windfarm%20Consumer%20Research%20final_docUpdatedx.pdf

[5] https://www.scottishrenewables.com/news/new-poll-suggests-scots-twice-favourable-wind-powe/

Table 3.2: Summary of Mitigation by Design

Topic / Issue	Environmental Constraint / Potential Effect	Mitigation by Design	Issues Remaining
Landscape and Visual	Visual impact of turbines	Avoided siting turbines on elevated locations and avoidance of prominent ridgelines and summits. Allowing a suitable set back from settlements Keyholing turbines were possible to maintaint available screening. Two shorter turbines on the more elevated positions to retain consistency turbine elevations within the view.	Remaining visual impact on surrounding receptors is explored in Chapter 4: Landscape and Visual.
	Visual impact of borrow pits	Borrow pit search area selected to minimise visual impacts. Restoration of borrow pits following construction.	Further assessment of the visual impact during the construction phase.
	Visual impact of infrastructure	Infrastructure situated to reduce the visibility of the wind farm project as much as possible. Existing forestry tracks used as much as possible. Key holing of infrastructure into forested areas to provide a natural screen.	Ongoing assessment during detailed design and the construction phases to ensure the necessary construction methods do not require additional works that will have a significant impact the surrounding landscape.
Hydrology	Pollution risk to watercourses	A 70 m buffer has been applied to all watercourses. Aligned tracks to minimise additional water crossings.	A total of 16 no water crossing (including 14 existing) will require further consideration during detailed design
	Increase in flood risk.	A SuDs system to be incorporated. Removal of non essential infrastructure from identified flood risk areas	Ensure the detailed design considers SuDs and this system provides adequate protection against flooding. Ongoing monitoring of drainage and construction methods throughout the construction phase
Ecology	Impact on terrestrial ecology	Sensitive ecological receptors such as bat roosts and badgers sets, identified and buffered to avoid these locations were possible.	Pollution prevention measures and species protection plans will be put in place to ensure protection during construction and decommissioning phases. See **Chapter 5 Ecology** and **Technical Appendix 8.1** Appointment of an Ecological Clerk of Works will be agreed with the local planning authority in consultation with SNH and SEPA.
	Impact on habitats	Avoidance of GWDTE's and SAC's and applying appropriate buffers.	
Ornithology	Impacts on bird species	500 m buffer was placed around known nest sites to prevent disturbance/displacement.	Collision risk still remains however and is covered in more detail in **Chapter 6 Ornithology.**
Cultural Heritage	Physical impacts on heritage assets	Appropriate routing of infrastructure to avoid heritage assets where possible.	Protection of assets, particularly during construction and decommissioning phases through security fencing and hoarding, effective traffic management and ongoing monitoring of same throughout the construction phase. Particular care around Dykeraw Tower.

Topic / Issue	Environmental Constraint / Potential Effect	Mitigation by Design	Issues Remaining
Forestry	Impacts on existing forestry operations	Key holing of turbine & track locations to avoid clear felling. Tall turbines used to allow maximum tree growth.	Forestry management plans such as restocking and compensatory planning are covered in more detail in **Chapter 10 Forestry**.
Aviation	Impact on military radar installations	The turbine layout was designed to terrain shield turbines from military radar installations.	Consultation with the DIO on the final submitted layout will determine if there are any ongoing concerns relating to threat radar or low flying.
	Impact on civil radar installations	The turbine layout was designed to terrain shield turbines from civil radar installations.	No issue remaining. NATS responded in March 2012 to report that they had no concerns
	Impact of turbine lighting	TBC	There is ongoing dialogue between RUK and the CAA regarding lighting requirements for onshore turbines. The applicant is fully engaged with these discussions and seeking to minimise visual impacts.
Telecommunications	Potential for interference with microwave communications links through physical obstruction.	Microwave links and telecoms masts were identified and added to the constraints map in order to prevent turbines being located in areas which would cause a problem.	No issue remaining.
Shadow Flicker	Potential for shadow flicker effects on residential amenity.	Turbines located over 10 rotor diameters from nearest dwellings.	No issue remaining.

Issues Remaining for Impact Assessment

3.83 The following issues have not been fully addressed through 'mitigation by design' and will be considered further in the remaining chapters of the ES. These are:

- Landscape and Visual
- Ecology
- Ornithology
- Cultural Heritage and Archaeology
- Geology, Hydrology and Hydrogeology
- Noise
- Forestry
- Traffic and Transport

HIGHLEE HILL WIND FARM

FIGURE 3.1

COMBINED CONSTRAINTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Turbine Layout

Site Boundary

Occupied Habitations

Occupied Habitations Buffer: 1170m (10xRD)

Ecology Constraints: Buffer varied

Hydrology Buffer: 70m (Jedd Water Buffer: 100m)

Microwave Link

Microwave Link Buffer: 158.5m (100m + RR)

Cultural Heritage Buffer: 186m (TH+10m)

Scottish Borders HER Historic Tracks Buffer: 30m

Scottish Borders Rights of Way Buffer: 176m (TH)

LiDAR Terrain Slope

< 12%

12% - 15%

> 15%

LAYOUT DWG	T-LAYOUT NO.
02836D0002-13	PSCOhhi041

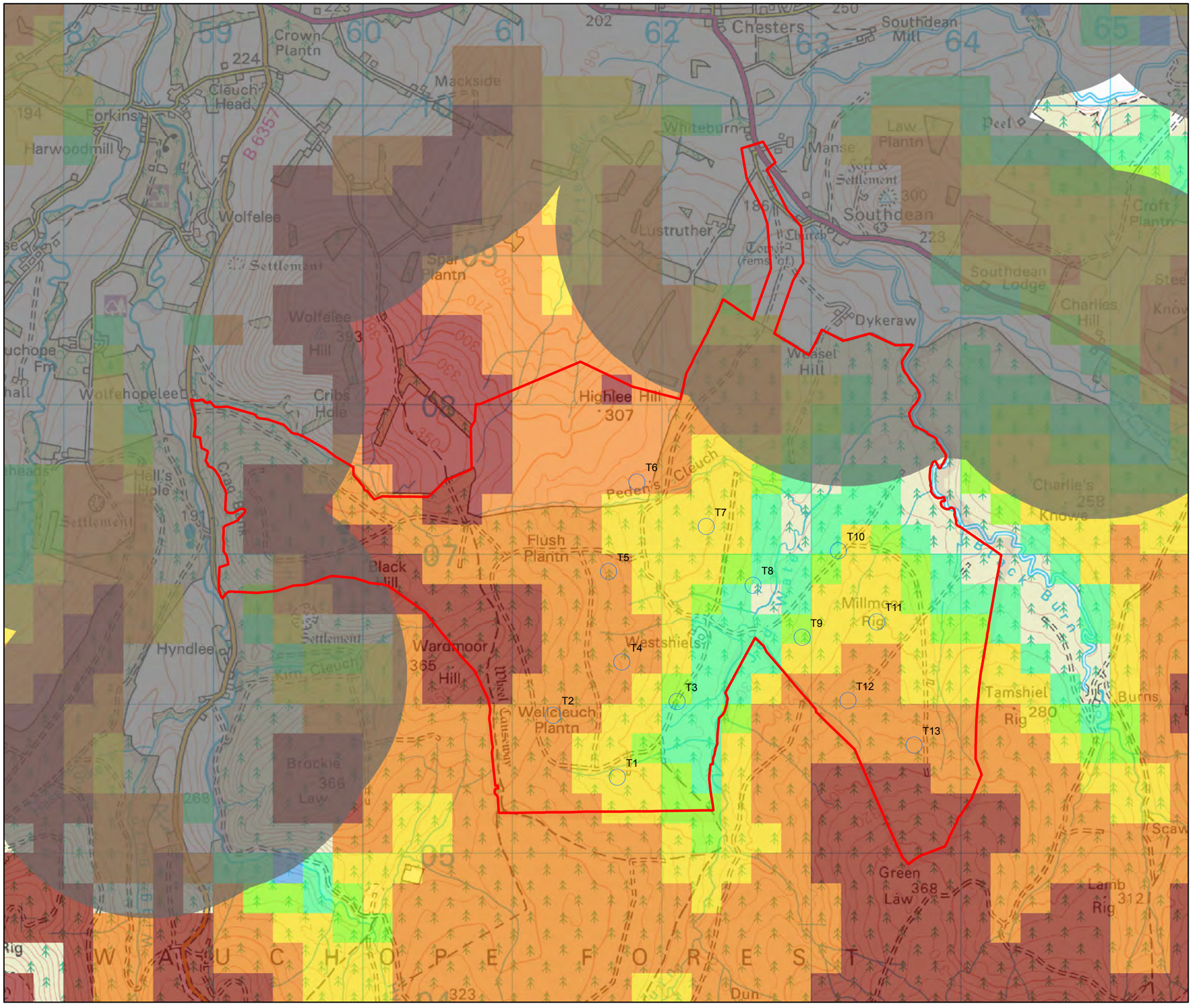
DRAWING NUMBER

02836D2112-01

SCALE - 1:25,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIGURE 3.2

SITE SELECTION RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

KEY

- PROPOSED TURBINE LAYOUT
- SITE BOUNDARY
- 1170m HOUSING BUFFER

SITE SELECTION SUITABILITY (%)

- < 30
- 31 - 50
- 51 - 60
- 61 - 70
- 71 - 80
- 81 - 85
- 86 - 90
- 91 - 95
- 96 - 100

LAYOUT DWG	T-LAYOUT NO.
02836D0002-13	PSCOhhi041

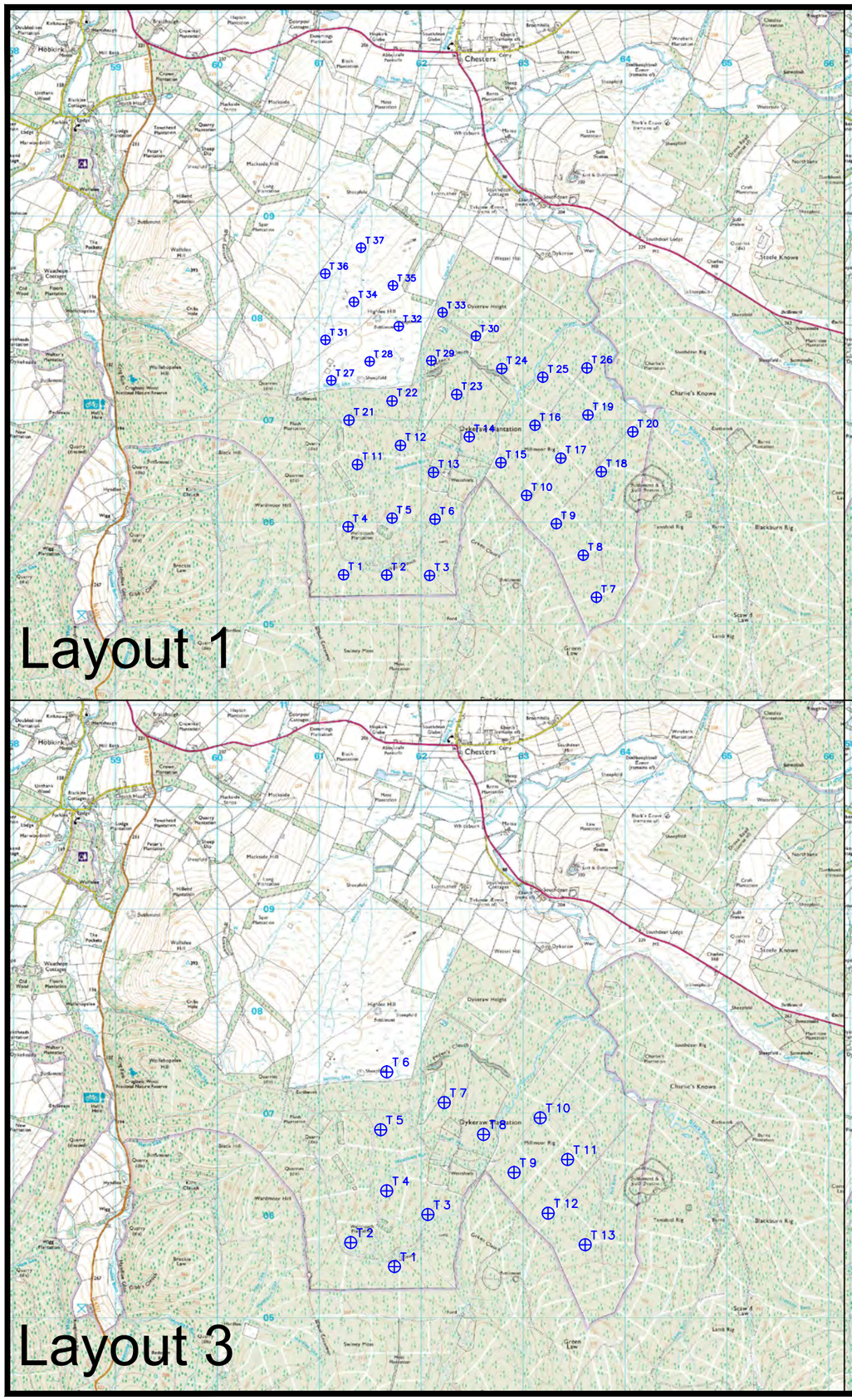
DRAWING NUMBER

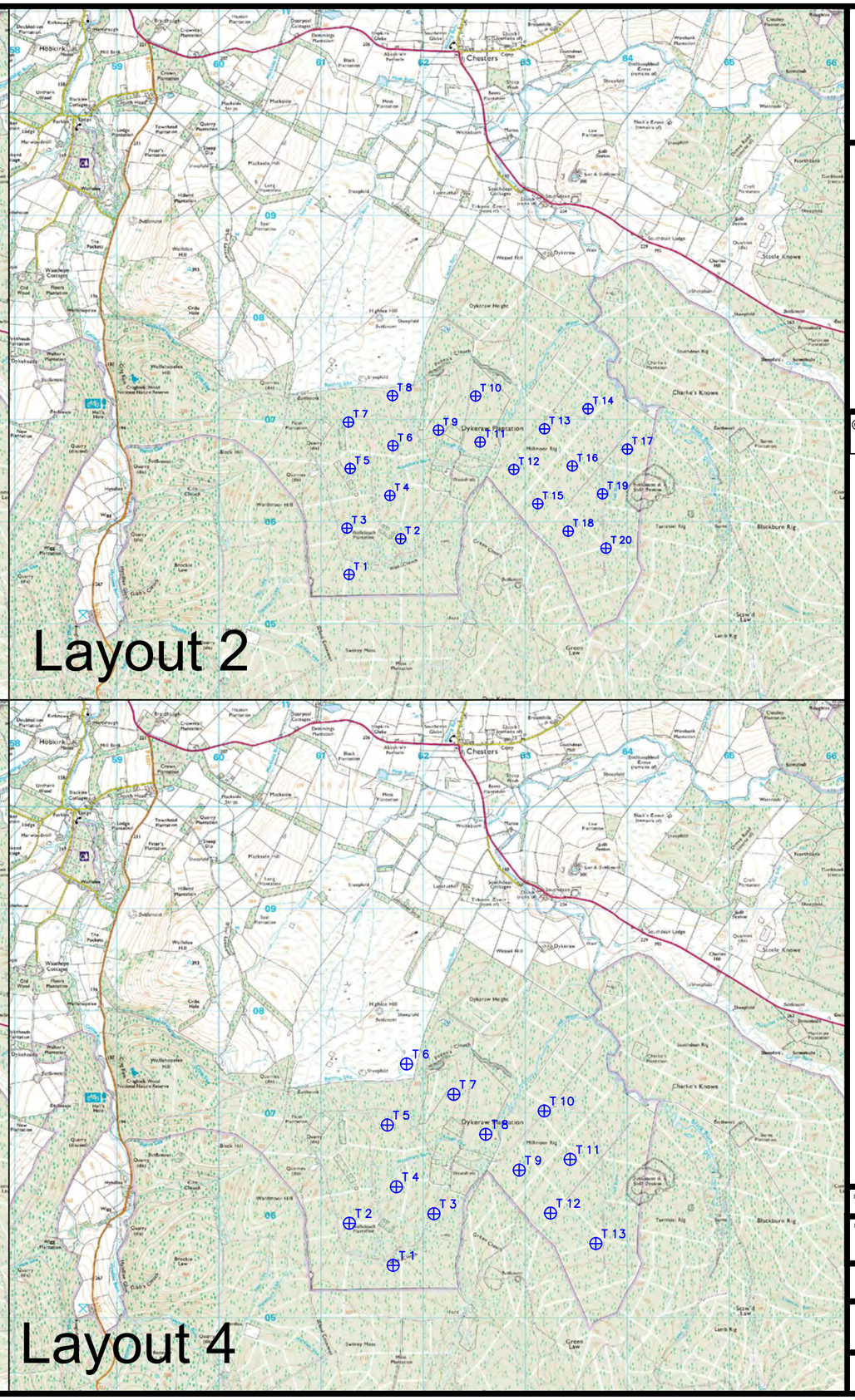
02836D2221-01

SCALE - 1:25,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION





HIGHLEE HILL
WIND FARM

FIGURE 3.3

TURBINE LAYOUT
EVOLUTION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED
2016 LICENCE NUMBER 0100031673.

T Turbine Location

Layout 1

37 turbines
Mixed 125m and 150m tip height

Layout 2

20 turbines
150m tip height

Layout 3

13 turbines
176m tip height

Layout 4

13 turbines
Mixed 150m and 176m tip height

LAYOUT DWG 02836D0002-13

T-LAYOUT NO. PSCOhhi012/028/035/041

DRAWING NUMBER 02836D0901-01

SCALE - 1 : 50,000

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIGURE 3.4

COMPARATIVE ZTV: FINAL LAYOUT VS 150m and 130m TURBINE

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

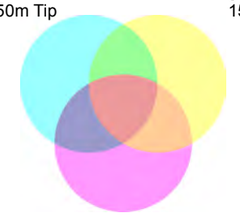
Key

- Proposed Turbines
- 40km Buffer from Outer Turbine
- 10km Radii from Proposed Turbines

Zones of Theoretical Visibility

Highlee Hill 176m & 150m Tip

Highlee Hill 150m Tip



Highlee Hill 130m Tip

1. The ZTV analysis does not take into account the screening effect of vegetation, buildings and other surface features
2. Predicted visibility based on a viewer eye height 2m above ground
3. Visibility calculated using Ordnance Survey Terrain 5 DTM on a 5m Grid
4. Effect of earth curvature and light refraction is included

LAYOUT DWG	T-LAYOUT NO.
XXXXXDXXXX-XX	PSCOhhi039

DRAWING NUMBER: 3.4

SCALE - 1:350,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

4. Landscape and Visual

Introduction

4.1. This Chapter assesses the landscape and visual effects of the proposed Development, which is described in **Chapter 2: Proposed Development**. The Landscape and Visual Impact Assessment (LVIA) is based on a candidate turbine being used at the site which has a maximum height to blade tip of 176 m. However, two of the proposed Development's turbines would have a maximum tip height of 150 m in order to provide mitigation in views from the A6088 corridor and the settlements of Chesters and Southdean.

4.2. The LVIA considers effects on:

- landscape fabric;
- landscape character; and
- visual amenity.

4.3. Effects on landscape fabric occur when there is physical change to components of the landscape such as the landform, land use or land cover. Effects on landscape character arise when there is change to the key characteristics of the landscape and its associated distinct and recognisable pattern of elements. Visual effects are a subset of landscape effects and comprise changes in views of the landscape and the overall effects on visual amenity.

4.4. Landscape and visual effects may have effects on cultural heritage facets of the landscape, specifically on the setting of Gardens and Designed Landscapes (GDLs) and on listed buildings and ancient monuments. The landscape and visual assessment considers potential effects on GDLs, whilst effects on other cultural heritage receptors are considered in **Chapter 7: Cultural Heritage and Archaeology**.

4.5. Landscape and visual considerations have influenced the design of the proposed wind farm and these are explained in **Chapter 3: Design Evolution Considerations and Alternatives**.

4.6. The sections of the LVIA Chapter comprise the following:

- Legislation and Policy Context;
- Consultations;
- Method of Assessment;
- Baseline Conditions;
- Assessment of Residual Effects; and
- Statement of Significance.

4.7. The Chapter is supported by the following **Technical Appendices**:

- **4.1 - Glossary;**
- **4.2 – Landscape Character Types Descriptions;**
- **4.3 – Residual Effects on Landscape Character;**
- **4.4 - Residual Effects on Landscape Designations and Classifications;**
- **4.5 – Route Analysis;**
- **4.6 - Viewpoint Assessment;**
- **4.7 - Residential Visual Amenity Survey[1] (RVAS); and**
- **4.8 – Borrow Pit Search Area Assessment.**

4.8. A series of Figures also support this chapter and these are contained in Volumes 3 of this ES.

Legislation and Policy Context

4.9. A desk study of the relevant national, regional and local planning guidance and landscape planning policy context was carried and the findings summarised in the following paragraphs. The individual policies are quoted in italics, with reference numbers from the Planning Policy documentation.

National Legislation and Policy

4.10. The Scottish Government's planning guidance on renewable developments is set out in the National Planning Framework (NPF3)[2] and in the Scottish Planning Policy (SPP) published in 2014.[3]

4.11. Much of the relevant material in the SPP in regard to onshore wind farm development relates to the development of spatial frameworks. Paragraph 161 of the SPP states that:

"Planning authorities should set out in the development plan a spatial framework identifying those areas that are likely to be most appropriate for onshore wind farms as a guide for developers and communities, following the approach set out below in Table 1 (page 39 of the SPP). Development plans should indicate the minimum scale of onshore wind development that their spatial framework is intended to apply to. Development plans should also set out the criteria that will be considered in deciding all applications for wind farms of different scales – including extensions and re-powering – taking account of the considerations set out at paragraph 169 of the SPP."

4.12. These criteria refer to a number of environmental factors. Those of relevance to the LVIA include:

- cumulative impacts;
- impacts on communities and individual dwellings;
- landscape and visual impacts, including effects on Wild Land;
- impacts on long distance walking and cycle routes and scenic routes identified in NPF3; and
- impacts on tourism and recreation.

4.13. The categories proposed for use in spatial frameworks comprise the following:

- Group 1 Areas: Where wind farms will not be acceptable such as in National Parks (NPs) or National Scenic Areas (NSAs).
- Group 2 Areas: Areas designated/classified for their international or national heritage value, outwith National Parks and National Scenic Areas including:
  - National and international designations including (principally those relating to cultural heritage and/or ecological value);

[1] RVAS does not compy with the methodology utilised in the LVIA or as advocated in GLVIA3.

[2] The Scottish Government (2014) Ambition, Opportunity, Place – Scotlands Third National Planning Framework.

[3] The Scottish Government (June 2014) Scottish Planning Policy

- Sites included in the inventory of Gardens and Designed Landscapes;
- Other nationally important mapped environmental interests such as Wild Land Areas (WLAs);
- Community separation for consideration of visual impact (i.e. an area not exceeding 2 km around cities, towns and villages identified on the local plan.

- Group 3 Areas: Areas with potential for wind farm development, subject to detailed consideration against policy criteria.

4.14. In addition to matters pertaining to spatial frameworks, the SPP provides guidance on the preparation of development plans. Paragraph 196 of the SPP states that:

"International, national and locally designated areas and sites should be identified and afforded the appropriate level of protection in development plans. Reasons for local designation should be clearly explained and their function and continuing relevance considered when preparing plans. Buffer zones should not be established around areas designated for their natural heritage importance. Plans should set out the factors which will be taken into account in development management. The level of protection given to local designations should not be as high as that given to international or national designations."

4.15. Paragraph 202 of the SPP provides guidance regarding the siting and design of wind farms and states that:

4.16. "The siting and design of development should take account of local landscape character. Development management decisions should take account of potential effects on landscape and the natural and water environment, including cumulative effects. Developers should seek to minimise adverse impacts through careful planning and design, considering the services that the natural environment is providing and maximising the potential for enhancement."

4.17. Paragraph 203 of SPP goes on to state that:

"Planning permission should be refused where the nature or scale of proposed development would have an unacceptable impact on the natural environment. Direct or indirect effects on statutorily protected sites will be an important consideration, but designation does not impose an automatic prohibition on development."

4.18. Paragraph 203 of SPP goes on to state that:

"Planning authorities should apply the precautionary principle where the impacts of a proposed development on nationally or internationally significant landscape or natural heritage resources are uncertain but there is sound evidence indicating that significant irreversible damage could occur. The precautionary principle should not be used to impede development without justification. If there is any likelihood that significant irreversible damage could occur, modifications to the proposal to eliminate the risk of such damage should be considered. If there is uncertainty, the potential for research, surveys or assessments to remove or reduce uncertainty should be considered."

Regional and Local Legislation and Policy

The Scottish Borders Local Development Plan (LDP)

4.19. Policy ED9: Renewable Energy Development of the LDP states that:

"Renewable energy developments will be approved provided that,

1. there are no unacceptable adverse impacts which cannot be fully mitigated on the natural heritage including the water environment, landscape, biodiversity, built environment and archaeological heritage; and,
2. there are no unacceptable adverse impacts which cannot be satisfactorily mitigated on recreation and tourism, population, communities and access routes.

If there are judged to be significant adverse impacts that cannot be mitigated, the development will only be approved if the Council is satisfied that the contribution to wider economic and environmental benefits outweigh the potential damage to the environment or to tourism and recreation."

4.20. The policy goes on to state, in respect of wind turbine developments that:

"In addition to the general provisions for assessment as set out in paragraph 2 of this policy, proposals for all wind turbine proposals should be judged against the following considerations and will only be approved where the overall impact is judged acceptable by the Council:

Guidance on planning constraints and landscape capacity can be obtained from the following diagrams:

- Fig ED9a – Spatial Strategy;
- Fig ED9b – wind Turbine Development Capacity Opportunities and Constraints;
- Fig ED9c – landscape capacity for turbines 25 – 50m in height;
- Fig ED9d – landscape capacity for turbines 50 - 100m in height; and
- Fig ED9e – landscape capacity for turbines 100m + in height.

If turbines are proposed which exceed the turbine heights identified within figs ED9b - e the onus would be on the applicant to demonstrate how the impacts of the proposal on the key constraints and any significant adverse effects can be mitigated in an effort to show a proposal can be supported."

4.21. The policy also identifies a series of specific landscape criteria of relevance:

- The landscape is capable of accommodating the proposal without significant detrimental impact on landscape character;
- The scale and design of the proposal is appropriate to the scale and character of the receiving landscape. large turbines are more likely to be acceptable in larger scale landscape types e.g. areas defined as upland types within the Borders landscape assessment; and
- proposals should not have adverse impacts on areas exhibiting remote qualities which are valued as wild land,"

4.22. The policy also identifies a series of specific criteria relating to potential visual impacts:

- "Views of the turbines including associated transmission lines, tracks, plant and buildings should demonstrate minimal effects on sensitive receptors including residential properties, important landscape features, prominent landmarks, major tourist routes and popular public viewpoints, including those out with the Scottish Borders boundary.
- Assessment must take into account the effects of distance between the developer and the receptor; and

- locations will be preferred where there is surrounding landform which minimises the external visibility of the development and where there is no interference with prominent skylines.

4.23. In regard to cumulative landscape and visual impacts, the policy states that:

- "*Significant coincident cumulative landscape and visual impacts must be avoided where an existing wind farm development is present in an adjoining area and can be viewed together with the proposed development;*
- *Significant sequential cumulative landscape and visual impacts over a wider area must be avoided where a number of windfarm developments can be viewed in succession on a journey leading to adverse impacts on routes such as roads and long distance footpaths; and*
- *within the areas identified in the spatial strategy where existing development means that potential cumulative impacts are likely to occur there will be a presumption against development unless it can be demonstrated to the satisfaction of the Council that there would be no significant additional detrimental impacts*."

4.24. Policy ED9 also states that:

"In all cases developers must demonstrate that they have considered options for minimising the operational impact of a turbine proposal including:

1. *Positioning of turbines in relation to landscape character, surrounding landform, wind farms and power lines;*
2. *Positioning of turbines in relation to the biodiversity interest of the site and surrounding area;*
3. *Siting and design of tracks and ancillary development;*
4. *Turbine positioning and separation from residential properties and radio telecommunications;*
5. *Turbine specification and technical controls, including consideration of predicted noise levels at specific properties closest to the wind farm at wind speeds corresponding to cut-in, full rated power and maximum operational wind speed, along with background noise levels and wind speeds;*
6. *Colours and finishes;*
7. *Routeing and timing of construction traffic; and*
8. *Road access and improvements, including taking account of constraints posed by wetland and upland habitats*."

4.25. The LDP also contains a number of policies related to specific receptors including Policies EP4: National Scenic Areas, EP5: Special Landscape Areas, and EP10: Gardens and Designed Landscape.

4.26. Policy EP4 states that

"Development that may affect National Scenic Areas will only be permitted where:

a) the objectives of designation and the overall landscape value of the site and its surrounds will not be compromised; or

b) any significant adverse effects on the qualities for which the site or its surrounds have been designated are clearly outweighed by social or economic benefits of national importance."

4.27. EP5: states that

"In assessing proposals for development that may affect Special Landscape Areas, the Council will seek to safeguard landscape quality and will have particular regard to the landscape impact of the proposed development, including the visual impact. Proposals that have a significant adverse impact will only be permitted where the landscape impact is clearly outweighed by social or economic benefits of national or local importance."

4.28. EP10: states that:

"The Council will support development that safeguards or enhances the landscape features,

- *• character or setting of:*
- *• a) sites listed in the Inventory of Gardens and Designed Landscapes, or*
- *• b) sites included in historic gardens and designed landscapes records.*
- *• All development should be carefully sited, be of the highest standards of design using*
- *• appropriate finishing materials and planting, and be informed by and respectful of the historic*
- *• landscape structure. Proposals that will result in an unacceptable adverse impact will be*
- *• refused.*
- *All applications affecting a Garden or Designed Landscape will be required to be supported by Design Statement."*

Scottish Borders Council Supplementary Planning Guidance on Wind Energy (May 2011)

4.29. Planning applications with the Scottish Borders Council (SBC) administrative area will be required to consider the guidance contained within the Supplementary Planning Guidance for Wind Energy published in March 2011.

4.30. The SBC Supplementary Planning Guidance Wind Energy[4] (SPGWE) was prepared in line with Scottish Planning Policy[5] (SPP) and the web-based advice on renewable energy which replaced Planning Advice Note (PAN) 45 Annex 2. This requires local planning authorities to identify:

- areas requiring significant protection because they are designated for their national or international landscape or natural heritage value, are designated as green belt or are areas where the cumulative impact of existing and consented wind farms limits further development;
- areas with potential constraints where proposals will be considered on their individual merits against identified criteria; and
- areas of search where appropriate proposals are likely to be supported subject to detailed consideration against identified criteria.

4.31. Appendix E of the SPGWE identifies that the application site extends over a number of different levels of constraints as shown on the Wind SPG Spatial Strategy April 2013[6]. The forested eastern section of the site, Milmoor Rig is in the Area of Significant Protection, the northern slope of Highlee Hill is identified as having 'Moderate constraints (Higher)', the summit of Highlee Hill along with the site's southern section are within 'Moderate constraints (Lower)', the western part and centre of the site, where the majority of the proposed turbines would be located, are identified as areas having 'Minor constraints'.

4.32. SPG Policy 2 determines that any planning applications within an area of constraints must take cognisance of the constraint(s) and be scrutinised under policy D4 and the supplementary policy in paragraph 6.4.

[4] The Scottish Borders Council Supplementary Planning Guidance Wind Energy May 2011

[5] Scottish Planning Policy, February 2010

[6] The Scottish Borders Council Supplementary Planning Guidance Wind Energy May 2011, Appendix E Spatial Strategy

4.33. Paragraph 6.4 of the SPG provides further clarity in relation to the requirements of Policy D4 of the SBLP in relation to the following:

- Areas of Great Landscape Value and National Scenic Areas;
- Tourism;
- Cumulative Impact - International Nature Conservation Sites;
- Shadow Flicker;
- Noise;
- Ecology - Ornithology;
- Biodiversity and Nature Conservation;
- Aviation;
- De-commissioning;
- Communities and Residencies; and
- Grid.

4.34. The SPG goes on to state in Policy 5 that:

"It is contended that policy D4 and the further supplementary set out in paragraph 6.4 (of the SPG) should be used to test all wind energy planning applications as well as taking cognisance of the spatial strategy in Appendix E (of the SPG)."

4.35. Figure 5 - 'Identification of Visually Sensitive Land' in the SPGWE[7] identifies roads as receptors vulnerable to sequential impact by identifying all Landscape Character Areas (LCAs) that are assessed as having a high external intervisibility and/or of high visual sensitivity. The roads identified in the table of Figure 5, and which are located within the ZTV for the proposed development, are included in the following assessment.

4.36. Appendix D 'Scenic Viewpoints in the SPGWE[8] (mapped on Appendix C Spatial Strategy 2013) provides a list of sensitive receptors, (including seven identified strategic recreational routes, three viewpoints of significant strategic importance, Abbeys & Castles, Houses & Gardens and scenic viewpoints), which, including their buffer areas, are identified on the spatial strategy. It is stated that planning applications for wind energy proposals should take cognisance of these viewpoints and confirm that any proposals have no unacceptable adverse impact upon them.

Wind Energy Consultancy Landscape Capacity and Cumulative Impact (July 2013)

4.37. The Landscape Capacity and Cumulative Impact Final Report[9] (hereafter referred to as the Capacity Study) provides guidance on turbine sizes, cluster sizes and separation between groups of turbines for each landscape type aiming to limit cumulative development to an 'acceptable' level.

4.38. Table 6.1(iv) 'Summary of Landscape Capacity and Cumulative Effects and Guidance for Future Wind Energy Development - Cheviot Hills' identifies Low capacity for Very Large turbines (i.e. over 100 m to blade tip) within Southern Uplands Forest Covered LCT and comments that:

"This upland large scale wooded landscape has potential to accommodate the occasional windfarm consisting of medium, large and very large turbines. Small/medium to medium sized windfarms are suitable in this landscape. This landscape can accommodate turbine developments due to the upland topography creating topographical containment, the sparsely populated landscape with the occasional farmstead being present and the lower degree of intervisibility from settlements, transport routes and viewpoints. Medium sized turbines should be located alongside individual farmsteads. This should not become a landscape with wind turbines, therefore emphasis should be placed on the limited capacity of this landscape. This is due to its location relatively close to the Northumberland National Park. The Carter Bar/A68 England Border viewpoint has a much higher local sensitivity with no capacity in the area immediately in the vicinity of this iconic viewpoint or in the short to mid-range view looking north."

Scottish Borders Council Supplementary Planning Guidance Local Landscape Designations (August 2012)

4.39. The Supplementary Planning Guidance[10] (SPG) is produced to incorporate the review and update of Local Landscape Designations in the Scottish Borders into the Council's planning policy framework.

4.40. The following three policies allowed for the proposed Special Landscape Areas (SLAs) to replace the existing Areas of Great Landscape Value and ensure that the Statements of Importance can be used as a material consideration to better evidence relevant development management decisions, and to help inform decisions on conservation and enhancement measures for management of the proposed SLAs.

- Policy A Boundaries - The Council will apply the Special Landscape Area boundaries as set out in Figures 9.2-9.10 (Annex 1 LLDR Revised Report) in the implementation of the Scottish Borders Local Plan policy EP2;
- Policy B Development Management - The Council will use the Statements of Importance attached to each of the proposed Special Landscape Areas as a material consideration in the determination of planning applications; and
- Policy C Landscape - The Council will promote the use of the proposed Special Landscape Areas for conservation and enhancement measures taking into account the Statements of Importance.

Consultation

4.41. Consultations with Scottish Natural Heritage (SNH) and SBC were undertaken at the scoping stage of the application in January 2014, and again in November 2015, with detailed consultations terminating in March 2016 regarding the scope of the LVIA and the methodologies to be used. The key issues identified during these consultations are summarised in Table 4.1, along with details of how they have been addressed in the LVIA.

[7] The Scottish Borders Council Supplementary Planning Guidance Wind Energy May 2011

[8] The Scottish Borders Council Supplementary Planning Guidance Wind Energy May 2011

[9] Ironside Farrar, July 2013, Wind Energy Consultancy, Landscape Capacity and Cumulative Impact, Scottish Borders Council

[10] Scottish Borders Council, August 2012, Supplementary Planning Guidance Local Landscape Designations

Table 4.1: Issues Identified During Consultations

Consultee	Issue	Where/How this is addressed
Scottish Borders Council (SBC)	SBCs landscape architect, in the original scoping response provided specific comment in respect of the LVIA. In general SBC considers the general approach proposed to be appropriate and acceptable.	
	The LVIA should focus primarily on the effects within 10 km radius of the outermost turbines as this is where, for most criteria, the magnitude of change will yield most, if not all significant effects. +	The LVIA assesses potential effects within 40 km of the proposed Development turbines in accordance with SNH's current guidance. This is considered relevant to the scale of the proposed turbines.
	SBC consider detailed appraisal of distant effects to be wasteful. SBC also state that they do not expect coincidental cumulative effects with wind farms more than 20 km from the proposed wind farm will be a determining factor and suggest that such schemes are not assessed. Sequential effects are considered to be germane, however, and should therefore be included in the LVIA. SBC also identify a number of cumulative schemes that they consider should be included in the assessment including Girthgate and Cummings Hill.	
	SBC request a ZTV is provided which is in accordance with their Technical Note Landscape and Visual Impact Assessment for Wind Energy Developments, October 2011.	All ZTVS presented in the LVIA are in accordance with SBC guidance.
	SBC recommend omission of the Broad Law, Dollar Law, Black Laws and Talla-Hart Fell wild land areas as they consider these classified landscapes to be too far from the development to be likely to be subject to significant effects, and suggest, instead, that the wild characteristics of Carter Fell are considered.	The Wild Land Ares identified were omitted from the assessment. The effect on the character of Carter Fell is considered in **Technical Appendix 4.3** and in respect of the Knox Knowe viewpoint (Viewpoint 19) as described in **Technical Appendix 4.6**: .
	SBC also make reference to the assessment of designed landscapes of Regional or Local importance as defined in Peter McGowan Associated – Borders Designed Landscapes Survey: Schedule of Identified Sites, 2008.	**Technical Appendix 4.4** and Paragraphs 4.242 to 4.246* of the LVIA include an assessment of the Gardens and Designed Landscapes within the study area.
	SBC also request that forestry operations associated with the proposed wind farm are included in the LVIA and cumulative assessment. In their response to the 2015 scoping submission SBC return to the issue of forestry, stating that: *"The site is partially forest covered and the Forestry Commission's views on forest clearance and compensatory planting must be sought. It is assumed that forest clearance is intended on the 'keyholing' approach and that compensatory planting will be provided within the site boundary? Impacts / changes of forest cover form an additional landscape and visual issue which needs to be fully identified and addressed in the LVIA."*	The proposed Development, in its modified state, does not require wholesale felling. Consequently, this concern is no longer germane. However, the proposed keyhole felling at the site has been taken into account in the assessment and shown, along with the effect of the extant Forest Plan, in the visualisations that accompany the assessment.
	In the 2015 consultation response SBC also state that: *"The general approach* (of the LVIA) *is appropriate and acceptable, in reference to the applicant's Scoping Report dated November 2015. Much of the previous scoping reply dated 26 February 2014 in relation to the previous application remains valid. In terms of the contents of the 2015 Scoping Report, the following supplementary comments are made:*	
	Designated Landscapes within 40 km includes, in addition to those listed, Tweed Lowlands SLA, Tweed, Ettrick and Yarrow Confluences SLA, Tweed Valley SLA and Tweedsmuir Uplands SLA.	**Technical Appendix 4.4** addresses potential effects on all landscape designations and classifications within the 40 km study area.
	It is noted that the proposed height of turbines is 176 m. This is 31 m higher than any turbine constructed in Scottish Borders and of a typology that is not envisaged in the existing spatial guidance. Effective assessment is therefore likely to be more challenging and the scaling relationships between the proposed development and the receiving landscape are likely to make the proposal more difficult to accommodate.	**Chapter 3: Design Evolution Consideration and Alternatives** contains an examination of the selection and appropriateness of the turbine size and layout proposed, whilst the LVIA considers the effect of the selected turbine size on landscape and visual receptors

Consultee	Issue	Where/How this is addressed
Scottish Natural Heritage (SNH)	SNH considered the scope of the LVIA to be comprehensive. SNH identified key concerns regarding potential landscape and visual impacts and the cumulative effects of the proposed wind farm in respect of existing, consented and proposed (schemes subject to a formal planning application) as well as some schemes approaching submission. SNH identify a number of specific wind farms for inclusion in the LVIA including: ▪ Cummings Hill Wind Farm (at application); ▪ Windy Edge Wind Farm (at application); and ▪ Leithope Wind Farm (at scoping). The ability for the landscape to receive turbines of this height (up to 176 m) needs to be carefully considered as will the design of the turbine layout and the potential cumulative impacts associated with existing and proposed wind farm developments in the area. Additionally there remains the possibility that the turbines of this height will require lighting to comply with aviation regulations, this could lead to significant effects and we therefore highlight it as a potential issue that requires assessment. We would however hope that the need for lighting could be avoided.	Table 4.7 of the LVIA identifies the cumulative context of the proposed Development. These schemes, along with a current scoping scheme formed the basis of the cumulative assessment. **Chapter 3: Design Evolution Consideration and Alternatives** contains an examination of the selection and appropriateness of the turbine size and layout proposed, whilst the LVIA considers the effect of the selected turbine size on landscape and visual receptors.
Southdean Community Council (SCC)	**Viewpoints** SCC suggests that the originally proposed locations were insufficient in extent and location and proposed the following inclusions: Chesters. SCC considered one viewpoint in Chesters on the A6088 and one on the western approach as insufficient, as requested additional viewpoints at Chesters Brae and a total of four or five viewpoints at least from the settlement allowing for the varying topography. SCC also proposed the inclusion of a viewpoint at Carter Bar and on the A6088 in its vicinity and for further viewpoints along the A6088 between Carter Bar and Chesters, and made reference to key tourist locations including Peniel Heugh, Scott's View, and the Eildons, and suggested the use of some of the viewpoints utilised in the ES that accompanied the Birneyknowe application. **Residential Amenity** SCC also expressed concerns regarding the effect of the increased turbine heights on residential amenity for a number of individual properties with particular regard to Dykeraw, Southdean Lodge and Southdean Lodge Bothy, where SCC considered the impacts could be overbearing. **Visual Receptors/Visual Effects** SCC also highlighted concerns over potential effects on the A68 to the north of Carter Bar. The felling plan for Dykeraw Plantation show the block of trees behind Lustruther are due for felling in 2016, the block behind Dykeraw in 2019. As Dykeraw Plantation is a commercial plantation, the felling plan will have an impact on the visibility of the turbines and their infrastructure, and should be taken into consideration in the visualisations.	Following extensive consultations with SNH and SBC a total of twenty-six viewpoints were identified, including one at Southdean, two at Chesters, and a further two on the approach to Chesters (Viewpoints 1, 2, 4, 11 and 23). Additional viewpoints have been included at Carter's Bar (Viewpoint 21) and between Carter Bar and Chesters (see Viewpoint 20). Table 4.7 of the LVIA identifies the cumulative context of the proposed Development. These schemes, along with a current scoping scheme formed the basis of the cumulative assessment. **Technical Appendix 4.7** considers the potential effects of the proposed Development on residential dwellings within 3 km of the proposed Development turbines Visibility from the A68 is substantially restricted by a combination of topography and coniferous plantations. However, an assessment of the potential residual effect of the proposed Development (including cumulative effects) is provided in **Technical Appendix 4.5** and paragraphs 4.277 to 4.280 of the LVIA. The photomontages provided in the visualisations take account of the felling planned prior to or during construction of the proposed Development. Additionally, where there is potential for the long term felling of forest coups to occur during the life of the proposed Development that would have a bearing on the findings of the assessment, this is commented upon in **Technical Appendix 4.6**.
	Cumulative Assessment SCC also requested that the assessment of cumulative effects should take account of other developments already within the planning process and about to enter so there is a degree of consistency, and these should conform to SNH standards. SCC accepted that the cumulative list had been adjusted since the original scoping submission, and several on SCC's suggestions had been incorporated. SCC also requested the inclusion of the Wauchope/Newcastleton scoping scheme in the cumulative assessment.	The cumulative scope for the assessment was agreed with SBC and SNH and includes consideration of potential effects resulting from the Wauchope/Newcastleton scoping scheme

Consultee	Issue	Where/How this is addressed
The Mountaineering Council of Scotland[11] (MCoS)	The MCoS largely confined their remarks to the selection of viewpoints and recommended the following: The inclusion viewpoints to represent effects on views from the upper slopes of the Cheviot, from Cauldcleuch Head, and Eildon Hills; The replacement of viewpoints 8, and 18 with a single viewpoint at Brownheart Law; The inclusion of a viewpoint at Carter Bar. However, MCoS also suggest that consideration is given to turbine colouring to take account of the extent to which the proposed turbines may be backclothed in views.	In response to MCoS representations viewpoints at the Eildon Hills and the Cheviot were included in the LVIA (Ref. Viewpoints 16 and 22). Additionally, a viewpoint at Carter Bar has been included (Viewpoint 20).
Natural England	Natural England also state that consideration should be given to the direct and indirect effects of the proposed wind farm on the Northumberland National Park, with particular regard to the purpose of its designation and the content of the management plan for the National Park.	**Technical Appendix 4.4 addresses** potential effects on the National Park.
	Natural England have requested the LVIA contain details of local landscape character areas mapped at a scale appropriate to the development and any management plans or strategies for the area addressed. Natural England go on to state that the LVIA should include an assessment of visual effects on the surrounding area and landscape together with any physical effects of the proposed wind farm. The National Character Areas should be referenced in the LVIA, along with any relevant capacity studies within the study area. Natural England also request assessment of cumulative effects attributable to the proposed wind farm when considered in conjunction with existing/completed projects, consented/approved but uncompleted projects, those subject to a formal planning application, those at scoping for which there is sufficient information with which to assess the likelihood of cumulative effects.	Table 4.7 of the LVIA identifies the cumulative context of the proposed Development. These schemes, along with a current scoping scheme formed the basis of the cumulative assessment.
	The EIA should include a full assessment of the potential impacts of the development on local landscape character using landscape assessment methodologies. We encourage the use of Landscape Character Assessment (LCA), based on the good practice guidelines produced jointly by the Landscape Institute and Institute of Environmental Assessment in 2013. LCA provides a sound basis for guiding, informing and understanding the ability of any location to accommodate change and to make positive proposals for conserving, enhancing or regenerating character, as detailed proposals are developed.	**Technical Appendix 4.3** and paragraphs 4.222 to 4.237 provide an assessment of the potential effects (including cumulative effects upon different landscape character types within the study area.
Scotways	In their scoping submission Scotways identify a number of Rights of Way within the application site, including: ▪ the BR143 (following the Wheel Causeway); ▪ the BR144 (utilised by cyclists and horse riders also); and ▪ BR145. However, as Scotways acknowledge, routes BR143 and BR145 have been affected by forestry operations.	The LVIA considers the potential effect of the proposed wind farm proposals, including proposed forest felling, on the Rights of Way within the site.

[11] The Mountaineering Council of Scotland (6th January, 2014) Culachy Wind Farm - Response to Request for Environmental Scoping Opinion

Method of Assessment

4.42. The purpose of the LVIA is to identify, predict and evaluate potential impacts associated with the proposed Development. Wherever possible, identified impacts are quantified, however the nature of LVIA requires interpretation by professional judgement. In order to provide a level of consistency to the assessment, the prediction of magnitude of change/impact and assessment of the significance of the residual landscape and visual effects have been based on pre-defined criteria.

4.43. The landscape and visual assessment has been based on guidelines provided in:

- Guidelines for Landscape and Visual Impact Assessment (GLVIA)[12];
- Landscape Character Assessment[13];
- Techniques for Judging Capacity and Sensitivity[14];
- Siting and Designing Wind Farms in the Landscape[15];
- Scottish Planning Policy[16];
- Guidance: Cumulative Effects of Wind Farms[17];
- Spatial Planning for Onshore Wind Turbines – natural heritage considerations[18]; and
- Visual Representation of Wind Farms[19].

4.44. The assessment has drawn on consultation responses from in 2014 and 2015. Key issues are listed in Table 4.1.

4.45. The LVIA also considers landscape and visual effects on designated landscapes in the study area, including the Northumberland National Park (NNP), the Eildon and Leaderfoot National Scenic Area (NSA) and the Moffat and Langholm Hills Regional Scenic Areas (RSAs), as well as non-designated sensitive landscapes such as Gardens and Designed Landscapes (GDLs).

4.46. In order to assist in evaluating potential landscape and visual effects arising from the proposed Development, Zones of Theoretical Visibility (ZTVs) were generated to identify the potential extent of the proposed wind farm's visibility over the study area. An assessment of the predicted visibility of the proposed Development from each of the landscape character types, designated and sensitive non-designated landscapes in the study area has been carried out by analysing the ZTVs and verifying the findings during field reconnaissance. The visibility assessment has concentrated on the publicly accessible areas including outdoor recreational areas, roads and the public rights of way.

4.47. Mitigation measures which have been incorporated into the final design and layout of the proposed Development are described in the following LVIA. Further details of the constraints which were identified and the design process are described in **Chapter 3: Design Evolution Considerations and Alternatives**.

4.48. A selection of viewpoints was chosen in consultation with SBC, SNH and non-statutory consultees in respect of this application. These viewpoints are considered to be representative of the main sensitive receptors in the study area. The viewpoints have also been checked against the cumulative ZTVs for existing, consented and proposed wind farms within the study area in order to ensure that they provide representative coverage of potential cumulative visibility and related effects. Viewpoint locations are described fully in the detailed assessment in **Technical Appendix 4.6**.

4.49. Analysis of the potential effects on landscape and visual amenity arising from the proposed wind farm at each of these viewpoints has been carried out. This analysis has involved the production of computer generated wirelines and/or photomontages which illustrate the operational views of the proposed wind farm from each of the agreed viewpoints. These visualisations include proposed site infrastructure and reflect the forestry management of the extant Forest Plan at the time of the assessment. The existing and predicted views from each of these viewpoints have been analysed to identify the magnitude of change and the residual effects on landscape character and visual amenity.

4.50. Finally, an assessment of the significance of the residual effects has been carried out to determine the impact of the wind farm in this locality in relation to landscape and visual amenity. The significance of a landscape or visual effect is a function of the sensitivity of the affected landscape or visual receptor, and the magnitude of change that would occur as a result of the proposed wind farm.

Study Area

4.51. The study area for the LVIA comprises a 40 km radius area extending from the outermost turbines of the proposed Development, as recommended in SNH Guidance[20] for wind turbines over 135 m to tip height.

4.52. In accordance with SNH Cumulative Best Practice Guidance[21] wind farms up to 70 km from the proposed development were also considered and where likely to contribute to potentially significant cumulative effects, were included in the LVIA.

Distances

4.53. Unless stated otherwise stated receptors' distances from the proposed wind farm should be taken to mean distance to the nearest turbine of the proposed wind farm.

Data

4.54. The LVIA utilised publicly available data and datasets , including:

- OS Terrain 5
- OS 1:25,000 Raster Mapping
- OS 1:50,000 Raster Mapping
- OS 1:250,000 Raster Mapping
- OS Meridian 2
- OS AddressLayer 2
- OS VectorMap District

[12] Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidance for Landscape and Visual Impact Assessment – Third Edition

[13] The Countryside Agency and Scottish Natural Heritage (2002) Landscape Character Assessment

[14] Scottish Natural Heritage and the Countryside Agency (2002) Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity

[15] Scottish Natural Heritage (2014) Siting and Design of Wind Farms in the Landscape Version 2

[16] The Scottish Government (February 2010)

[17] Scottish Natural Heritage (2012) Assessing the Cumulative Impact of Onshore Wind Energy Developments

[18] Scottish Natural Heritage, (June 2015), Spatial Planning for Onshore Wind Turbines – natural heritage considerations, Guidance

[1919] Scottish Natural Heritage, (December 2014), Visual Representation of Wind Farms Version 2.1

[20] Scottish Natural Heritage, (December 2014), Visual Representation of Wind Farms Version 2.1

[21] Scottish Natural Heritage (March 2012), Assessing the Cumulative Impact of Onshore Wind Energy Developments

4.55. The assessment of Baseline Conditions was undertaken with reference to existing character assessments. Landscape character types (LCTs) considered in the baseline and subsequent assessment are derived from the following SNH and Natural England (NE) Landscape Character Assessments (LCAs):

- The Borders Landscape Assessment[22];
- Dumfries and Galloway Landscape Assessment[23];
- Natural England, Corporate Report National Character Area profiles: data for local decision making[24];
- Northumberland Landscape Character Assessment[25]; and
- Cumbria Landscape Character Guidance and Toolkit[26].

4.56. These studies have been referenced as they provide descriptions of landscape types that would be subject to potential visibility of the proposed wind farm. Landscape types not subject to potential visibility have not been assessed.

4.57. These studies have been considered and verified on site, and for the purposes of the landscape and visual impact assessment of the proposed wind farm, the findings of the LCA's have generally been adopted as defining the baseline landscape character with the exception of the Black Burn Valley to the east of the site which is partially identified as being the Southern Uplands Forest Covered LCT. For the purposes of this assessment, Black Burn valley is considered to be more similar in character to the Wooded Upland Fringe Valley and has been accorded a High sensitivity to wind farm development due to its enclosed nature with varied landscape elements and landform resulting in a smaller scale and more intimate landscape character.

4.58. The key characteristics of each landscape character type in the study area with predicted visibility of the proposed wind farm have been described, together with the nature of views and the sensitivity of each landscape to change of the nature associated with wind farm development.

Field Survey

4.59. The application site and surrounding area were visited in October 2013, March 2015 and March 2016 to consider the predicted visibility of the proposed wind farm. The field surveys were carried out during periods of very good to excellent visibility[27].

Assessment of Significance

Nature of Effects and Nature of Receptors

4.60. As identified in the GLVIA 3[28] the effects are identified by establishing and describing the changes to the landscape and visual baseline resulting from the different components of the development and the resulting effects on individual landscape or visual receptors.

4.61. The assessment of the significance of effects is derived from a comparison of the nature of the effects (magnitude), as well as the nature of the receptors (sensitivity) and differentiates between them according to the phases (construction and operational) in which they would occur.

Landscape Sensitivity

4.62. The sensitivity of landscape receptors to change arising from the type of development proposed is defined as high, medium and low based on professional interpretation, combining judgements of their value attached to the landscape and susceptibility to the type of change or development proposed. Landscape receptors include the different landscape character types or areas which may be affected by the proposed Development, as well as landscape designations and Gardens and Designed Landscapes (GDLs) within the study area.

4.63. Susceptibility to change concerns the ability of the landscape receptor to accommodate the proposed Development without undue consequences for the maintenance of the baseline situation and/or the landscape planning policies and strategies.

Landscape Character

4.64. The value attached to landscape receptors (landscape character) is reflected by landscape designations and the level of importance which they signify. However, landscape designations are not the sole indicator of landscape value. The following range of factors also are considered in order to identify valued landscape:

- landscape quality;
- scenic quality;
- rarity;
- representativeness;
- conservation interest;
- recreation value;
- perceptual aspects; and
- cultural associations.

4.65. Susceptibility of landscape character to change is defined as high, medium or low based on an interpretation of a combination of parameters including:

- the scale and pattern of the landscape and its elements/features;
- the simplicity or complexity of the landscape;
- the nature of skylines;
- landscape quality or condition;
- existing land use;
- visual enclosure/openness of views; and
- the scope for mitigation, which would be in character with the existing landscape.

Sensitivity of visual receptors

4.66. Sensitivity of visual receptors is defined as high, medium, low or negligible based on professional interpretation, combining judgements of their susceptibility to the type of change or development proposed and the value attached to the particular views. Visual receptors, consist

[22] Ash Consulting Group, 1998, The Borders landscape assessment, Scottish Natural Heritage Review No 112

[23] Land Use Consultant, 1998, Dumfries and Galloway landscape assessment, Scottish Natural Heritage Review No 94

[24] https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles

[25] Land Use Consultant, (August 2010), Northumberland Landscape Character Assessment, prepared for Northumberland County Council

[26] Cumbria County Council, March 2011, Cumbria landscape character guidance and toolkit

[27] Based on definitions provided by the Met Office (http://www.metoffice.gov.uk/guide/weather/symbols#visibility)

[28] Landscape Institute and Institute of Environmental Management & Assessment (December 2013), Guidelines for Landscape and Visual Impact Assessment, Third Edition

of the particular person or group of people likely to be affected at a specific viewpoint, and are assessed in terms of both their susceptibility to change in views and visual amenity and also the value attached to particular views.

4.67. The susceptibility of different visual receptors to change in views and visual amenity is mainly a function of:

- the occupation or activity of people experiencing the view at particular locations; and
- the extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at particular location.

4.68. In relation to the occupation or activity of people experiencing the view at the viewpoint, visual susceptibility is defined in Table 4.2.

Table 4.2: Definitions of Susceptibility of Visual Receptors

Level of Susceptibility	Definition
High	Residents of dwellings; users of outdoor recreational facilities including strategic recreational footpaths, cycle routes or rights of way, whose attention is focused on the landscape; visitors to cultural/historic assets, important landscape features with physical, cultural or historic attributes; beauty spots or picnic areas. Travellers on key tourist routes.
Medium	General road users, commuters and travellers not primarily focused on the landscape.
Low	People engaged in outdoor sports or recreation (other than appreciation of the landscape), commercial buildings, and other locations where people's attention may be focused on their work or activity, rather than their surroundings, and where there is not important to the quality of working life.

Magnitude of Change/Impact

4.69. Each of the landscape and visual effects identified are evaluated in terms of their size or scale, the geographical extent of the area influenced, and their duration and reversibility.

4.70. The magnitude of change arising from the proposed Development in respect of landscape character is described as Substantial, Moderate, Slight or Negligible or None based on the interpretation of a combination of largely quantifiable parameters, as follows:

- the distance of the receptor from the proposed Development;
- the extent of existing landscape elements that will be lost or by adding of new ones;
- the proportion of the total extent of the particular landscape elements that this represents;
- the degree to which aesthetic or perceptual aspects of the landscape would be altered by removal of existing components or with the addition of new elements;
- the context in which the proposed Development would be seen (i.e. similar land uses in the vicinity of the development);
- the geographic area over which the loss of landscape elements will be perceived;
- the alteration of the skyline/altering the vertical scale in relation to the existing landscape features;
- the duration of the change; and
- the reversibility of the change.

4.71. The criteria utilised in ascribing magnitude of change in respect of visual amenity is as follows:

- The scale of change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the proposed development;
- The degree of contrast or integration of any new features of changes in the landscape with the existing or remaining landscape elements and characteristics in terms of form, scale and mass, line, height, colour and textures;
- The nature of the view of the proposed development;
- the relative amount of time over which it will be experienced and whether views will be full, partial or glimpsed;
- The angle of view in relation to the main activity of the receptor;
- The distance of the viewpoint from the proposed Development; and
- The extent of the area over which the changes would be visible.

4.72. Cumulative change arising from the proposed Development when considered in conjunction with other similar developments in the vicinity is determined taking account of the above criteria as well as the following:

- the number of existing, consented and proposed wind farms visible;
- the distance to each of the visible developments from the receptor location;
- the direction of each development in relation to the viewpoint;
- the extent of the view occupied by each development;
- the cumulative effect of development upon the fabric or key landscape components; and
- in the case of landscape character types (LCTs), residential areas and transportation/recreational routes: the proportion of the area or route subject to cumulative views.

4.73. Table 4.3 outlines the key definitions adopted in the LVIA for the purposes of ascribing the cumulative magnitude of change.

Table 4.3: Cumulative Magnitude of Change

Magnitude	Criteria
Substantial	The proposed Development would represent a considerable increase in the influence of wind energy development on the character of the landscape and/or the composition of views.
Moderate	The proposed Development would represent a notable increase in the influence of wind energy development on the character of the landscape and/or the composition of views. Moderate cumulative change equates to localised change, within an otherwise essentially unaltered context.
Slight	The proposed Development would represent a Minor addition to the influence of wind energy development on the character of the landscape and/or the composition of views. Cumulative change arising from the proposals would be discernible but the original baseline conditions would be largely unaltered.
Negligible	The proposed Development would represent a very Minor addition to the influence of wind energy development on the character of the landscape and/or the composition of views. The baseline conditions of the landscape and view would, for all intents and purposes, be unaffected.

4.74. For the purposes of the assessment cumulative wind farms are defined as being operational, consented or proposed. Proposed wind farms include those that are at the application stage, or

are the subject of a formal planning appeal. At the request of SBC the proposed Wauchope and Newcastleton development (which is currently at scoping), has also been considered. However, this development is at an early stage and is likely to undergo substantial redesign and any assessment of cumulative effects including this scheme is indicative only and should be given limited weight. Because of the uncertainty in respect of the Wauchope and Newcastleton development, two sets of cumulative wirelines have been presented with the LVIA; one set showing the existing, consented and proposed cumulative context, and a second comprising the existing, consented and proposed cumulative context with the Wauchope and Newcastleton development included.

Significant Effects

4.75. The effect of any identified landscape or visual impact is assessed as Major, Moderate, Minor or None. These categories are based on a comparison of landscape or visual sensitivity, and the predicted magnitude of change, as shown by Table 4.4.

Table 4.4: Landscape and Visual Effects

Magnitude / Sensitivity	Substantial	Moderate	Slight	Negligible
High	**Major**	**Major/moderate**	Moderate	Moderate/minor
Medium	**Major/moderate**	Moderate	Moderate/minor	Minor
Low	Moderate	Moderate/minor	Minor	Minor/none

4.76. In line with the GLVIA 3[29], the matrix has not used as a prescriptive tool and the methodology and analysis of potential effects (including cumulative) at any particular location must allow for the exercise of professional judgement.

4.77. Where the landscape or visual impact has been classified as **Major** or **Major/moderate**, this is considered to be equivalent to a significant effect as referred to in the Environment Impact Assessment (Scotland) Regulations 2011[30].

4.78. The LVIA is primarily concerned with Direct effects (i.e. effects attributable to the proposed Development), but where appropriate comment is made on Indirect or Secondary effects (effects that result indirectly from the proposed Development, often occurring away from the application site, or as a sequence of interrelationships or a complex pathway).

4.79. Landscape and visual effects may be either positive/beneficial or adverse; for the purpose of this assessment effects are assumed to be adverse unless stated otherwise.

Baseline Conditions

Site Description

4.80. The site is located to the south of Chesters, approximately 12 km to the south-east of Hawick, in the Scottish Borders. The application site would be accessed by a modified forest track from the A6088 by Southdean.

4.81. The site's western boundary abuts with the B6357 within the narrow valley of Hyndlees Burn, whereas its eastern boundary follows the course of Black Burn. The northern part of the site is formed by the north facing/descending slope of Highlee Hill, and abuts the A6088 carriageway and the properties of Lustruther and Whiteburn.

4.82. Elevations across the site vary from 190 m Above Ordnance Datum (AOD) at Chesters in the north, rising gradually to the south, up to 365 m AOD on Wardmoor Hill. The proposed turbines would be located on elevations of between 219 m AOD (Turbine 8) up to 298 m AOD (Turbine 2) and would be enclosed to the west by Wardmoor Hill and Brockie Law, to the South by Needs Law and Carter Fell, and to the east by Charlie's Knowe, Blackburn Rig. To the north, the edge of site is partially contained by the elevated summits of Highlee Hill and Weasel Hill, but the alignment of the site access extends downslope to Black Burn and Southdean.

4.83. The majority of the main site area, to the south of the summit of Highlee Hill, is covered by large scale commercial forest plantation. The forestry cover extends around 6 km to the west and east of the application site, 12 km to the south-west, with occasional open summits and clear felled areas. However, land cover in the northern part of the site (i.e. the location of Turbine 6 and the main site access) mainly consists of semi-improved pasture, hedgerows, and blocks of coniferous forestry, with moorland grassland present on the more elevated open parts of the site, in the vicinity of Highlee Hill. The proposed turbines would be located to the south of the summit of Highlee Hill, the relief of which would provide further containment, separating the proposed Development from the lower lying.

Landscape Character

National and Regional Context

4.84. There are two published character assessments of relevance to this LVIA:

- The landscape character assessment for the Scottish Borders[31] categorises the regional landscape context, firstly as a series of Regional Landscape Areas (RLAs), and then as a series of distinctive constituent Landscape Character Types (LCTs); and
- Natural England's national character area assessments[32] which describe the National Character Areas (NCAs) within England

4.85. The study area contains the Lammermuir and Moorfoot Hills, Central Southern Uplands and Cheviot Hills RLAs, as well as the Northumberland moors, which form part of the Cheviots National Character Area[33] (NCA). These elevated landforms enclose the Study Area to the north, south and south-east, respectively. The River Tweed and its chief tributaries emerge from the Uplands and form the agricultural heartland of the River Tweed Lowlands RLA. The River Tweed

[29] Landscape Institute and Institute of Environmental Management & Assessment (December 2013), Guidelines for Landscape and Visual Impact Assessment, Third Edition

[30] Scottish Government (February 2011), Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011

[31] Ash Consulting Group, 1998, The Borders landscape assessment, Scottish Natural Heritage Review No 112

[32] http://publications.naturalengland.org.uk: NCA Profile: 04 Cheviots (NE457)

[33] http://publications.naturalengland.org.uk: NCA Profile: 04 Cheviots (NE457)

Basin extends from Hawick (8 km to the north-west of the site) to the north-eastern boundary of the study area.

4.86. Notable topographical features and focal points in the study area include locally prominent hill summits such as Rubers Law (424 m AOD), Dunion Hill/Blacklaw (338 m AOD) and Bonchester Hill (323 m AOD). Further to the north-west the Eildon Hills comprise prominent igneous cones rising above the Tweed valley lowlands.

4.87. The upland landscapes are bisected by a pattern of river valleys, which constitute notable contrasting features in the large-scale and generally simple exposed, upland context, providing comparatively intimate, enclosed spaces. These valleys are relatively settled in comparison with the uplands, are accompanied by a greater prevalence of improved and semi-improved pasture land, hedgerows and deciduous tree cover, and form the basis for key communication routes.

4.88. The surrounding uplands are largely uninhabited other than by hamlets and individual farms, many of which are located in the transitional upland fringes or relatively sheltered valleys of minor watercourses within the uplands. The Cheviot NCA is almost totally devoid of settlement, although scattered farmsteads and a few small hamlets can be found nestled in the bottom of the steep-sided valley.

Landscape Character Types

4.89. Within this regional context, as described in paragraphs 4.84 - 4.88, more detailed Scottish Landscape Character Types (LCTs) were identified. These are tracts of countryside which have a coherence of character due to particular combinations of landform, land cover and a consistent pattern of constituent elements. The boundaries of the LCTs within the study area are available as Geographic Information Systems (GIS) Datasets from SNH.

4.90. The LCTs within the study area which are subject to potential/theoretical visibility of the proposed Development include the following:

- Southern Upland Type with Forest Covered - Wauchope/ Newcastleton (LCT BDR5);
- Grassland with Hills - Bonchester/Dunion (LCT BDR1);
- Grassland with Hills - Rubers Law (LCT BDR1);
- Grassland with Hills – Eildon Hills (LCT BDR1);
- Wooded Upland Fringe Valley - Rule Water (LCT BDR2);
- Cheviot Foothills - Falla Group (LCT BDR7);
- Southern Uplands Type with Scattered Forest - Cauldcleuch Head Group (LCT BDR4);
- Rolling Farmland - Oxnam (BDR8);
- Lowland valley with Farmland - Lower Teviot (LCT BDR29);
- Cheviot Uplands - Cocklaw Group (LCT BDR6); and
- Grassland with Rock Outcrops – Whitehaugh (LCT BDR10.

4.91. Whilst visibility of the proposed Development from locations within England would be limited, the Borders Moors and Forest and Cheviot National Character Areas have been used as a basis for the assessment of potential effects on the landscape and visual amenity south of the border.

4.92. **Technical Appendix 4.3** provides descriptions of these LCTs, along with an assessment of their sensitivity to the type of development proposed.

Landscape Designations

4.93. The application site is not subject to any landscape designation.

4.94. Details of the relevant landscape designations within the 40 km Study Area are shown on Figure 4.3 Landscape Designations, and key characteristics and sensitivity of these landscape designations is summarised in **Technical Appendix 4.4**.

Eildon and Leaderfoot National Scenic Areas

4.95. The Town and Country Planning (Scotland) Designation Directions 2010 defines a National Scenic Areas (NSAs) as an areas *"which are nationally important for their scenic quality*[34]."

4.96. In 2007 and 2008 SNH surveyed all the NSAs and produced an up-to-date description of the special qualities of each NSA, a summary of which is provided in **Technical Appendix 4.4**.

4.97. The Eildon and Leaderfoot NSA is situated around 20 km to the north-west of the application site, on the River Tweed, between Melrose and St Boswells. The NSA is situated where the Border uplands meet the lower lying lands, encompassing areas of both as well as the transitional lands in between.

4.98. The Scottish Borders Local Landscape Designation Review Revised Report (June 2012) cites the special qualities of the Eildon and Leaderfoot NSA, which are defined in the SNH Commissioned Report No.374: The special qualities of the NSAs[35].

Northumberland National Park

4.99. All the National Parks in England, Wales and Scotland are intended to promote understanding and enjoyment of the special qualities of these designated areas.

4.100. The Northumberland National Park (NNP) extends across the eastern side of the study area and its closest point to the site is 5.5 km, at Carter Bar.

4.101. The Northumberland National Park Authority (NNPA) has a duty to prepare a National Park Management Plan as the framework for the delivery of the National Park statutory purposes and duty.

4.102. The 2009 - 2014 National Park Management Plan[36] sets out the special qualities of the National Park and identifies land use planning system as crucial to safeguarding and enhancing the special qualities of the National Park. It also highlights that development outwith the National Park can have an adverse effect on the designation, stating that:

4.103. "Major infrastructure or the cumulative effect of new developments within or near to the edge of the National Park (e.g. wind farms, telecommunications masts, and electricity pylons) can have a significant impact on the openness and tranquillity."

Regional Scenic Area (RSA)

4.104. Based on an analysis of the ZTVs, views of the proposed Development from the Langholm Hills RSA would be confined to the summit of Crumpton Hill (480 m AOD) which is located around 28 km to the south west of the site. At this location only the ends of blade tips of up to four turbines would theoretically be visible.

[34] http://www.gov.scot/

[35] Scottish Natural Heritage (2010), The special qualities of the National Scenic Areas, SNH Commissioned Report No.374

[36] Northumberland national park management Plan 2009-2014, Inspiring landscapes, thriving Communities

4.105. Given the distance at which the proposed Development would be seen, and the screening effect of the intervening topography of Southern Uplands, and consequent predicted limited visibility this designated area has not been assessed further.

Special Landscape Areas (SLAs)

4.106. Special Landscape Areas (SLAs) are locally important designations. According to SNH's SPG on Local Landscape Designations[37], SLAs are used by local authorities to guide countryside developments and complement the National Scenic Area designation, which identifies those landscapes that are seen as nationally important, but are considered in SPP to carry less weight than nationally important landscapes.

4.107. The aim of the designation is to ensure that the important qualities and characteristics of particularly sensitive and highly valued landscapes are safeguarded.

4.108. The SPG document contains a Statement of Importance for each of the new Special Landscape Areas (SLAs) (The Figures 9.1-9.11 of the LLDR Revised Report contain maps of the 9 SLAs).

4.109. The ZTV indicates visibility from the following 6 SLAs within the study area, including:

- Teviot Valleys – 900 m to the site entrance
- Cheviot Hills – 3.2 km to the east of the site;
- Tweed Lowlands – 16.3 km to the north of the site;
- Tweed, Ettrick and Yarrow Confluence – 21.5 km to the north-west of the site;
- Tweedsmuir Uplands – 29.3 km to the north-west of the site; and
- Tweed Valley – 32.4 km to the north-west of the site.

4.110. Due to the distance and limited extent of the theoretical viewshed (i.e. confined to Minch Moor, Welldean Hill and Mountbenger Law) it is considered that the Tweedsmuir Uplands SLA would be highly unlikely to be significantly affected by the proposed Development and has therefore not be assessed further.

4.111. Similarly, the Tweed Valley SLA is considered unlikely to be significantly affected due to its distance from the proposed Development and the substantially restricted visibility shown (confined to areas within Elibank and Traquair Forest). Consequently, this SLA has not been considered further in the LVIA.

Gardens and Designed Landscapes

4.112. The Inventory of Gardens and Designed Landscapes managed by Historic Environment Scotland includes private gardens, parks, country estates and botanical gardens. Gardens and Designed Landscapes (GDLs) are not statutory designated sites.

4.113. Scottish Borders LDP Policy EP10[38] seeks to protect GDLs from inappropriate development.

4.114. The GDLs which occur within the ZTV within the 40 km study area include:

- Monteviot - situated 11.9 km to the North-east of the site, within the Lower Teviot UNIT of the Lowland Valley with Farmland LCT and within the SLA of the Teviot Valley;
- Dryburgh Abbey - 20.7 km to the North of the site within the Lower Tweed UNIT of the Lowland Valley with Farmland LCT and NSA of the Eildon and Leaderfoot;
- Bemersyde - lies 22.6 km to the North of the site, at the junction of the Upland Fringe Valley with Settlements (Tweed/Gala/Ettrick Confluence), the Lower Tweed UNIT of the Lowland Valley with Farmland LCT and within the NSA of the Eildon and Leaderfoot; and
- Floors Castle - 23.5 km to the north-east of the site within the SLA of the Tweed lowlands.

4.115. Whilst subject to theoretical visibility, field reconnaissance suggests that the proposed Development would, in fact, be screened from the following GDLs within the study area:

- Newton Don - 26.4 km to the north-east of the application site;
- Mellerstain - 26.5 km to the north of the application site;
- Hendersyde Park - 26.8 km to the north-east of the application site;
- Carolside and Leadervale - 29.3 km to the north-west of the application site;
- Thirlestane Castle - 37.5 km to the North-west of the application site; and
- Marchmont - 38.8 km to the north-east of the application site.

4.116. Consequently, these GDLs have not been assessed further.

Visual Receptors

4.117. The visual receptors considered in the LVIA comprise:

- residents/visitors to key settlements in the study area;
- users of transportation routes in the study area;
- walkers and cyclists on long distance recreational trails;
- walkers and horse riders on the core path network within 10 km of the application site.

4.118. In addition to these receptors **Technical Appendix 4.6: Residential Visual Amenity Survey (RVAS)**, comments on the potential for effects on individual properties within 3 km of the proposed turbines. It should be noted, however, that the assessment of residential visual amenity effects should be considered in conjunction with the findings in **Chapter 9: Noise**. The RVAS is intended to address issues of public, rather than private interest to avoid unacceptable levels of impact on the amenity and living conditions at properties, and to avoid overwhelming or oppressive effects. The RVAS is distinct from the methodology utilised in the LVIA and advocated in GLVIA3.

Settlements

4.119. The main settlements within the study area, such as Coldstream, Galashiels, Greenlaw, Earlston, Lauder, Melrose and Selkirk, are outwith the theoretical viewshed for the proposed Development, as indicated in the ZTV. This is also the case in respect of other villages[39] within 10 km distance such as Bonchester Bridge and Denholm (and the hamlets such as Ashybank, Bairnkine, Camptown, Falla, Hallrule, Hobkirk, Kirkton, Mervin's Law, Mossburnford, Saughtree and Swingdean). These settlements have therefore not been considered further in the LVIA.

4.120. The ZTV (Figure 4.5) shows only blade tip visibility on the following settlement edges:

- Jedburgh – 9.9 km to the north-east of the site;
- Hawick – 10 km to the north-west of the site; and
- Kelso – 24.5 km to the north-east of the site.

[37] Scottish Borders Council, August 2012, Supplementary Planning Guidance, Local Landscape Designations
[38] The Scottish Borders Council Supplementary Planning Guidance Wind Energy May 2011, Appendix A Scottish Borders Council Policy
[39] As defined in SBCs database at http://www.scotborders.gov.uk/directory/50/a_to_z/k

4.121. A few small hamlets are identified within the ZTV, such as Abbotrule and Ruletownhead, approximately 2.5 km to the north of the proposed development.

4.122. Key settlements addressed in the LVIA are the village of Chesters and the hamlet of Southdean which are located within 3.5 km of the proposed Development.

Transportation Routes

4.123. The main transport routes within the study area are generally positioned within incised river valleys where predicted visibility would be limited by a combination of topography and vegetation and likely to be intermittent at best. The following routes are assessed in relation to the potential visibility and sequential cumulative views of the other wind farms within the study area.

- A6088 – a 22 km route which abuts the application site's northern boundary and which links the A698 with the A68;
- B6357 – which abuts with the application site's western boundary. The route extends from the south western edge of the study area through the Liddel Water valley to Saughtree, thereafter meandering through the Wauchope Forest before linking with the A6088 Southeast of Bonchester Bridge;
- A68 – extends through the NSA of Eildon and Leaderfoot, crossing the study area between Lauder (to the north) and Ridsdale (to the Southeast);
- A698 – extends through/on the River Teviot valley, crossing the study area between Hawick (to the north-west) and Coldstream (to the north-east);
- A7 – which utilises several river corridors (Ewers Water, Teviot, Gala, Tweed), crosses the study area between Stow (to the north-west) and Canonbie (to the south west); and
- A699 – which crosses the study area between Cappercleuch and Kelso.

Long Distance Recreational Routes

4.124. In addition to the key transport routes described above, there are a small number of strategic long distance recreational routes (LDRR). These are described in paragraphs 4.125-4.136.

Pennine Way National Trail

4.125. The Pennine Way National Trail (the very first National Trail, which was opened on 24th April 1965) is a 429 km walking route from Edale in Derbyshire to Kirk Yetholm in the Scottish Borders. It crosses some of the finest upland landscapes in England, from the Peak District, through the Yorkshire Dales, across the North Pennines and over Hadrian's Wall in Northumberland to the Cheviots.

St Cuthbert's Way

4.126. St Cuthbert's Way is a 100 km long trail (one of Scotland's Great Trails) between the Scottish Borders town of Melrose and Lindisfarne off the coast of Northumberland, England.

Cross Borders Drove Road

4.127. The Cross Borders Drove Road is one of the newest additions to a group of specially selected long distance walks, known as Scotland's Great Trails. It starts in Hawick and extends to the north to Harpering.

Borders Abbeys Way

4.128. The Borders Abbeys Way is a long distance walk and also one of Scotland's Great Trails, and links four Abbeys: Melrose, Dryburgh, Jedburgh, and the more ruinous Kelso in a circular route of 107 km.

Southern Upland Way (SUW)

4.129. This official Long Distance Route (LDR) provides a coast to coast traverse of southern Scotland by a variety of paths which pass through sparsely populated terrain, generally avoiding the high tops. Approximately 76 km length of the 341 km route between Moffat and Lauder crosses the north-western part of the Study Area. Examination of the ZTV indicates no visibility. Consequently, this route is not considered further in the LVIA.

Romans and Reivers Route

4.130. The Romans and Reivers route, one of Scotland's Great Trails, follows old Roman roads, forest tracks, drove roads and short sections of quiet lane through the heart of notorious Reivers country, providing enjoyable walking, cycling and riding through the Southern Uplands. The route extends within the sporadic ZTV in 2.7 km section on Craik Cross Hill (449 m AOD) within the Craik Forest, approximately 30.2 km to the south west of the nearest turbine.

4.131. Due to the distance and limited visibility, it is considered that the route would not be affected by the proposed development and therefore is not assessed further.

Core Paths & Rights of Way

4.132. Every local authority and National Park authority in Scotland is required to draw up a plan for a system of paths (Core Paths) sufficient for the purpose of giving the public reasonable access throughout their area. As highlighted within national guidance, Core Paths are of particular importance close to where people live.

4.133. The LVIA study area contains a relatively large number of Core Paths, most of which are located close to key settlements, and at some distance to the proposed Development. It is also the case that many of the Core Paths are located within incised landscape such as the Teviot, River Tweed, Ettrick and Gala Water valleys, and as a consequence are almost entirely shielded from views of the proposed Development. Consequently, the LVIA has focused on Core Paths within 10 km of the proposed Development turbines (i.e. the distance within which the majority of significant effects are expected to occur) or immediately adjacent to this radius.

4.134. Only two Core Paths are located within 10 km of the proposed Development's turbines; these comprise:

- Core Path 116 which is located west of the B6357, approximately 450 m to the north of Bonchester Bridge, 6 km from the proposed development turbines; and
- Core Path 203, which is located approximately 2 km to the south-east of Hawick and over 9 km from the proposed Development.

4.135. Other Core Paths situated close to the 10 km radius from the proposed Development include

- Core path1, which at its closest is around 10.5 km north of the proposed Development; and
- Core path 192 – Between Oxnam and Mossburnford, and at its closest is around 10 km from the proposed Development; and

4.136. The application site contains two Public Rights of Way PROWs comprising:

- The Wheels Causeway – bisecting the site at Flush Plantation and linking to the forest tracks in Wauchope Forest; and
- A route following forest tracks within Dykeraw Forest, to the east of Turbines 3,4,5 and 6 of the proposed Development.

Scenic Viewpoints

4.137. Table 4.5 lists the 'Scenic Viewpoints' identified in the SPG[40] (and mapped on Appendix C Spatial Strategy 2013) which would provide potential views of the proposed Development.

Table 4.5: Scenic Viewpoints

Route	Scenic Viewpoint	Angle/ Direction of View (degrees)	Direction of the application site	Distance from the site	Main points of interest
SUW	Three Brethren	360	NE	28.7 km	Much of the Scottish Borders
	Browne Knowe	360	SE	31.9 km	Tweed and Yarrow valleys
	Minchmoor	360	SE	35 km	Tweed and Yarrow valleys
St Cuthbert's Way	Grubbit Law	360	SW	14.5 km	Eastern & Central Borders, Cheviot Hills
	Littledeanlees Crailing	180/NW	SW	21.1 km	Teviot Valley (to the north/NW)
	Eildon Hills	360	SE	23 km	Much of the Scottish Borders
Pennie Way	Windy Gyle	360	SW	22.8 km	Cheviot Hills
	The Schil	360	SW	27.2 km	Cheviot Hills
	White Law	360	SW	27.8 km	Eastern & Central Borders, north Northumberland & Cheviot Hills
	Auchnope Cairn	180/W	SW	27.9 km	Cheviot Hills, Eastern Borders
Borders Abbeys Way	Black Law Jedburgh	360	S	7.4 km	Cheviot Hills, Rubers Law, & Teviot valley
	Drinkstone Hill, Hawick	360	SE	15.7 km	Teviot Valley, Cheviot Hills & Tweedsmuir Hills
Dere Street	Whitton Edge to Pennymuir	360	W/SW	13.6/15.1 km	Cheviot Hills & Central Borders
A68	Carter Bar	180/N	W	5.4 km	Cheviot Hills, Eastern & Central Borders
A6105	Greenlaw Moor	180/SW	SW	38.1 km	Central Borders
Hills	Rubers Law	360	SE	6.3 km	Teviot Valley & Cheviot Hills
	Peniel Heugh (Waterloo Monument (within Monteviot GDL))	360	S	16 km	Cheviot Hills, Teviot valley eastern & central Borders
	Hills/Black Hill, Earlston	360	SE	26.7 km	Eildon Hills, Lauderdale Lammermuir Hills & central Borders
Historic Site	Scott's View	180/W	SE	23.8 km	Eildon Hills & Tweed valley
	Smailholm Tower	360	S	24 km	Lammermuir Hills, Cheviot Hills, Eildon Hills & Tweed valley
	Hume Castle	360	SW	31.8 km	Lammermuir Hills, Cheviot Hills, Eildon Hills & Tweed valley

4.138. Viewpoints at Black Halls, Rubers Law, Eildon Hills and Carter Bar are included in the list of representative viewpoints in Table 4.6, and in the Viewpoint Assessment in **Technical Appendix 4.6**.

Representative Viewpoints

4.139. The assessment of landscape and visual effects is informed by consideration of the predicted changes arising from the proposed development at 26 representative viewpoints. All viewpoint locations were agreed in consultation with SBC and SNH.

4.140. Viewpoints were selected to represent the main sensitive landscape and visual receptors within the study area, and to capture potential significant effects. Whilst intended to be representative, the viewpoints selected are intended to illustrate a worst case scenario (i.e. the clearest views of the proposed Development).

4.141. The viewpoints include locations of specific importance including: recognised viewpoints (e.g. Eildon Hills), designated landscapes (for example SLAs), important recreational routes (for example the Borders Abbeys Way and The Pennine Way National Trail) and 'Scenic Viewpoints' identified in the SPG[41]. A variety of landscape character types and locations at different directions, distances and elevations from the site have been represented in the selected viewpoints.

4.142. The detailed assessment of residual effects on selected viewpoints is set out in **Technical Appendix 4.6: Viewpoint Assessment**, and is based on the computer generated wirelines and photomontages in Figures 4.8 – 4.33 and field reconnaissance.

4.143. Table 4.6 lists the viewpoints and provides information on their location and distance from the site, and they are shown in Figure 4.4.

[40] The Scottish Borders Council Supplementary Planning Guidance Wind Energy May 2011

[41] The Scottish Borders Council Supplementary Planning Guidance Wind Energy May 2011

Table 4.6: Representative Viewpoints

VP ID	Viewpoint Name	Landscape Receptor	Visual Receptor	Direction to propose Development	Approximate Distance
1	A6088, Chesters	Bonchester/Dunion of Grassland with Hills	Residents/ road users	South	3.03 km
2	A6088, Southdean	Wauchope/Newcastleton Southern Uplands Forest Covered	Residents/ road users	South west	2.09 km
3	Fort north-east of Southdean	Wauchope/Newcastleton Southern Uplands Forest Covered	Walkers	South	2.39 km
4	Western Approach Chesters	Bonchester/Dunion of Grassland with Hills	Residents/ road users	Southeast	3.14 km
5	Bonchester Hill	Bonchester/Dunion of Grassland with Hills	Walkers	Southeast	4.84 km
6	B6357 Vantage Point	Wauchope/Newcastleton Southern Uplands Forest Covered	Walkers	North-east	3.16 km
7	Pennine Way, Black Halls	Cocklaw Group of Cheviot Uplands	Walkers	South west	15.92 km
8	Borders Abbey Way, Black Law	Bonchester/Dunion of Grassland with Hills ‘Scenic Viewpoint’	Walkers	South	10.72 km
9	Minor Road & Footpath, Townfoot Hill	Oxnam of Rolling Farmland	Walkers/ road users	South west	15.69 km
10	Pike Fell	Claudcleuch Head Group of Southern Uplands with Scattered Forest	Walkers	North-east	7.8 km
11	Footpath and Minor Local Road, Chesters Brae	Bonchester/Dunion of Grassland with Hills	Residents/ road users	South west	3.61 km
12	Rubers Law	Rubers Law of Grassland with Hills ‘Scenic Viewpoint’	Walkers	Southeast	8.93 km
13	Five Stanes	Falla Group of Cheviot Foothills	Walkers	South west	15.82 km
14	Oxnam to Camptown Road	Falla Group of Cheviot Foothills	Walkers/ road users	South west	9.44 km
15	Wolfelee Hill	Wauchope/Newcastleton Southern Uplands Forest Covered	Walkers	North-east	2.34 km
16	Eildon Hills Vantage Point	Eildon Hills Grassland with Hills	Walkers	Southeast	25.78 km
17	A6088 Approach to Bonchester Bridge	Rubers Law of Grassland with Hills	Road users	Southeast	7.81 km
18	Minor Road by Cummings Hill, south of Jedburgh	Bonchester/Dunion of Grassland with Hills	Road users	South	6.03 km
19	Footpath at Knox Knowe	Wauchope/Newcastleton Southern Uplands Forest Covered	Walkers	North-west	3.42 km
20	A6088 north-west of Carter Bar	Wauchope/Newcastleton Southern Uplands Forest Covered ‘Scenic Viewpoint’	Road users	West	4.21 km
21	Carter Bar (eastern vantage point)	Wauchope/Newcastleton Southern Uplands Forest Covered	Visitors/ Road users	West	6.21 km
22	Pennine Way by Cairn Hill, Cheviots	Cocklaw Group of Cheviot Uplands	Walkers	South west	28.91 km
23	Northern Approach to Chesters	Bonchester/Dunion of Grassland with Hills	Residents/ road users	South	4.26 km
24	Drinkstone Hill	Whitehaugh of Grassland with Rock outcrops ‘Scenic Viewpoint’	Walkers	Southeast	17.51 km
25	Minto Hill	Lower Teviot of Lowland Valley with farmland	Walkers	North-east	14.41 km
26	A7 approach to Hawick	Upper Teviot Pastoral Upland Fringe Valley	Road users	North-east	14.22 km

Cumulative Context in the Study Area

4.144. The locations of all wind farms (operational, under construction, consented, application, at appeal and scoping) within the study area are shown on Figure 4.6. The status of the wind farms is taken to be as of mid-February 2016.

4.145. Table 4.7 lists the existing/operational, consented and proposed wind farms located within the study area, which have been included in the cumulative assessment.

Table 4.7: Cumulative Wind Farms

Status	Wind Farm	Approx Distance from proposed Development	Direction from the proposed Development	Number of Turbines	Size of Turbines (metres to blade tip)
Operational	Aikengall	62.2 km	North	16	125
	Bassendeanhill Farm turbine	38.8 km	North	1	67
	Black Hill	49.0 km	North-east	22	79
	Craig	35.30 km	South-west	6	100
	Crystal Rig Phase I & II	59.3 km	North	85	100-121
	Dun Law/Dun Law Extension	50.6 km	North-west	26	64-75
	Fallago Rig	50.7 km	North	48	125

Status	Wind Farm	Approx Distance from proposed Development	Direction from the proposed Development	Number of Turbines	Size of Turbines (metres to blade tip)
	Langhope Rig	24.0 km	North-west	10	121
	Longpark	36.7 km	North-west	19	100
	Toddleburn	47.9 km	North-west	12	105
Consented	Green Rigg	36.2 km	South-east	18	115
	Ewe Hill/ Ewe Hill Extension	38.0 km	South-west	26	126.5
	Ray	36.3 km	South-east	16	125
Proposed Application	Birneyknowe	7.5 km	North-west	15	132
	Crossdykes	38.2 km	South-west	15	130
	Loganhead	35.1 km	South-west	13	130
Refused/ Pending Appeal	Longpark Extension	37.4 km	North-west	8	100-110
Refused/ Pending Appeal	Windy Edge	14.4 km	South-west	9	110-125
Scoping	Newcastleton Forest	16.9 km	South-west	20	132
	Wauchope Forest East	748 m	South	50	132
	Wauchope Forest West	3.7 km	South-west	20	132

4.146. Examination of the cumulative context in Figure 4.6 indicates that existing and consented wind farms are generally concentrated at a considerable distance to the north of the proposed Development and at the south-western and southeastern extremes of the Study Area. Even the Langhope Rig turbines, which represent the closest of the existing/consented schemes to the proposed Development, are situated over 25 km to the north-west.

4.147. In contrast there are a number of closer proposed schemes of greater relevance to the proposed Development, including Birneyknowe and the scoping proposals at Wauchope Forest. However, this scoping scheme is likely to undergo substantial design modifications prior to submission as a formal application.

Analysis of Baseline Appraisal

4.148. Based on the preceding baseline appraisal it is concluded that:

- the rolling topography that characterises much of the study area affords potential for mitigation of development;
- the landscape in the application site and in its vicinity is typified by widespread large scale commercial forestry which is accompanied by existing infrastructure suitable for adaption for the proposed Development
- the landscape is not subject to formal designation on landscape grounds;
- there are no landscape classifications such as Wild Land or GDLs in close proximity to the application site;
- the landscape within which the proposed Development would be located is large scale with a predominance of forest that is capable of accommodating development, subject to careful siting and design;
- whilst containing a number of formal Scenic Viewpoints, strategic recreational routes and Core Paths, these are often located at a considerable distance or in low lying, enclosed positions subject to potential screening of the proposed Development by intervening topography and/or vegetation; and
- there are few transportation routes or settlements in elevated uplands. Roads and settlements are generally concentrated within incised valleys where views are often constrained by a combination of topography and vegetation, thereby providing opportunities to reduce the prominence of the proposed Development, and the potential extent of significant effects associated with development.

Potential Sources of Significant Effects

4.149. Any onshore wind farm development in the UK has potential to cause significant effects on landscape and visual amenity of a given location, including locations outwith the development site itself.

4.150. The proposed wind farm development would comprise three phases:

- a construction phase;
- an operational phase; and
- a decommissioning phase.

4.151. From the perspective of the LVIA there are two aspects to a wind farm development that have potential to result in landscape and visual effects, these comprise of:

- activities and elements that would affect the fabric of the landscape; and
- elements that would affect the character and amenity of the surrounding landscape.

Potential Construction Effects

4.152. The construction phase would be approximately 18 - 24 months in duration. The methods that would be utilised during the construction stage are described in **Chapter 2: Proposed Development**.

4.153. The following elements and activities associated with the construction phase of the proposed wind farm have the potential to result in effects on the landscape and visual amenity of the study area:

- widening of existing on-site access tracks and construction of new ones;
- felling of forestry to accommodate additional tracks, crane pads and turbines;
- off-site highway improvements / construction of additional roads for abnormal loads lorries;
- erection of turbines, one permanent met mast and temporary guyed met masts;
- construction of control building compound;
- construction of site compound and grid connection;
- construction of off-site grid connection;
- construction of lay-down areas;
- temporary site compound incorporating site offices;
- excavation and construction of turbine foundations and crane pads;
- excavation of borrow pits;

- excavations for underground cables;
- HGV and abnormal load deliveries to site and movement of vehicles on site; and
- reinstatement work, including removal of temporary accommodation.

4.154. The majority of effects occurring during this phase would concern disturbance of existing landcover at the site and potential for long term change or loss of characteristic vegetation with consequent effects on the character and amenity of the site and adjoining area.

Potential Operational Effects

4.155. The operational life of the wind farm would be 30 years. The operational elements with the potential to affect the landscape and visual amenity of the study area are:

- wind turbine generators and anemometer masts;
- aviation lighting on turbines;
- on-site access tracks and hardstandings;
- on and off-site grid connection; and
- site control building compound.

4.156. The nature of these components is described in detail in **Chapter 2: Proposed Development**.

Potential Decommissioning Effects

4.157. Decommissioning of the proposed wind farm could have effects similar to that of the construction period with temporary disturbance of landscape fabric and effects on landscape character and visual amenity, both within the site and in the wider study area. Detailed decommissioning proposals would be agreed in conjunction with SBC, SNH and other statutory consultees prior to the commencement of this phase, the emphasis being upon minimising landscape and visual effects.

Mitigation

4.158. A number of measures have been incorporated into the design of the scheme to ameliorate potential landscape and visual effects of the proposed wind farm.

Standard/General Measures

4.159. The development would make use of three bladed horizontal axis turbines with tubular steel towers. Research (Stevenson and Griffiths, 1995) has confirmed that tubular turbine towers reduce visual clutter.

4.160. As the proposed turbines would generally be seen against the skyline from the closest viewpoints they would be finished in a semi-matt pale anti-reflective grey finish. The exact colour of the turbines would be agreed with the local planning authority prior to the construction of the wind farm.

4.161. Cabling within the proposed wind farm connecting turbines and proposed substation would be underground to avoid cluttering of the development site and typically located alongside proposed tracks.

Iterative Design

4.162. The design optimisation process is described in **Chapter 3: Design Evolution Considerations and Alternatives**. A key consideration in this process was the potential for adverse effects on the landscape resource and visual amenity of the study area. In anticipation of this, and in response to the particulars of the landscape and visual context, as previously described, these included:

- location of the proposed Development outwith and distant from areas subject to formal landscape designations;
- the application of a suitable 'set back' from settlements and key transportation and recreational routes in order to minimise significant visual effects at these receptor locations;
- location of the proposed Development turbines and key infrastructure within a low to medium sensitivity large scale upland landscape which is dominated by large scale coniferous plantations, and which already contains suitable infrastructure and borrow pits;
- avoidance of locating turbines on prominent elevated locations at the southern end of the application site where they are likely to be most visible from locations south of the Scottish/ English border, the NNP, and could be seen from Carter Bar vantage point;
- the application of a set back from more enclosed landscapes such as river valleys and enclosed farmland landscapes to reduce the visibility and prominence of the proposed Development and avoid the potential for turbines to tower over such landscapes;
- the avoidance of prominent ridgelines and summits, especially where such summits form prominent focal points in the landscape (e.g. Rubers Law and cheviot);
- preferential positioning of turbines in a part of the application site that is enclosed on three sides by topography;
- use of turbines of a scale that will provide for the continuation of forest production at the site; and
- use of two shorter turbines (150 m to blade tip) on elevated locations overlooking Chesters to ensure that their prominence is reduced and to ensure consistency with the elevation of other of the proposed Development turbines.

Site Specific Measures: On-Site Access Tracks

4.163. In order to minimise the need for a new site access tracks preference has been given to the use of existing farm and forest tracks at the site, as indicated in Figure 2.1 of the ES. However, a total of 5.5 km of new tracks would be required, principally as spurs to link main access tracks to turbine positons. The majority of tracks would be located in forested areas and have been designed to be as short as possible whilst avoiding environmentally sensitive locations and exposed summits and slopes. The new tracks have also been positioned to avoid the necessity of the formation of unsightly or incongruous cuttings or embankments.

4.164. In order to further minimise potential landscape and visual effects associated with this aspect of the proposed wind farm, new tracks would match, as far as practicable, the character and appearance of existing farm and forest tracks in the vicinity, would avoid steeply graded or highly visible slopes and exposed edges and have been designed to occupy the gentler gradients of the site, thereby minimising the amount of track surface visible from external viewpoints. Moreover, the running width of proposed tracks would be restricted to 5 m except on bends, with shoulders to each side of the track adding 0.5 m. Construction working widths would be carefully controlled, thereby ensuring that disturbance is kept to a minimum. Additionally, any disturbed ground situated along the edges of tracks would be reinstated to match adjoining ground as soon as practicable to minimise the prominence of the tracks.

Site-Specific Measures: Substation and Control Building

4.165. The substation and control building would be located in the Dykeraw Heights Forest, between Turbines 5, 6 and 7, and would be enclosed by surrounding topography, thereby screening this aspect of the proposed Development from the majority of neighbouring receptor locations. The extent of enclosure would be augmented by forest cover.

Site-Specific Measures: Crane Pads and Laydown Areas

4.166. These would be kept to a minimum size and would be surfaced to match the track construction. Laydown areas would be removed and the ground reinstated during completion of construction works.

4.167. It is also the case that these elements would be situated in forested areas and set back from prominent ridgelines and edges of the uplands, thereby screening thee aspects of the proposed Development form the majority of external viewpoints.

Site Specific Measures: Borrow Pits

4.168. It is proposed that aggregate for new tracks would be won from borrow pits at the site. Current search areas for borrow pits are identified in Figure 2.1 and are briefly assessed in **Technical Appendix 4.8**.

4.169. Each borrow pit option would be located to avoid prominent elevated topography which may be visible from external receptor locations. The scale and configuration of the borrow pits would be carefully designed to minimise potential visual intrusion through adoption of mitigation measures such as roll over slopes. Moreover, once extraction ceases each pit would be restored at the earliest practical opportunity. Detailed borrow pit designs and restoration proposals would be provided to SBC prior to commencement of construction works at the site

Mitigation during Construction

4.170. The location and management of construction elements has been carefully considered to minimise environmental effects including potential landscape and visual effects during the construction stage. Additionally, the following general precautionary measures would be adopted:

- all working areas would be restricted as far as practicable to the specified areas and demarcated to prevent incursion of site plant into no construction locations;
- minimal clear felling is anticipated as a result of the proposed Development with much of the infrastructure To be keyholed instead;
- designated haul routes would be utilised that correspond with the longer term site access tracks;
- material storage/temporary stockpiles would be retained for the shortest duration practicable and would be sited to minimise visual intrusion to neighbouring receptor locations;
- lay down areas, temporary site compounds and borrow pits would be reinstated at the end of the construction phase to avoid the necessity of retaining restoration materials on site over the operational period and to avoid sustained effects on landscape fabric character and visual amenity; and
- excavations for turbines foundations, laydown areas and underground cables would be reinstated prior to commencement of the operational phase of the development and all track sides, including floating tacks (if there are any), would be reinstated with translocated turves where available to ensure they blend in with the adjoining (undisturbed) ground in the site.

Mitigation during Operation

4.171. Mitigation measures relating to the operational phase of the proposed wind farm were incorporated into design of the proposed wind farm, as described above and in **Chapter 3: Design Evolution and Alternatives**.

4.172. No detailed or firm proposals in respect of aviation lighting were available at the time of this assessment and there remains some uncertainty as to what would therefore constitute a realistic development scenario on which to base a detailed assessment of this aspect of the proposed Development.

4.173. The applicant, in recent correspondence with the Civil Aviation Authority (CAA) argues that there is no need for such lighting on the basis of comparison with other wind farm schemes of similar or higher elevation in the vicinity. However, the applicant also suggests that, if lighting is required by the CAA, that it could comprise nacelle mounted lights on four of the peripheral turbines (e.g. Turbines 1, 6, 10 and 13). Such lighting would be 2,000 candela and upward facing (i.e. incorporating a shield to obscure the lights from nearby low lying positions).

4.174. The efficacy of this approach is indicated by a comparison of the relative elevations of the principal night time receptors in the vicinity of the proposed Development, including Chesters Brae, Southdean and along the A6088 and that of the nacelle height of turbines (m AOD). Indeed, of the night viewpoints considered in the LVIA (e.g. Viewpoints 1, 2, 4, 6, 9, 11, 14, 17, 18, 20, 21, 23 and 26), only the viewpoint at Carter Bar would provide theoretical visibility of the lighting on Turbine 6. However, this viewpoint is located over 6 km from the proposed Development and is screened by intervening coniferous forestry.

4.175. Whilst some illumination of low lying cloud or mist is always a possibility, such an affect is likely to be infrequent and of short duration. Similarly, whilst illumination of turbine blades as they rotate past the light is a possibility, care would be taken to ensure that the lighting shield was designed to avoid this. On this basis, this aspect of the proposed Development is considered to be unlikely to represent a significant effect on the character or visual amenity of the study area and has therefore not been considered further.

Mitigation during Decommissioning

4.176. The decommissioning phase of the proposed wind farm would be of a shorter duration to that of the construction phase, with the dismantling of all above ground structures and reinstatement of disturbed ground. Below ground structures would be left in place to avoid further disturbance. There would therefore be a temporary impact from the activities on site to remove structures, but this would be of relatively short duration. Accordingly, the decommissioning phase is considered to have a minimal effect on the landscape and visual amenity of the locality, and has not been assessed in any further detail.

Assessment of Residual Effects

Theoretical Visibility

Blade Tip ZTV

4.177. The Blade tip ZTV is shown in Figure 4.4. The ZTV illustrates potential (or theoretical) visibility of the proposed development turbines up to the blade tip height of up to 176 m in the study area.

4.178. The ZTV analysis does not take into account any landscape elements such as trees, woodland or buildings etc. The ZTV analysis is made on the basis of topography alone. Actual visibility can only accurately be determined by site survey since there are a multitude of local variables that may affect lines of sight. The ZTV does not convey the nature or magnitude of visual effects and whether these are likely to be significant or not.

4.179. As the proposed turbines would be located on elevations of between 218 m AOD up to 298 m AOD, surrounded by hills, the summits of which range between 258 m and 551 m AOD, the most continuous area of visibility is limited to the application site and immediate surroundings within a 4.5 km radius of the outermost turbines. Beyond this the ZTV becomes fragmented, reflecting the influence of the rolling topography of the study area. The ZTV indicates that the proposed Development's viewshed would not extend to any large extent across the border into England (including NNP), outwith the [highest points of the] Cheviot Hills.

4.180. To the north, between Rule Water and Jet Water, the ZTV extends to a distance of around 4.4 km to Doorpool Hill (270 m AOD). Visibility then occurs on the south facing slopes of the higher landforms such as Faw Hill (331 m AOD) and Watch Knowe (292 m AOD). Limited visibility occurs within the Rule Water valley on the east facing slope of Rubers Law (424 m AOD) and mainly blade tip visibility is shown along the eastern side of Jed Water valley. Further north, sporadic visibility occurs on elevated topography including Black Law (338 m AOD), Minto Hills (276 m AOD) within the Lowland Valley between River Tweed and River Teviot, and on south facing slopes of the Eildon Hills (422 m AOD) to the south of Melrose and on higher undulations within the Lowlands between Melrose and Kelso, Leader Water and the River Tweed.

4.181. To the north-east the viewshed is impeded at the immediate distance by the hills, which form the north-eastern side of Carter Burn (including Southdean Hill at 300 m AOD and Steel Knowe at 273 m AOD. Further on to the north-east, sporadic and elevated visibility occurs on the sides of Jed Water. The ZTV also extends over the ridge of the Cheviot Foothills, including Five Stanes (291 m AOD), Bleak Law (297 m AOD), Falla Knowe (296 m AOD), Townfoot Hill (288 m AOD), in between Oxnam Water and Kale Water. Visibility is also predicted on the south west facing slopes of Cheviot Uplands (including Craik Moor (456 m AOD), Hownam Law (449 m AOD), The Schill (606 m AOD), The Curr (564 m AOD)).

4.182. To the east the ZTV extends approximately 5.4 km across Wauchope Forest and is shielded by the landmass of Black Cleugh (579 m AOD) at Carter Bar. Sporadic visibility also occurs on the Cheviot Hills, including locations at Ogre Hill (516 m AOD), Brownhart Law (508 m AOD), Wedder Hill (456 m AOD), and Thirl Moor (558 m AOD).

4.183. The south-eastern visibility is restricted by the range of Carter Fell (556 m and 579 m AOD) at a distance of 4.2 km, extending up to 5.7 km on the summit of Limestone Knowe (551 m AOD) at a distance of 5.7 km.

4.184. To the south the range of hills (ranging between 323 m up to 521 m AOD at Scratny Holes) in Wauchope Forest largely confines views to locations within 4.1 km from the outmost proposed turbines. However, some localised visibility is indicated at Larriston Fells (512 m AOD) the highest summit to the south within the study area, also on nearby Currick Hill (454 m AOD) within the Kielder Forest, and at Caplestone Fell (479 m AOD).

4.185. To the south west visibility is limited at the immediate distance on the upper slopes of the incised valleys of Hyndlee Burn, Wigg Burn and Wauchope Burn, by the landform of Brockie Law (366 m AOD). Further to the south west views are predicted from the nearby hills of Wauchope Forest, which in turn limit visibility 6.4 km from the outmost proposed turbine. Mainly blade tip visibility of up to six turbines occurs on Saughtree Fell (434 m AOD) at a distance of 9.3 km. Views of up to 6 turbines would also occur at Greatmoor Hill (599 m AOD), Cauldecleuch Head (619 m AOD), whilst up to three turbines would be visible from Dod Hill (422 m AOD), and Din Fell (529 m AOD).

4.186. To the west visibility is limited at the immediate distance by the landform of Black Hill and Wardmoor Hill (365 m AOD) on the western boundary of the site. Beyond, visibility occurs on the upper slopes of the incised valleys at the head of the Rule Water (including valleys of Hyndlee Burn, Wigg Burn, Wauchope Burn and Lurgies Burn). Views are predicted from nearby summits (including Stonedge Hill (369 m AOD), Pike Fell (400 m AOD)) of the Southern Uplands, which in turn limit the visibility 9 km beyond the outmost proposed turbine.

4.187. To the north-west visibility is restricted at the immediate distance by the nearby landforms of Wolfelee Hill (393 m AOD), on the north-western corner of the site, precluding views from the Rule Water valley. The ZTV extends on the Southeast facing Bonchester Hill (323 m AOD) and on the landmass of Rubers Law (424 m AOD), which in turn restricts visibility from the River Teviot valley. Visibility is indicated on low landforms which rise from the platform of neatly ordered pastureland between Rule Water and River Teviot. Beyond this sporadic visibility occurs on the strongly undulating Upland Fringe, which forms the north-western side of the River Teviot valley and on the south west north-east orientated ridges of Southern Uplands with Scattered Forest, between Craik and Ettrick Forests.

Analysis of Blade Tip and Hub Height Comparison ZTV (BTHHZTV)

4.188. In addition to the Blade Tip ZTV, a comparative ZTV has been produced which identifies where views of just turbine blade tips would occur, and where turbine hubs (and potentially lower sections of turbine columns) would also be visible. It is apparent from this figure that, where the proposed Development would be visible, both blade tips and hubs would generally be theoretically visible. The exceptions to this occur in the following locations:

- Locations on the lower northern slopes of a number of the fells within the Kielder Forest;
- Low, west and north-west facing slopes within the Cheviots;
- Parts of the Rule Water;
- The southeast facing sides of the River Teviot valley;
- The vicinity of Jedburgh; and
- The vicinity of Kelso.

4.189. This trend is indicative of the incised or enclosed nature of these positions from where the lower parts of turbines would be substantially obscured by intervening topography. It should be noted,

however, that these findings do not reflect the screening effect of structural vegetation within the study area.

4.190. The findings of the BTHHZTV also indicate that a reduction in turbine height, even to a maximum blade tip height of 130 m, would have little effect on the extent of the viewshed of the proposed Development. This is borne out in Figure 3.4.

Analysis of the Cumulative Zones of Theoretical Visibility (CZTV)

4.191. In addition to the Blade Tip ZTV and the Blade Tip and Hub Height Comparison ZTV, a series of paired CZTVs were prepared to demonstrate visibility when paired with other wind farms within the Study Area and are illustrated in Figures 4.7a to 4.7k. Each CZTV has been calculated to blade tip based on the available turbine dimensions and layouts for each site at the time of assessment.

4.192. The following text describes the theoretical cumulative visibility of the proposed development within the 40 km study area, considered in addition to the identified groups and single wind farms listed in Table 4.7. It is apparent from the following analysis that the key cumulative developments in the formation of cumulative effects are located within 10 km of the proposed Development and comprise the proposed Birneyknowe Wind Farm and the Wauchope and Newcastleton Wind Farm scoping scheme. Both these schemes have considerably larger viewsheds than that of the proposed Development. It is also the case that, viewed from the north-west, north and north-east (the predominant direction affected by views of the proposed Development) these two cumulative schemes are generally more prominent in views from, locations beyond 4.5 km of the proposed Development's turbines and that Birneyknowe would often be interposed between receptors and the proposed Development. Moreover, the Wauchope and Newcastleton turbines would be interposed between the southernmost viewpoint at Knox Knowe the proposed Development.

Aikengall, Crystal Rig Phase I & II, Black Hill Wind Farms, and the Proposed Development (Figure 4.7a)

4.193. The Crystal Rig Phases I & II and Aikengall Wind Farms are located within the Lammermuirs Dissected Plateau Moorland landscape, and Black Hill is situated within the Grassland with Hill LCT. These developments are located beyond the 40 km study area boundary to the north-west.

4.194. The extent of the ZTVs for these wind farms is extensive due to their positioning adjacent to the expansive low lying River Teviot catchment area between Lammermuirs and The Cheviots. Intervisibility between these schemes and the proposed Development is, despite the comparative size of the Highlee Hill turbines, relatively limited and mainly occurs to the south and north of Kelso, on elevated ground west of the B6357 and individual summits to the east of the A7 corridor and on the north facing edge of Carter Fell and at Carter Bar.

Bassendeanhill turbine and the Proposed Development (Figure 4.7b)

4.195. Bassendeanhill Farm turbine is located within Rolling Farmland, 38.8 km to the north-west of the proposed Development.

4.196. According to the CZTV Highlee Hill would appear simultaneously with the single turbine along the Cheviot Fringe and, occasionally, on the Tweed Lowlands, close to which the single turbine is located.

Craig, Ewe Hill and Ewe Hill Extension Wind Farm, and the Proposed Development (Figure 4.7c)

4.197. The Craig turbines are located within Southern Uplands, as are the Ewe Hill/Ewe Hill Extension turbines, which straddle the Foothills landscape. These wind farms are located on the most south-eastern boundary of the study area. Due to the intervening higher parts of the Southern Uplands which range between the proposed Development and Craig/Ewe Hill and Ewe Hill Extension Wind Farms, predicted simultaneous visibility is limited on a small number of ridges of the Southern Uplands (including Larriston Fells, Ettrick Pen and Black Knowe).

Dun Law, Dun Law Extension, Fallago Rig and Toddleburn Wind Farms and the Proposed Development (Figure 4.7d)

4.198. Dun Law, Dun Law Extension and Toddleburn are located within the Lammermuirs Plateau Grassland landscape and Fallago Rig is located within Dissected Plateau Moorland LCT. These developments are located beyond the 40 km study area boundary to the north-west.

4.199. The ZTVs for these wind farms are extensive due to their location adjacent to the expansive low lying River Teviot catchment area between Lammermuirs and The Cheviots. Intervisibility between these schemes and the proposed Development would be widespread across high points and hill summits in the Cheviots, Cheviot Fringe and Foothills, the rolling farmlands and lowland margin to the east of Kelso and the north facing slopes of Larriston and Carter Fell. Intervisibility with Fallago would largely be confined to the Cheviots and Carter Fell.

Langhope Rig and Longpark Wind Farm, and the Proposed Development (Figure 4.7e)

4.200. Langhope Rig Wind Farm is located within the Southern Uplands with Scattered Forest LCT, 24.0 km to the north-west of Highlee Hill Wind Farm.

4.201. The proposed Development would be seen in conjunction with Langhope Rig from summits on the Southern Uplands and from the Tweed Lowlands, although the visibility of Langhope Rig is more pronounced across the Central Southern Uplands (including Ettrick Forest) and Tweed Lowlands between Melrose and Coldstream.

4.202. Longpark Wind Farm is located within Plateau Grassland, 38 km to the north-west of Highlee Hill Wind Farm.

4.203. According to the CZTV Highlee Hill appears simultaneously with Longpark Wind Farm sporadically, only on the summits of the Moorfoot Hills and on the Cheviot Fringe, and occasionally on the Teviot Lowlands.

Green Rig and Ray Wind Farms, and the Proposed Development (Figure 4.7f)

4.204. Both Green Rig and Ray Wind Farms are located within the Northumberland Sandstone Hills landscape, almost on the Southeastern boundary of the study area. Due to the intervening Cheviot Hills between Highlee Hill Wind Farm and Green Rig/Ray Wind Farms, predicted cumulative visibility is limited on a few summits of Cheviot Hills and on Larriston Fells.

Birneyknowe, Windy Edge and the Proposed Development (Figure 4.7g)

4.205. The Birneyknowe turbines would be located 7.5 km to the north-west of the proposed Development within Grassland with Hills LCT; some turbines within the Southern Uplands with Scattered Forest and some within Grassland with Rock Outcrops landscape.

4.206. The proposed Development would be seen in conjunction with Birneyknowe Wind Farm from locations adjoining the B6357 corridor, the A6088 corridor, Carter Bar, elevated summits in the Cheviots and Carter Fell, as well as in locations north of Hawick and south of Melrose. It is notable that intervisibility between Birneyknowe and the proposed Development is relatively limited to the south and east of Hawick.

4.207. The Windy Edge is located 14.4 km to the south west of Highlee Hill Wind Farm within Southern Uplands with Scattered Forest LCT. Due to its elevated location on the south facing shoulders of Greatmoor Hill (599 m AOD), the Windy Edge turbines would be simultaneously visible with the proposed Development, except from the southern part of the Study Area, at Liddesdale.

Longpark Extension Wind Farm and Highlee Hill Wind Farm (Figure 4.7h)

4.208. Longpark Extension Wind Farm is located within Plateau Grassland, 37.4 km to the north-west of the proposed Development.

4.209. According to the CZTV Highlee Hill appears simultaneously with Longpark Extension Wind Farm sporadically, only on summits of the Moorfoot Hills and on the Cheviot Fringe, and occasionally on the Teviot Lowlands.

Crossdykes and Loganhead Wind Farm, and Highlee Hill Wind Farm (Figure 4.7i)

4.210. The Loganhead Wind Farm is located on the Southern Uplands whilst Crossdykes turbines, are situated on the boundary of the Southern Uplands and Foothills with Forest LCTs. These Wind Farms are located on the most south-eastern boundary of the study area. Due to the intervening higher parts of the Southern Uplands which range between the proposed Development and Crossdykes and Loganhead Wind Farms, predicted cumulative visibility is limited on a small number of elevated ridges of the Southern Uplands (including Larriston Fells, Ettrick Pen and Black Knowe).

Wauchope East and Wauchope West, and the Proposed Development (Figure 4.7j)

4.211. The Wauchope East and West turbines would be located within Wauchope Forest, adjoining the proposed Development, in the Southern Uplands Forest Covered LCT.

4.212. The ZTVs of Wauchope East and West are far more extensive than the ZTV for the proposed Development due to their elevated location on the north-west facing slopes of Carter Fell. On this basis the proposed Development would have a high degree of intervisibility with Wauchope East and West. The exception to this would be the southern part of the study area (Liddesdale and Kielder Forests), where only visibility of Wauchope East and West is shown.

Newcastleton and the Proposed Development (Figure 4.7k)

4.213. Newcastleton turbines would be located within Newcastleton Forest, in the Southern Uplands Forest Covered LCT, 20.2 km to the south west of the proposed Development.

4.214. Due to the intervening range of hills of Wauchope Forest, which confine views of the proposed Development at a distance of 3.8 km, its predicted simultaneous visibility with Newcastleton Wind Farm is limited on a few summits of the Cheviot Hills (including Sightly Crag (518 m AOD), Caplestone Fell and The Cheviot). Sporadic visibility is shown on higher topography between the River Tweed and its tributaries in the north-west part of the study area.

Residual Effects

4.215. Residual Effects refer to the landscape and visual effects which are predicted to occur as a result of the proposed Development after the mitigation outlined in **Chapter 3: Design Evolution and Alternatives**.

Effects on Landscape Fabric

4.216. Effects on landscape fabric are associated with physical changes to landscape elements such as topography, vegetation cover.

4.217. The key impacts on the landscape fabric of the proposed Development are summarised as:

- construction of 5.5 km of new access track, with a running width of 5 m;
- localised felling of coniferous forestry as shown on Figure 10.6;
- formation of the laydown areas and the assembly area/crane hardstandings (approximately 35,880 m^2, of which 23,400 m^2 would be permanent).
- formation of foundations (25 m diameter for turbines;
- crane pads for each turbine (30 x 60 m^2);
- meteorological mast foundations;
- the control building compound (50 m x 37 m, incorporating a single storey building of 32 m x 14 m);
- Excavation of borrow pits (as shown in Figure 2.1 and 2.14a-2.14e and discussed in **Technical Appendix 4.8: The Proposed Development Borrow Pit Assessment**).

4.218. The majority of the site is currently utilised for large scale commercial forest production and is subject to an extant felling plan (Figure 10.4). That indicates a rolling programme of large scale clear felling and replanting from 2013-2022 and beyond. The Applicant is seeking consent to fell up to 29.98 hectares of forestry to accommodate site infrastructure. The existing Forest Plan already identifies the mature coupes affected to be felled at approximately the same timeframe of the predicted wind farm construction (2019). As these forest coupes were scheduled for felling anyway the introduction of the wind farm will not have a significant impact on the felling programme. The accommodation of much of new tracks, crane pads, and turbines would be achieved by localised keyhole felling of forestry and replacement planting undertaken at a suitable juncture thereafter (please refer to **Chapter 10: Forestry** for details).

4.219. Having regard to the moderate to poor condition of the landscape within the application site; the lack or rarity; limited conservation interest and lack of any particularly notable perceptual qualities, the value of the landscape fabric of the site is consider to be medium to low. The susceptibility of these landscape elements to change of the nature associated with the type of development proposed is considered to be medium given the extent to which these particular elements contribute to the key characteristics of the surrounding landscape. The overall sensitivity of the landscape fabric of the site is therefore considered to be Medium.

4.220. The proposed temporary construction compound, localised ground disturbance alongside the new access track caused by undergrounding of the proposed cabling, and any further areas subject to disturbance during construction would be reinstated after construction is complete. Similarly, the proposed borrow pits would be restored using a combination of soils recovered from the borrow pit areas and other excavations elsewhere at the application site.

4.221. Based on the above analysis, the construction phase is anticipated to affect mainly the groundcover of the site where elements of the proposed Development would be sited, leaving the

majority of the landform and ground cover in the site unaffected. Disturbance of the landscape fabric would be limited to the footprint occupied by the various components of the proposed Development, including the grasslands and forestry which are considered to be of medium to low landscape and/or amenity value, medium susceptibility and overall medium sensitivity to the type of development proposed. When considered in the context of the existing baseline condition of the site, the construction phase would represent a Moderate magnitude of change on landscape fabric resulting in a Moderate and not significant effect on this medium sensitivity landscape fabric. Moreover, reinstated land at the proposed temporary compound, borrow pits and new track edges would be assimilated into the adjoining undisturbed land.

Residual Effects on Landscape Character

4.222. **Technical Appendix 4.3** outlines the residual effects of the proposed wind farm on LCTs within the study area. Of the 11 LCTs which were assessed the following LCTs were assessed as being liable to significant effects, as follows:

- Southern Upland with Forest Covered - Wauchope/ Newcastleton (LCT BDR5), in which the proposed Development is located;
- Cheviot Foothills - Falla Group (LCT BDR7);
- Grassland with Hills - Bonchester/Dunion - (LCT BDR11) – which contains the site access; and
- Grassland with Hills - Rubers Law – (LCT BDR11).

4.223. Key change to these LCTs are described below, including cumulative effects associated with the existing/consented wind farm scenario, as well as scenarios incorporating proposed wind farms.

4.224. Whilst the proposed Wauchope/Newcastleton scoping proposals have been included for completeness and in accordance with SBCs requests, it should be noted that this scoping scheme is likely to change significantly during the application process, and as there is considerable uncertainty to its potential success, no weight should be given to this development in the determination of the proposed Development's application.

Southern Upland Type with Forest Covered - Wauchope/ Newcastleton (LCT BDR5)

4.225. Given that the proposed Development is located within this LCT, it is inevitable that significant effects would occur in the landscape. The assessment in **Technical Appendix 4.3** concludes that significant effects would be experienced within the application site, within the enclosed landscape adjoining the A6088, and at elevated summits such as Wolfelee Hill, Southdean Fort and Carters Fell.

4.226. The key changes wrought by the proposed Development would concern the introduction of large scale vertical engineered elements and movement to an essentially still, undulating landscape dominated by dense commercial forestry. Turbine colouring would also contrast with the dark green of the forest cover and green and browns of the open areas of moorland, such as at Highlee Hill. These contrasts would be most evident in elevated locations, whilst the scale and form of the turbines relative to the topography and forest cover may be most evident from low lying locations such as those in the A6088 corridor and along the B6357 corridor, where breaches on forest cover permit (e.g. at Viewpoint 6). Despite these differences the proposed Development is not considered to undermine the scale of the uplands, would not require the removal or cessation of forest cover and operations, and would not adversely affect the essential simplicity of the landscape.

4.227. Currently, the cumulative context is limited to a concentration of wind farms located on the Lammermuir Hills around 50 km to the north of the proposed Development, and the Langhope development which is situated around 25 km to the north-west of the proposed Development. A consequence of the separation and distance of these wind farms from the proposed Development is that intervisibility and cumulative effects are limited, especially within the enclosed landscape adjoining the A6088, but across much of the rest of this LCT. However, if the proposed Birneyknowe turbines are included the proximity of this scheme would provide a more immediate cumulative context that would lead to increased cumulative visibility and potentially significant cumulative effects elevated locations such as Southdean Fort, and Carters Fell/ Knox Knowe, but the majority of the LCT would be subject to Moderate or Moderate/minor cumulative effects.

4.228. The introduction of the Wauchope/Newcastleton scheme would establish a particularly large scale and expansive wind farm development within this LCT, and one which has a considerable viewshed. Significant cumulative effects would occur in low lying locations in the A6088 corridor and on the B6357 as well as elevated position in this LCT. It should be noted, however, that this is dependent upon how the proposed Development and the Wauchope/Newcastleton schemes relate in views. For example, in views from Knox Knowe, the presence of the Wauchope/Newcastleton scheme would diminish the prominence/conspicuousness of the proposed Development. Some inconsistencies between the proposed Development and the Wauchope/Newcastleton scheme would be apparent, not only in respect of the scale of each of the respective schemes, but the typology of turbines utilised. This could result in some visual confusion, which, coupled with the considerable proliferation of turbines within this LCT, could represent a fundamental shift in its character.

Cheviot Foothills - Falla Group (LCT BDR7);

4.229. **Technical Appendix 4.3** concludes that the proposed Development would generally represent a Moderate/minor effect on a large proportion of this LCT due to the restricted nature of views of the proposed Development. However, significant effects were predicted on the elevated minor road above the Jed Water Valley and on the approach to Chesters Brae. In such locations, the landscape is influenced by the confluence of LCTS (BDR5, BDR11 and BDR7), the settled farmland of the Black Burn Valley in the mid ground of views in this part of the LCT. Views from this part of the LCT contain a series of interlocking slopes that emphasise the Grassland with Hill LCT and the edge of the Southern Uplands. In this context, the proposed Development turbines would be prominent on a ridgeline and would intersect with the distant horizon formed by the Southern Uplands and Cheviots. Whilst the proposed Development would not adversely affect key characteristics of this landscape, it would result in the introduction of large scale engineered form, with the exception of the Black Burn valley to the east of the site which is partially identified as being the Southern Uplands Forest Covered LCT. For the purposes of this assessment, Black Burn valley is considered to be more similar in character to the Wooded Upland Fringe Valley and has been accorded a High sensitivity to wind farm development due to its enclosed nature with varied landscape elements and landform resulting in a smaller scale and more intimate landscape character and movement to a part of contextual views of this landscape and reduce the primacy of the southern uplands skyline.

4.230. Existing and consented wind farms are concentrated distantly to the north of this LCT and are therefore of little influence on much of this LCT. Similarly, the inclusion of the proposed

Birneyknowe development is considered to represent insufficient cumulative context to lead to significant cumulative effects.

4.231. In the event of the proposed Wauchope/Newcastleton scoping scheme be constructed it would provide such a cumulative context. Seen in the context of this scoping scheme, the proposed Development would appear to extend wind turbines closer to viewpoints in the western part of the LCT, adjoining the Black Burn valley. The introduction of such a large development as the Wauchope/Newcastleton scheme would result in a considerable if not fundamental alteration to a key element of the perceived character of the landscape in this location.

Grassland with Hills - Bonchester/Dunion - (LCT BDR11)

4.232. This LCT contains the main site access of the proposed Development. However, this element of the proposal is, in itself, not considered to pose a significant effect as it would be based on an existing farm track/forest access track that extends across the pastoral farmland to the south of the A6088 carriageway and would be narrowed after construction operations have ceased. However, the proximity of this LCT to the proposed turbines means that some significant effects are considered inevitable. These are predicted to affect receptors in the vicinity of Chesters, at Bonchester Hill, and at Chesters Brae. The experience of this LCT varies according to elevation; the enclosed and smaller scale parts of the LCT adjoining the A6088 emphasising the skyline formed by the edge of the Southern Uplands Forest Covered LCT, whilst more elevated locations such as Rubers Law, Dunion Hill and Chesters Brae providing more expansive views across neighbouring river valleys and LCTs.

4.233. The proposed Development would not affect the diversity of this landscape or its characteristic topography and landcover, but would introduce a new focal point, large scale vertical engineered elements and movement to an essentially gently graded and still landscape. Whilst the scale of the proposed Development turbines would be evident in views from elevated positions, it would be partially mitigated in views from low lying positions by intervening topography and forest cover, where much of the lower columns of turbines would be obscured by intervening topography and forest cover, thereby avoiding the impression of the turbines towering over the viewer. The turbines would none-the-less, remain prominent elements due to the foreshortening of the view by the edge of the Southern Uplands, which places particular emphasis upon the elevated skyline.

4.234. Cumulative visibility is currently confined to elevated locations within this LCT, and is derived from the concentrations of wind farms to the north of the LCT. However, these schemes are situated a considerable distance from the LCT and are therefore of limited influence. In the event of the proposed Birneyknowe Wind Farm being built, however, significant effects would be experienced at Bonchester Hill.

4.235. The introduction of the Wauchope/Newcastleton scheme, would introduce a particularly large scale and expansive wind farm development relatively close to this LCT, and would provide a more immediate cumulative context for the proposed Development. As a consequence, Moderate to Substantial cumulative change would be experienced from a larger number of locations, with significant effects experienced in location in the vicinity of Chesters. It should be noted, however, that this is dependent upon how the proposed Development and the Wauchope/Newcastleton schemes relate in views. For example, in views from Knox Knowe, the presence of the Wauchope/Newcastleton scheme would diminish the prominence/conspicuousness of the proposed Development.

Grassland with Hills - Rubers Law– (LCT BDR11).

4.236. The assessment of residual effect on this LCT suggests that significant effects would be confined to the summit and elevated southern slopes of Rubers Law itself, from where open expansive views towards the application site are provided. From this position the interior of the wooded upland fringe valley of Rule Waters and the adjacent Bonchester/Dunion - Grassland with Hills landscape form the middleground context, beyond which the southern uplands form a distinctive backdrop. The proposed Development would be visible below the distant skyline of the Cheviots and set back and distinct from the contrasting verdant character of the Grassland with Hills. Whilst the proposed Development would undoubtedly form a new focal point in the landscape and introduce large scale vertical engineered elements and movement to the borrowed prospect of locations from Rubers law, it would not cause the undermining or loss of key characteristics of this LCT.

4.237. No significant cumulative effects were identified in connection with existing and consented wind farms within this Unit of the Grassland with Hills LCT. However, the proposed Birneyknowe Wind Farm, which would be located within the south western corner of this Unit, 7.5 km to the north west of the proposed Development, and would introduce a closer and more obvious cumulative context which, whilst not affecting the majority of this Unit, would significantly affect the character at the summit of Rubers Law. If the proposed Wauchope/Newcastleton scheme is included, the proposed Development would generally be seen as overlapping with and consequently less prominent than this scoping scheme, thereby causing a reduction in the cumulative effect attributable to the proposed Development.

Residual Effects on Landscape Designations and Classifications

4.238. **Technical Appendix 4.4** contains a detailed assessment of the potential residual effects on the special qualities of each of the identified landscape designations within the study area. The magnitude of change on the scale of the designated areas, identified in the Baseline; the Eildon and Leaderfoot NSA, Northumberland NP, Tweed, Ettrick and Yarrow Confluence SLA, Tweed Lowlands SLA and Cheviot Foothills SLA, is considered Negligible, resulting in a Moderate and non significant effect. The main factors reducing the magnitude of change are the distance and the incidence of intervening topography which serves to limit potential visibility to elevated areas only.

4.239. The only designation subject to significant effects would be the Teviot Valleys SLA. This is due to its proximity to the proposed Development. Residual effects experienced in Teviot Valleys SLA would range from None to **Major/moderate**, such effects occurring at a small number of open elevated locations due to the extent of screening provided by intervening topography, vegetation within much of the valley.

4.240. The SPG LLD42 identifies one of the forces for change of the Teviot Valleys SLA 'the potential for visual impact of development on hills outside the SLA'. The proposed turbines would present this kind of effect on hills outside the SLA. However the proposed Development would not undermine the views of the visually prominent hills (including Bonchester Hill, Rubers Law) from/within the valleys of Teviot, Jed Water and Rule Water Valley with which the identified hills have a strong relationship, as stated by the Designation Statement of the Teviot Valleys SLA43. Consequently,

[42] Scottish Borders Council, August 2012, Supplementary Planning Guidance, Local Landscape Designations

[43] Scottish Borders Council, August 2012, Supplementary Planning Guidance, Local Landscape Designations

the proposed Development is not considered to represent an undermining of the integrity of this designation, despite a small number of localised significant effects within it.

4.241. The factors that limit the magnitude of change are as follows:

- The distance of the proposed development from the receptor, which ensures that the turbines would not appear as immediately apparent features;
- The proposed development benefits from backclothing which is provided by the landmass of the Cheviot Hills, thereby reducing the perceived scale of the turbines;
- The appearance of the proposed development as a single turbine group;
- The limited proportion of the elevated views that would be affected by the proposed development, so that extensive parts of the designated area would remain unaffected; and
- The lack of visibility of long-term infrastructure including tracks, substation, and control building

Gardens and Designed Landscapes

4.242. As the GDLs are identified in the Inventory with notes of the specific qualities attributable to each inventory property, they are considered to be highly sensitive landscape receptors to the proposed development.

4.243. GDLs are typically sited in lowland areas and valleys, where shelter from the weather has been a consideration in their original siting. Such areas also have a generally higher degree of woodland and tree cover that enclose the landscapes and limit views in or out of the GDLs. As a consequence limited/no change visual effects from the proposed development.

4.244. Distance would be a limiting factor for any clear views that exist from these locations and it is predicted that no significant visual effects would occur.

4.245. The nearest GDL is Monteviot circa 12 km from the proposed Development, where potential visibility of the blades of the proposed Highlee Hill Wind Farm turbines would be possible on the summit and south facing slope of Peniel Heugh. However the proposed Development would not be visible from Monteviot House, which is, according to the HS Inventory, a vantage point for long landscape views to the south, towards the Cheviots. Therefore the magnitude of change on the scale of the Monteviot GDL is considered negligible, resulting in a Moderate/minor and non significant visual effect on the GDL.

4.246. The residual and cumulative effects on the GDLs are summarised in **Technical Appendix 4.4**.

Residual Effects on Visual Amenity

Settlements

4.247. As the views from houses are generally static, the same view being obtained on a daily basis, the value attached to these views is considered to be high. Susceptibility to the proposed Development in views from residential buildings is judged to be high because residents are considered to be concerned about views from their properties and therefore susceptible to changes in these views. The overall sensitivity of all residential receptors therefore is regarded as high.

Hawick

4.248. Hawick is set in the valley of the River Teviot around its confluence with the Slitrig Water. According to the SBC's Profile of Hawick[44], the rivers are important focal points, in the town when viewed from the bridges, public buildings and Wilton Park.

4.249. The ZTV indicates only blade tip visibility from the north-western edge of Hawick, by the B6359. Viewpoint 26 is located over 14 km to the north-west of the proposed Development at an elevated of around 170 m AOD and is illustrative of the more elevated to properties in Hawick, the lower lying positions in the town being at around 90 m AOD. The view illustrates visibility of two blades tips and one rotor with blades above the intervening wooded landform.

4.250. Due to the distance and predicted imperceptible visibility of the proposed Development from the town, the magnitude of change is considered to be Negligible, equating to a Minor effect upon the visual amenity at the settlement.

4.251. Similarly, given the highly restricted nature of views of the proposed Development, any potential cumulative effects would be Negligible, especially in respect of existing/consented wind farms which are mainly located a considerable distance from this settlement and/or to the north, in the opposite direction to the proposed Development.

Jedburgh

4.252. Jedburgh straddles the Jed Water which runs on a north- south axis, and is framed by Lanton Hill (280 m AOD) and Black Law (338 m AOD) to the west and south-west and by lower, more undulating topography to the east.

4.253. The views from parts of the settlement that occur on the low lying valley floor are substantially restricted by a combination of intervening topography and vegetation. According to the SBC's Profile of Jedburgh[45], the views from the south to the Abbey are particularly important and require protection and from the higher parts of Jedburgh there are more extensive views over the town to the east and west.

4.254. The ZTV indicates only blade tip visibility from the low hills on either side of the Jed Water Valley above the settlement of Jedburgh. According to the wireline analysis a few blade tips of the proposed Development would occur above the intervening terrain on the backcloth of the distant terrain and which would be difficult to distinguish within the wider and well wooded valley landscape.

4.255. Given the distance (12.6 km) and predicted limited visibility of the proposed Development from the town, the magnitude of change is considered as Negligible, resulting in a Minor effect upon the amenity of Jedburgh.

Kelso

4.256. Kelso is located along an attractive meander in the River Tweed. According to the SBC's Profile of Kelso[46], the town takes considerable benefit of its open riverside with many walkways alongside and is described as follows:

4.257. "The River Tweed separates the town in a north-south divide and therefore allows for many attractive views, the most attractive being from the west on the A699 route past Floors Castle.

[44] http://www.scotborders.gov.uk/downloads/file/1338/chesters (Town and village profiles)

[45] http://www.scotborders.gov.uk/downloads/file/1338/chesters (Town and village profiles)

[46] http://www.scotborders.gov.uk/downloads/file/1338/chesters (Town and village profiles)

The views from other approaches to the town are less dramatic and are shortened by the topography and landscape features that exist in the area."

4.258. The ZTV indicates only blade tip visibility on the northern edge of the town adjacent to the A6089. Due to its distance from the proposed Development (over 27 km) and the extent of screening produced by intervening topography, vegetation and built forms, views from this area are unlikely to be available. Therefore there would be no change experienced in Kelso, and therefore no residual significant effect.

Chesters

4.259. The village of Chesters is located next to the site's northern boundary and approximately 6 km from the nearest proposed turbine (Turbine 6). The SBC Profile of the village of Chesters states the following:

"The nucleus of the village is centred on the crossroads where the A6088 road is met by minor roads from Camptown and Jedburgh. Another cross roads lies to the east, due south of the original Southdean church and close to the ruin of the church and its cemetery.

The village has developed in a linear form between two clusters and also more recently to the east along the Camptown road. The existing trees and hedgerow around the village add to its rural character. The area around the ruined churchyard, former school building and school house is particularly attractive.

The village is dominated by the high hills on all sides and by the relationship and views to the south towards the Cheviot Hills. The land surrounding the village is agricultural in character, which slopes into a natural basin to the south west of the village. The slopes of the adjoining hill are however dominated by the regular geometric planting areas of the Forestry Commission. The village enjoys impressive views and a sunny aspect to the south. The land slopes steeply to the south towards Jed Water" [47] .

4.260. Views from the southernmost part of the village (adjoining the Chesters Brae and A6088 junction would be partially filtered through intervening built forms and structural vegetation. However, the relative sparseness of built forms and vegetation to the south of the A6088 provides for relatively open views towards the proposed Development. Viewpoints 1 and 4, illustrate the western and southern approaches to the village, respectively, and confirm that several properties adjoining the A6088 carriageway have direct open views towards the proposed Development.

4.261. Views from the northern edge of the village would be subject to greater restriction as a result of intervening vegetation. Whereas, views from 14 properties in the eastern part of the village at Chesters Brae are generally open and direct, as illustrated in the visualisations for Viewpoint 11. This is due to the increased elevation of these properties relative to the western part of the village.

4.262. Given the settlements proximity to the proposed Development and the consequent prominence of the propose turbines on the skyline of view, the magnitude of change would be Substantial, constituting a **Major** residual effect.

4.263. Based on an analysis of the findings of viewpoint assessments for Viewpoints 1, 4, 11 and 23 and the CZTVs it is apparent that cumulative visibility of the proposed Development and existing/consented wind farms would be Negligible, representing a Moderate/minor residual effect. If the proposed Birneyknowe Wind Farm is taken into account potentially significant effects would be experienced from properties in Chesters Brae as well as the western end of the settlement. Significant (**Major/moderate**) cumulative effects would also occur in the event of the proposed Wauchope/Newcastleton scheme being implemented in its current scoping form.

Southdean

4.264. The group of properties in the hamlet of Southdean, which lie adjacent to the A6088 and 2 km from the nearest of the proposed Development turbines.

4.265. The visualisations for Viewpoint 2 indicate that despite the proximity of this settlement to the proposed Development, intervening topography and vegetation would substantially screen the majority of turbine columns, the proposed Development appearing at a series of blades and two rotors. Notwithstanding this, proximity of Southdean dwellings to the proposed Development, the prominent skyline position of the visible turbines and extent of the view affected means that the magnitude of change would be Substantial, and the residual effect would be **Major**.

4.266. Because of its enclosed position no existing/consented wind farms would be visible from this settlement. However, in the event of the proposed Wauchope/Newcastleton scoping scheme being implemented in its current form this development would provide a highly visible cumulative context within which the proposed Development would constitute a **Major/moderate** cumulative effect.

Abbotrule

4.267. Abbotrule is located on the eastern side of Fodderlee Burn, 5.5 km to the north of the outmost proposed Development turbine. Potential views from the properties of Abbotrule would be screened by the intervening dense coniferous woodland. Consequently no change is anticipated at this settlement and no residual effects are anticipated.

Ruletownhead

Ruletownhead properties are located within Rule Burn valley, 5.4 km to the north of the outmost proposed turbine. Two blades and two rotors with blades would be visible above the western flank of Doorpool Hill. Whilst views from these properties would be partially obscured/filtered by intervening landform/vegetation the magnitude of change is considered to be Moderate, equating to a **Major/moderate** and significant effect upon these properties.

Routes Analysis

4.268. **Technical Appendix 4.5** contains a detailed statistical analysis of the intervisibility of the proposed Development and the other wind farms listed in Table 4.7 and is accompanied by Figure AP2, which shows the alignment of the routes assessed. The statistical analysis is based on a 5 km segments interval for each route and provides the basis for the following summarised assessment of residual effects and cumulative effects on each route.

Transportation Routes

4.269. The value and susceptibility of receptors on key transportation routes varies from medium in respect of general commuter road users (who may be travelling on their own and concentrating on the road rather than adjoining landscape), and high in respect of tourists who are more likely to carry passengers who will be focused upon the landscape.

4.270. It is apparent from a comparison of the Route Analysis drawing in **Technical Appendix 4.5** and the topography mapping in Figure 4.1 that the majority of transportation routes in the study area

[47] http://www.scotborders.gov.uk/downloads/file/1338/chesters (Town and village profiles)

are located in relatively low lying, incised positions, the enclosure of which is often augmented by large scale forest plantations and/or woodlands. A consequence of which is that visibility of the proposed Development is largely fragmented, especially beyond 5 km of the proposed turbines. Visibility of both the proposed Development and the cumulative wind farms identified in Table 4.7 is briefly summarised in paragraphs 4.271 - 4.299, along with the anticipated residual effects and anticipated cumulative effects on the visual amenity of individual routes.

4.271. **A7 (Scotsdike to Stow):** The statistical analysis and ZTVs indicate potential intermittent views of the proposed Development from a total of 4.2 km of this 37 km section of the A7, within the study area. Theoretical visibility would affect southbound road users in the vicinity of Brown Moor Hill, south of Selkirk, and on the northern approach to Hawick. However, the proposed Development would be seen at distances of over between 21 km and 13.7 km, and only seen as blade tips on the skyline. Moreover, according to field reconnaissance it is apparent that, seen from the approach to Hawick, the blade tips would be seen in the context of a partially treed skyline, thereby further reducing their visibility and prominence in views from this route. This is illustrated in the photomontage image in Figure 4.33d which depicts the operational view in views from the approach to Hawick.

4.272. Given the limited extent of this route affected, the distance at which the proposed Development would be viewed, and its substantially obscured position, the magnitude of change attributable to the proposed Development would be negligible, equating to a Minor residual effect on general road users, and Moderate/minor in respect of tourists.

4.273. Cumulative visibility would be highly restricted. The principal location affording views of wind farm developments is south of Selkirk, from where the existing/consented Langhope Rig and Longpark turbines are visible on the skyline to the west and north, respectively, the closest wind farm being the Langhope Rig development at a distance of around 6 km, but appearing mainly as blade tip. Langhope Wind Farm would be seen briefly, but would occupy a more prominent skyline position than the Langhope array. The proposed Development would be seen at distances of around 21 km and would also appear as blade tips, and would therefore constitute a negligible addition to this cumulative context and constitute a Minor cumulative effect on the amenity of general road users, and Moderate/minor in respect of tourists. This would remain the case should the proposed Birneyknowe Wind Farm or Longpark Extension were to be constructed.

4.274. In the event of the currently proposed Wauchope and Newcastleton scheme going ahead, this would appear as a complex array partially overlapping with Birneyknowe and forming a considerable concentration of turbines across much of the view to the south. The proposed Development would overlap with the easternmost part of the Wauchope array and as a consequence would be less prominent and not constitute a significant cumulative effect, as a result.

4.275. **A68 (Colt Craig to Lauder):** According to the ZTVs and statistical analysis, a total of 9.9 km of this 89.3 km section of this route within the study area would be subject to theoretical. This would comprise intermittent visibility on a section of the route between Carter Bar and Camptown. However, field reconnaissance suggests that actual visibility would be substantially constrained by intervening vegetation, the only visibility being glimpsed from a small number of locations on the A68 between the Huntford property and Carter Bar on a winding stretch of the route. Where the proposed Development is seen, it would appear as a single group of turbines approximately 5.5 km to the west of the route, and partially screened by intervening topography and vegetation.

4.276. Given the limited extent of the route affected by the proposed Development, and the short duration of potential views, the magnitude of change experienced is predicted to be Slight, equating to a Moderate/minor residual effect in respect of general road users and Moderate in respect of tourists.

4.277. Because of the largely enclosed nature of this route and limited opportunities for intervisibility between the proposed Development and other existing, consented or proposed wind farms, cumulative effects are considered to be Minor in respect of general road users and Moderate/minor in respect of tourists and would generally arise from sequential visibility.

4.278. The Wauchope Wind Farm proposals, if constructed in accordance with the currently submitted scoping design, would merge with the proposed Development. The disparity between the turbine sizes used for each of the respective schemes may be evident, but would be seen fleetingly.

4.279. **A698 (Coldstream to Hawick):** The ZTVs indicate that the proposed development would be screened from the majority of this route by topography. However, views of up to nine of the proposed turbines would be visible from south-west bound vehicles between Kelso and Kale Water. However, field reconnaissance suggests that visibility would be intermittent and interrupted by roadside hedgebanks in places and by outgrown hedgerows/hedgerow trees in adjoining/intervening fields. Moreover, where visibility does occur the proposed Development would be seen at a distance of over 20 km. Consequently, the magnitude of change on this route would generally be Negligible or None, equating to a Moderate/minor or no effect on the amenity of this route.

4.280. Cumulative visibility on this route would similarly be limited, the existing and consented wind farms not being discernible. The proposed Birneyknowe turbines would be intermittently visible between Hawick and Kelso, where it would be seen in conjunction with the proposed Development. Both schemes would be seen at distances of over 20 km and would be subject to the restrictions previously described. In this context the cumulative magnitude of change attributable to the proposed Development would be Negligible and the residual cumulative effect would be Moderate/minor.

4.281. **A6088 (Burnfoot to Carter Bar):** Intermittent views of the proposed Development are predicted from around 12.7 km of this 22 km route within the study area. The main concentrations of visibility would occur on the approach to Bonchester Bridge (Viewpoint 17), at the settlements of Chesters and Southdean (Viewpoints 1, 2 and 4 and between these settlements and Carter Bar (Viewpoints 20 and 21, respectively).

4.282. Viewed from the approach to Bonchester Bridge, the proposed Development would be seen to the south of the route at a distance of around 4.7 km and would largely appear below the skyline, with a small number of blade tips exceeding the distant skyline formed by the Cheviots, and a number of the turbines obscured by the intervening domed form of Wolfelee Hill. This is illustrated in Figure 4.24f, which depicts the operational view from the approach to Bonchester Bridge (Viewpoint 17).

4.283. As the route progresses southeastwards through Chesters and Southdean all thirteen turbines would be visible to the south and south-west of the route, the turbines seen at a distance of around 2 km. The proposed turbines would be partially backclothed by the southern uplands and partially obscured by intervening topography and forest cover, thereby reducing their apparent scale. Views from this part of the route are illustrated in Figures 4.8d and 4.9f (Viewpoints 1 and 2).

4.284. Between Southdean and Carter Bar views of all thirteen turbines would be provided to the west of this route. The proposed turbines would be seen at distance of between 2.2 km and 4 km, and would be partially backclothed by topography. Views from this part of the route are illustrated in Figure 4.27d.

4.285. Views from this route at Carter Bar would be confined to locations by the vantage point on the eastern side of the carriageway by intervening topography and forest cover at Catcleuch Shin, which forms the easternmost edge of the Carter Fell ridgeline. The proposed Development would be seen to the north-west of this section of the route, in the context of a large scale panoramic view, and would be seen as up to four turbines (two rotors and two blade tips) backclothed by the forested southern uplands in the background of views.

4.286. Given the extent of this route likely to be affected by the proposed Development, its proximity to receptors and consequent prominence, the residual effect is anticipated to be **Major** to **Major/moderate** and significant.

4.287. The proposed Development would be seen in conjunction with Langhope Rig, Longpark, Aikengall, Black Hill, Crystal Rig, Dun Law and Toddleburn developments. However, all of these developments are located at a considerable distance from the route and to the north and north-west and are therefore generally viewed in the opposite direction to the proposed Development. It is also the case that views of these developments would only be provided from locations between Burnfoot and Bonchester Bridge and at Carter Bar, from where the proposed Development would constitute a Slight magnitude of cumulative change and Moderate/minor to Moderate residual cumulative effect in respect of the existing/consented wind farm context.

4.288. Whilst intervisibility with the operational Bassendeanhill turbine is theoretically possible, it is located over 31 km to the north of the route (i.e. in the opposite direction to the proposed Development) and was not apparent during field reconnaissance of this route. In the event of the proposed Birneyknowe turbines being incorporated these would be especially prominent in views from the approach to, and interior of, Bonchester Bridge and in views from Chesters, such visibility falling away as the route extends southwards to Southdean. At Carter Bar, Birneyknowe would form a cluster of turbines midway between the proposed Development and the Langhope Rig scheme and would be more prominent than the proposed Development. In this context the proposed Development would constitute a **Major/moderate** sequential effect on the visual amenity of this route.

4.289. In the event of the current scoping schemes of Wauchope and Newcastleton turbines being constructed these developments would result in a substantial increase in the visibility, prominence and complexity of wind farm developments in views from this route, establishing a series of separate turbine clusters close to or on the skyline. The proposed Development, viewed from locations approaching Bonchester Bridge, would overlap with the Wauchope array and therefore have lessened prominence. However, viewed from locations between Chesters and Carter Bar, the proposed Development would be seen to extend northwards from the Wauchope development, resulting in a **Major/moderate** and significant effect.

4.290. **A6089 (Whiteburn to Kelso):** Of the 21 km section of this route within the study area, the statistical analysis identifies a total of 7.4 km (between Gordon and Kelso) that would be subject to potential views of the proposed Development. However, field reconnaissance suggests that views would be intermittent and confined to approximately 5 km of the route between the Mellerstain House estate and Kelso. On this section of the route, the proposed Development would be seen distantly and would be partially backclothed by topography, with seven turbines appearing on the skyline (four rotors and three blade tips). Given the distance, restricted visibility and partially backclothed position of the proposed Development and consequent limited proportion of the view it would occupy, the magnitude of change would be Slight, and the residual magnitude of change would be Moderate/minor in respect of general road users and Moderate in respect of tourists or recreational road users.

4.291. The proposed Development would also have theoretical intervisibility with the existing/consented Langhope Rig, Longpark. Pinnacle Hill, Aikengall, Black Hill, Crystal Rig, Dun Law and Toddleburn developments, all but the Langhope Rig and Pinnacle schemes appearing distantly to the north of this route (i.e. in the opposite direction to the proposed Development). Similarly, the Longpark turbines would be see at a considerable distance to the west and north-west of the route, whilst Langhope Rig would be seen at a distance of over 3.0 km to the west. In this context the proposed Development would represent a Slight cumulative change and a Moderate cumulative effect in respect of tourists or recreational road users. This would remain the case in the event of the proposed Birneyknowe Wind Farm being consented.

4.292. The Wauchope and Newcastleton scheme (currently in scoping) if consented, would introduce a large number of turbines, organise in three separate clusters, to the southern view. The proposed Development would be entirely overlapped by the Wauchope array and as a consequence would have reduced legibility/prominence with corresponding reductions in the cumulative effects attributable to it to, resulting in Moderate/minor cumulative effects when the Wauchope scheme (in its current form) is taken into account.

4.293. **A699 (Kelso to Selkirk):** Of the 29 km of this route within the study area a total of 6 km is subject to theoretical visibility of the proposed Development. The main areas of potential visibility are shown in the ZTV to be located on the western approach to Kelso, between St. Boswells and Bowden, and south of Bell Hill, east of Selkirk. However, field reconnaissance suggests that views from locations in the vicinity of Kelso would be screened by a combination of flood embankments and forest cover. Elsewhere along this route, visibility would be intermittent due to the incidence of forest cover and/or undulating nature of the intervening topography. Where the proposed Development is visible, it would appear to the south as a single cluster of turbines (sometimes rotors and upper columns, but often blade tips only) backclothed by the southern uplands and glimpsed at distances of between 22 km and 24 km. Given the limited and short duration of visibility of the proposed Development from this route, the distance at which it would be, and consequent limited prominence, the magnitude of change anticipated on the amenity of this route would be Slight, equating to a Moderate/minor effect in respect of general road users and Moderate in respect of tourists.

4.294. The key cumulative context, as experienced from this route would comprise existing/consented Langhope Rig, Longpark and Pinnacle Industrial Estate turbines, as well as the Dun Law array which would be seen concurrent with the proposed Development, and generally to the west, north and north-west of this route. The proposed Development would be seen to the south, and would represent one of the most distant wind farms relative to this route. On this basis, the cumulative magnitude of change attributable to the proposed Development would be Slight, equating to a Moderate/minor cumulative effect in respect of general road users and Moderate in respect of tourists. The introduction of the proposed Birneyknowe development would introduce more prominent skylined turbines into views towards the propose Development.

4.295. In the event that the proposed Wauchope Wind Farm (currently at scoping) is developed, this scheme would In the event of the currently proposed Wauchope and Newcastleton scheme going ahead, this would appear as a complex array forming a considerable concentration of turbines across much of the view to the south (especially, when viewed in conjunction with the proposed Birneyknowe scheme. The proposed Development would overlap with the Wauchope array and as a consequence would be less prominent and not constitute a significant cumulative effect as a result.

4.296. **B6357 (Evertown to Jedburgh):** The statistical analysis and ZTVs indicate that, of this 60 km section of the B6357 within the study area, a total of 6.3 km would be subject to potential views of the proposed Development. Visibility would, theoretically, be provided from locations in the vicinity of Greena Hill and as the route bisects Wauchope Forest, at the junction with the A6088 south of Bonchester Bridge, and by Wester Foderlee. However, field reconnaissance suggest that actual visibility would largely be confined to the more open and elevated parts if the route within the Wauchope Forest, east of Wigg Knowe only. From such locations, the proposed Development would be clearly visible on the skyline to the north-east of the route. The proposed turbines would be visible at distances of around 3 km.

4.297. The majority of this route would be subject to no visibility, and therefore no residual effects as a result of the proposed Development. However, northbound road users on the open elevated sections of the route in Wauchope Forest would be subject to Substantial change to their views, equating to a localised **Major** to **Major/moderate** effect in respect of general road users and tourists, respectively. This is illustrated in the assessment of Viewpoint 6 (Ref. Figures 4.13f).

4.298. Whilst the statistical analysis indicates cumulative visibility with the existing/consented Bassendeanhill, Longpark, Pinnacle, Black Hill, Dun Law, Fallago Rig, and Toddleburn wind farms, field reconnaissance suggest that these schemes would not be readily apparent in views from this route. In this context, no perceived cumulative effects are anticipated.

4.299. In the event of the proposed Wauchope and Newcastleton development (currently at scoping) being implemented this development would introduce a large number of turbines to views from elevated sections of the route in Wauchope Forest. The Wauchope array would be prominent in views, along with the proposed Development forming an almost continuous concentration of turbines in views to the north-east and east.

Recreational Routes

4.300. **Pennine Way (Hadrian's Wall to Yetholm):** Of the 85 km of this route within the study area, a total of 16.3 km of the more elevated and open sections of the route would be subject to intermittent views of the proposed Development, between Resedale Forest, the Cheviot Hills and Yetholm.

4.301. Where visibility does occur (e.g. Brownhart Law, Lamb Hill, Windy Gyle and on the Cheviot summit) all thirteen of the proposed turbines would be visible at distances of between 13.6 km and 28.8 km to the north and north-west of the route. The proposed Development would be backclothed by topography and would occupy a relatively limited proportion of the expansive views obtained from this route. Given the proportion of the route likely to be affected, the relatively long distance at which the proposed Development would be view and consequent reduced prominence in views, the magnitude of change on this route is predicted to range from None across 68 km of the route, increasing to Moderate in elevated locations north of the A68 (e.g. at Windy Crag and at Black Halls) to Slight in more distant locations (e.g. the Cheviots). This equates to residual effects from None to **Major/moderate**, significant effects being confined to sections of this route adjoining the A68, at Windy Crag.

4.302. Cumulatively, the proposed Development would be seen in conjunction with the majority of the existing/consented wind farms in the study area, with the exception of Craig Wind Farm and Ewe Hill Phase 1. However, the cumulative developments would generally be seen at a considerable distance to the north-west of this route and clearly separate from the proposed Development. Given this distance and separation the proposed Development is considered to represent a Moderate to Slight cumulative change and **Major/moderate** to Moderate cumulative effect in respect of existing/consented turbines, significant effect being confined to less than 2 km of this lengthy route at elevated locations at Windy Crag and at Black Halls. This would remain the case in if proposed wind farms are taken into account.

4.303. **Borders Abbeys Way:** Within the study area, the Borders Abbeys Way forms a broadly circular route which extends from Kelso to Jedburgh, and thereafter to Hawick, Selkirk and Melrose, before connecting back with Kelso. Whilst intermittent views of the proposed Development are theoretically possible from around 21 km of this 103 km route, field reconnaissance suggests that actual visibility would be considerably less than this.

4.304. Between Kelso and Jedburgh restricted views of the blade tips of up to six turbines would be provided along the alignment of the River Teviot from the southern fringes of Kelso, but would be substantially restricted by topography and intervening vegetation within the river valley. The proposed Development would be entirely screened from the remainder of this section of the route by intervening topography. Given the limited proportion of this section of the route affected and the distance between this section of the route and the proposed Development, the magnitude of change would be Negligible and the residual effect Minor.

4.305. Whilst the statistical analysis identifies potential visibility between the proposed Development and the existing/consented Black Hill, Langhope Rig and Pinnacle hill developments, field reconnaissance suggests that views of these developments would be screened by intervening vegetation and topography. Consequently, no cumulative effects are anticipated in respect of existing and consented wind farms. None of the proposed wind farms would be visible from this part of the route. In the event of the proposed Wauchope and Newcastleton scheme progressing in its current scoping form, this would be visible on the skyline at a distance of between 22 km and 29 km to the south of this part of the route, but would be partially screened by intervening vegetation and topography.

4.306. Between Jedburgh and Hawick visibility would be confined to locations at Black Law. Viewed from this elevated position the proposed Development would be seen to the south at a distance of 10.7 km and would represent a notable, but localised change in an otherwise unaltered expansive panoramic view. On the basis of the limited extent of this section of the route that would be affected the magnitude of change is considered to be Negligible, with localised **Major/moderate** effects on visual amenity experienced at Black Law, as described in respect of Viewpoint 8 (please see **Technical Appendix 4.6**).

4.307. Between Hawick and Selkirk views of the proposed Development would be confined to open elevated locations between Stirches Mains and the junction with the Cross Borders Drove Road, south of Drinkstone Hill, the remainder of the route to Selkirk being subject to substantial screening by topography and vegetation. From this stretch of the route southbound receptors would experience intermittent views of all thirteen turbines at distances of over 13.36 km. The

turbines would be partially obscured by the intervening topography of Wolfelee Hill, and would be backclothed by the Cheviots. On the basis of the limited visibility from this route, its distance from the proposed Development and the consequent reductions the prominence of the proposed Development, the magnitude of change would generally be none, with localised Slight change between Stirches Mains and the junction with the Cross Borders Drove Road, equating to residual effects ranging from None to Moderate.

4.308. Whilst theoretical intervisibility with the existing/consented Aikengall, Bassendeanhill Farm, Blackhill, Dun Law (1 and 2), Fallago Rig, Longpark and Pinnacle turbines is predicted in the ZTVs these schemes, they are generally located to the north and at a considerable distance and are therefore unlikely to represent prominent elements in views from this section of the route. However, sequential and concurrent intervisibility with the Langhope turbines is possible, these operational turbines appearing at distances of between 3 and 4 km to the west of the route, and over 25 km to the north-west of the proposed Development. Given the limited visibility of the proposed Development and other cumulative development and the distance and separation between the proposed Development and Langhope Rig, the cumulative magnitude of change would range from None to Slight, equating to residual cumulative effects in respect of the existing/consented cumulative scenario of None to Moderate. If the proposed Birneyknowe Wind Farm is taken into account the cumulative effect would remain unchanged.

4.309. Should the proposed Wauchope and Newcastleton be introduced, the cumulative effect attributable to the proposed Development would reduce to Minor due to the scale and particular prominence that this scoping scheme would have on the skyline.

4.310. No views of the proposed Development would be provided from the final leg of this route, between Selkirk and Melrose and so no residual effect or cumulative effect is anticipated on the section of the Borders Abbeys Way.

4.311. On the basis of the preceding analysis, the proposed Development is not anticipated to result in a significant effect on the Borders Abbeys Way.

4.312. **Cross Borders Drove Road (Glen Ho to West of Hawick):** The statistical analysis and ZTVs indicate that the proposed Development would theoretically be visible from a total of around 11 km of this route within the study area. However, field reconnaissance suggests that visibility on the ground would be restricted between Glen Ho and Drinkstone Hill by the screening effect of the undulating topography and incidence of dense coniferous plantations. Despite Drinkstone Hills elevated and open aspect the proposed Development would be largely obscured by intervening topography and vegetation, the proposed turbines appearing predominantly as blade tips and backclothed by the southern uplands in the distance. Between Drinkstone Hill and Hawick visibility would be substantially constrained by a combination of topography and vegetation, with only glimpsed views of a small number of blade tips possible.

4.313. Given the restricted visibility of the proposed Development and its distance from the route (between 15.4 km and 33 km), the proposed Development is considered to represent a generally Negligible change to the amenity of walkers, with localised Slight change experienced in the vicinity of Drinkstone Hill. Consequently, the residual effect on this route would be Moderate/minor, with localised Moderate effects at Drinkstone Hill.

4.314. The proposed Development would theoretically be visible concurrently and sequentially with all of the existing/consented wind farms with the exception of Green Rigg and Crystal Rig Phase 1 and 2. However, visibility of individual developments would often be restricted by the topography and forest cover, and where developments are visible the majority would be seen to the north or north-east, in the opposite direction to the proposed Development.

4.315. Given the restricted visibility of the proposed Development and cumulative developments from this route, their separation and relative positions, the magnitude of cumulative change experienced on this route would range from None to Slight, equating to residual cumulative effects of None to moderate, the most apparent cumulative effects experienced in locations east of Drinkstone Hill. In the event of the proposed Birneyknowe development receiving consent it would be interposed between Drinkstone Hill and the propose Development, and would appear prominently on the skyline. Despite this increased cumulative context the proposed Development's less prominent visibility compared with Birneyknowe would result in the cumulative effect attributable to the proposed Development remaining Moderate on this part of the route. This would remain the case in the event of the proposed Wauchope and Newcastleton development proceeding in its current (scoping) form.

4.316. **St. Cuthbert's Way (Wooler to Melrose):** Within the study area this route has a total length of 69 km. Of this, the proposed Development would have theoretical visibility from around 6.42 km of the route, between the Eildon Hills and the elevated summit of Grubbit Law, east of Morebattle. However, views of the Development would be highly localised, with long intervening sections of the route without visibility. Where the proposed Development is visible it would be seen at a considerable distance (between 16 km and 27 km. The key vantage point that would be affected by the proposed Development is located on the section of the route that crosses the summit of Grubbit Law, and another on the saddle between the Eildon Hills. From these locations all thirteen of the proposed turbines would be visible below the horizon at a distance of around 21.8 km and 23 km, respectively.

4.317. Given the limited proportion of this route affected, the distance at which it would be seen and consequent limited proportion of views it would occupy, the magnitude of change experienced on this route would range from None to Slight, equating to no effect to localised Moderate effect, most notably on the Eildon Hills.

4.318. Cumulative effects on this route would also range from None to Slight, the greatest cumulative visibility occurring at Grubbit Law and Eildon Hills section of the route where, due to the open and elevated nature of these locations, the majority of existing/consented wind farms would be visible to the north and west of the route, and would include the concentration of turbines on the Lammermuir Hills, and would be seen distantly. Given the distance at which these schemes are seen, their separation from the proposed Development (often seen in an opposing direction), the magnitude of cumulative change would be Slight. This would remain the case in the event of the proposed Birneyknowe development being included. In the event of the proposed Wauchope and Newcastleton scheme being taken into account, this scoping scheme would introduce a substantial and complex assemblage of turbines to the south of the proposed Development and reduce its prominence in the view, with consequent reductions in the cumulative effects associated with it.

Core Paths & Rights of Way

4.319. **Core Path 116:** This is a relatively short route that extends along the western side of the Rule Water valley providing views of up to 10 of the proposed Development's turbines. The proposed Development would be seen at a distance of over 6 km, but would represent a relatively

prominent new feature in views, and a **Major/moderate** residual effect on the amenity of this route.

4.320. No existing/consented wind farms would be apparent from this route. In the event of the proposed Birneyknowe scheme being consented this development would be seen in conjunction with the proposed Development from the elevated north-western end of this route. In this event the proposed Development would represent a substantial cumulative change and a **Major**, if highly localised, cumulative effect.

4.321. The proposed Birneyknowe Wind Farm would appear against the skyline at a distance of 3.9 km to the west.

4.322. Three blades of Windy Edge would be discernible above the skyline, in between the landforms of Wyndburgh (50 m AOD) Hill and Greatmoor Hill (599 m AOD), 14.13 km to the south west.

4.323. **Core Path 203:** Whilst visibility would occur on Core Path 203 west of Buckstruther Moss, it would only occur for around 1 km of the route and the proposed Development would be seen at a distance of over 9 km and would be partially screened by intervening vegetation and topography. Given the limited proportion of this route affected, and its distance from the proposed Development, the magnitude of change experienced on this route would be Slight and the residual effect would be Moderate and localised.

4.324. **Core path 1:** Views of the proposed Development would be confined to locations in the vicinity of Black law from where all thirteen of the proposed Development's turbines would be visible. The proposed turbines appear above the western shoulder of Faw Hill, at a distance of around 10 km. The turbines would be almost entirely backclothed by the Cheviot Hills, only a few blade tips and the rotor with blades would overtop the skyline. In this context, the magnitude of change experienced would be Moderate, representing a **Major/moderate**, but localised effect on the visual amenity of this route. It should be noted, however, that the majority of this route would be subject to no visibility and no residual effect at all.

4.325. Sequential views of the proposed Development and the operational Langhope Rig and Longpark Wind Farms are predicted, but these operational schemes would be seen at a considerable distance and in the opposite direction to the proposed Development and would therefore provide little by way of a cumulative context. Similarly, whilst some theoretical sequential visibility of the wind farms on the Lammermuirs: including Toddleburn, Dun Law 1&2, Crystal Rig, Aikengall, Fallago Rig and Black Hill Wind Farms is predicted, these schemes are all located at a distance of over 40 km from this route. The proposed Birneyknowe Wind Farm would appear next to Bonchester Hill, over 9 km to the south of route. In the context of the preceding analysis the proposed Development would represent a slight magnitude of cumulative change and a Moderate cumulative effect on the amenity of what is a small part of this lengthy route.

4.326. **Core path 192:** The majority of this route would be subject to no visibility of the proposed Development as a result of the screening effect of intervening topography and coniferous forestry. Even the more open locations on this route, north of Towbank Plantation, the proposed Development would be substantially screened. Consequently the magnitude of change on this route would be Negligible and the residual effects would be Moderate/minor. Similarly, there would be no discernible cumulative visibility from this route.

4.327. **The Wheels Causeway:** Given the proximity of this route to the proposed Development significant effects are considered inevitable, especially as the forest management plan for the site will result in the phased revealing of the proposed turbines.

4.328. **PROW through Dykeraw Forest:** Given the proximity of this route to the proposed Development significant effects are considered inevitable, especially as the forest management plan for the site will result in the phased revealing of the proposed turbines.

Viewpoint Analysis

4.329. **Technical Appendix 4.6**: Viewpoint Assessment contains an analysis of theoretical visibility and cumulative visibility of the proposed Development during its operational life. Table 4.8a and 4.8b, summarise the findings of the Viewpoint Assessment.

Table 4.8a: Summary of Residual Effects on Landscape Character at Representative Viewpoints

VP ID	Viewpoint Name	Landscape Receptor	Character Sensitivity at Viewpoint	Residual Effect on Character at Viewpoint	Cumulative Effect Existing/Consented Wind Farm Scenario	Cumulative Effect Existing/Consented and Proposed Wind Farm Scenario	Cumulative Effect Existing/Consented, Proposed and Scoping Wind Farm Scenario
1	Chesters	Bonchester/Dunion of Grassland with Hills	High	**Major**	None	**Major/Moderate**	**Major/moderate**
2	Southdean	Wauchope/Newcastleton Southern Uplands Forest Covered	High	**Major**	None	None	**Major/moderate**
3	Fort north-east of Southdean	Wauchope/Newcastleton Southern Uplands Forest Covered	Medium	**Major/moderate**	Moderate	**Major/Moderate**	**Major/moderate**
4	Western Approach Chesters	Bonchester/Dunion of Grassland with Hills	Medium	**Major/moderate**	None	None	**Major/moderate**
5	Bonchester Hill	Bonchester/Dunion of Grassland with Hills	Medium	**Major/moderate**	**Major/Moderate**	**Major/moderate**	Moderate
6	B6357 Vantage Point	Wauchope/Newcastleton Southern Uplands Forest Covered	Medium	**Major/moderate**	None	None	**Major/moderate**
7	Pennine Way, Black Halls	Cocklaw Group of Cheviot Uplands	Medium	Moderate	Moderate/minor	Moderate	Moderate
8	Borders Abbey Way, Black Law	Bonchester/Dunion of Grassland with Hills	Medium	Moderate	Moderate	Moderate	Moderate/minor
9	Minor Road & Footpath, Townfoot Hill	Oxnam of Rolling Farmland	Medium	Moderate	Moderate	Moderate	Moderate
10	Pike Fell	Claudcleuch Head Group of Southern Uplands with Scattered Forest	Medium	Moderate	Moderate/minor	Moderate	Moderate
11	Footpath and Minor Local Road, Chesters Brae	Bonchester/Dunion of Grassland with Hills	Medium	**Major/moderate**	None	None	**Major/moderate**
12	Rubers Law	Rubers Law of Grassland with Hills	Medium	**Major/moderate**	Moderate	**Major/moderate**	Moderate
13	Five Stanes	Falla Group of Cheviot Foothills	Medium	Moderate/ minor	Moderate/ minor	Moderate	Moderate
14	Oxnam to Camptown Road	Falla Group of Cheviot Foothills	Medium	Moderate/ minor	Minor	Moderate/minor	Moderate/minor
15	Wolfelee Hill	Wauchope/Newcastleton Southern Uplands Forest Covered	Medium	**Major/moderate**	Moderate	Moderate	Moderate
16	Eildon Hills Vantage Point	Eildon Hills Grassland with Hills	High	Moderate	Moderate	Moderate	Moderate/minor
17	A6088 Approach to Bonchester Bridge	Rubers Law of Grassland with Hills	Medium	Moderate	Moderate/ minor	Moderate	Moderate/ minor
18	Minor Road by Cummings Hill, south of Jedburgh	Bonchester/Dunion of Grassland with Hills	Medium	Moderate/ minor	Moderate/ minor	Moderate/minor	Moderate/minor
19	Footpath at Knox Knowe	Wauchope/Newcastleton Southern Uplands Forest Covered	Medium	**Major/moderate**	Moderate	**Major/moderate**	Moderate
20	A6088 north-west of Carter Bar	Wauchope/Newcastleton Southern Uplands Forest Covered	Medium	**Major/moderate**	Moderate	**Major/moderate**	**Major/moderate**
21	Carter Bar (eastern vantage point)	Wauchope/Newcastleton Southern Uplands Forest Covered	High	None	None	None	None
22	Pennine Way by Cairn Hill, Cheviots	Cocklaw Group of Cheviot Uplands	High	Moderate	Moderate	Moderate	Moderate

VP ID	Viewpoint Name	Landscape Receptor	Character Sensitivity at Viewpoint	Residual Effect on Character at Viewpoint	Cumulative Effect Existing/Consented Wind Farm Scenario	Cumulative Effect Existing/Consented and Proposed Wind Farm Scenario	Cumulative Effect Existing/Consented, Proposed and Scoping Wind Farm Scenario
23	Northern Approach to Chesters	Bonchester/Dunion of Grassland with Hills	Medium	**Major/moderate**	Moderate/minor	Moderate/minor	Moderate
24	Drinkstone Hill	Whitehaugh of Grassland with Rock outcrops	Medium	Moderate/ minor	Moderate/ minor	Moderate/ minor	Minor
25	Minto Hill	Lowland Valley with farmland	High	Moderate	Moderate	Moderate	Moderate
26	A7 approach to Hawick	Upper Teviot Pastoral Upland Fringe Valley	Medium	Minor	None	Minor	Minor

Table 4.8b: Summary of Effects on Visual Amenity at Representative Viewpoints

VP ID	Viewpoint	Visual Receptor	Receptor Sensitivity	Residual Effect	Cumulative Effect Existing/Consented Wind Farm Scenario	Cumulative Effect Existing/Consented and Proposed Wind Farm Scenario	Cumulative Effect Existing/Consented, Proposed and Scoping Wind Farm Scenario
1	A6088, Chesters	Residents Road users	High Medium	**Major – Major/moderate**	None	**Major/moderate** **Moderate**	**Major/moderate** **Moderate**
2	A6088, Southdean	Residents Road users	High Medium	**Major – Major/moderate**	None None	None None	**Major/Moderate** **Moderate**
3	Fort north-east of Southdean	Walkers	High	**Major**	Moderate	**Major**	**Major/Moderate**
4	Western Approach Chesters	Residents Road users	High Medium	**Major** **Major/moderate**	None None	None None	**Major** **Major/moderate**
5	Bonchester Hill	Walkers	High	**Major**	**Major**	**Major**	**Major/moderate**
6	B6357 Vantage Point	Walkers	High	**Major**	None	None	**Major/moderate**
7	Pennine Way, Black Halls	Walkers / Scenic Viewpoint	High	**Major/ moderate**	Moderate	**Major/moderate**	**Major/moderate**
8	Borders Abbey Way, Black Law	Walkers / Scenic Viewpoint	High	**Major/ moderate**	**Major/ moderate**	**Major/moderate**	Moderate
9	Minor Road & Footpath, Townfoot Hill	Walkers Road users	High Medium	**Major/ moderate** Moderate	**Major/ moderate** Moderate	**Major/ moderate** Moderate	**Major/ moderate** Moderate
10	Pike Fell	Walkers	High	**Major/ moderate**	Moderate	**Major/ moderate**	**Major/ moderate**
11	Footpath and Minor Local Road, Chesters Brae	Residents Road users	High Medium	**Major** **Major/moderate**	None None	None None	**Major** **Major/Moderate**
12	Rubers Law	Walkers /Scenic Viewpoint	High	**Major**	**Major/ moderate**	**Major**	**Major/ moderate**
13	Five Stanes	Walkers	High	Moderate	Moderate	**Major/moderate**	**Major/moderate**
14	Oxnam to Camptown Road	Road users	Medium	Moderate/ minor	Minor	Moderate/minor	Moderate/minor
15	Wolfelee Hill	Walkers	High	**Major**	**Major/moderate**	**Major/moderate**	**Major/moderate**
16	Eildon Hills Vantage Point	Walkers / Scenic Viewpoint	High	Moderate	Moderate	Moderate	Moderate/minor
17	A6088 Approach to Bonchester Bridge	Road users	Medium	Moderate	Moderate/ minor	Moderate	Moderate/ minor
18	Minor Road by Cummings Hill, south of Jedburgh	Road users	Medium	Moderate/ minor	Moderate/ minor	Moderate/minor	Moderate/minor

VP ID	Viewpoint	Visual Receptor	Receptor Sensitivity	Residual Effect	Cumulative Effect Existing/Consented Wind Farm Scenario	Cumulative Effect Existing/Consented and Proposed Wind Farm Scenario	Cumulative Effect Existing/Consented, Proposed and Scoping Wind Farm Scenario
19	Footpath at Knox Knowe	Walkers	High	**Major**	**Major/Moderate**	**Major**	**Major/moderate**
20	A6088 north-west of Carter Bar	Road users	Medium	**Major/moderate**	Moderate	**Major/moderate**	**Major/moderate**
21	Carter Bar (eastern vantage point)	Visitors/ Scenic Viewpoint Road users	High Medium	None None	None None	None None	None None
22	Pennine Way by Cairn Hill, Cheviots	Walkers /Scenic Viewpoint	High	Moderate	Moderate	Moderate	Moderate
23	Northern Approach to Chesters	Road users	Medium	**Major/moderate**	Moderate/minor	Moderate/minor	Moderate
24	Drinkstone Hill	Walkers /Scenic Viewpoint	High	Moderate	Moderate	Moderate	Moderate/minor
25	Minto Hill	Walkers	High	Moderate	Moderate	Moderate	Moderate
26	A7 approach to Hawick	Road users	Medium	Minor	None	Minor	Minor

Summary

4.330. The preceding LVIA was undertaken in accordance with current best practice and was intended to identify potentially significant effects on the landscape and visual resource of a study area equivalent to 40 km radius from the outermost turbines of the proposed wind farm.

4.331. The assessment includes a brief summary of the legislative and policy context and guidance of relevance to the development and this assessment. Consideration of this and other non landscape policies is given in the Planning Statement that accompanies the application for the proposed Development.

4.332. The LVIA comprises details of the baseline context against which the effects of the proposed wind farm were judged. This comprised a description of existing landforms and hydrological features in the study area and site, landcover and landuse, settlement, transportation and recreational routes, landscape designations and classifications, and landscape character types. It is apparent from this baseline appraisal that the proposed Development would be located in a landscape that:

- has a rolling topography which affords potential for mitigation of development;
- has widespread large scale commercial forestry which is accompanied by existing infrastructure suitable for adaption for the proposed Development
- is not subject to formal designation on landscape grounds;
- is not subject to classification as Wild Land or GDLs;
- has a relatively simple and large scale landscape character and predominance of forest that is capable of accommodating development, subject to careful siting and design;
- whilst containing a number of formal Scenic Viewpoints, strategic recreational routes and Core Paths, these are often located at a considerable distance or in low lying, enclosed positions subject to potential screening of the proposed Development by intervening topography and/or vegetation;
- has few transportation routes or settlements in elevated uplands. Roads and settlements are generally concentrated within incised valleys where views are often constrained by a combination of topography and vegetation, thereby providing opportunities to reduce the prominence of the proposed Development, and the potential extent of significant effects associated with development.

4.333. The baseline also outlined the cumulative context of existing, consented and proposed wind farms within the study area and immediately surrounding it that may contribute to any significant cumulative effects. Currently, the pattern of wind energy development is largely concentrated at a considerable distance to the north of the proposed Development and at the south-western and southeastern extremes of the Study Area. Even the Langhope Rig turbines, which represent the closest of the existing/consented schemes to the proposed Development, are situated over 25 km to the north-west of the proposed Development.

4.334. In contrast a number of currently proposed schemes, including Birneyknowe and the scoping proposals at Wauchope/Newcastleton are situated within 10 km of the proposed Development, thereby presenting a more conspicuous cumulative context. It is noted, however, that the Wauchope/Newcastleton scheme is likely to undergo substantial design modifications prior to submission as a formal application and should therefore be given less weight in the determination of the application for the proposed Development.

4.335. Paragraphs 4.149 to 4.157 of the LVIA identify potential sources of significant effect associated with the proposed Development during its construction and subsequent operation, and paragraphs 4.158 to 4.176 set out the proposed design and mitigation measures adopted in order to avoid, ameliorate or compensate such effects. The primary source of mitigation in respect of the operational wind farm concerns the siting and design of turbines. However, care has also been taken to mitigate effects arising from ancillary elements such as site tracks, the substation, control building and borrow pits.

4.336. The design adopted is based upon a number of key landscape and visual priorities, including:

- the location of the proposed Development outwith and distant from areas subject to formal landscape designations;
- The application of a suitable 'set back' from settlements and key transportation and recreational routes in order to minimise significant visual effects at these receptor locations;
- Location of the proposed Development turbines and key infrastructure within a low to medium sensitivity large scale upland landscape which is dominated by large scale coniferous plantations, and which already contains suitable infrastructure and borrow pits;
- Avoidance of locating turbines on prominent elevated locations at the southern end of the application site where they are likely to be most visible from locations south of the Scottish/ English border, the NNP, and could be easily seen from Carter Bar vantage point;
- The application of a set back from more enclosed landscapes such as river valleys and enclosed farmland landscapes to reduce the visibility and prominence of the proposed Development and avoid the potential for turbines to tower over such landscapes or to become overbearing at residential properties;
- The avoidance of prominent ridgelines and summits, especially where such summits form prominent focal points in the landscape (e.g. Rubers Law);
- Preferential positioning of turbines in a part of the application site that is enclosed on three sides by topography;
- Use of turbines of a size sufficient to provide for the continuation of forest production across the site; and
- The incorporation of two turbines with a maximum blade tip height of 150 m on elevated land at the northern end of the array to mitigate potential views from Chesters and the A6088 corridor.

4.337. **Chapter 3: Design Evolution and Alternatives** provides a summary of the key iterations undertaken during the course of the design of the proposed Development. It is apparent from the preceding assessment that, despite the size of the proposed Development turbines, it would have a relatively constrained viewshed and fragmented outwith the immediate proximity of the site and A6088 corridor, and would result in a concentration of largely localised significant effects within 10 km of the propose Development's turbines and only a small number of localised significant effects outwith this area, on elevated positions in the Cheviots, but outwith the Northumberland National Park. This is not considered exceptional for commercial onshore wind farms, even those with smaller turbines than those proposed.

4.338. The proposed Development would not significantly affect landscapes or visual receptors of national importance, and it is noted that significant cumulative effects identified are primarily derived from the inclusion of proposed wind farm developments that are currently in planning, rather than existing/consented developments. Such developments are routinely given less weight in the determination of planning applications. The greatest cumulative effects identified in the

LVIA were associated with the cumulative scenario that included the Wauchope/Newcastleton scoping scheme. However, as previously commented, this scheme is at an early stage and likely to undergo considerable alteration prior to submission of a planning application and is therefore considered an unrealistic scenario, and should therefore be given even less weight than schemes currently in planning.

4.339. Table 4.9, summarises the significant landscape and visual effects predicted to arise from the proposed wind farm. These findings should, however, be read in conjunction with the preceding assessment.

Table 4.9: Summary of Potential Impacts of the proposed wind farm, Mitigation and Residual Impacts

Likely Significant Effects	Mitigation Proposed	Means of Implementation	Outcome/Residual Effects
Construction			
Key sources of potential significant effects as described in paragraphs 4.149 to 4.157.	In accordance with the Mitigation section of this Chapter.	Integrated design and working methods in accordance with the Mitigation section of this Chapter.	Reduction of land take and disturbance as well as duration of effects with consequence that construction effects on landscape fabric would be Moderate and not significant.
Key sources of potential effects as described in paragraphs 4.149 to 4.157. Effects on landscape character and visual amenity would include alteration to the existing gently graded topography at the application site and loss of characteristic moorland and forest vegetation, and establishment of what could be anomalous infrastructure.	In accordance with the Mitigation section of this Chapter.	Integrated design and working methods in accordance with the Mitigation section of this Chapter, paragraphs 4.158 to 4.176.	Minimisation of disturbance, reduction in the extent of existing landcover and landform that would be altered and rapid reinstatement of temporary construction elements. Effects on landscape character and visual amenity would be Moderate in the immediate vicinity of the site, reducing to Moderate/Minor or None in more distant locations.
Operational			
Potential sources of operational effects would include • wind turbines; • aviation lighting; • anemometer masts; • access tracks; • any retained off-site highway improvements; • cabling and grid connection; • external transformer buildings; and • sub-station/Site control building; • persistence of felled areas	In accordance with the Mitigation section of this Chapter.	Integrated design and working methods in accordance with the Mitigation section of this Chapter.	Localised significant effects are predicted within parts of the Teviot Valleys SLA. Of the 82 LCTs within the study area significant effects on landscape character would be confined to parts of • Southern Upland Type with Forest Covered - Wauchope/ Newcastleton (LCT BDR5), in which the proposed Development is located; • Cheviot Foothills - Falla Group (LCT BDR7); • Grassland with Hills - Bonchester/Dunion (LCT BDR11) – which contains the site access; and • Grassland with Hills - Rubers Law – (LCT BDR11). Significant effects on visual amenity are predicted at the following receptor locations: • Chesters; • Southdean; • Ruletownhead; • the A6088; • the B6357 at the formal vantage point and picnic site; • the Pennine Way adjoining the A68, at Windy Crag; and • the Borders Abbey Way at Black Law; • Black Law Scenic Viewpoint; and • Rubers Law Scenic Viewpoint. • Core Paths 1, 116,192 and 203; and • The Wheels Causeway and Dykeraw Forest PROWs.

5 Ecology

Introduction

5.1 This chapter considers the potential effects of the proposed wind farm on the ecological receptors present within and around the site and its surroundings. It details the methods used to establish the presence and distribution of ecological receptors, together with the process used to determine the nature conservation value of each ecological receptor present.

5.2 The ways in which ecological receptors might be affected (directly or indirectly) by the construction, operation and decommissioning of the proposed wind farm are assessed. In addition, any cumulative effects are considered. This ecology assessment was undertaken by MacArthur Green. The proposed wind farm is described in full within **Chapter 2: Proposed Development**.

5.3 Effects on birds are addressed separately in **Chapter 6: Ornithology**.

5.4 The effects on hydrology are addressed separately within **Chapter 8: Geology, Hydrology and Hydrogeology**.

5.5 This chapter is supported by the following Technical Appendices provided in Volume 4 of this ES and illustrated within **Figures 5.1** to **5.26**.

- **Appendix 5.1** Extended Phase 1 Habitat Survey Report;
- **Appendix 5.2** National Vegetation Classification Survey Report;
- **Appendix 5.3** Protected Species Surveys Report;
- **Appendix 5.4** Bat survey Report;
- **Appendix 5.5** Fisheries Survey Report;
- **Appendix 5.6** Peat Depth Survey & Surface Vegetation Characteristics Report; and
- **Appendix 5.7** Draft Species Protection Plan.

Study Area Description

5.6 The study area refers to the proposed wind farm site, plus appropriate buffer distances relating to potential connectivity, which differ between ecological receptors. The study area is relevant to results of both field surveys and desk-based studies.

5.7 Specific baseline surveys covered the site plus appropriate buffer distances, and are described in more detail in the Baseline Conditions section below, and in associated Technical Appendices. In many cases the survey areas extended further than the required area around proposed wind farm infrastructure, as a result of previous iterations of the proposed wind farm covering a larger extent than the final layout.

Assessment Structure

5.8 The assessment considers the potential effects, includingconstruction, operational, decommissioning and cumulative effects, of the proposed wind farm, within which "scoped in" target species, habitats and designated sites are considered at the appropriate geographic level (e.g. Natural Heritage Zone (NHZ)/regional, national, catchment or designated site reference populations).

5.9 The assessment makes the following assumptions:

- The construction period will last for 18-24 months and includes forestry management and felling, borrow pit creation, construction or upgrade of access tracks, hard standing, turbines, temporary guyed lattice wind monitoring (anemometer) masts and other infrastructure, and site restoration (see **Chapter 2: Proposed Development** for more details).
- The changes to the forest structure resulting from the incorporation of the proposed wind farm is described in **Chapter 10: Forestry**. Areas accommodating wind farm infrastructure will require to be felled. This will likely include a mix of clear felling and keyholing. To accommodate the infrastructure there will be a loss of 26.13 ha of forest (see **Chapter 10: Forestry** for further details). Offsite compensatory planting to offset the loss of forest land due to the proposed wind farm infrastructure will occur under the Policy on the Control of Woodland Removal[1].
- The proposed wind farm would result in the construction of approximately 5.5 km of new track and a further 7.7 km of existing track will also be upgraded. The running width of the track would be 5 m on straight sections, with 0.25 m wide shoulders on each side. Tracks will be wider on bends. It is expected 100% of the on-site tracks would be constructed as excavated track as little or no peat is expected to be met on site.
- It is assumed that a Species Protection Plan will be agreed in consultation with SNH in advance of construction under the terms of an appropriate planning condition. A draft version of the plan can be found in **Technical Appendix 5.7.** This plan will ensure that all necessary measures are taken to avoid disturbance to protected species. This is taken into consideration during the initial assessment of effects.
- All electrical cabling proposed between the turbines and the site substation will be underground and follow tracks wherever possible.
- Routine maintenance of the turbines would be undertaken approximately twice yearly. This would not involve any large vehicles or machinery.

Legislation and Policy

5.10 The following legislation and policy have been considered as part of the assessment.

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna ("Habitats Directive");
- Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy ("Water Framework Directive");
- Environmental Impact Assessment Directive 85/337/EEC (as amended);
- European Commission (27 October 2010) Natura 2000 Guidance Document *'Wind Energy Developments and Natura 2000*'. European Commission, Brussels.
- Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations (2011);
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (the Habitats Regulations);
- The Water Environment and Water Services (Scotland) Act 2003 (WEWS);
- The Wildlife and Countryside Act 1981 (as amended);

[1] Forestry Commission Scotland (2009). Control of Woodland Removal. http://www.forestry.gov.uk/pdf/fcfc125.pdf/$file/fcfc125.pdf

- Nature Conservation (Scotland) Act 2004 (as amended);
- The Wildlife and Natural Environment (Scotland) Act 2011;
- The Protection of Badgers Act 1992 (as amended);
- SERAD (Scottish Executive Rural Affairs Department) 2000. Habitats and Birds Directives, Nature Conservation: Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds ('The Habitats and Birds Directives'). Revised Guidance Updating Scottish Office Circular No 6/1995;
- Scottish Executive (2004). The Scottish Biodiversity Strategy: It's in Your Hands.
- Scottish Government (2013). 2020 Challenge for Scotland's Biodiversity.
- The Scottish Biodiversity List (http://www.biodiversityscotland.gov.uk).
- DEFRA (2011). Biodiversity 2020: A strategy for England's wildlife and ecosystem services.
- Natural England (2013). Section 41 Species - Priority Actions Needed (B2020-008)
- Policy Advice Note PAN 1/2013 - Environmental Impact Assessment (Scottish Government 2013);
- Planning Circular 3 2011;
- Nature Conservancy Council (1989, revised 2013). Guidelines for selection of biological SSSIs;
- Scottish Borders Local Biodiversity Action Plan;
- Scottish Borders Structure Plan (2001-2018); and
- Consolidated Scottish Borders Local Plan (2011).

Issues Identified During Consultation

5.11 Table 5.1 summarises the consultation responses received with regard to ecology and provides information on where and how they have been addressed in the assessment.

5.12 A Scoping Report for the site was previously submitted in January 2014 to the Scottish Government Energy Consents and Deployment Unit (ECDU) under Section 36 of the Electricity Act as the proposed wind farm was then expected to be over 50 MW (37 turbines up to a tip height of 150 m). As the capacity of the scheme is now estimated to be under 50MW (31 – 44 MW) and will now be determined by the local planning authority under the Town and Country Planning (Scotland) Act 1997 (as amended), it was deemed appropriate to re-consult statutory and non-statutory consultees to seek their opinion on assessment work that should be carried out as part of the Environmental Impact Assessment (EIA). A second Scoping Report was submitted in November 2015. Responses to the original Scoping Report that are still applicable have been included here.

Table 5.1: Issues Identified During Consultation

Consultee	Issue	Where/How this is addressed
Forestry Commission Scotland (FCS) Scoping Response 23/01/2014	A [Special Area of Conservation] SAC designated for woodland interests and smaller semi-natural woodlands are within the site.	The Borders Woods SAC is considered within the Designated Sites section. It is approximately 1.7 km from the closest proposed infrastructure, and no connectivity is predicted.
	The applicant should consider the implications of any tree felling on wildlife and impacts of forestry activities on the water environment.	Felling and forestry activities, both in relation to the proposed wind farm and the "do nothing" scenario are considered for each receptor in the Potential Impacts section. **Chapter 10: Forestry** details the forestry plans.
Scottish Natural Heritage (SNH) Scoping Response 12/02/14	The ES should contain a detailed assessment of the implications on biodiversity, in terms of Scottish Biodiversity Strategy aims, and specifically the impacts on priority species and habitats.	The Scottish Biodiversity Strategy guidance has been considered (see Legislation and Policy), with particular emphasis on priority species and habitats in the Potential Impacts assessment.
FCS Second Scoping Response 09/11/2015	No change from our previously stated position on this wind farm.	Noted.
	Consideration must be given to potential effects of construction, operation and decommissioning of the proposed development in relation to the qualifying features of the River Tweed SAC. SNH considers that this proposal is likely to have a significant effect on the qualifying interests of the SAC, particularly during the construction phase of the proposal, and an appropriate assessment will be required.	The River Tweed SAC is assessed within a Habitats Regulations Appraisal context in the Potential Impacts section.
	Due to its location, scale, and connectivity with the Borders Woods SAC, SNH considers that this proposal is likely to have a significant effect on the qualifying interests of the SAC, particularly during the construction phase of the proposal, and an appropriate assessment will be required. Sufficient information should be provided by the EIA to inform the appropriate assessment. Potential impacts on Cragbank and Wolfehopelee Site of Special Scientific Interest (SSSI) are the same as those for the SAC, and so the assessment of impacts on the SAC would also address the SSSI.	The SAC is considered in the Potential Impacts section, but has been scoped out of the assessment based on the distance from the nearest proposed infrastructure in the final layout (1.7 km). No connectivity, and hence no Likely Significant Effects are predicted.
	Include reference to any designated sites just over the border in England.	These are included in the Designated Sites section (see also Figure 5.1).
	Advised to contact The Wildlife Information Centre (TWIC) regarding habitat and species information for the site and immediate surrounds.	Data were provided by the TWIC and species records are considered within the impact assessment.

Consultee	Issue	Where/How this is addressed
	Advised to contact Project Officer South Scotland for Saving Scotland's Red Squirrels.	Relevant Project Officer contacted. Squirrel records received and used to inform the assessment where relevant (see Baseline Conditions Section).
	Pine marten can be scoped out of the assessment since they are not known to naturally occur in the Scottish Borders, as can freshwater pearl mussels, since they are not present in the Tweed river system.	A historic pine marten record was obtained for the wider area, and possible evidence was found within the site. The species was thus included as a Valued Ecological Receptor. Freshwater pearl mussel has been scoped out.
	A judgement will need to be made in relation to reptiles and invertebrates after the Extended Phase 1 Habitat Survey and desk studies have been carried out.	Reptiles and invertebrates have been scoped out of the assessment as the habitats that they prefer are unlikely to be affected by the proposed wind farm. The project is likely to be of neutral impact.
	Habitat Management Plan (HMP) required as part of mitigation works. HMP to include proposals to mitigate any habitat and, where appropriate, species loss and damage. HMP to include compensation planting for expected woodland loss and connection of two strips of woodland within the SAC/SSSI across Wolfehopelee Hill is recommended.	An HMP is not considered necessary due to the lack of predicted significant effects as a result of careful design stage mitigation. The areas of woodland referred to by SNH lie approximately 1.7 km away from the closest infrastructure. Because of the lack of connectivity to the site, these areas of woodland were scoped out of the impact assessment and compensation planting is therefore not required in relation to the SAC/SSSI woodland.
	Reference should be made to the Ecological Audit for Dykeraw Forest prepared by John Gallacher and Baxter Cooper of Tilhill following their visits to the site in summer 1998 and winter 2000.	The Ecological Audit, and follow-up *Dykeraw Ecological Site Classification* (Gallacher, 2005) were considered in this chapter, within the Baseline Characterisation and Potential Impacts sections. The ecological descriptions generally correlated with the results of baseline surveys.
SNH Correspondence email (scope of survey work, 2015) 15/04/2015	SNH agrees with the scope of the surveys proposed for 2015, provided that there has been no significant change in land-use within the development site that would make the habitat surveys that have already been carried out meaningless.	Refresher protected species surveys were carried out in 2015 to provide up to date information on site usage. Methods and results are presented in **Technical Appendix 5.3** and are included in the assessment of potential impacts.
SNH, Second Scoping Response 27/11/2015	Much of the ecological survey work that had been undertaken at the time of the original submission is now out of date or approaching the limit generally accepted for EIA. Through consultation with Macarthur Green consultants we are aware that this has been addressed with respect to data for otter, badger and red squirrel. Although SNH has not seen the data with respect to bats we accept that the level of activity alleged for the site combined with the forestry location of the new turbine layout means that a reassessment of the bat data is probably not necessary.	Results from the 2015 refresher surveys are detailed in **Technical Appendix 5.3**, and are considered in full in the impact assessment.
	We note there may be mitigation opportunities to compensate for any habitat loss, particularly around the mixed ash woodland to the western edge of the site.	Loss of extent of habitats of conservation concern will be negligible, and no specific mitigation is required. A negligible amount of broadleaved woodland will be lost as a result of the proposed wind farm and this will be reflected in the make-up of the offsite compensatory planting.
Scottish Environmental Protection Agency (SEPA) Scoping Response 04/02/14 Second Scoping Response 10/11/2015	The ES should demonstrate how the layout and design of the proposed wind farm has taken into consideration any wetland or peatland systems present.	See Design Mitigation section
	Phase 1 Habitat and NVC surveys should be conducted to identify wetland habitats and associated Groundwater Dependent Terrestrial Ecosystems (GWDTEs). In order to assess the potential risk to GWDTE a Phase 1 habitat survey must be carried out within the following distances of development as a minimum: - within 100 m radius of all excavations shallower than 1m - within 250 m of all excavations deeper than 1 m.	Phase 1 and NVC surveys were undertaken in 2011 and 2013, and results are assessed within this chapter. **Technical Appendices 5.1 and 5.2** detail Phase 1 and NVC surveys and results respectively. GWDTEs are assessed here in an ecological context, and further information is found in **Chapter 8: Hydrology, Geology and Hydrogeology**.

Consultee	Issue	Where/How this is addressed
	The route of roads, tracks and trenches within 100 m of GWDTEs should be reconsidered. The locations of borrow pits or foundations within 250 m of GWDTEs should also be reconsidered. The results of the assessment and any mitigation measures should be included in the ES.	Mitigation measures are described in the Potential Impacts section of this Chapter and in **Chapter 8: Hydrology, Geology and Hydrogeology**. Much of the mitigation was considered at the design stage, which was been informed by detailed peat depth, vegetation surveys across the site.
	A detailed map of peat depths (this must be to full depth) should be submitted with relevant infrastructure to indicate how deep peat (>1 m depth) has been avoided. The peat depth survey should include details of the basic peatland characteristics.	This is addressed in **Technical Appendix 5.6 Peat Depth Survey and Surface Vegetation Characteristics**, and displayed in Figures 5.16 and 5.17. Comments on how the infrastructure has been designed in relation to peat depth are provided in **Chapter 2: Proposed Development**.
Scottish Wildlife Trust (SWT) Scoping Response 17/02/2014	SWT would expect to see a peat depth map with turbine locations/access track marked as well as depth probe figures to show how deep peat (<1 m) has been avoided. Similarly, active blanket bog should be avoided as well as areas containing hummocks/hollows and bog pools.	See Figures 5.16 and 5.17, Figure 5.3 and **Technical Appendix 5.6**. Blanket bog has been avoided in the design layout process (see Design Mitigation section).
	SWT would expect to see an NVC survey of the proposed locations of the turbines and access track and an extended phase 1 habitat survey with full species list for the whole of the site.	See **Technical Appendices 5.2 and 5.1** for details of NVC and Extended Phase 1 surveys.
Southdean Community Council Scoping Response 1 03/02/2014 Scoping Response 2 26/11/2015	The Community Council has significant concerns about the ecology of the site, and potential impact, and wishes to ensure those are adequately covered in the proposed development	All identified potential ecological impacts are addressed within the Potential Impacts section.
Natural England (NE) Scoping Response 1 17/02/2014 Scoping Response 2 12/11/2015	Assess potential impacts of development on designated sites (statutory and non-statutory) and include an Appropriate Assessment if likely significant effects have been identified on designated SACs.	Impacts on designated sites are considered in the Potential Impacts section, and the Natura 2000 sites have been assessed within a "Habitats Regulation Assessment" (HRA) context.
	Assess potential impacts (direct and indirect) on protected habitats and/or species listed as "Habitats and Species of Principal Importance" within the England Biodiversity List.	The England Biodiversity List has been included as a source of guidance for determining Valued Ecological Receptors.
	Bat surveys should conform to current NE guidance. Reference should also be made to the latest Bat Conservation Trust (BCT) guidance for onshore wind farms.	Current NE and BCT guidance has been adopted for the bat survey work at the site (see Guidance section).
Royal Society for the Protection of Birds Scoping Response 20/02/2014	The site of the proposed wind farm lies next to two components (Wolfhopelee Hill and Cragbank) of the Borders Wood SAC and it is likely, therefore, that an appropriate assessment will be required.	Impacts on designated sites are considered in the Potential Impacts section, and the Natura 2000 sites have been assessed within an HRA context.
	The developer should draw up a habitat management plan detailing measures to ensure the integrity of the SAC and contribute to its consolidation and enhancement through native planting and connectivity of its constituent parts.	An HMP is not considered necessary due to the lack of predicted significant effects as a result of careful design stage mitigation. The SAC lies approximately 1.7 km away from the closest infrastructure. Because of the lack of connectivity to the site, these areas of woodland were scoped out of the impact assessment and compensation planting is therefore not required in relation to the SAC/SSSI woodland.
	The location, extent and depth of peat on the site should be quantified so that the positions of access tracks and turbines avoid this habitat.	See **Technical Appendix 5.6** and Figures 5.16 and 5.17 for details of peat within the site.

Assessment Methodology

Baseline Characterisation

Desk Study

5.13 A desk study collated available ecological data within the study area and surrounds. This comprised a thorough search of available datasets such as those provided by SNH's siteLink website[2], Natural England's website[3], The Wildlife Information Centre (TWIC) and Saving Scotland's Red Squirrels. The

[2] https://gateway.snh.gov.uk/

[3] https://designatedsites.naturalengland.org.uk/siteSearch.aspx

desk study searched for species records within 5 km of the site boundary and the results are summarised in the 'Baseline Conditions' section of this chapter.

5.14 Information on designated sites with an ecological (non-ornithological) interest (including Local Nature Reserves (LNR)) within 5 km of the site was collated from SNH and Natural England. Given the geographical ranging distance of species identified in this chapter and given that **Chapter 8 Hydrology, Hydrogeology and Geology** predicts no hydrological impacts to designated sites over 5 km downstream of the site, only designated sites within 5 km are considered in this chapter.

Field Surveys

5.15 The following field surveys were undertaken from 2011 to 2015, to establish the baseline ecological conditions in the relevant study areas, and were carried out in line with standard methodologies and guidance:

- Extended Phase 1 habitat survey. Surveying of a preliminary wind farm layout was conducted in April 2011, and a subsequent survey was conducted in July 2013 to cover an additional area within the site, following a layout change;
- National Vegetation Classification (NVC) survey. Carried out in August 2013;
- Peat depth and surface vegetation characteristics assessment. Carried out in September 2013;
- Protected species surveys (badger, otter, water vole, red squirrel, pine marten and reptiles. Carried out in August 2013, with a follow-up badger survey in February 2014, and a refresher protected species survey in June 2015;
- Great crested newt habitat suitability survey. Carried out in March and May 2012, after an initial Habitat Suitability Index survey in 2011;
- Bat habitat assessment and activity survey (targeted survey across the site; tree survey across the site and affected areas along the access route). Carried out from April to September 2012 within conifer plantation, and April to October 2013 within farmland in the north of the site; and
- Fisheries assessment (across the site and within the wider catchment downstream of the site). Carried out in July 2012.

5.16 Detailed survey methods and results are provided within **Technical Appendices 5.1 - 5.6**.

Method of Assessment

Guidance

5.17 The following guidance has been considered as part of the assessment.

- CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester;
- Hundt (2012) Bat Surveys: Good Practice Guidelines, 2nd edition, Bat Conservation Trust;
- Natural England (2014) Natural England Technical Information Note TIN 051. Bats and Onshore Wind turbines - Interim Guidance, Edition 3;
- SEPA (2014): Guidance Note 4 - Planning Advice on Windfarm Developments. Version 7;
- SEPA (2014): Guidance Note 31 - Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems;
- Scottish Natural Heritage (2013) Planning for Development: What to consider and include in Habitat Management Plans;
- Scottish Renewables, SNH, SEPA, FCS (Scotland), Historic Environment Scotland (2015, Version 3) Good Practice During Windfarm Construction; and
- Scottish Natural Heritage (2012) Assessing the cumulative impact of onshore wind energy developments.

Methodology for Assessing Wider-Countryside Ecological Interests

5.18 The assessment method follows the process set out in the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (the "EIA Regulations").

5.19 The evaluation for wider-countryside interests (interests unrelated to an SAC, but including an SSSI) involves the following process:

- identification of the potential impacts of the proposed wind farm;
- consideration of the likelihood of occurrence of potential impacts where appropriate;
- defining the nature conservation value and conservation status of the habitat extent/populations present to establish level of sensitivity;
- establishing the magnitude of the impact (both spatial and temporal);
- based on the above information, a judgement is made as to whether or not the resultant effect is significant with respect to the EIA Regulations;
- if a potential effect is determined to be significant, measures to mitigate or compensate the effect are suggested where required;
- opportunities for enhancement are considered where appropriate; and
- residual effects after mitigation, compensation or enhancement are considered.

Assessing Significance

5.20 This section defines the methods used to assess the significance of effects by the evaluation of the sensitivity of a receptor combined with the magnitude of likely effects acting upon it.

5.21 Determination of the level of sensitivity of a receptor is based on a combination of the receptor's nature conservation value and conservation status, described in the sections below.

Determining Nature Conservation Value

5.22 Nature conservation value is defined on the basis of the geographic scale given in Table 5.2 (based on standard CIEEM (2016[4]) guidance and Hill et al (2005[5])). Attributing a value to a receptor is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of a value level (e.g. a SAC is of European (International) importance). In the case of habitats or species, assigning value is less straightforward as detailed in CIEEM (2016) "*When determining the importance of a species population, contextual information about distribution and abundance is fundamental, including trends based on historical records*". This means that even though a species may be protected through legislation at a national or international level, the relative value of the population on site may be quite different (e.g. the site population may consist of a single transitory animal, which within the context of a thriving local/regional/national population of a species, is clearly of local or county value.

[4] CIEEM (2016) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.

[5] Hill, D., Fasham, M., Tucker, G., Shewry, M & Shaw, P. (2005) Handbook of Biodiversity Methods – Survey, Evaluation and Monitoring. Cambridge University Press.

5.23 Where possible, the valuation of habitat/populations within this assessment will make use of any relevant published evaluation criteria (e.g. The Scottish Biodiversity List, the JNCC guidance on selection of biological SSSIs). Furthermore, JNCC/NBN guidance (2008[6]) has been consulted where relevant so that cross-referencing of classifications within different systems can be standardised (e.g. correctly matching NVC types with Annex I habitats where relevant etc.).

5.24 Where relevant, information regarding the particular receptor's conservation status (within a particular geographical context, e.g. at a NHZ level or a designated site level) shall also be considered in order to fully define its sensitivity. This will enable an appreciation of current population or habitat trends to be incorporated into the assessment.

Table 5.2: Approach to valuing ecological receptors

Value of Receptor	Description
International and European	An internationally designated site (e.g., SAC, potential SAC), or site meeting criteria for international designations.
	Species or habitats present in internationally important numbers (>1% of biogeographic population or extent).
National	A nationally designated site (SSSI, or a National Nature Reserve, NNR), or sites meeting the criteria for national designation.
	Species present in nationally important numbers (>1% UK population).
	Areas of priority habitat listed on Annex I of the Habitats Directive that are essential to maintain the viability of that ecological resource at a national level.
Regional (Natural Heritage Zone)	Species present in regionally important numbers (>1% of Regional or NHZ population); and regionally important populations of a species (e.g. at the edge of a range distribution).
	Regionally significant and viable areas of key habitat identified as being of regional value in the appropriate NHZ.
	A viable, good quality habitat or species population identified on the Scottish Biodiversity List under "Conservation Action Needed".
County (Scottish Borders LBAP area)	Local statutory or non-statutory nature reserves, e.g. Local Biodiversity Sites, Scottish Wildlife Trust or RSPB reserves.
	Viable areas of Priority Habitat identified in the Scottish Borders LBAP or smaller areas of such habitat which are essential to maintain the viability of the habitat as a whole.
	Areas of semi-natural ancient woodland between 0.25 ha and 50 ha.
	A habitat or species identified on the Scottish Biodiversity List under "Avoid Negative Impacts".
Local	A habitat or species identified on the Scottish Biodiversity List under "Watching Brief Only"
	Areas of semi-natural ancient woodland smaller than 0.25 ha.
	Areas of habitat or species considered to appreciably enrich the ecological resource within the local context, e.g., species-rich flushes or hedgerows. Ecological features that play a key functional role in the landscape.
Negligible	Usually widespread and common habitats and species. Receptors falling below local value are not normally considered in detail in the assessment process.

Method Used to Evaluate the Magnitude of Impacts

5.25 Impact magnitude refers to changes in the extent, abundance, distribution and integrity of an ecological receptor. The only definition of ecological "integrity" within Scottish planning policy is found within circular 6/1995 updated by SERAD (2000) which states that, "*The integrity of a site is the coherence of its ecological structure and function, across its whole area, which enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*". Although this definition is used specifically regarding SACs and SPAs, it is applied here to wider countryside habitats and species.

5.26 Determining the magnitude of any impact requires an understanding of how the ecological receptors are likely to respond to the proposed wind farm. This change can occur during construction, operation or decommissioning of the wind farm.

5.27 Impacts can be adverse, neutral or beneficial, and are judged in terms of magnitude in space and time. There are five levels of spatial effects and temporal effects as detailed in Table 5.3 and Table 5.4.

Table 5.3: Definition of Spatial Effect Magnitude upon the VERs

Spatial Magnitude	Definition
Very High	Would cause the loss of the majority of a receptor (>80%), or would be sufficient to damage a receptor sufficient to immediately affect its viability.
High	Would have a major effect on the receptor, sufficient to result in short-term losses and impacts upon its long-term viability. For example, more than 20% habitat loss or damage.
Moderate	Would affect the receptor in the short and medium-term, but should not alter its long-term viability. For example, between 10 - 20% habitat loss or damage.
Low	Would have a minor effect upon the receptor, either of sufficiently small-scale or of short duration to cause no long-term harm. For example, less than 10% habitat loss or damage.
Negligible	Minimal change on a very small scale; effects not dissimilar to those expected within a "do nothing" scenario.

Table 5.4: Temporal Effect Magnitude

Temporal Magnitude	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as 26+ years), except where there is likely to be substantial improvement after this period in which case the category Long Term may be more appropriate.
Long term	Between 15 years up to (and including) 25 years.
Medium term	Between 5 years up to (but not including) 15 years.
Short term	Up to (but not including) 5 years.
Negligible	No effect.

[6] JNCC/NBN. 2008. NVC & Other Classification (webpage and link to corresponding xls) http://jncc.defra.gov.uk/page-4266

Significance Criteria

5.28 The predicted significance of the effect on a VER (in most cases within the context of a reference population or habitat extent) is determined through a standard method of assessment based on professional judgement, considering both sensitivity (i.e. each VER's relative sensitivity to impacts) and magnitude of change.

5.29 Table 5.5 details the significance criteria that have been used in assessing the effects of the proposed wind farm.

Table 5.5: Significance Criteria

Significance Level	Definition
Major	*Significant effect, as the effect is likely to result in a long term significant adverse effect on the integrity of the receptor.*
Moderate	*Significant effect, as the effect is likely to result in a medium term significant adverse effect on the integrity of the receptor.*
Minor	*The effect is likely to adversely affect the receptor at an insignificant level by virtue of its limited duration and/or extent, but there will probably be no effect on its integrity. This is not a significant effect.*
Negligible	*No material effect. This is not a significant effect.*

5.30 Using these definitions, it must be decided whether there will be any effects which will be sufficient to adversely affect the VER to the extent that its conservation status deteriorates above and beyond that which would be expected should baseline conditions remain (i.e. the 'do nothing' scenario). Major and moderate effects are considered significant in accordance with the EIA Regulations, whereas minor or negligible effects are not considered significant.

Methodology for Assessing Likely Significant Effects on an SAC

5.31 The method for assessing the significance of a likely effect on an SAC is different from that employed for wider-countryside interests. The Habitats Directive is transposed into domestic legislation by the Habitats Regulations. Regulation 48 indicates a number of steps to be taken by the competent authority before granting consent (these are referred to here as a "Habitats Regulations Appraisal", HRA). In order of application, the first four are:

- **Step 1.** Consider whether the proposal is directly connected to or necessary for the management of the site (Regulation 48 (1b)). If not:
- **Step 2.** Consider whether the proposal, alone or in combination, is likely to have a significant effect on the site (Regulation 48 (1a)). If so:
- **Step 3.** Make an Appropriate Assessment of the implications for the site in view of that site's conservation objectives (Regulation 48 (1)).
- **Step 4.** Consider whether it can be ascertained that the proposal will not adversely affect the integrity of the site ("Integrity Test") having regard to the manner in which it is proposed to be carried out or to any conditions or restrictions subject to which they propose that the consent, permission or other authorisation should be given (Regulation 48 (5 & 6)). Relevant information can be considered at Step 2.

5.32 The Likely Significant Effects test (Stage 2) and recommendation for an Appropriate Assessment (Stage 3) in relation to the proposed wind farm is presented in this chapter. The results of baseline surveys and conclusions presented in the wider countryside EIA assessment are used to inform the HRA process.

Cumulative Assessment

5.33 SNH (2012[7]) cumulative assessment guidance is used to inform the cumulative assessment in this chapter. The spatial extent of the cumulative assessment is dependent on the ecology of the receptor. For example, for water voles it may be appropriate to consider effects specific to individual catchments, should the distance between neighbouring catchments be sufficient to assume no movement of animals between them, whereas for blanket bog habitat the region or the NHZ may be the relevant spatial scale.

Limitations

5.34 The following survey limitations were identified.

- All ecological survey methods followed contemporary recommended guidance methodology, taking place during the recommended survey periods, in good conditions.
- Although the weather conditions during the 2013 protected species survey, and on the days immediately prior to the survey were good, the monthly rainfall in July was higher than average for that time of year and for this reason there is a possibility that some older field signs (e.g. older otter spraints) may have been washed away. Follow-up surveys in 2014 and 2015 have however increased the confidence of baseline survey findings, and it is not considered that this limitation will have significantly affected the results of the survey and therefore the impact assessment.
- The proposed wind farm design has been an iterative process, resulting in changes in layout throughout the baseline survey and pre-application period. Because of this, in some cases the respective survey areas for each survey type did not correspond with the final layout. Where possible surveys were conducted at a later date to cover these areas (e.g. repeat Phase 1 and bat surveys covering the northernmost turbines to the north of the forestry).
- Although some baseline data dates back to 2011, follow-up surveys up to 2015 are likely to have provided results that typify the current baseline conditions within the site.
- Limitations exist with regard to the knowledge base on how some species, and the populations to which they belong, react to effects. A precautionary approach is taken in these circumstances, and as such it is considered that these limitations do not affect the robustness of this assessment.
- It should be noted that the layout of the turbines, and hence tracks and cables, would be subject to 50 m micrositing. The assessment of impacts presented within this chapter has been based upon the layout defined in **Chapter 2: Proposed Development**. Any micrositing changes would respect the exclusion zones defined within this chapter such that no infrastructure would be moved to the extent that impacts would be any greater than those reported in this chapter.

Baseline Conditions

Site Description

5.35 The site spans two landownerships, with farmland in the northern area and commercial conifer plantation covering the majority of the site. There are four main burns within the site, the most

[7] Scottish Natural Heritage (2012) Assessing the cumulative impact of onshore wind energy developments

prominent being the Jed Water running through the eastern section of the site. On average, the Jed Water is around 5 m wide on site, with a depth up to 0.5 m with a substrate dominated by cobbles and boulders, and banks of marshy grassland. Additional smaller watercourses include Peden's Cleuch and the Black Burn. These watercourses drain into the Jed Water, and are smaller with a maximum width of 1-2 m and depth of 0.5-1 m.

5.36 Dykeraw Forest is actively managed while the areas of open ground across the central and northern sections of the site are managed at quite an intense level for grazing.

Designated sites

5.37 The following sites designated for their ecological importance are present within the site and within 5 km of the site boundary (Figure 5.1):

- **River Tweed SAC -** designated for its populations of river, brook, and sea lamprey as well as Atlantic salmon, otter and floating vegetation. The Black Burn which borders the eastern side of the site is part of the SAC, as is the Jed Water below the confluence with Black Burn. Catlee Burn, close to the westernmost part of the site is also part of the SAC.
- **Borders Woods SAC** - designated for its mixed woodland on base-rich soils associated with rocky slopes. The Cragbank and Wolfehopelee components are adjacent to, and in part overlapping with the western site boundary, approximately 1.7 km from the closest proposed turbine location.
- **Cragbank and Wolfehopelee SSSI** - designated for its sections of broadleaved, mixed, and yew woodland, and beetle assemblage. Located overlapping with and adjacent to the western site boundary, coincidental in extent with the Borders Woods SAC components.
- **Cragbank Woods National Nature Reserve (NNR) -** designated for its woodland habitat. Coincidental in extent with Borders Woods SAC and Cragbank and Wolfehopelee SSSI.
- **Border Mires, Kielder - Butterburn SAC -** designated for its areas of blanket bog, wet heath, dry heath, transition mires and quaking bogs, and petrifying springs. Located approximately 2.4 km south-east of the site.
- **Kielderhead Moors: Carter Fell to Peel Fell SSSI -** designated for its blanket bog and subalpine dry heath habitats. Located approximately 1.1 km southeast of the site.
- **Kielderhead and Emblehope Moors SSSI -** designated for its blanket bog, dry heath, and wet heath habitats. Located approximately 2.4 km southeast of the site.
- **Kielderhead National Nature Reserve (NNR) -** designated for its undisturbed moorland. Located approximately 2.4 km south-east of the site.
- **Whitelee Moor NNR -** designated for its active blanket bog and heathland. Located approximately 3.5 km southeast of the site.

Ancient Woodland

5.38 There are areas of Ancient Woodland (as recorded within SNH's Ancient Woodland Inventory) within 5 km of the site; the nearest of which being the woodland of semi-natural origin which forms part of the Cragbank and Wolfehopelee SSSI, adjacent to the westernmost site boundary. No Ancient Woodland is found within the site (Figure 5.1).

Habitat Description

5.39 Table 5.6 summarises the Phase 1 habitats and extents (following JNCC, 2010[8] standard Phase 1 categorisation) recorded within the survey areas in 2011 and 2013, and these are illustrated in Figure 5.2a to 5.2c. Further details of each habitat type are presented in **Technical Appendix 5.1**.

Table 5.6: Phase 1 Habitat Types by Area (within the survey area)

Phase 1 Habitat Description	Phase 1 Habitat Code	Area (Ha)	% Overall
Broad-leaved plantation woodland	A1.1.2	1.04	0.09
Coniferous plantation woodland	A1.2.2	590.29	53.79
Mixed semi-natural woodland	A1.3.1	1.73	0.16
Dense/continuous scrub	A2.1	0.04	0.00
Recently felled coniferous woodland	A4.2	272.75	24.86
Unimproved acid grassland	B1.1	5.26	0.48
Semi-improved acid grassland	B1.2	9.12	0.83
Unimproved neutral grassland	B2.1	61.02	5.56
Semi-improved neutral grassland	B2.2	1.77	0.16
Improved grassland	B4	25.71	2.34
Marsh/marshy grassland	B5	99.98	9.11
Wet dwarf shrub heath	D2	0.03	0.00
Wet heath/acid grassland mosaic	D6	0.07	0.01
Blanket bog	E1.6.1	5.37	0.49
Wet modified bog	E1.7	2.41	0.22
Swamp	F1	0.04	0.00
Standing water	G1	0.07	0.01
Quarry	I2.1	2.26	0.21
Arable	J1.1	1.27	0.12
Building	J3.6	0.06	0.01
Bare ground	J4	10.27	0.94
Running water*	G2	-	-
Flush and Spring: acid/neutral*	E2.1	-	-
Semi-natural Broadleaved Woodland*	A1.1.1	-	-
Scattered bracken*	C1.1	-	-
Dry dwarf shrub heath*	D1.1	-	-
Other tall herb & Fern: Tall Ruderal**	C3.1	-	-
Total Area (Ha)		**1097.35**	**100.00**

* These features were not large enough to be mapped by area so are not included in the habitat calculations, but are referenced within the target notes in **Technical Appendix 5.3**.

** This habitat is very common within the Dykeraw forestry plantation but is mainly restricted to areas of recently felled plantation where, although abundant in places, it forms the sub-dominant habitat. As a result the habitat is not included in the habitat calculations.

[8] Joint Nature Conservancy Council, 2010. *Handbook for phase 1 habitat survey – a technique for environmental audit*. JNCC

5.40 The following 34 NVC communities (including different sub-communities) were recorded within the 2013 survey area as shown below in Table 5.7, and also in Figure 5.3. A further 11 non-NVC habitats were also identified. Further detail is provided in **Technical Appendix 5.2**. It should be noted that NVC community representation across the site is often within the context of a mosaic habitat and that, although the following habitats were recorded, this does not necessarily translate to dominance within a particular stand.

Table 5.7: NVC Communities Recorded within the 2013 Survey Area

Community Type	Community Name and Title		Potential Groundwater Dependency	Annex 1 Habitat	Equivalent Phase 1 Habitat
Mires, bog pools and flushes	M6c	Carex echinata-Sphagnum fallax/denticulatum mire, Juncus effusus sub-community	High		E2.1 Flush and spring: acid/ neutral
	M6d	Carex echinata-Sphagnum fallax/denticulatum mire, Juncus acutiflorus sub-community	High		
	M17a	Trichophorum germanicum-Eriophorum vaginatum blanket mire, Drosera rotundifolia-Sphagnum sub-community		Blanket bog	E1.6.1 Bog: blanket
	M19a	Calluna vulgaris-Eriophorum vaginatum blanket mire, Erica tetralix sub-community		Blanket bog	
	M20	Eriophorum vaginatum raised and blanket mire		Blanket bog	
	M23a	M23a Juncus effusus/acutiflorus-Galium palustre rush-pasture, Juncus acutiflorus sub-community	High		B5 Marsh/ marshy grassland
	M23b	Juncus effusus/acutiflorus-Galium palustre rush-pasture, Juncus effusus sub-community	High		
	M25a	Molinia caerulea-Potentilla erecta mire, Erica tetralix sub-community	Moderate	Blanket bog	E1.7 Bog: wet modified
	M25b	Molinia caerulea-Potentilla erecta mire, Anthoxanthum odoratum sub-community	Moderate	Blanket bog	B5 Marsh/ marshy grassland
	M27	Filipendula ulmaria – Angelica sylvestris mire	Moderate		
Calcifugous grassland	U2	Deschampsia flexuosa grassland			B1.1 Acid grassland: unimproved
	U4a	Festuca ovina-Agrostis capillaris-Galium saxatile grassland, Typical sub-community			
	U4b	Festuca ovina-Agrostis capillaris-Galium saxatile grassland, Holcus lanatus-Trifolium repens sub-community			B1.2 Acid grassland: semi-improved
	U5a	Nardus stricta-Galium saxatile grassland, Species-poor sub-community			B1.1 Acid grassland: unimproved
	U6d	Juncus squarrosus-Festuca ovina grassland, Agrostis capillaris-Luzula multiflora sub-community	Moderate		
	U6h	U6H Juncus squarrosus-Festuca ovina grassland, provisional heathy sub-community with abundant Calluna vulgaris	Moderate		D2 Wet dwarf shrub heath (poor fit)
	U20	Pteridium aquilinum-Galium saxatile grassland			C1.1 Bracken: continuous
Mesotrophic grassland	MG1	Arrhenatherum elatius coarse grassland, Festuca rubra sub-community			B2.1 Neutral grassland: unimproved
	MG2	Filipendula ulmaria-Arrhenatherum elatius grassland			
	MG5	Cynosurus cristatus-Centaurea nigra meadow and pasture			
	MG6	Lolium perenne – Cynosurus cristatus grassland			B4 Improved grassland
	MG7a	Lolium perenne leys and related grasslands, Lolium perenne-Trifolium repens leys			
	MG9	Holcus lanatus – Deschampsia cespitosa grassland	Moderate*		B2.1 Neutral grassland: unimproved
	MG10a	Holcus lanatus-Juncus effusus rush-pasture, Typical sub-community	Moderate*		
	MG12a	Festuca arundinacea coarse grassland, Lolium perenne-Holcus lanatus sub-community			B2.2 Neutral grassland: semi-improved
Wet heath	M15d	Trichophorum germanicum-Erica tetralix wet heath, Vaccinium myrtillus sub-community	Moderate	Northern Atlantic wet heaths with Erica tetralix	D2 Wet dwarf shrub heath

Community Type	Community Name and Title		Potential Groundwater Dependency	Annex 1 Habitat	Equivalent Phase 1 Habitat
Woodland and Scrub	W7	Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum woodland	High	Yes: Alluvial forests with Alnus glutinosa and Fraxinus excelsior**	A1.1.2 Woodland: broadleaved, plantation
	W23	W23 Ulex europaeus-Rubus fruticosus agg. scrub			A2.1 Scrub – dense/continuous
Tall herb/ ruderal	OV25	Urtica dioica – Cirsium arvense community			C3.1 Other tall herb & fern: tall ruderal
	OV27	Chamerion angustifolium community			
Swamp	S3	Carex paniculata swamp	Moderate		F1 Swamp
	S7	Carex acutiformis swamp	Moderate		
	S22	Glyceria fluitans swamp			
	S28	Phalaris arundinacea fen			
Non-NVC Categories	Je	Juncus effusus 'acid grassland' community	Moderate		B5 Marsh/ marshy grassland
	Ja1	Juncus acutiflorus 'acid grassland' community	Moderate		
	Ja2	Juncus acutiflorus 'wet heath' community	Moderate		D2 Wet dwarf shrub heath (v. poor fit)
	Beech	Small patch of mature beech			A1.1.2 Broadleaved woodland – plantation
	YBP	Young broadleaved plantation			
	BG	Bare ground/building/quarry			J3 Built-up areas I2.1 Quarry
	SW	Standing water			G1 Standing water
	CP	conifer plantation			A1.2.2 Woodland: coniferous, plantation
	FC	felled conifers			A4.2 Recently-felled woodland, coniferous
	YCP	Young conifer plantation			A1.2.2 Woodland: coniferous, plantation
	WW	Wet willow woodland	Moderate		A1.1.2 Woodland: broadleaved, plantation
	AR	Arable			J11 Cultivated/ disturbed land: arable

* The community recorded within the Dykeraw plantation is a highly degraded form which represents a pioneer habitat re-colonising areas of recently cleared coniferous woodland. The moderate classification has been assigned as part of a precautionary approach.

** Woodland is located on the upland margins and is on a slope. These two criteria may exclude it from the Annex 1 category.

Groundwater Dependent Terrestrial Ecosystems

5.41 The NVC survey results in Table 5.7 were referenced against SEPA (2014[9]) guidance in order to identify those habitats classified as potential GWDTEs, as detailed in Figure 5.4 (see also **Chapter 8: Geology, Hydrology and Hydrogeology** for further assessment details). Only those communities where a GWDTE habitat was considered to be the dominant factor in that community's hydrological structure and function are mapped and included for assessment. Subsequently, those incidental potential GWDTE habitats within a wider non-GWDTE community/mosaic are not considered any further in this regard.

Peat Depth and Mire Condition Assessment

5.42 The site was surveyed in September 2013. Peat depths and data on surface vegetation were collected at 1,140 sample points located on a 100 m^2 systematic grid across the site (**Technical Appendix 5.6**, Figure 5.16).

5.43 Results show that peat depths are generally shallow throughout the site, with areas over 0.5 m deep located in the east and southeast of the site. 167 samples (14.7%) fell on land with more than 0.5 m depth of peat. Thirteen samples (1.1%) fell on land with more than 1 m depth of peat.

5.44 A total of 591 samples (51.8%) fell on land with solely mineral soils (mineral soils recorded as zero peat depth).

5.45 Areas where peat depth is greater than 0.5 m are largely restricted to small areas within the extensive conifer plantation and do not form part of an overall coherent and connected mire complex.

5.46 The mire condition study also utilised information regarding dominant vegetation and *Sphagnum* abundance, and signs of anthropogenic influence to gauge the current status of the habitat across the site.

5.47 In general, the mire habitats across the site were seen to be highly degraded, reflected in a general absence of typical peatland species, such as hare's-tail cottongrass *Eriophogurm vaginatum* and *Sphagnum* moss species, across large areas. Similarly, the abundance of additional typical mire associates heather *Calluna vulgaris* and purple moor-grass is low and are absent across large areas.

5.48 Overall Sphagnum coverage is very low, with only three species recorded (S*phagnum capillfolium, S. fallax,* and *S. palustre*) across the site; none of which are of the broad-branched variety that are good for peat-forming.

5.49 The extensiveness of the mature forestry plantation has degraded the peatland habitats present and resulted in the loss of typical peatland species in many areas or reduced their abundance to very low

[9] SEPA (2014): Guidance Note 31 - Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems

levels as found through the surveys of surface vegetation characteristics and features. Peat erosion is present throughout the site in both planted and unplanted peat-based areas (16% of peat-based samples), but is more common in planted areas.

5.50 It is considered that the bog habitats have suffered mainly from historical and prolonged drainage associated with the Dykeraw Plantation, which has resulted in a lowered water table across this area and the subsequent lowered abundance and even loss of typical peatland species in many areas. Drains were more commonly than not classified as inactive and were within planted areas. These were most often forest drains or forest plough furrows which have largely occluded since planting of the forestry.

5.51 More information on peat depths is presented in **Chapter 8: Geology, Hydrology and Hydrogeology**.

Protected Species

Badger

5.52 Full details pertaining to the legal status of badgers are included within **Technical Appendix 5.3**.

5.53 Data received from The Wildlife Information Centre revealed several historic records of badger presence within the westernmost part of the site, around Cragbank Wood. Some "holes" were also recorded northwest of the site in open farmland. These records, all over 2 km from the nearest proposed turbine location, form part of an SNH database from 1970 to 2002.

5.54 Presence of badger was confirmed through the identification of a number of field signs across the site as well as several badger sett locations. Details of the survey results from 2013 to 2015 are detailed in **Technical Appendix 5.3** and **Confidential Figure 5.6**.

5.55 The Dykeraw forestry plantation has a predominantly shallow peat-based soil which is generally sub-optimal for badger setts. However, five of the six setts or sett complexes recorded during baseline surveys were located within the plantation. The forest rides may offer potential commuting routes and both rides and areas of clear-fell could offer moderate foraging potential. Badger trails were recorded leading into the clearfell from at least one sett.

5.56 The open ground across Highlee Hill, where one sett complex was recorded, is more suitable for badgers with a predominantly mineral based soil and a mixture of open farmland and forested patches offering suitable foraging opportunities.

5.57 In some cases, setts did not show any signs of recent use, whereas for others there were recent signs such as hairs, prints and bedding.

Bats

5.58 Full details pertaining to the legal status of bats are included within **Technical Appendix 5.4**. Bat survey information is detailed in Figures 5.8 to 5.15.

5.59 The Wildlife Information Centre provided no records of bat presence within 2 km of the site, with the closest records being a pipistrelle just over 2 km distant in 1992.

5.60 According to a search of the 'Scottish Leisler's Bat Project' database the nearest Nyctalus record is 23 km from the closest (2013) site boundary.

5.61 Surveys in 2012 within predominantly conifer plantation recorded the following bat species during the temporal and spatial surveys: common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared bats *Plecotus auritus*, plus *Pipistrellus* and *Myotis* sp. which could not be identified below genus level. The daytime inspection identified potential tree roost sites within the study area. These were surveyed during dusk and dawn emergence surveys and no roosts were found.

5.62 Surveys in 2013 within open farmland habitats in the north of the site recorded the following species during the temporal and spatial surveys: common pipistrelle, soprano pipistrelle, and brown long-eared bat, plus *Nyctalus* sp., *Pipistrelle* sp. and *Myotis* sp. The daytime inspection recorded potential tree roosts within the survey area but not within 200 m of any proposed infrastructure.

5.63 Relatively high numbers of bat passes were recorded during the 2012 and 2013 spatial (walked transect) surveys with a total rate of bat passes per hour (bpph) of 12.8 (conifer plantation) and 25.3 (open farmland) respectively, mainly the result of high numbers of pipistrelle bats commuting and feeding within the survey areas.

5.64 During the 2012 and 2013 temporal (static bat detector) surveys the total bpph activity levels for the survey area in 2012 were low (2.25) and in 2013 were medium (8.05).

5.65 The results of the 2012 spatial and temporal surveys show the highest concentration of fidelity to be in the eastern section of the site around Westshiels, Peden's Cleuch, Jed Water and Black Burn (see Figures 5.9 and 5.10). Bat numbers peaked in July for spatial surveys and peaked in June for temporal surveys.

5.66 The results of the 2013 spatial and temporal surveys show the highest concentration of fidelity in the northern section of the site parallel to linear plantations at Weasel Hill, Cleuch Burn Lustruther Strip and Spar Spike. Bat numbers peaked in June for spatial surveys and peaked in August for temporal surveys. Paired detectors showed that open areas had lower activity levels than edge habitat.

Otter

5.67 Full details pertaining to the legal status of otters are included within **Technical Appendix 5.3**.

5.68 Otter is a qualifying interest of the River Tweed SAC. Historic data received from The Wildlife Information Centre revealed one record of otter from 1999, along a section of the Black Burn over 500 m east of the site.

5.69 The presence of otter was confirmed through the identification of a number of separate sprainting locations during the 2013 surveys; however no evidence of breeding was recorded (**Technical Appendix 5.3** and Figure 5.5). Spraints were recorded along sections of the Jed Water and the Peden's Cleuch Burn, and a small tributary of the Battle Sike Burn in the western edge of the site. Additional field signs in the form of slides and footprints were recorded along sections of the Fell Burn and the Black Burn in the eastern end of the site.

5.70 Follow-up surveys in 2015 recorded one otter spraint east of Westshiels, along the upper reaches of the Jed Water.

5.71 It is likely that otter regularly use the Jed Water for foraging and commuting, particularly given the good population of fish recorded (see paragraphs 5.86-5.96). Smaller watercourses such as the Peden's Cleuch Burn or the Black Burn were assessed to be too small to support good fish populations and are thought to be used for commuting and/or resting up sites. It was also noted that sections of the Peden's Cleuch Burn may be suitable for otter resting up sites due to the steep banks, presence of cover, and the relatively lower disturbance from forestry operations.

Red squirrel

5.72 Full details pertaining to the legal status of red squirrel are detailed within **Technical Appendix 5.3**.

5.73 Data received from The Wildlife Information Centre revealed a number of historic red squirrel records within the site, and the species was the subject of advised management measures in the Ecological Audit for Dykeraw Forest in 2000. Most of the historic records provided by The Wildlife Information Centre were in the westernmost part around Cragbank Wood, but one record from 2000 was within the area of proposed infrastructure, and two further were in grid squares to the north of this (both were from 1991). Red squirrel sightings provided by Saving Scotland's Red Squirrels showed that the species is widespread across the Scottish Borders, with two records within and adjacent to the site in 2012-13.

5.74 Squirrel feeding signs from two locations within the plantation were also noted during the Extended Phase 1 survey in 2011 (**Technical Appendix 5.1**), although it could not be determined whether these belonged to red or grey squirrel.

5.75 No evidence of red squirrel presence was recorded during the 2013 or 2015 protected species surveys.

5.76 Much of the commercial forestry in the survey area is considered sub-optimal for drey building as the age-structure is not ideal - many of the trees are too small and there are large areas of clear-fell. It is also considered sub-optimal as a food source as there is little species diversity within the plantation, being comprised almost exclusively of Sitka spruce *Picea sitchensis,* often with limited cone crops.

5.77 However, due to the number of historical red squirrel records revealed in the desk study it is reasonable to assume that there may be red squirrel using the site, although probably infrequently and/or at low density. There appears to be good connectivity of woodlands in the local area so individuals based in other areas may be using the site occasionally.

Pine marten

5.78 Full details pertaining to the legal status of pine marten Martes martes are detailed within **Technical Appendix 5.3**.

5.79 Data received from The Wildlife Information Centre showed one record (from 2005) of pine marten approximately 2.7 km north of the site.

5.80 During the 2013 survey a number of possible pine marten scats were identified throughout the forested areas of the survey area, although at times identification was difficult due to scats being very old and without a noticeable smell, and differentiation with fox scats is often difficult in the field. Woodland is the preferred habitat of pine marten so it is unsurprising that the scats that were found were all either within or at the edge of the plantation. No pine marten evidence was recorded during follow-up surveys in 2015.

5.81 The woodland on site is generally sub-optimal for den construction so the site is unlikely to be used for den locations. However, the presence of possible scats throughout the site suggests the plantation may be used for both commuting and foraging.

Great crested newt

5.82 Full details pertaining to the legal status of great crested newt *Triturus cristatus* are included within **Technical Appendix 5.3**.

5.83 The Wildlife Information Centre did not have any historic records of great crested newt, although there were "newt" records at the westernmost edge of the site, and within 2 km to the north of the site.

5.84 During the Extended Phase 1 survey in 2011, only palmate newts were recorded in ponds within the survey area, but it was considered possible that given the nature of the habitat (i.e. a well-developed pond network within suitable terrestrial habitat), that great crested newt may also be present. Subsequently four of the waterbodies assessed in the survey area were judged to have a Habitat Suitability Index (HSI) score of between 0.7 and 0.79, which indicates 'good' pond suitability for great crested newts. These are located at Dykeraw Height and disused quarry sites at Flush Plantation within the forestry towards the north of the site.

5.85 The subsequent suite of presence/absence surveys in 2012 did not record any evidence of great crested newt, although palmate newts were regularly observed in reasonably large numbers, and smooth newts were recorded in one pond. Although great crested newts are often found with other types of newt, palmate newts can occur in ponds with no other newt species, and this appears to be the case within the site.

Fish

5.86 The Wildlife Information Centre provided historic data within 2 km of the site for the following species: Atlantic salmon *Salmo salar*, brown/sea trout *Salmo trutta*, European eel *Anguilla anguilla*, brook lamprey *Lampetra planeri* and unidentified lamprey species.

5.87 Brown trout and eel have been recorded along the Black Burn and Jed Water, with Atlantic salmon recorded near the confluence of the Jed Water and Black Burn, and further upstream within Carter Burn to the northeast of the site. Brown/sea trout was also recorded within one of the small tributaries of the Jed Water, south of the site.

5.88 Lampreys were recorded in Black Burn, Carter Burn and Jed Water, on the edge of the site boundary.

5.89 Timed and semi quantitative electrofishing surveys and a general fish habitat assessment of the burns were carried out by the Tweed Foundation in 2012 and are detailed within **Technical Appendix 5.5**. These surveys covered the Jed Water, Black Burn, and the Peden's Cleuch which drain from the site, and ultimately into the River Tweed. All the survey points were located within the site. The Black Burn and Peden's Cleuch each had one time electrofishing survey point, while the Jed Water had three survey points.

5.90 Atlantic salmon fry were recorded at all three time electrofishing survey points along the Jed Water (catch per unit efforts (CPUE) ranging from 13 - 17 fish/3 min). Each of these sample points was assigned a "Moderate" fish abundance category. Atlantic salmon were also recorded at the single electrofishing survey point along the Black Burn (a CPUE of 16 fish/3 min, and "Moderate" abundance category). Brown trout fry were recorded on both the Jed Water (CPUE value ranging from 2 - 18 fish/3 min) and the Black Burn (CPUE value of 8 fish/3 min). The abundance category assigned to the Jed Water samples ranged from "Low" to "High" while the sample at Black Burn was assigned the "Low" category.

5.91 Atlantic salmon parr were recorded in very low numbers at two sample locations along the Jed Water (CPUE of 1 fish/3 mins at both locations) and on the Black Burn (CPUE of 1 fish/3 mins). Brown trout parr were also recorded in very low numbers at two locations along the Jed Water (CPUE of 1 fish/3 mins) and on the Black Burn (CPUE of 1 fish/3 mins).

5.92 Lamprey were also recorded at all sample points along the Jed Water (CPUE ranging from 0.3 - 6.5 fish/min) and on the Black Burn (CPUE of 4.5 fish/min).

5.93 The results confirm the findings from the general habitat assessment, with habitat suitability classified as "Moderate" along both the Jed Water and Black Burn for Atlantic salmon fry. Both of

these watercourses afford suitable access for adult salmonids, relative to the Peden Cleuch, due largely to their larger channel size. However, these sites are likely to be in the upper range of adult spawning and therefore numbers may be quite variable from year to year.

5.94 In contrast the low numbers of trout fry recorded along the Jed Water and Black Burn is likely a result of the watercourses being too wide for trout spawning. Numbers are likely to be higher further upstream and in some of the nearby tributaries. One sample point along the Jed Water was assigned the "High" abundance category which indicates that a number of adult trout spawned in this locality in 2011. The Peden Cleuch site would appear to be too small for trout fry production, although spawning may have taken place further downstream on this watercourse where access may be easier for adult fish.

5.95 Salmonid parr were either absent or in low numbers at all sample points. This correlates with the shallow riffle habitat at the sample locations which is unsuitable for juvenile salmonids.

5.96 The presence of lamprey at four of the five surveyed sites was surprising as their preferred habitat (substrate of silt, sand and gravel) is conspicuously absent across large stretches of the recorded watercourses. The likelihood is that the sampled lamprey are resident brook lamprey and that the population recorded at the site is resident, stable, and self-sustaining.

Reptiles

5.97 Full details pertaining to the legal status of reptiles are included within **Technical Appendix 5.3**.

5.98 Data received from The Wildlife Information Centre showed several records of adder and common lizard, concentrated around the Cragbank and Wolfehopelee Woods area at the west of the site.

5.99 No evidence of reptile presence was recorded during the dedicated protected species surveys; however one incidental sighting of an adder was recorded during an ornithological survey. Furthermore, several areas of potential habitat were identified during the surveys, including small sections of dry heath, areas of open rock, and a number of dry stone walls in areas of the site (**Technical Appendix 5.3**).

Additional Fauna

5.100 **Water vole:** The desk study did not reveal any water vole records for the study area. No water voles were recorded within the survey area as suitable habitat is very limited across the site, with the majority of watercourses having unsuitable channel and bankside characteristics. In addition high levels of disturbance from farming activity and grazing lowers the suitability of any watercourses in the more open areas in the northern end of the site.

5.101 **Freshwater pearl mussels (FWPMs)***:* have been scoped out of the assessment, due to location of the site. The fish surveys revealed very low abundances of migratory salmonid parr along the watercourses. As this assessment considers salmonid species outwith the site but within the catchment area, the mitigation proposed for protecting those watercourses is considered equally suitable should FWPM be present in those areas.

5.102 Due to the lack of suitable habitat on site and likely absence, the above species will not be considered further in this assessment.

Future Baseline - The 'Do Nothing' Scenario

5.103 The site is comprised of habitats that are indicative of ongoing anthropogenic influence, namely commercial forestry within the majority of the site, and agriculture in the north. In the absence of the proposed wind farm, the site would continue to be modified by clear-felling and re-planting as part of the Dykeraw Forest Management Plan, and ongoing farming operations. It is likely that the existing habitats would prevail but at varying levels, reflecting the effects of current management across the site, in particular forest felling and replanting.

Design Mitigation

5.104 An iterative design process allowed the incorporation of various ecological constraints in order that potential impacts of the proposed wind farm can be prevented/minimised from the outset. This has resulted in minimising impacts on key habitat areas such as Annex I blanket bog (see Table 5.8 for habitat loss extent) and has also seen all watercourses on the site being avoided (except by water course crossings) by at least 70 m (a measure which reduces potential impacts to a number of ecological and non-ecological receptors).

5.105 GWDTEs have also been considered through the design process, with iterations to the infrastructure layout made to adhere to the SEPA (2014[9]) recommended buffer distances, where possible. Where infrastructure will be constructed in areas of habitat considered to be potentially highly groundwater dependent (likely limited to the area around Turbine 6, see Figure 5.4), suitable mitigation measures will be put in place, following SEPA (2014[9]) guidance (see **Chapter 2 Proposed Development** and **Chapter 8 Geology, Hydrology and Hydrogeology** for further details).

5.106 The design process has also avoided, where possible, areas of peat depth greater than 1.0 m (as measured in the Peat Depth Survey, refer to **Technical Appendix 5.6**). **Chapter 8 Geology, Hydrology and Hydrogeology** details this process further.

5.107 Two new watercourse crossings would be required as part of the track layout with a further 14 existing crossing requiring upgrade or replacement. These crossings would be designed to ensure that mammal movement is not restricted, and sized to ensure flood flows are not restricted. An example of the watercourse crossing design is shown in Figure 2.11.

5.108 The location of all badger setts and potential bat roosts have been avoided by at least 30 m and 200 m respectively, as per SNH guidance.

Potential Impacts

5.109 This section provides an assessment of the potential impacts of the proposed wind farm on the Valued Ecological Receptors (VERs) identified through baseline studies. The assessment is based upon the project description outlined in **Chapter 2: Proposed Development** and is structured as follows:

- Scoped-out receptors;
- Valued Ecological Receptors;
- Potential construction impacts;
- Potential operational impacts;
- Potential decommissioning impacts; and
- Cumulative impacts.

Scoped-out Receptors

5.110 Impacts on water vole, great crested newt and freshwater pearl mussel are scoped out of this assessment. Some limited areas of habitat were considered suitable for the above species, although no records were obtained during all baseline studies, suggesting these species are likely to be absent. A Draft Species Protection Plan is proposed in **Technical Appendix 5.7** which will ensure that all reasonably practicable measures are taken so that provisions of the relevant wildlife legislation are complied with in relation to these protected species, should any evidence be found in future.

5.111 Reptiles have also been scoped out of the assessment, as although presence was confirmed during baseline surveys, conifer plantations are only likely to support populations at very low density. The most important areas tend to be localised open spaces, such as forest ponds, forest tracks or clearfell areas, and these areas are unlikely to be affected by the proposed wind farm, and indeed increased habitat availability may result from the presence of infrastructure and tree clearing.

5.112 Although extensive across the site (Table 5.8), conifer plantation, felled conifer plantation, unimproved neutral grassland and improved grassland are species-poor and are considered to be of Negligible Nature Conservation Value, and therefore scoped out.

5.113 Based on the predicted extent loss for each habitat type (Table 5.8), the following habitats occupy such small areas within the site and the loss of habitat (if any occurs) is so minor that effects on them are scoped out of the assessment:

- Semi-improved neutral grassland, semi-improved acid grassland, broadleaved plantation woodland and unimproved acid grassland.

5.114 Running water (mapped as a linear feature, so not shown in habitat calculations) is included as a VER.

Table 5.8: Estimated loss of habitat (by area and % of habitat type) within the site

Habitat	Direct Habitat Loss (ha)	Relative Loss by Habitat within Study Area (%)	Direct and Indirect Habitat Loss (ha)	Relative Loss by Habitat within Study Area (%)
Coniferous plantation woodland*	12.07	47.39	26.23	45.12
Recently felled coniferous woodland*	7.50	29.44	13.73	23.62
Marsh/marshy grassland	0.78	3.05	1.91	3.28
Unimproved neutral grassland*	2.34	9.21	7.96	13.70
Improved grassland*	0.96	3.76	3.36	5.77
Bare ground*	1.29	5.06	3.77	6.48
Semi-improved acid grassland*	0.16	0.62	0.37	0.64
Blanket bog	0.05	0.21	0.09	0.16
Unimproved acid grassland*	0.03	0.13	0.09	0.15
Wet modified bog	0.06	0.24	0.16	0.27
Quarry*	0.15	0.59	0.15	0.26
Semi-improved neutral grassland*	0.04	0.16	0.18	0.31
Arable*	0.03	0.10	0.08	0.14
Broad-leaved plantation woodland*	0.01	0.05	0.06	0.10
Total Area (Ha)	25.47	100.00	58.14	100.00

Indirect habitat loss considers an area up to 10 m from the infrastructure which may be affected by changes in hydrological regimes, e.g. drying.

Impacts on the habitats with the superscript '*' have been scoped out of this assessment due to the minor nature of habitat loss involved and/or their low nature conservation value.

The maximum potential area of borrow pit extraction is considered in the calculations, but it is not anticipated that these areas would be fully exploited. At this point, the exact extent of borrow pit extraction cannot be defined, but it is not expected that all of the search areas would be utilised providing that sufficient volume and quality of suitable material can be found from the most optimal locations.

5.115 With the exception of the River Tweed SAC, all other designated sites are scoped out of the assessment, based on their lack of ecological or hydrological connectivity to the site (see Figure 5.1). Although the Borders Woods SAC, Cragbank and Wolfehopelee SSSI and NNR border the western site boundary, it is approximately 1.7 km from the closest infrastructure, and no connectivity is predicted. Timber felled in relation to construction of the proposed wind farm will be removed via the existing western site entrance. However, timber felled as part of the ongoing forest plan will be removed via the same exit even if the proposed wind farm is not consented. Therefore there would be no significant change from the "do nothing" scenario.

Valued Ecological Receptors

5.116 A summary of the Nature Conservation Value of the remaining VERs identified within the site is given in Table 5.9, together with the justification for inclusion.

Table 5.9: Nature Conservation Value of VERs within the site

Valued Ecological Receptor (VER)	Nature Conservation Value	Relevant Legislation/Guidance; Justification
River Tweed SAC	International	Designated for its European-level importance for Atlantic salmon, river, brook, and sea lamprey, otter and floating vegetation. Scoped in due to proximity to site, presence of qualifying interests and connectivity with many of the watercourses within the site.
Blanket Bog	Local	Blanket bog is listed as an Annex 1 Priority Habitat within the Habitats Directive and it is listed as a priority habitat on the UK BAP as well as the Scottish Borders LBAP. Blanket bog is restricted to two large patches across the summit and slopes of Highlee Hill and several small sections of forestry ride in the south-eastern end of the site. The blanket bog across the site is a relatively degraded example of the habitat with a low abundance and often absence of typical mire species. As such a Local Nature Conservation value is considered appropriate.
Wet Modified Bog	Local	The wet modified bog across the site is a relatively degraded example of blanket bog habitat. Despite the association with Annex 1 habitat, the habitat is degraded to an extent that assigning value higher than Local is not deemed appropriate.
Marshy grassland	Local	A large area of the non-forested open ground on site falls under the M23a Juncus effusus/acutiflorus-Galium palustre rush-pasture NVC community type that is listed on the UK BAP. Rush pasture has a Habitat Action Plan within the Scottish Borders LBAP. M23a is classified as a potentially highly GWDTE. M25b Molinia caerulea – Potentilla erecta mire is included as part of the Annex I habitat Blanket Bog description, where capable of natural regeneration. These areas are associated with the open ground across Highlee Hill and also along several watercourses. Given its widespread nature within the region, but inclusion in the LBAP and UKBAP this is assigned a Local nature conservation value.

Valued Ecological Receptor (VER)	Nature Conservation Value	Relevant Legislation/Guidance; Justification
Running Water and fish	Regional	Rivers and burns are listed on the Scottish Borders LBAP, and Atlantic salmon, brown trout and lamprey are listed in the Scottish Biodiversity List and Scottish Borders LBAP. Atlantic salmon and lamprey are listed under Annex II and V of the EC Habitats Directive. Atlantic salmon and brown trout fry, as well as lamprey were recorded along stretches of burns within the site. The potential for Atlantic salmon to be using the Jed Water as spawning grounds, combined with the fact the burns drain into an internationally designated site, means the habitat is assigned a Regional nature conservation value.
Otter	Local	Otter is listed in Annex II of the EC Habitats Directive, and are on the Scottish Biodiversity List and Scottish Borders LBAP Priority Species list. The current increasingly favourable conservation status of the species within Scotland is also noted. In light of this, their nature conservation value within the study area is considered to be Local, with no evidence of breeding recorded.
Bats	Local	Bats are listed on Annex II of the Habitats Directive, and fully protected through the Habitats Regulations. Bats are also categorised under "Avoid Negative Impacts" on the Scottish Biodiversity List. Activity of five bat species was confirmed on the site, although no roosts were identified. Their Nature Conservation Value across the site is assessed to be Local.
Badger	Local	Badgers are protected under the Protection of Badgers Act 1992 (as amended by the Nature Conservation (Scotland) Act 2004 (as amended)). Badger populations are widespread across Scotland; therefore their nature conservation status within the study area is considered to be Local.
Pine marten	County	Pine marten is a Schedule 5 species on the Wildlife and Countryside Act (1981) (as amended) and the Nature Conservation (Scotland) Act 2004 (as amended). Pine marten is also listed on the Scottish Biodiversity List and Scottish Borders LBAP. Pine marten populations are slowly increasing across Scotland, including into the Scottish Borders (JNCC, 2007[10]); however anthropogenic factors continue to limit this increase from an already depleted population. Pine marten presence on site is probable and it is thought the species may use the site for foraging and commuting purposes. However, as no dens were found, pine marten is considered to be of County nature conservation value.
Red squirrel	Local	Red squirrels are protected under the Wildlife and Countryside Act 1981 (as amended) and the Nature Conservation (Scotland) Act 2004. Red squirrels are also listed on the Scottish Biodiversity List and Scottish Borders LBAP. The forested habitat within the site is sub-optimal for drey building and foraging. However, with historic data within the site, a nature conservation value of Local is assigned to this species.

Potential Construction Impacts

5.117 The most tangible effect during the construction stage of the proposed wind farm will be direct habitat loss due to infrastructure placement, although some indirect habitat loss due to drainage effects, changes to the hydrological regime or pollution may also occur. Table 5.8 details the estimated relative losses expected to occur, by habitat type, for all infrastructure.

5.118 For mammal species, disturbance caused by construction and decommissioning activities may also pose a risk.

5.119 The following sections assess the effect of these losses for each VER.

Marshy Grassland

5.120 Marshy grassland (NVC categories M23a, M23b and M25b) is considered to be of Local nature conservation value and is the dominant habitat across the open ground in the north of the site around Highlee Hill, where infrastructure associated with Turbine 6 would be located. The habitat has a variable species composition but mostly consists of a dominance of either rush species, including soft rush and sharp-flowered rush, or purple moor grass. A total of 0.78 ha is predicted to be directly impacted by the proposed wind farm, which increases to 1.91 ha when including unmitigated indirect impacts (a 10 m drainage buffer).

5.121 Whilst M23a and M23b is technically classed as a potentially highly GWDTE, the slope and the presence of till in the area suggests that the NVC community is ombrogenous in nature (possible locally-perched water table) and there is limited potential for interaction with groundwater resources within the bedrock geology. It has also been drastically modified by drainage ditches and cuttings to drain the area, which suggests that the area is of low sensitivity (see **Chapter 8: Geology, Hydrology and Hydrogeology** for further details).

5.122 When considering the above, and accounting for the relative poor quality of the habitat, and abundance within the wider area, an impact of **Negligible** spatial and Long Term temporal magnitude is assigned.

5.123 The overall effect significance is therefore considered to be **Negligible** and **Not Significant** in the context of the EIA Regulations.

Blanket Bog and Wet Modified Bog

5.124 Blanket bog (NVC categories M17a, M19a and M20) is restricted to two large patches across the summit and slopes of Highlee Hill and several small sections of forestry ride in the south-eastern end of the site. In general, the results of the surface vegetation characteristic assessment showed that mire habitats across the site are highly degraded, and often lack a variety of typical peatland species.

5.125 There is a marked degree of variation in species richness across this habitat which is reflected in the varying abundances of the dominant vascular species. Hare's-tail cottongrass is a regular throughout the habitat but separate distinct areas are distinguished by local abundances of either deer grass, or common heather. Furthermore, certain areas of this habitat are characterised by an almost exclusive dominance of hare's-tail cottongrass. The composition of the basal layer varies throughout but is mostly comprised of a mixture of *Sphagnum* mosses including *S. capillifolium* and *S. palustre*, and non-Sphagnum mosses.

5.126 Wet modified bog (M25a) is restricted to several sections of forestry ride in the south-eastern end of the site and was also recorded in one small patch in the eastern edge of the site. The species composition of the habitat varies little across its extent, consisting of a dominance of purple moorgrass, alongside typical mire associates including wavy hair-grass, cross-leaved heath, and tormentil. Common heather was also recorded in isolated patches. The associated basal layer consists of a patchy carpet of *Sphagnum capillifolium, S. cuspidatum, S. palustre*, and *Polytrichum commune*.

[10] Joint Nature Conservation Committee. 2007. Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Conservation status assessment for : S1357: Martes martes - Pine marten. Available from: www.jncc.gov.uk/article17

5.127 A total of 0.11 ha (less than 1 % of the total habitat area loss) of blanket bog and wet modified bog is predicted to be directly impacted by the proposed wind farm, which increases to 0.25 ha when including a 10 m drainage buffer.

5.128 When considering the above, and accounting for the localised distribution and relative poor quality of the habitat, an impact of **Negligible** spatial and Long Term temporal magnitude is assigned.

5.129 The overall effect significance is therefore considered to be **Negligible** and **Not Significant** in the context of the EIA Regulations.

Running Water and Fishes

5.130 Running water and fish are considered to be of Regional nature conservation value and are assessed here as part of the wider countryside interest. The assessment of the River Tweed SAC is conducted separately under the HRA process.

5.131 The main potential impacts during construction would be habitat loss, changes to the hydrological regime, pollution to, or realignment of the watercourses which would affect fish populations. The design process of the proposed wind farm has considered these effects and a buffer of at least 50 m from watercourses has been created around all infrastructure (excluding watercourse crossings). There will therefore be no direct habitat loss of running water habitat, although there is still some potential for watercourses to become degraded as an indirect result of the construction activities, through pollution to the watercourses on site and increased sedimentation from groundworks. The greatest risk of such pollution would occur around the watercourse crossing points.

5.132 There are 13 existing watercourse crossings that will be upgraded and two new water crossings proposed. Where river crossings are proposed the Scottish Executive (2000[11]) guidance will be considered. The extent of impact on these watercourses and associated fish populations is likely to be small and short-term in nature, and as such the magnitude of disturbance to these receptors is assessed as **Low** both spatially and temporally.

5.133 The overall effect significance on running water and fishes is therefore considered to be **Minor adverse** and **Not Significant** under the terms of the EIA Regulations.

Badger

5.134 Badger is considered to be of Local nature conservation value, and presence was confirmed through the identification of field signs across the site as well as several sett locations.

5.135 The main impacts to this VER will be the potential destruction of setts, construction disturbance and also habitat alteration due to felling of sections of the Dykeraw forestry plantation.

5.136 The proposed wind farm design process has taken into consideration the location of badger setts across the site, and as such none are located within SNH's prescribed 30 m stand-off distance from proposed turbine locations (no piling work is required, which would necessitate a larger buffer distance). There will therefore be no direct habitat loss for setts. Some territory and foraging habitat may be lost due to the presence of infrastructure, particularly in open farmland around Turbine 6. However, the presence of new access track and forest felling associated with the proposed wind farm may in time provide greater opportunities for ranging and foraging than the current situation. Construction disturbance is unlikely to significantly affect badgers since the baseline levels of human activity are already relatively high, with farming and forestry occurring across the site. Impacts during construction are therefore considered to be of **Low** magnitude both spatially and temporally.

5.137 The overall effect significance on this VER of Local nature conservation value is considered to be **Minor adverse** and **Not Significant** under the terms of the EIA Regulations.

Otter

5.138 Within the context of the wider countryside interest, otter is considered to be of Local nature conservation value. The assessment of the species, within the context of the River Tweed SAC is conducted separately under the HRA process.

5.139 No protected features (couches or holts) were identified within the site. There was evidence of otter commuting along the Jed Water and several of its tributaries including the Peden's Cleuch Burn and Black Burn.

5.140 Unmitigated, the main impacts to this receptor will therefore likely be direct disturbance, or pollution to the watercourses which may render them uninhabitable to the resident fish stocks, thus reducing the foraging potential of these watercourses for otter. As mentioned above, watercourses have been avoided by at least 50 m, excluding crossing points. New crossing points would be located at minor tributaries of the main watercourses within and adjacent to the site, and so are unlikely to be important areas for otter. Upgraded water crossing locations may be used more frequently.

5.141 Construction disturbance is unlikely to significantly affect otter since the baseline levels of human activity are relatively high, with farming and forestry occurring across the site. There is however a possible unmitigated risk of death or injury to individuals due to vehicles, machinery or earthworks close to watercourses.

5.142 Direct or indirect impacts on otter during construction are therefore considered to be of **Low** magnitude both spatially and temporally.

5.143 The overall effect significance is considered to be **Minor adverse** and **Not Significant** under the terms of the EIA Regulations.

Red Squirrel

5.144 Red squirrel is considered to be of Local nature conservation value. Historic data have shown that red squirrel has been present within the site, although the current situation is unclear, with ongoing forestry operations potentially limiting habitat suitability. It has therefore been assumed that the VER may be present, albeit infrequently or at a low density.

5.145 The main impact to this receptor will be habitat alteration and displacement due to the felling of sections of Dykeraw Forest for the proposed wind farm. Much of the habitat in the site is considered sub-optimal for drey building as the age-structure is not ideal as many of the trees are too small, have little cone crop, and there are large areas of clear-fell. Therefore increased felling, additional to that planned for the current site felling plan, is considered to be of **Negligible** magnitude both spatially and temporally.

5.146 The overall effect significance is considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations. The species is therefore not considered further in this assessment in relation to construction activities.

[11] Scottish Executive (2000 River Crossings and Migratory Fish. http://www.scotland.gov.uk/Topics/marine/science/Publications/publicationslatest/rivercrossings

Pine marten

5.147 Pine marten is considered to be of County nature conservation value. The main impact to this VER will be habitat alteration and displacement due to the felling of sections of the Dykeraw Forest. The presence of pine marten was considered possible due to the presence of a series of unconfirmed scats at separate locations within the forested areas of the site, plus a historic record in the wider area. No dens were identified within the site and the Dykeraw forestry plantation is assessed as being largely unsuitable for den building.

5.148 As the site is likely to be sub-optimal for the species, individuals are only likely to be present infrequently or at low density, and so disturbance and habitat loss during construction is considered to be of Negligible magnitude both spatially and temporally, over and above current forestry operations.

5.149 The overall effect significance is considered to be **Minor adverse** and **Not Significant** under the terms of the EIA Regulations.

Bats

5.150 Bats are considered to be of Local nature conservation value.

5.151 Within the conifer plantation across the site, the following bat species were recorded in flight: common pipistrelle, soprano pipistrelle, brown long-eared bat, plus *Pipistrellus* and *Myotis sp*. which could not be identified below genus level. Within open farmland in the north of the site, *Nyctalus* sp. was also recorded. No roosts were identified within 200 m of any proposed infrastructure (as per extent recommended in Hundt (2012[12]).

5.152 The main potential impact on bats during construction is likely to be loss of foraging and commuting habitat. The proposed wind farm construction will result in some forest felling, but may also open up previously inaccessible edges of plantation for foraging opportunities. The overall habitat suitability for bats is therefore not predicted to change significantly as a result of construction, and the magnitude of impact is considered to be **Negligible** both spatially and temporally.

5.153 The overall effect significance is considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

River Tweed SAC

5.154 The assessment of the River Tweed SAC is conducted under the HRA process (see Assessment Methodology section for further details).

5.155 The SAC comprises sections of the Jed Water and the Black Burn which borders the eastern side of the site. Other smaller non-designated watercourses within the site may also flow into the SAC, and are also considered here.

5.156 The design process of the proposed wind farm has considered potential impacts on watercourses and the closest turbine location will be 750 m from the SAC, which is likely to avoid any direct disturbance, or pollution events, including via forestry felling activities. A proposed turbine location (T8) is within 150 m of a smaller part of the Jed Water, which although not part of the SAC, flows into it 1.5 km downstream. Nevertheless, it is unlikely that any SAC qualifying interest will be affected at this distance from the turbine, and the SAC. As outlined above in the wider countryside assessments of running water and fish, and otter, there will be 14 upgraded water crossings and two new crossings, where there is the theoretical possibility for unmitigated construction activities to affect watercourses that flow into the SAC, or kill/injure individuals. All crossings are over minor tributaries unlikely to be important for populations of fish species, or otter. As such, any construction activity or pollution events are likely to be localised. If no mitigation measures are prescribed, a Likely Significant Effect cannot be ruled out. Suitable mitigation measures will however be enforced, and these are considered in the Mitigation section.

Potential Operational Impacts

Marshy Grassland, Blanket Bog and Wet Modified Bog

5.157 During the operational period, the wind farm infrastructure would not cause any further loss/disturbance to habitats beyond that identified during the construction period, and the impact is therefore considered to be of **Negligible** magnitude for each VER.

5.158 The overall effect significance is considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Running Water, Fishes and Otter

5.159 During the operational period, a risk exists that pollution would occur to the watercourses within the site from any maintenance activities that would be required. As outlined in the Potential Construction Impacts section, all infrastructure would be located at least 50 m from any watercourse, except from crossing points. Any maintenance activity associated with crossing points is likely to be small-scale and short-term in nature, and so any unmitigated indirect impacts through pollution are likely to be of **Negligible** magnitude both spatially and temporally.

5.160 The overall effect significance is considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Badger

5.161 During the operational period, a risk exists that disturbance to a sett during maintenance activities may lead to displacement of the species. The layout design process has however ensured that all known setts are located at least 30 m from proposed turbine locations and so this risk is considered to be minimal. Any unmitigated disturbance impacts are therefore likely of **Negligible** magnitude both spatially and temporally.

5.162 The overall effect significance is considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations.

Bats

5.163 Foraging and commuting bats may be at risk from collisions with rotating turbine blades or other infrastructure during the operational period.

5.164 Of the five species recorded during baseline surveys, *Myotis* spp. and brown long-eared bats are assessed by Natural England (2014[13]) guidance to be of low risk in terms of collision risk and threats to national populations. Common and soprano pipistrelle bats are assessed to be of medium risk in terms of collision although they are of low risk in terms of any threat to national populations. Noctule bats are considered to be high risk both in terms of collision and national populations.

[12] Hundt (2012) Bat Surveys: Good Practice Guidelines, 2nd edition, Bat Conservation Trust.

[13] Natural England (2014) Natural England Technical Information Note TIN 051. Bats and Onshore Wind turbines - Interim Guidance, Edition 3

5.165 *Myotis*, brown long-eared bat and pipistrelles regularly fly at low heights, typically less than 25 m and, assuming that their behaviour is not modified by the presence of turbines, then the potential impact risk is considered to be low.

5.166 *Nyctalus* species are relatively more active at a height of 30 m (Collins & Jones, 2009[14]). *Nyctalus* sp. were recorded in open habitat in sufficiently low numbers (a total of nine passes, 0.01 bpph) to suggest that bats are only present within the north of the site very infrequently, and so the risk to bats around T6 is low.

5.167 The spatial and temporal magnitude of impacts on the populations of these species across the site is therefore considered to be **Low** spatial and **Long Term** temporal. This would result in an overall **Minor adverse** and **Not Significant** effect in the context of the EIA Regulations.

Pine Marten and Red Squirrel

5.168 Any maintenance activity is likely to be small-scale and short-term in nature within the context of baseline forestry activity levels, and so any unmitigated indirect impacts are likely of **Negligible** magnitude both spatially and temporally.

5.169 The overall effect significance is considered to be **Negligible** and **Not Significant** under the terms of the EIA Regulations for both VERs.

River Tweed SAC

5.170 As identified for running water, fishes and otter, operational impacts associated with maintenance activities are likely to be localised and short-term in nature, with only those associated crossing points having the potential to impact on watercourses. A negligible magnitude of impact on SAC qualifying interests during the operational period is therefore predicted.

5.171 In light of the above information it is considered that there are **no Likely Significant Effects** predicted on the River Tweed SAC during the operational period.

Potential Decommissioning Impacts

5.172 Decommissioning effects, because of the long timeframe until their occurrence (>30 years) are difficult to predict with any confidence. They are however considered for the purpose of this chapter to be similar to those of construction effects in nature, but are likely to be of shorter duration (up to 12 months). The significance of effects predicted for each VER in the Potential Construction Impacts section are therefore considered appropriately precautionary for assessing decommissioning effects.

5.173 A Species Protection Plan, similar to that outlined in **Technical Appendix 5.7** for the construction phase would be implemented during decommissioning of the proposed wind farm.

5.174 Implementation of appropriate Good Practice Measures will occur across the site as standard, similar to those planned for the construction phase.

Mitigation

5.175 No significant unmitigated effects on VERs within the context of the wider countryside have been predicted. Likely Significant Effects on the River Tweed SAC however could not be ruled out during the construction phase. A number of mitigation measures are proposed in order to reduce the likelihood of any significant effects, to be implemented at various stages of the proposed wind farm, as follows:

Measures Prior to Construction and Decommissioning

5.176 Arrangements for pre-construction ecological monitoring and baseline water quality monitoring will be set out in a draft Construction Method Statement (CMS). The draft CMS will ultimately require to be approved by the planning authority in consultation with SNH and SEPA.

Mitigation during Construction and Decommissioning

5.177 Pollution prevention, mitigation measures and arrangements for ecological and water quality monitoring during construction would also be set out in the draft CMS. These aspects of the draft CMS should be monitored by a suitably qualified Ecological Clerk of Works (ECoW).

5.178 The ECoW would also be required to advise and supervise, where appropriate, and would have the power to stop works at any stage should it be deemed necessary. The following mitigation is required:

Mammal Protection / Disturbance Reduction

5.179 Good practice measures would be implemented throughout the construction and decommissioning phases in order to minimise the risks associated with a construction/decommissioning site on all wild animals in line with SNH guidance.

- A Species Protection Plan will be agreed with the Local Authority, in consultation with SNH, and agreed prior to construction commencement (**Technical Appendix 5.7** for the draft Species Protection Plan);
- Night time working will be minimised to reduce disturbance to nocturnal and diurnal fauna. Where this is not possible, directional lighting away from features (including mammal paths) will be used to minimise light disturbance;
- A speed limit of 15 mph for all vehicles will help to reduce disturbance and mortality to protected species;
- Watercourse crossings will be designed to allow the passage of fish and small mammals in the site where appropriate.
- Badger setts within the site will be protected by a 30 m protection zone, demarcated using coloured tape, or something of similar visible marking prior to commencement of works. A licence to disturb badgers from SNH will not be required if this buffer distance is maintained.
- As per Natural England (2014[13]) guidance, a minimum 50 m separation between turbine blade tips and the nearest tree line will be maintained. This will reduce the collision risk for bat species using the site.
- Monitoring of salmon fry and lamprey would be conducted, as recommended by the Tweed Foundation as a best practice measure. It is recommended that the same sample locations from the baseline survey are used. The surveys would be conducted periodically throughout the life of the proposed wind farm. The methodology for these surveys would be detailed in the CMS and agreed with SNH prior to commencement of construction. The results of these surveys would provide information regarding status of the water quality in addition to the water quality monitoring proposed in **Chapter 8 Geology, Hydrology and Hydrogeology**.

[14] Collins J. & Jones G. (2009) Differences in bat activity in relation to bat detector height: implications for bat surveys at proposed wind farm sites. Acta Chiropterologica 11: 343-350.

Mitigation during Operation

5.180 No unmitigated significant effects are predicted during the operational period, and so mitigation measures are required.

Assessment of Residual Effects

5.181 This section provides an assessment of the residual effects of the proposed wind farm on the VERs, taking into account mitigation measures outlined above.

5.182 For all wider-countryside VERs, no unmitigated significant effects were predicted during the construction, operation or decommissioning phases, and significance was rated as either Minor adverse or Negligible. When considering the above mitigation measures, the significance of these effects either remain **Minor adverse**, or can be reduced to **Negligible** for each VER.

5.183 For the River Tweed SAC, Good Practice measures to avoid pollution incidents near watercourses, and implementing measures to avoid disturbance, injury or death to otters during construction will ensure that **no Likely Significant Effects** on the SAC will result from the proposed wind farm.

Cumulative Effects

5.184 The proposed wind farm is located within the Border Hills NHZ, and there are no operational wind farms within 20 km of the site. There are some projects >5 MW currently within the planning process that are in comparable habitats:

- **Wauchope - Newcastleton**: up to 70 turbines (Wauchope East and West sections) plus up to 20 turbines (Newcastleton section). The Wauchope section is within conifer plantation directly adjacent to the south of the site. Scoping report submitted in December 2015. Potential VERs affected are likely to be similar to that associated with the proposed wind farm. The project site overlaps with the Kielderhead Moors: Carter Fell to Peel Fell SSSI, the Border Mires, Kielder - Butterburn SAC, Kielder Mires SSSI, Kielderhead and Emblehope Moors SSSI and Kielderhead NNR, the River Tweed SAC and SSSI, and is adjacent to the Borders Woods SAC.
- **Birneyknowe**: up to 15 turbines, 3.9 km northwest of the site. In planning with further environmental information expected in Summer 2016. Main ecological impacts identified are on Buckstruther Moss SSSI which lies wholly within the application boundary and Adderstonlee Moss SSSI which is located approximately 180 metres west of the site. Both are designated for their basin fen - a habitat type that is not affected by the proposed wind farm.
- **Windy Edge**: revised layout of up to nine turbines. 9.1 km southwest of site. Appeals decision pending. Main ecological concerns identified through consultation, outlined in the Environmental Statement Addendum are for blanket bog, which is unaffected by the proposed wind farm.

5.185 The information presented above suggests that no cumulative impacts are likely, with ecological receptors identified at Birney Knowe and Windy Edge not being found within the proposed wind farm site. There is insufficient information on Wauchope – Newcastleton Wind Farm to conduct a detailed assessment, but nature, and magnitude of impacts are likely to be similar to that for the proposed wind farm, and therefore Not Significant, alone or cumulatively.

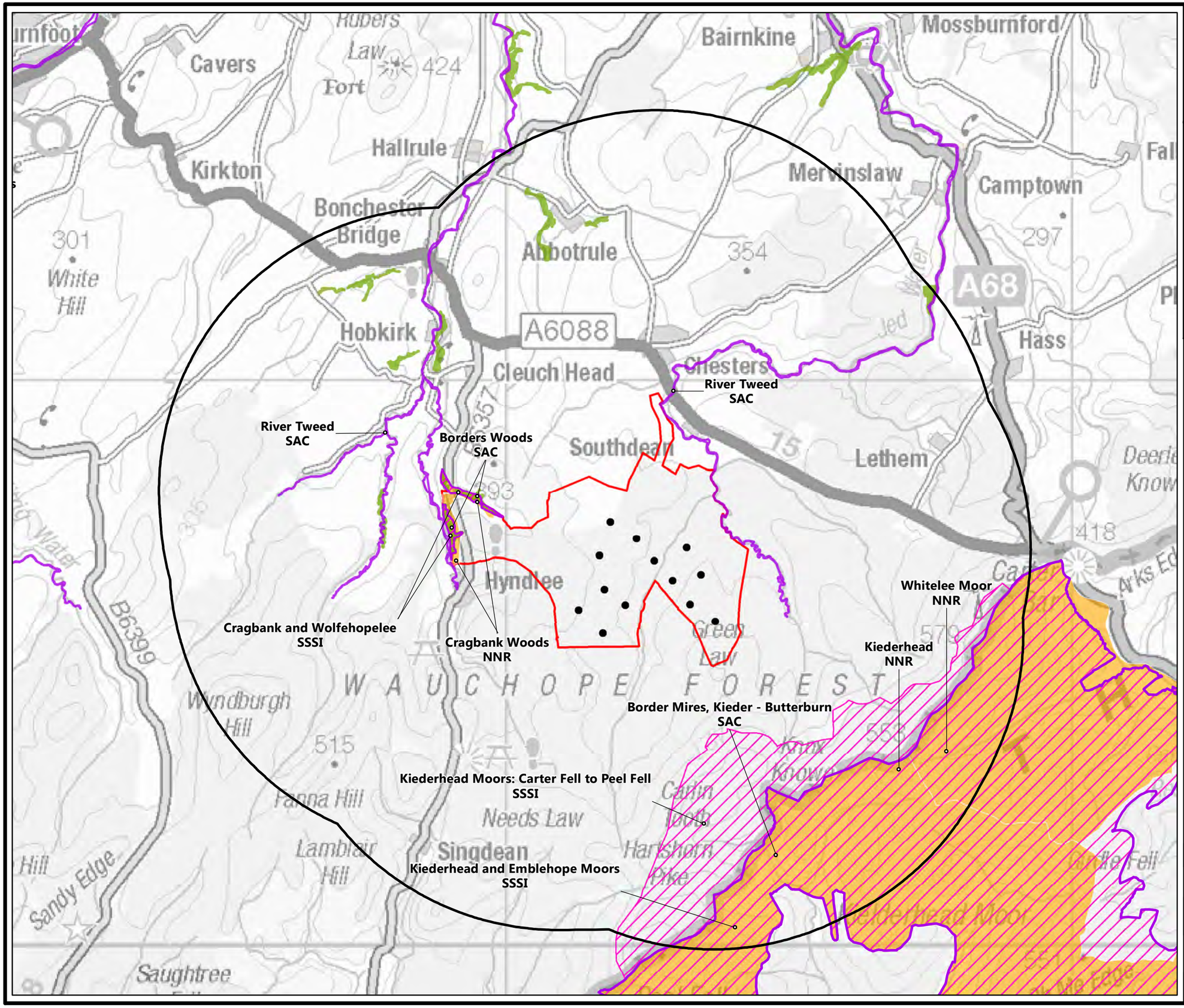
5.186 The main other activity within the area is commercial forestry operations, which is a long-established industry, and therefore accounted for in baseline results as well as other regional survey programme results. Locally, forestry operations at Dykeraw will likely continue throughout the construction and operational periods of the proposed wind farm, but it is considered unlikely that both activities occurring at the same time will significantly alter the presence and abundance of VERs over the long-term. No cumulative impacts over and above the significance of effects identified for the proposed wind farm alone are therefore predicted.

Summary

5.187 A summary of the predicted significance of unmitigated impacts, associated mitigation and residual effects is presented in Table 5.10 for each VER

Table 5.10: Summary of Potential Impacts of the Proposed Wind Farm, Mitigation and Residual Impacts

Potential Impact	Significance of Effect	Mitigation	Residual Effect
Construction and Decommissioning			
Marshy grassland	Negligible	Good Practice construction measures	Negligible
Blanket bog	Negligible		Negligible
Wet modified bog	Negligible		Negligible
Running water and fishes	Minor adverse	Good Practice construction measures, SPP	Minor adverse
Otter	Minor adverse		Minor adverse
Badger	Minor adverse		Minor adverse
Red squirrel	Negligible		Negligible
Pine marten	Minor adverse		Minor adverse
Bats	Negligible		Negligible
River Tweed SAC	Likely Significant Effect		No Likely Significant Effects
Operation			
Marshy grassland	Negligible	None required	Negligible
Blanket bog	Negligible	None required	Negligible
Wet modified bog	Negligible	None required	Negligible
Running water and fishes	Negligible	None required	Negligible
Otter	Negligible	None required	Negligible
Badger	Negligible	None required	Negligible
Red squirrel	Negligible	None required	Negligible
Pine marten	Negligible	None required	Negligible
Bats	Minor adverse	Set-back distance of trees from turbines	Minor adverse
River Tweed SAC	No Likely Significant Effects	None required	No Likely Significant Effects



HIGHLEE HILL WIND FARM

FIG 5.1

ECOLOGICAL DESIGNATED SITES WITHIN 5 KM

© SCOTTISH NATURAL HERITAGE. CONTAINS ORDNANCE SURVEY DATA © CROWN COPYRIGHT AND DATABASE RIGHT 2016, CONTAINS ORDNANCE SURVEY DATA © CROWN COPYRIGHT AND DATABASE RIGHT 2016

- Turbine Location
- Site Boundary
- 5 km Distance Band
- Special Area of Conservation (SAC)
- National Nature Reserve (NNR)
- Site of Special Scientific Interest (SSSI)
- Ancient Woodland

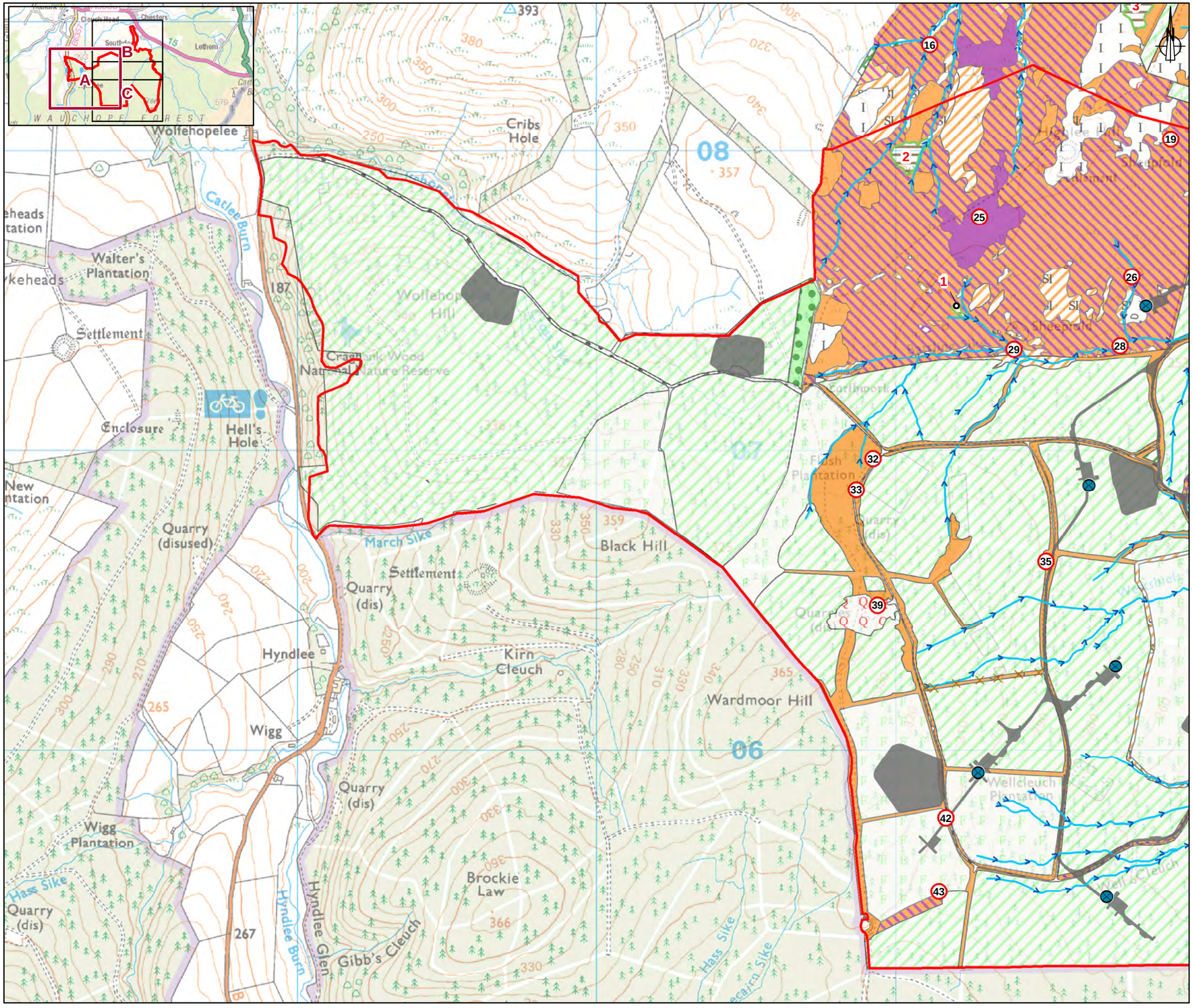
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER: ES_E_Fig5.1_DS_HIH

SCALE - 1:65,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.2A

PHASE 1 HABITAT SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Broad-leaved Plantation Woodland (A1.1.2)
- Coniferous Plantation Woodland (A1.2.2)
- Mixed Semi-natural Woodland (A1.3.1)
- Dense/Continuous Scrub (A2.1)
- Recently Felled Coniferous Woodland (A4.2)
- Unimproved Acid Grassland (B1.1)
- Semi-improved Acid Grassland (B1.2)
- Unimproved Neutral Grassland (B2.1)
- Semi-improved Neutral Grassland (B2.2)
- Improved Grassland (B4)
- Marsh/Marshy Grassland (B5)
- Wet Dwarf Shrub Heath (D2)
- Wet Heath/Acid Grassland Mosiac (D6)
- Blanket Bog (E1.6.1)
- Wet Modified Bog (E1.7)
- Quarry (I2.1)
- Bare Ground (J4)
- Phase 1 Habitat Mosaic*
- Running Water (G2)
- Dense/Continuous Scrub (A2.1)
- Continuous Bracken (C1.1)
- Target Note

*Mosaic Code	Mosaic Description
1	Semi-improved acid grassland/Marshy grassland mosaic
2	Semi-improved neutral grassland/Marshy grassland mosaic
3	Improved grassland/Marshy grassland mosaic
4	Marshy grassland/Wet modified bog mosaic

LAYOUT DWG: 02836D0002-11

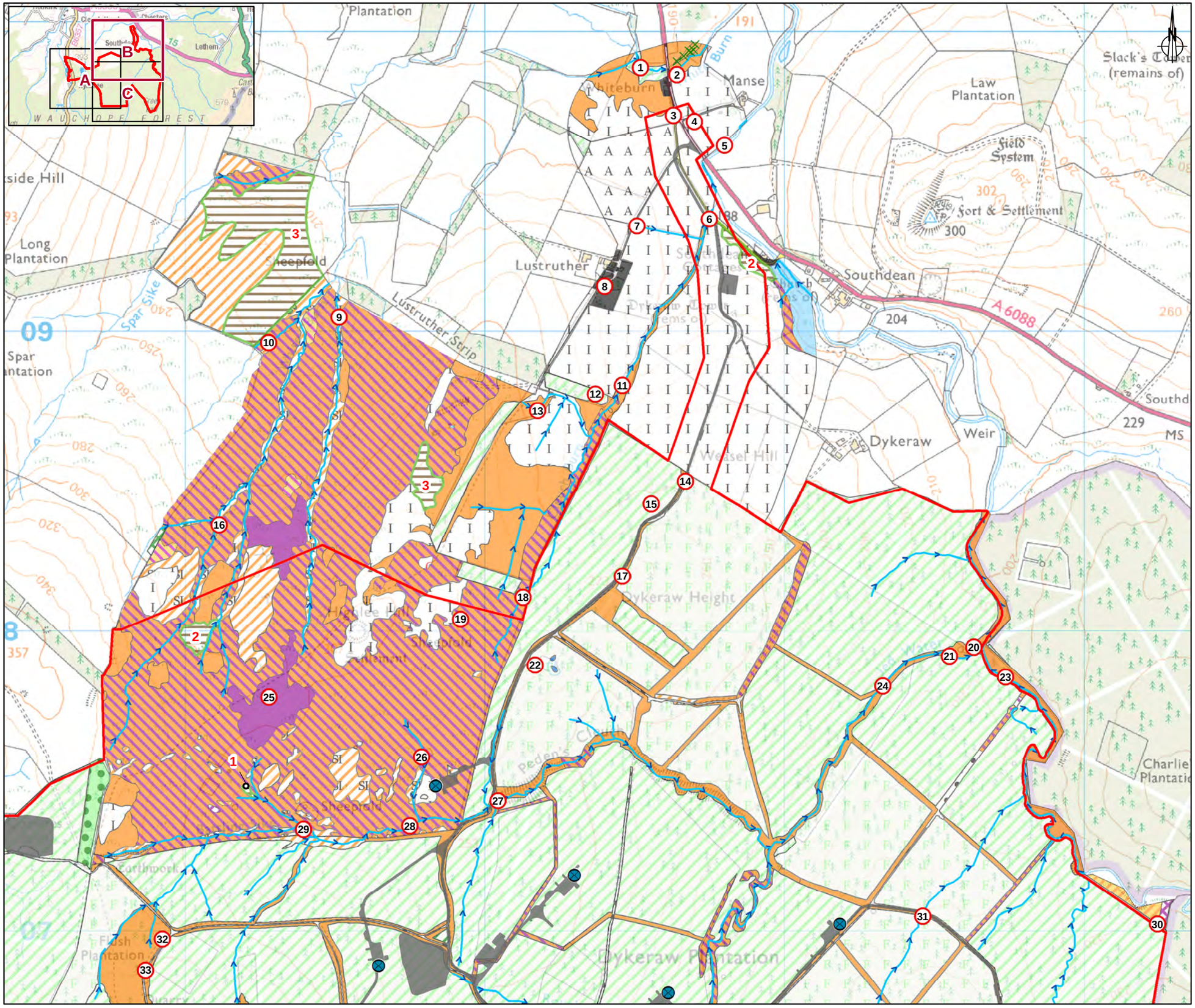
T-LAYOUT NO.: PSCOhhi041

DRAWING NUMBER: ES_E_Fig5.2A_Phase1_Habitat_HIH

SCALE - 1:12,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL
WIND FARM

FIG 5.2B

PHASE 1 HABITAT
SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Broad-leaved Plantation Woodland (A1.1.2)
- Coniferous Plantation Woodland (A1.2.2)
- Mixed Semi-natural Woodland (A1.3.1)
- Dense/Continuous Scrub (A2.1)
- Recently Felled Coniferous Woodland (A4.2)
- Unimproved Acid Grassland (B1.1)
- Semi-improved Acid Grassland (B1.2)
- Unimproved Neutral Grassland (B2.1)
- Semi-improved Neutral Grassland (B2.2)
- Improved Grassland (B4)
- Marsh/Marshy Grassland (B5)
- Wet Dwarf Shrub Heath (D2)
- Dry Heath/Acid Grassland Mosiac (D5)
- Wet Heath/Acid Grassland Mosiac (D6)
- Blanket Bog (E1.6.1)
- Wet Modified Bog (E1.7)
- Swamp (F1)
- Standing Water (G1)
- Quarry (I2.1)
- Arable (J1.1)
- Building (J3.6)
- Bare Ground (J4)
- Phase 1 Habitat Mosaic*
- Running Water (G2)
- Dense/Continuous Scrub (A2.1)
- Continuous Bracken (C1.1)
- Target Note

*Mosaic Code	Mosaic Description
1	Semi-improved acid grassland/Marshy grassland mosaic
2	Semi-improved neutral grassland/Marshy grassland mosaic
3	Improved grassland/Marshy grassland mosaic
4	Marshy grassland/Wet modified bog mosaic

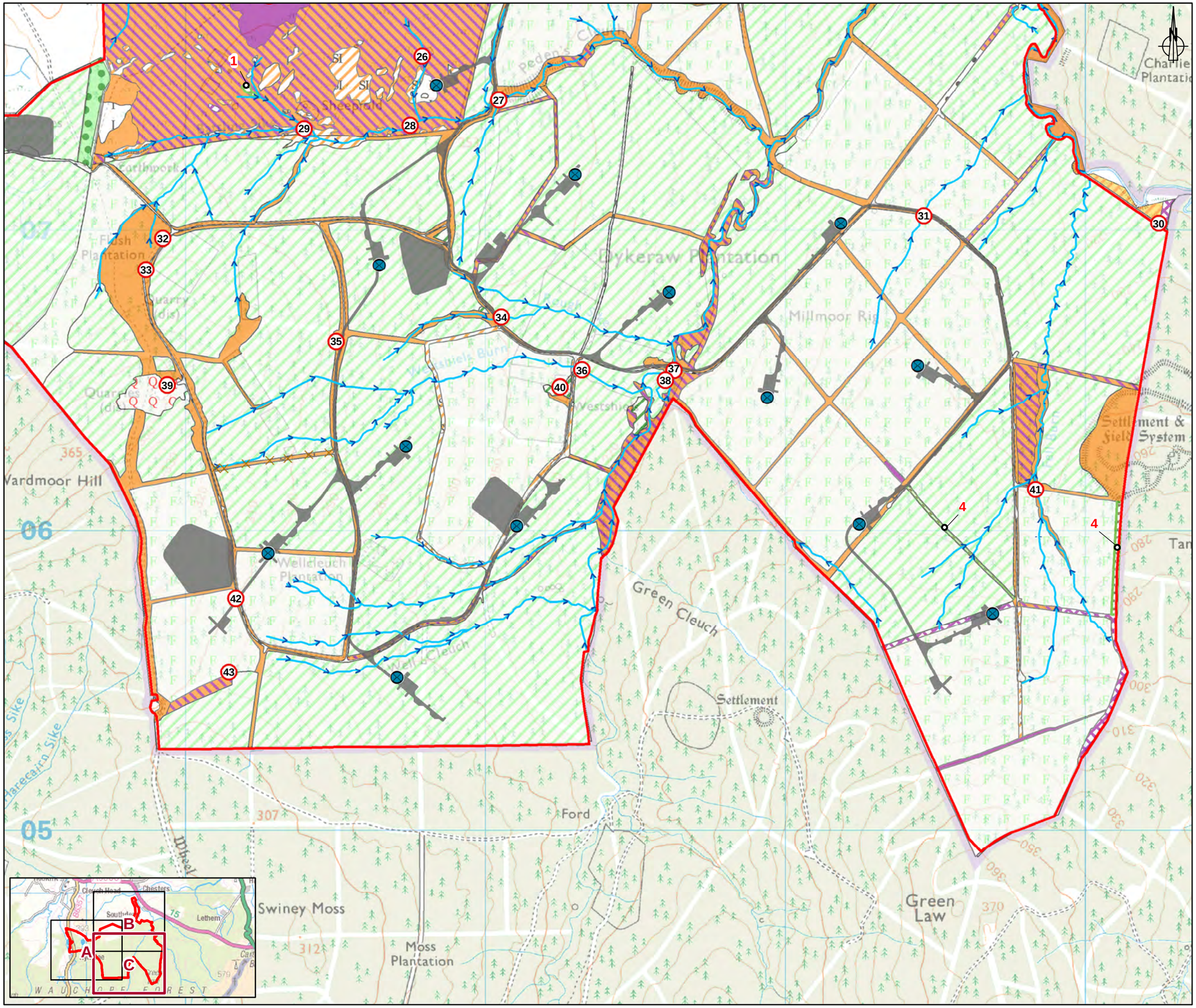
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.2B_Phase1_Habitat_HIH

SCALE - 1:12,500 @ A3

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.2C

PHASE 1 HABITAT SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Broad-leaved Plantation Woodland (A1.1.2)
- Coniferous Plantation Woodland (A1.2.2)
- Mixed Semi-natural Woodland (A1.3.1)
- Dense/Continuous Scrub (A2.1)
- Recently Felled Coniferous Woodland (A4.2)
- Unimproved Acid Grassland (B1.1)
- Semi-improved Acid Grassland (B1.2)
- Unimproved Neutral Grassland (B2.1)
- Semi-improved Neutral Grassland (B2.2)
- Improved Grassland (B4)
- Marsh/Marshy Grassland (B5)
- Wet Dwarf Shrub Heath (D2)
- Dry Heath/Acid Grassland Mosiac (D5)
- Wet Heath/Acid Grassland Mosiac (D6)
- Blanket Bog (E1.6.1)
- Wet Modified Bog (E1.7)
- Swamp (F1)
- Quarry (I2.1)
- Bare Ground (J4)
- Phase 1 Habitat Mosaic*
- Running Water (G2)
- Dense/Continuous Scrub (A2.1)
- Continuous Bracken (C1.1)
- Target Note

*Mosaic Code	Mosaic Description
1	Semi-improved acid grassland/Marshy grassland mosaic
2	Semi-improved neutral grassland/Marshy grassland mosaic
3	Improved grassland/Marshy grassland mosaic
4	Marshy grassland/Wet modified bog mosaic

LAYOUT DWG: 02836D0002-11

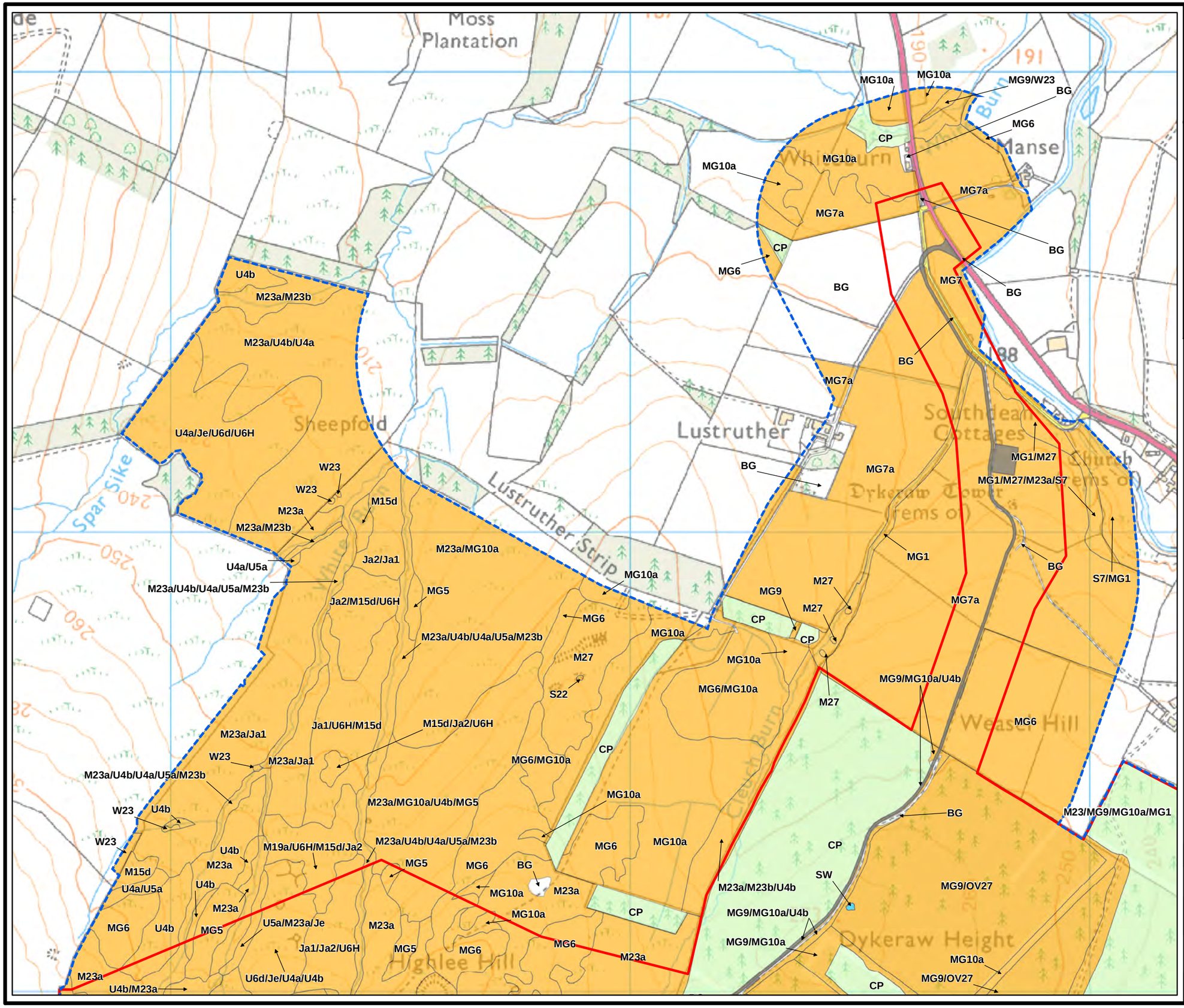
T-LAYOUT NO.: PSCOhhi041

DRAWING NUMBER: ES_E_Fig5.2C_Phase1_Habitat_HIH

SCALE - 1:12,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



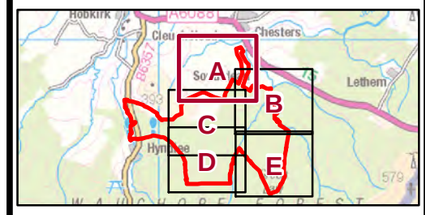
HIGHLEE HILL
WIND FARM

FIG 5.3A

NVC
SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- NVC Habitat
- Conifer Plantation/Felled Conifer Plantation
- Young Broad-leaved Plantation
- Bare Ground/building/quarry
- Standing Water



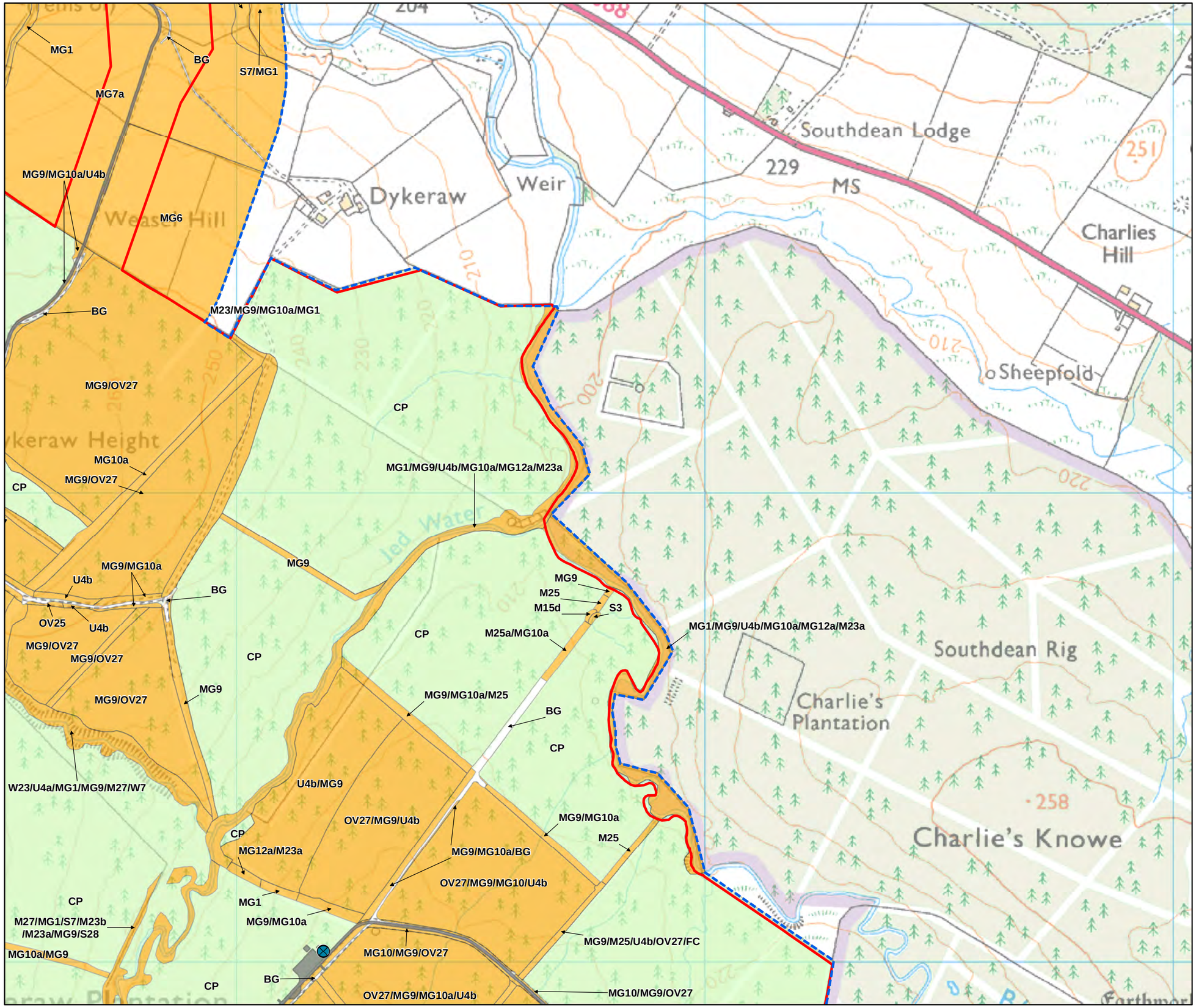
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.3A-E_NVC_Habitat_HIH

SCALE - 1:8,000 @ A3

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



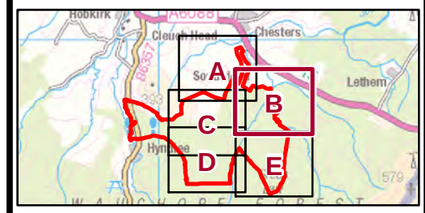
HIGHLEE HILL WIND FARM

FIG 5.3B

NVC SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- NVC Habitat
- Conifer Plantation/Felled Conifer Plantation
- Young Broad-leaved Plantation
- Bare Ground/building/quarry
- Standing Water



LAYOUT DWG	02836D0002-11
T-LAYOUT NO.	PSCOhhi041
DRAWING NUMBER	ES_E_Fig5.3A-E_NVC_Habitat_HIH
SCALE -	1:8,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

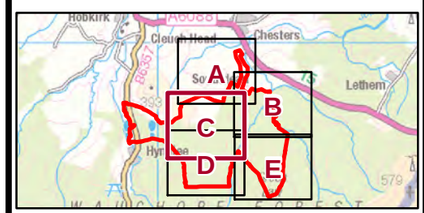
HIGHLEE HILL WIND FARM

FIG 5.3C

NVC SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- NVC Habitat
- Conifer Plantation/Felled Conifer Plantation
- Young Broad-leaved Plantation
- Bare Ground/building/quarry
- Standing Water

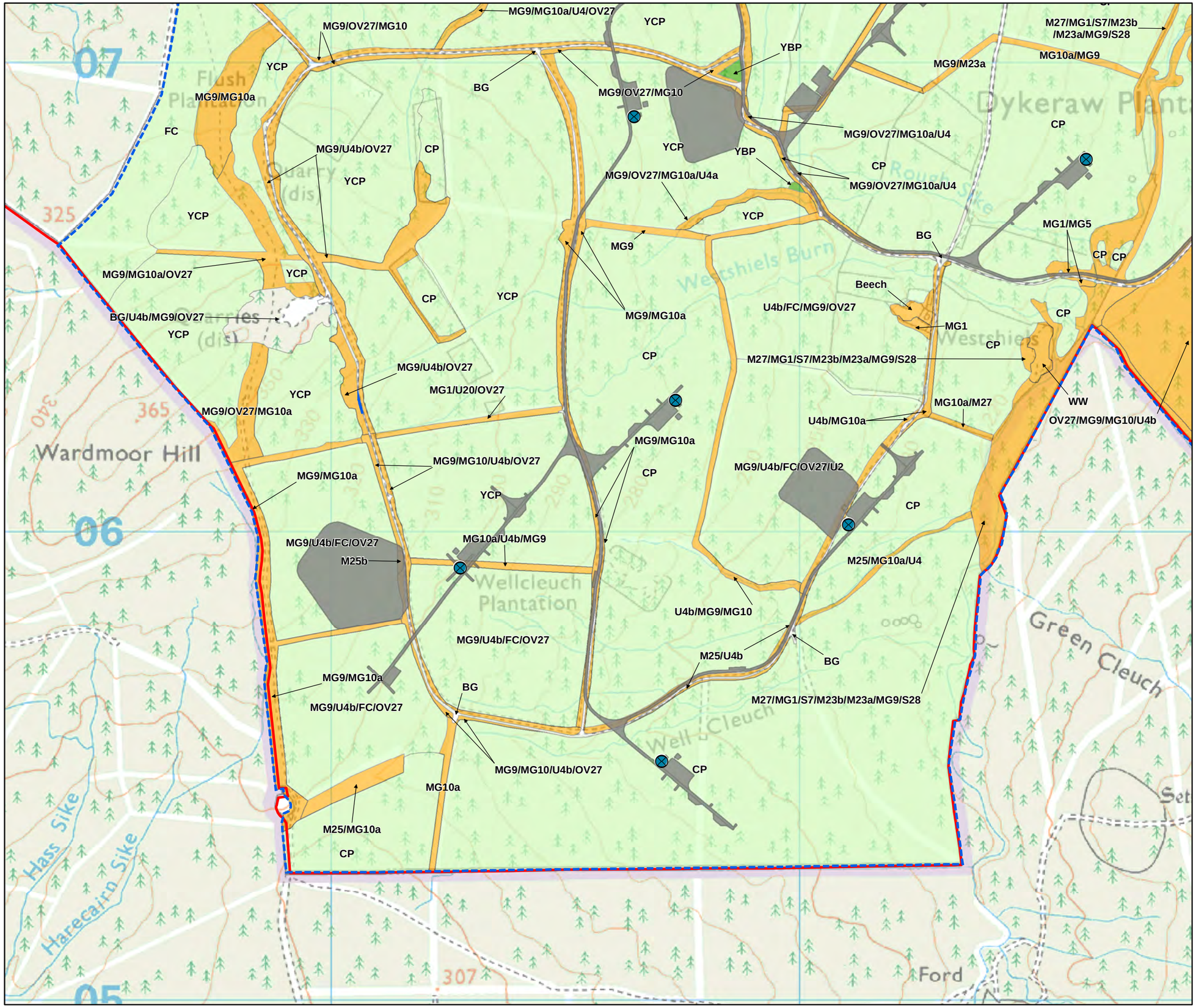


LAYOUT DWG	02836D0002-11
T-LAYOUT NO.	PSCOhhi041
DRAWING NUMBER	ES_E_Fig5.3A-E_NVC_Habitat_HIH

SCALE - 1:8,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



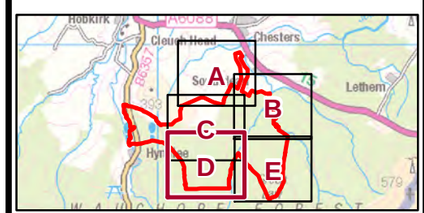
HIGHLEE HILL WIND FARM

FIG 5.3D

NVC SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- NVC Habitat
- Conifer Plantation/Felled Conifer Plantation
- Young Broad-leaved Plantation
- Bare Ground/building/quarry
- Standing Water



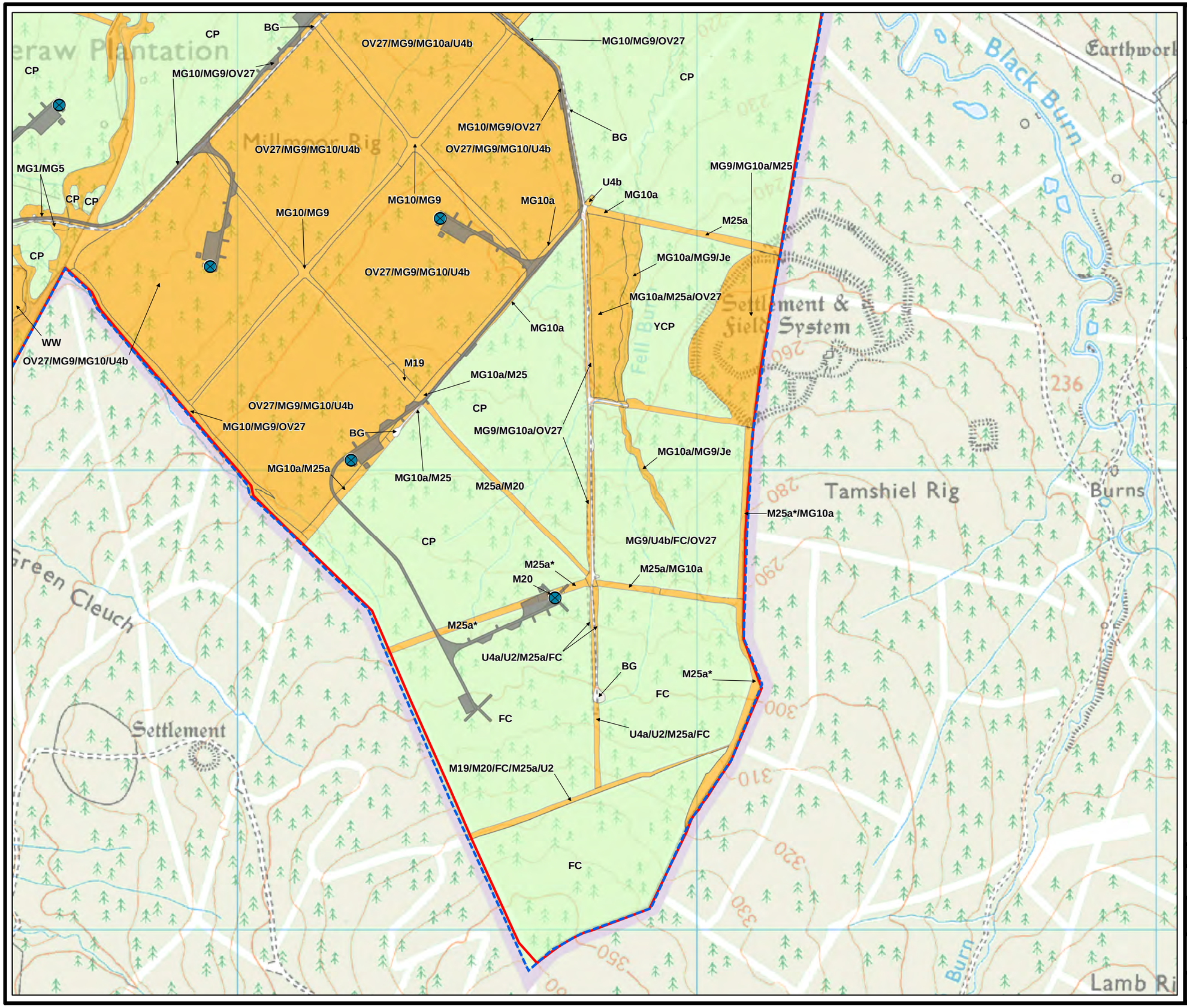
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.3A-E_NVC_Habitat_HIH

SCALE - 1:8,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



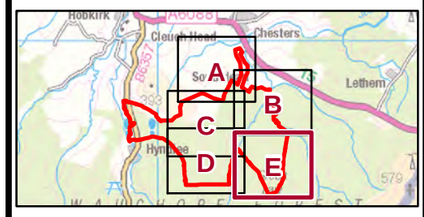
HIGHLEE HILL WIND FARM

FIG 5.3E

NVC SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- NVC Habitat
- Conifer Plantation/Felled Conifer Plantation
- Young Broad-leaved Plantation
- Bare Ground/building/quarry
- Standing Water



LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.3A-E_NVC_Habitat_HIH

SCALE - 1:8,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

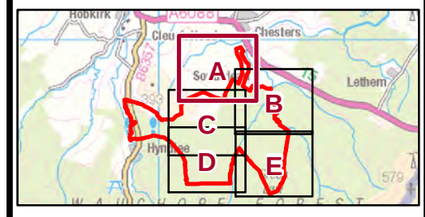
HIGHLEE HILL WIND FARM

FIG 5.4A

GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS (GWDTE) SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- Highly GWDTE
- Moderately GWDTE



LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER: ES_E_Fig5.4A-E_GWDTE_HIH

SCALE - 1:8,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

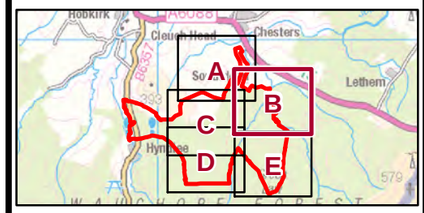
HIGHLEE HILL WIND FARM

FIG 5.4B

GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS (GWDTE) SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- Highly GWDTE
- Moderately GWDTE



LAYOUT DWG	02836D0002-11
T-LAYOUT NO.	PSCOhhi041
DRAWING NUMBER	ES_E_Fig5.4A-E_GWDTE_HIH
SCALE -	1:8,000 @ A3
	ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

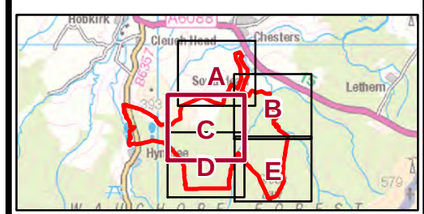
HIGHLEE HILL WIND FARM

FIG 5.4C

GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS (GWDTE) SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- Highly GWDTE
- Moderately GWDTE



LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.4A-E_GWDTE_HIH

SCALE - 1:8,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.4D

GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS (GWDTE) SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- Highly GWDTE
- Moderately GWDTE

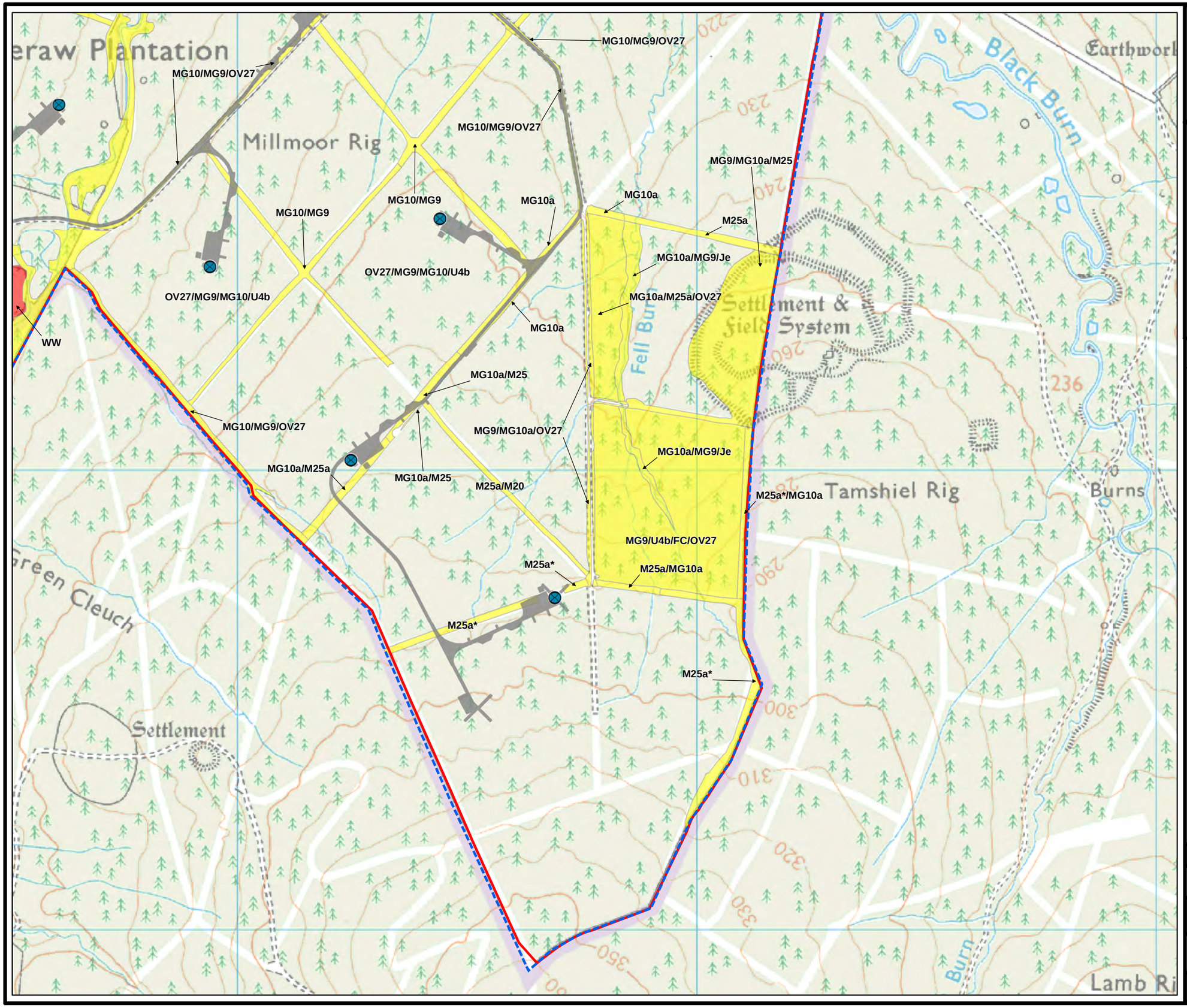
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER: ES_E_Fig5.4A-E_GWDTE_HIH

SCALE - 1:8,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



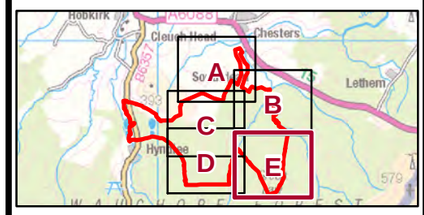
HIGHLEE HILL
WIND FARM

FIG 5.4E

GROUNDWATER DEPENDENT TERRESTRIAL ECOSYSTEMS (GWDTE) SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- Highly GWDTE
- Moderately GWDTE



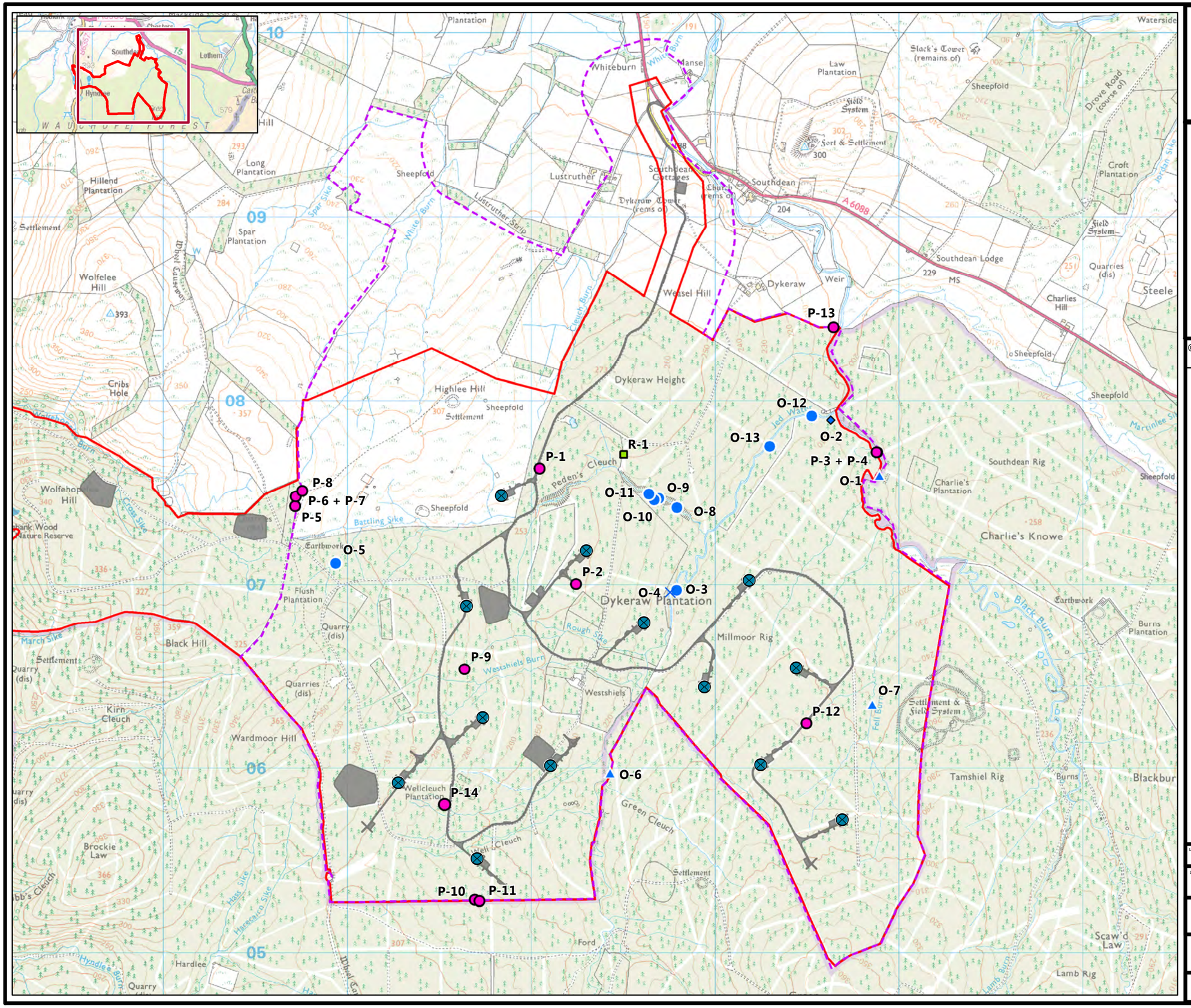
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.4A-E_GWDTE_HIH

SCALE - 1:8,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.5

PROTECTED SPECIES SURVEY RESULTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area

Species, Type

- Otter, Spraint
- Otter, Possible Print
- Otter, Possible Slide
- Otter, Possible Tracks
- Pine Marten, Possible or Probable Scat
- Reptiles, Habitat

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.5_ProtectedSpecies_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.7

GREAT CRESTED NEWT POND SURVEY LOCATIONS 2012

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area
- Pond Location

TN 1
TN 2
TN 3
TN 4
TN 5
TN 6
TN 7
TN 8
TN 9
TN 10
TN 11
TN 12
TN 13
TN 14
TN 15

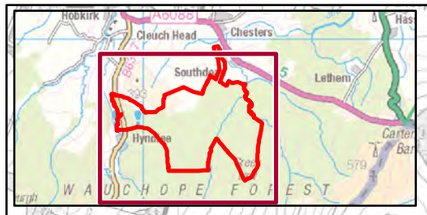
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.7_GCN_HIH

SCALE - 1:25,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.8

BAT SURVEY LOCATIONS 2012

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area (2012)
- Point Count Location
- Anabat Location

Transect Route

- Transect 1 - 1 to 22
- Transect 2 - 23 to 41
- Transect 3 - 42 to 60

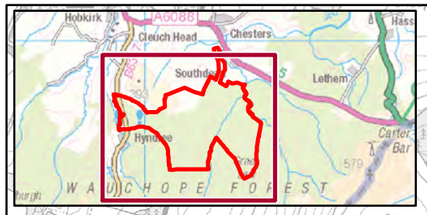
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.8_Bat_SurveyLocations_2012_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.9

BAT SPATIAL SURVEY RESULTS 2012

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area (2012)
- Point Count Location

Transect Route

- Transect 1 - 1 to 22
- Transect 2 - 23 to 41
- Transect 3 - 42 to 60

Total Bat Passes at Static Locations*

- 5-10
- 11-20
- 21-30

Total Bat Passes Between Static Locations*

- 5-10
- 11-20
- 21-30
- >30

*Only bat passes of 5 or more are shown on this figure.

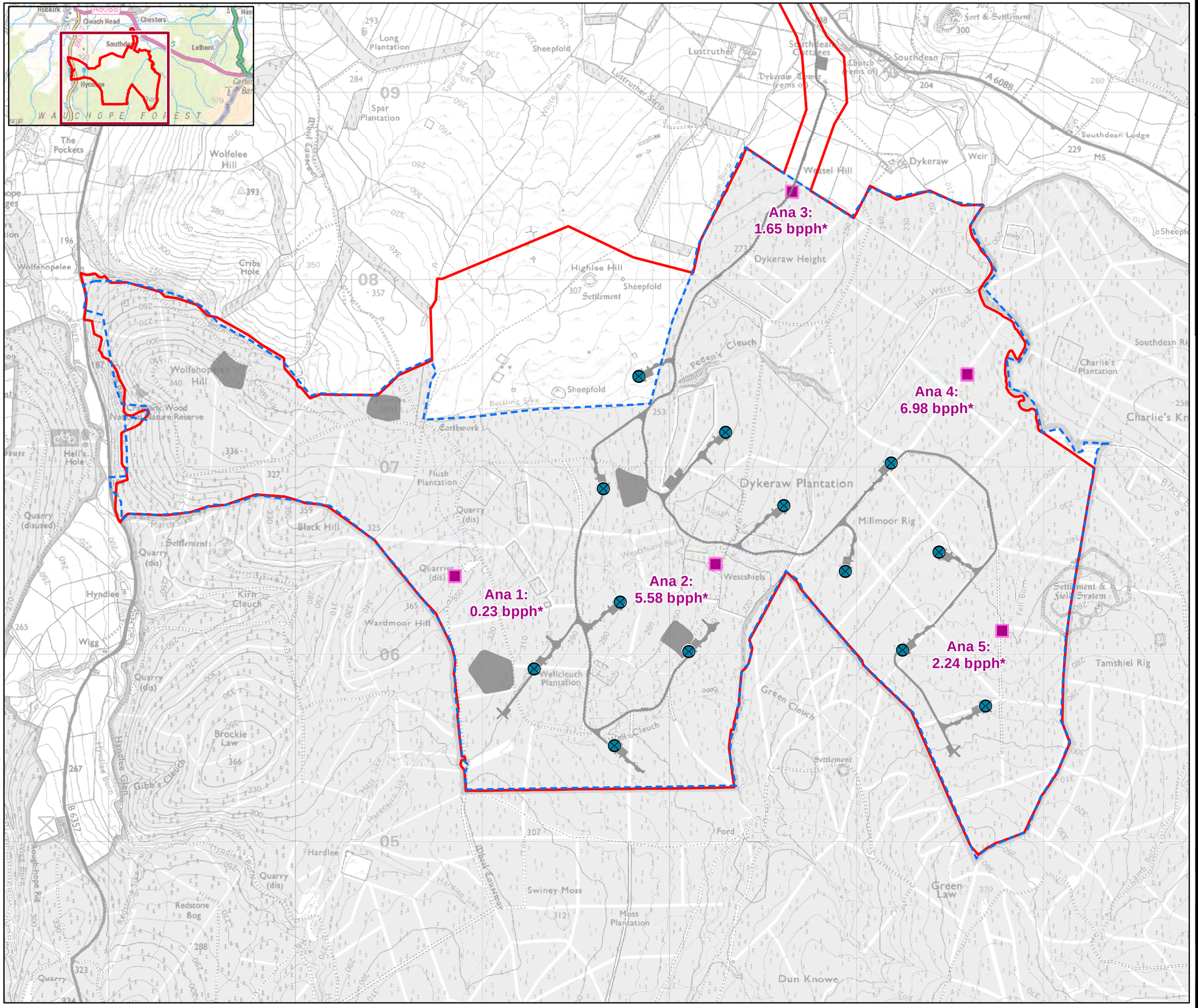
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.9_Bat_SpatialResults_2012_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL
WIND FARM

FIG 5.10

BAT TEMPORAL
SURVEY RESULTS
2012

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Survey Area (2012)
- Anabat Location

Total bat activity given in bat passes per hour (bpph)

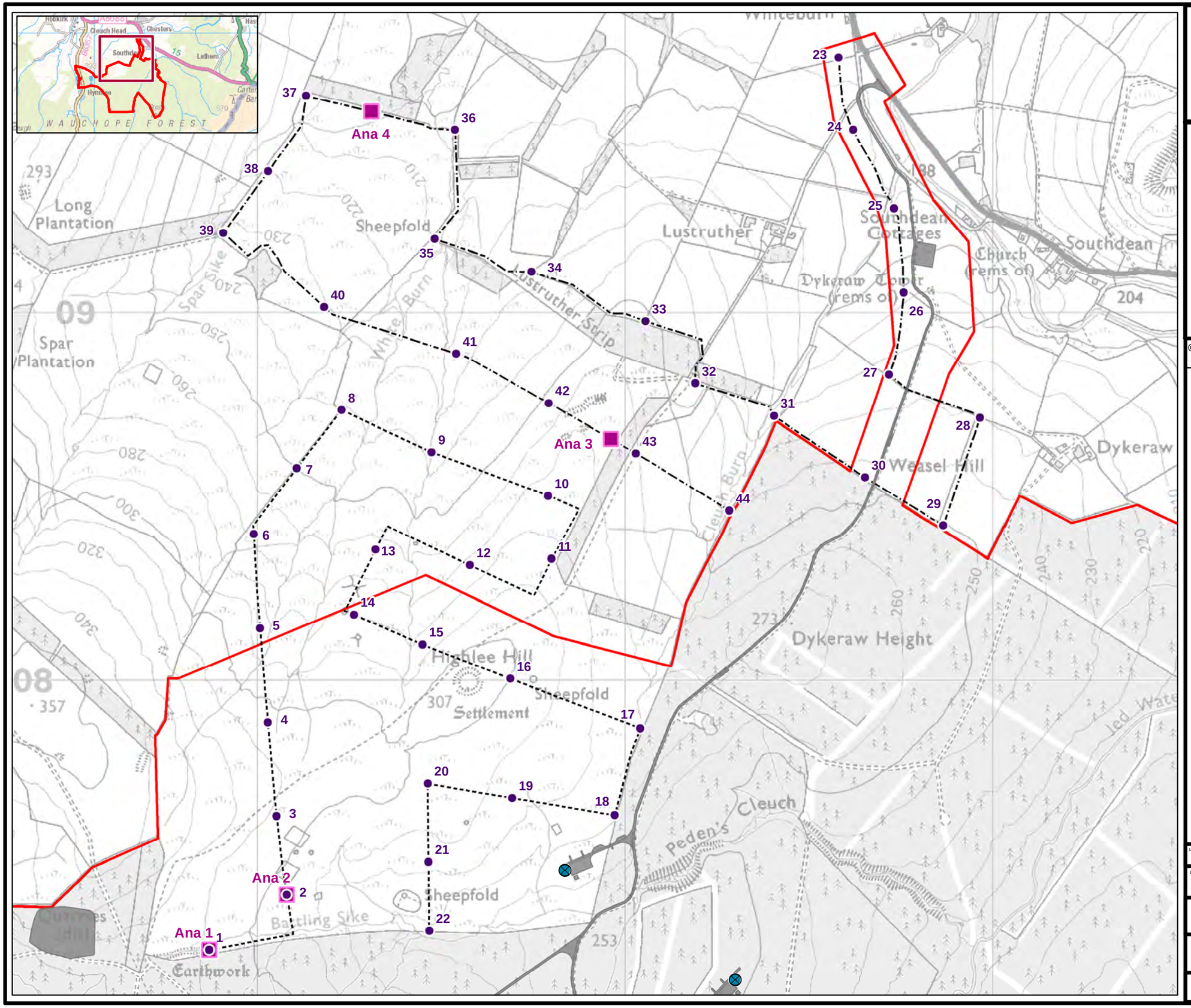
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.10_Bat_TemporalResults_2012_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.11

BAT SURVEY LOCATIONS 2013

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Point Count Location
- Anabat Location

Transect Route

- Transect 1 - 1 to 22
- Transect 2 - 23 to 44

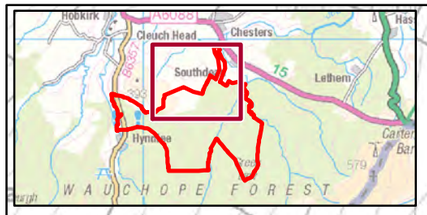
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.11_Bat_SurveyLocations_2013_HIH

SCALE - 1:10,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.12

BAT SPATIAL SURVEY RESULTS 2013

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Point Count Location

Transect Route

- Transect 1 - 1 to 22
- Transect 2 - 23 to 44

Total Bat Passes at Static Locations*

- 5 - 10
- 11 -20
- 21 - 30
- >30

Total Bat Passes Between Static Locations*

- 5 - 10
- 11 - 20
- 21 - 30
- >30

Only bat passes of 5 or more are shown on this figure.

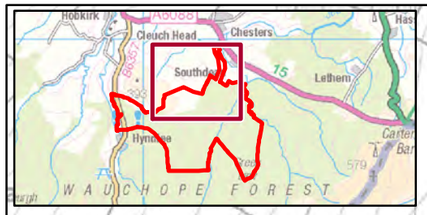
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.12_Bat_SpatialResults_2013_HIH

SCALE - 1:10,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



Ana 4:
12.55 bpph*

Ana 3:
18.1 bpph*

Ana 2:
1.76 bpph*

Ana 1:
2.44 bpph*

Long Plantation
Spar Plantation
Sheepfold
Spar Sike
White Burn
Lustruther
Lustruther Strip
Southdean Cottages
Church (rems of)
Southdean
Dykeraw Tower (rems of)
Dykeraw
Weasel Hill
Cleuch Burn
Highlee Hill
Settlement
Dykeraw Height
Peden's Cleuch
Battling Sike
Earthwork
Quarries (dis)
Jed Water

HIGHLEE HILL WIND FARM

FIG 5.13

BAT TEMPORAL SURVEY RESULTS 2013

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Anabat Location

Total bat activity given in bat passes per hour (bpph)

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.13_Bat_TemporalResults_2013_HIH

SCALE - 1:10,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.14

BAT TARGET NOTE LOCATIONS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- 200m Potential Roost Buffer

Potential Bat Roost

- Category 1*
- Category 1

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.14_Bat_TargetNotes_HIH

SCALE - 1:25,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.15

BAT BUFFER ZONES FROM TURBINES

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary

50m Habitat Edge Buffer

- Forestry
- Running Water

N.B. - The edge of the rotor-swept area (blade tip) needs to be at least 50m from the nearest part, usually the highest point of the habitat feature.

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_E_Fig5.15_Bat_BufferZones_HIH

SCALE - 1:25,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.16A

SITE LOCATION AND SAMPLING GRID

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Peat Sample Location

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.16A_PeatSamplePoints_HIH

SCALE - 1:25,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.16B

SITE LOCATION AND SAMPLING GRID

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Peat Sample Location (Sample No)

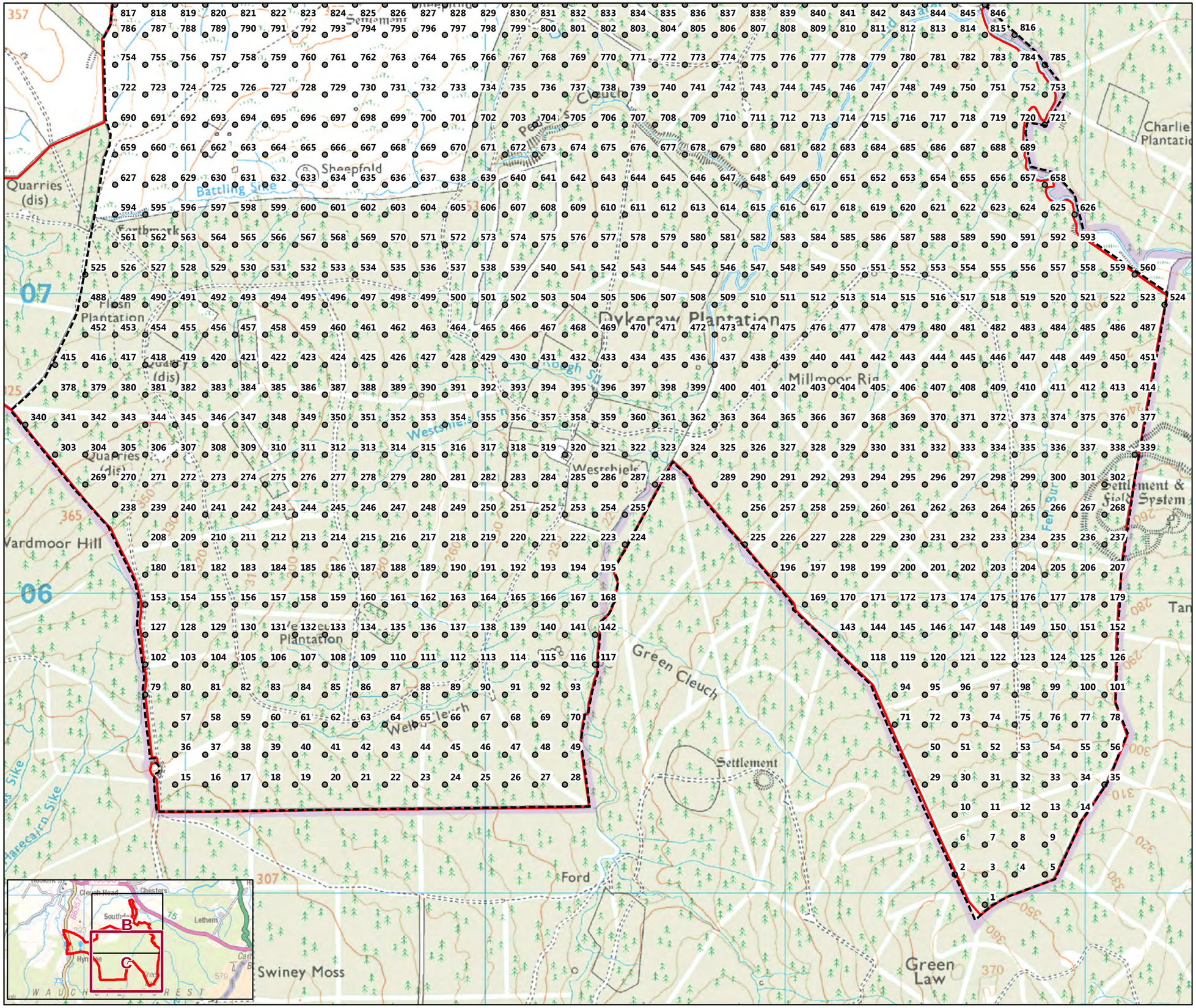
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.16B_PeatSamplePoints_HIH

SCALE - 1:12,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.16C

SITE LOCATION AND SAMPLING GRID

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Site Boundary
- Peat Analysis Boundary
- Peat Sample Location (Sample No)

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.16C_PeatSamplePoints_HIH

SCALE - 1:12,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.17A

INTERPOLATED PEAT DEPTH

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Peat Analysis Boundary
- Peat Sample Location

Interpolated Peat Depth (cm)

- 0
- 1-25
- 26-50
- 51-100
- 100-150
- 151-200
- 200-250

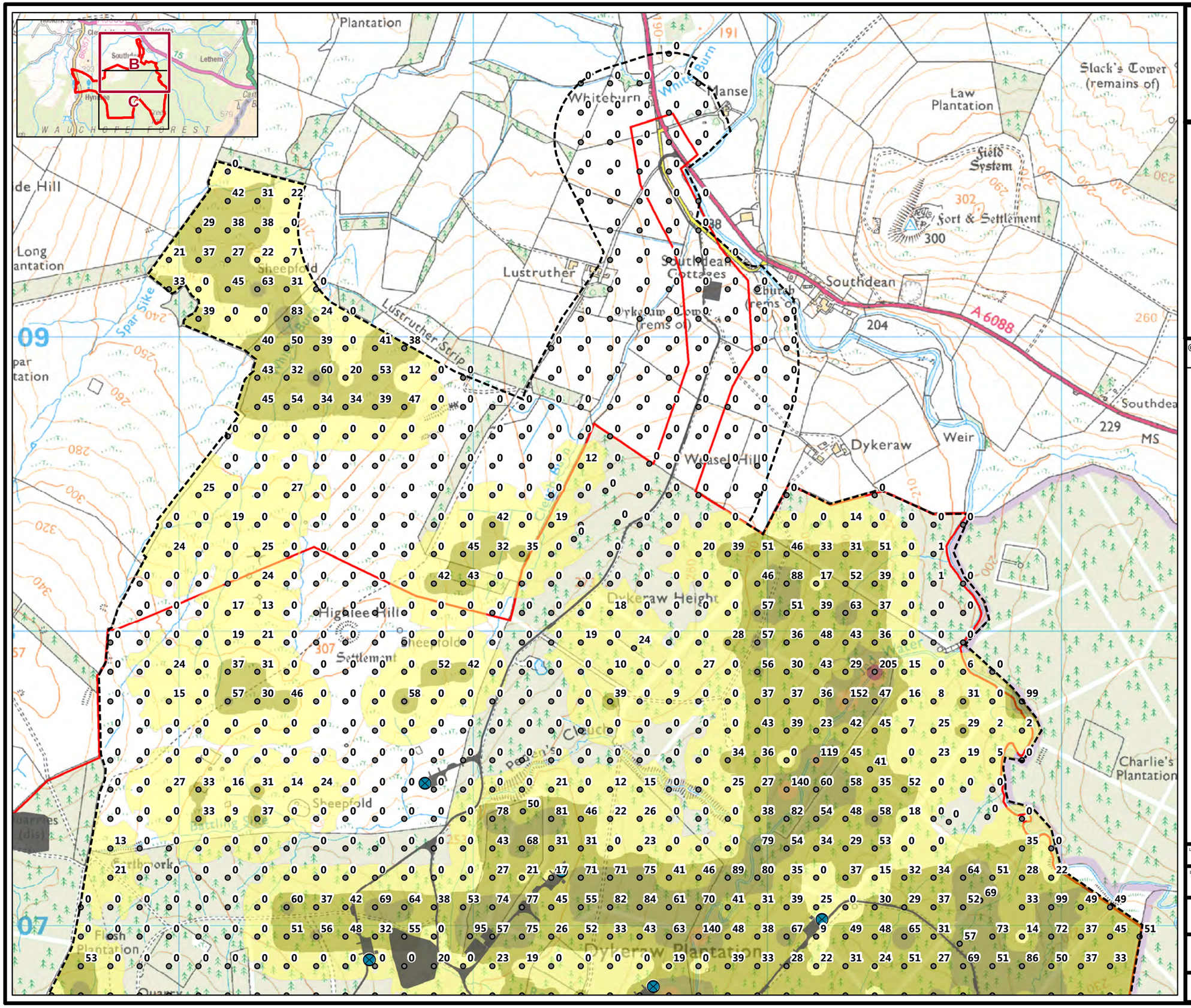
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.17A_InterpolatedPeatDepth_HIH

SCALE - 1:25,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.17B

INTERPOLATED PEAT DEPTH

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Peat Analysis Boundary
- Peat Sample Location (Depth in cm)

Interpolated Peat Depth (cm)

- 0
- 1-25
- 26-50
- 51-100
- 100-150
- 151-200
- 200-250

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.17B_InterpolatedPeatDepth_HIH

SCALE - 1:12,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.17C

INTERPOLATED PEAT DEPTH

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Peat Analysis Boundary
- Peat Sample Location (Depth in cm)

Interpolated Peat Depth (cm)

- 0
- 1-25
- 26-50
- 51-100
- 100-150
- 151-200
- 200-250

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.17C_InterpolatedPeatDepth_HIH

SCALE - 1:12,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.17D

INTERPOLATED PEAT DEPTH MIRE AND NON-MIRE

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- Peat Analysis Boundary

Interpolated Peat Depth (cm)

- Non-mire (1-50)
- Mire (51+)

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.17D_InterpolatedPeatDepth_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.18

SPHAGNUM ABUNDANCE AND DISTRIBUTION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Sphagnum Abundance

1-25%

26-50%

51-100%

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER: ES_P_Fig5.18_SpgAbn_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.19

NON-SPHAGNUM ABUNDANCE AND DISTRIBUTION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Non-Sphagnum Abundance

1-25%

26-50%

51-100%

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER: ES_P_Fig5.19_NonSpgAbn_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.20

CALLUNA VULGARIS ABUNDANCE AND DISTRIBUTION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Calluna Vulgaris Abundance

1-25%

26-50%

51-100%

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.20_CallunaVulgaris_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.21

ERIOPHORUM VAGINATUM ABUNDANCE AND DISTRIBUTION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Eriophorum Vaginatum Abundance

1-25%

26-50%

51-100%

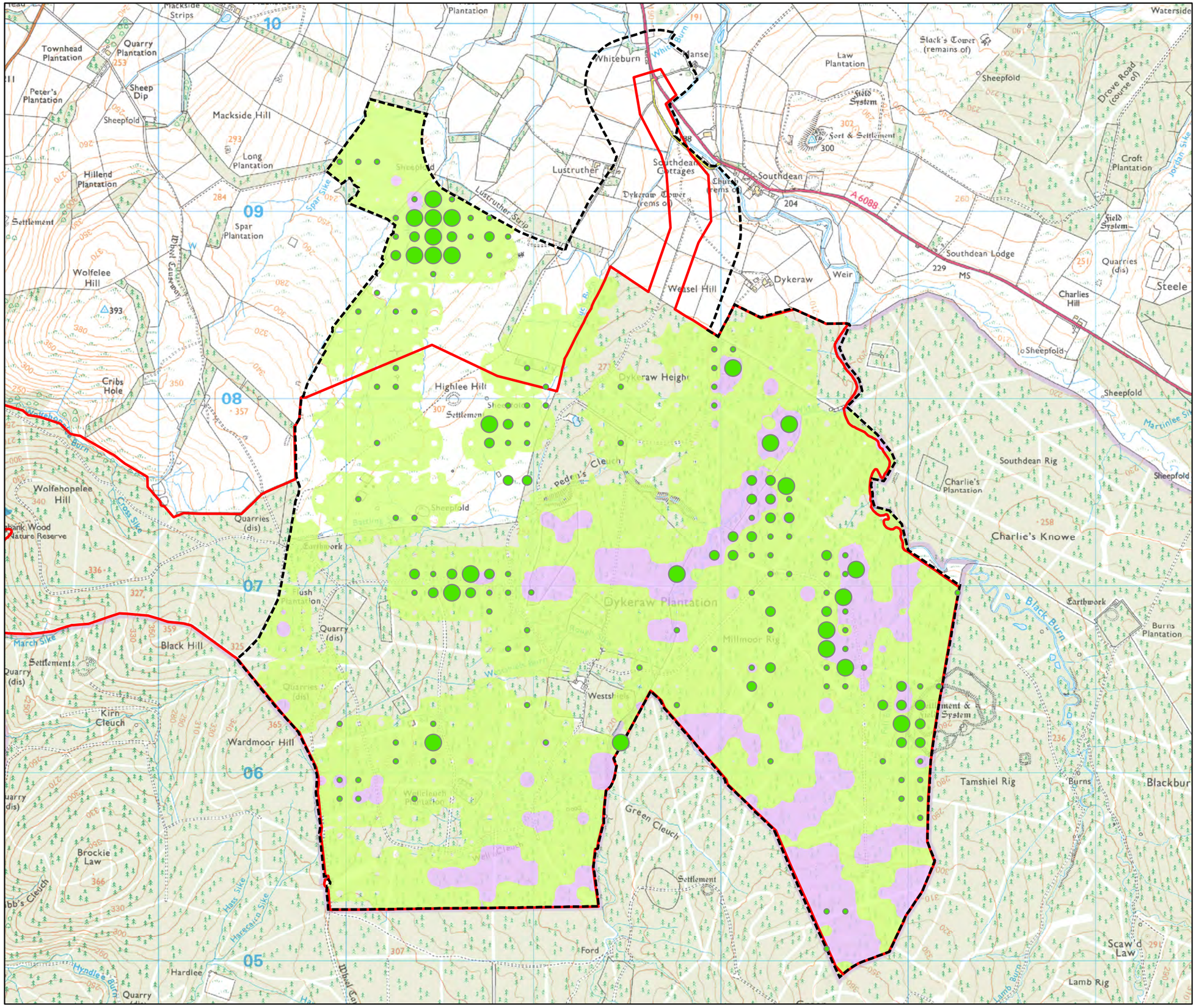
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER: ES_P_Fig5.21_EriophorumV_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 5.22

MOLINIA ABUNDANCE AND DISTRIBUTION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Molinia Abundance

1-25%

26-50%

51-100%

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER: ES_P_Fig5.22_Molinia_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.23

OTHER GRASSES, BRACKEN AND RUSHES ABUNDANCE AND DISTRIBUTION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Other Grasses, Bracken and Rushes Abundance

1 - 25%

26 - 50%

51 - 100%

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.23_OtherGrasses_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.24

BARE GROUND/CONIFER NEEDLE ABUNDANCE AND DISTRIBUTION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Bare Ground/Conifer Needle Abundance

1-25%

26-50%

51-100%

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.24_BG_CON_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.25

PEAT EROSION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Peat Erosion

Present

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.25_PeatErosion_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 5.26

DRAIN ACTIVITY

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Site Boundary

Peat Analysis Boundary

Interpolated Peat Depth (cm)

Non-mire (1-50)

Mire (51+)

Drain Activity

Active

Semi-active

Inactive

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_P_Fig5.26_DrainActivity_HIH

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

6 Ornithology

Introduction

6.1 This chapter considers the potential effects of the proposed wind farm on birds. It summarises the methods used to establish the bird populations within the site and its surroundings, the results of the baseline surveys, and the process used to determine the sensitivity of the bird populations present. The ways in which birds might be affected (directly or indirectly) by the construction, operation and decommissioning of the proposed wind farm are assessed, prior to and after any mitigation measures are considered. In addition, any cumulative effects of the proposed wind farm are assessed, taking together effects of other regulated projects or activities in the area whether operational, consented or at application, along with the significance of any predicted effects of the proposed wind farm. The ornithology assessment was undertaken by MacArthur Green Ltd.

6.2 This chapter complements the assessment of potential ecological effects presented in **Chapter 5: Ecology**.

6.3 This chapter is supported by **Technical Appendix 6.1** which contains the following Annexes:

- Annex A – Legal Protection.
- Annex B – Bird Survey Methodologies.
- Annex C – Survey Effort and General Information.
- Annex D – Survey Results.
- Annex E – Collision Risk Assessments.

6.4 **Confidential Technical Appendix 6.2** contains breeding information on sensitive and protected species listed in Schedule 1 of the Wildlife & Countryside Act 1981 as amended.

Study Area Description

6.5 The site spans two landownerships, with farmland in the northern area and commercial conifer plantation covering the majority of the site. There are four main burns within the site, the most prominent being the Jed Water running through the eastern section of the site. Dykeraw Forest is actively managed while the areas of open ground across the central and northern sections of the site are managed at quite an intense level for grazing.

6.6 The ornithological assessment focuses on the site and appropriate buffer areas (collectively the "study areas") which have been applied, as recommended by Scottish Natural Heritage (SNH) guidance (2010[1], and updated in 2013 and 2014[2]) (**Technical Appendix 6.1** and Figure 6.1). Field surveys were conducted from 2011 to 2015. SNH has advised that where baseline surveys have commenced prior to the publishing of updated versions of the guidance in 2013 and 2014, the 2010 version should remain as the primary reference. However, in general the requirements of the 2013 and 2014 versions were also met by the baseline surveys (see **Technical Appendix 6.1, Annex B** for details). The specific study areas are as follows:

- Designated and non-designated sites - site plus a 20 km buffer (Figure 6.2);
- Flight activity - areas within a 500 m buffer of the outermost turbine locations, referred to here for collision risk modelling purposes as the Collision Risk Analysis Area (CRAA) (**Technical Appendix 6.1, Annex E** and Figure 6.3);
- Breeding birds (general) - 500 m buffer around the turbine layout[3] (Figure 6.1);
- Scarce breeding birds - 2 km buffer around the turbine layout[1] (Figure 6.1), extending to 6 km for golden eagle;
- Black grouse - 1.5 km buffer around the turbine layout[1] (Figure 6.1);
- Non-breeding birds - 500 m buffer around the turbine layout[1] (Figure 6.1); and
- Cumulative effects - projects or activities within the same Natural Heritage Zone (NHZ) as the site (Figure 6.11).

Assessment Methodology

Assessment Structure

6.7 The assessment considers the potential effects, including construction, operational, decommissioning and cumulative effects, of the proposed wind farm, within which "scoped in" target species and designated sites are considered at the appropriate level (NHZ/regional, national or designated site reference populations).

6.8 The following effects have been assessed:

- Direct habitat loss for birds through construction of the proposed wind farm infrastructure.
- Displacement of birds through indirect loss of habitat where birds avoid the proposed wind farm, and its surrounding area due to construction activities, turbine operation and maintenance, or visitor disturbance. Displacement can also include barrier effects in which birds are deterred from using normal routes to feeding or roosting grounds due to the presence of turbines or other infrastructure.
- Habitat modification due to change in land cover (e.g. forestry removal), and consequent effects on bird populations.
- Death or injury through collision with turbine blades, overhead wires (if any), met masts, or fences (if any) associated with the proposed wind farm.
- Cumulative effects of the proposed wind farm when considering other regulated projects or activities within a particular geographical frame of reference.

6.9 The assessment makes the following assumptions:

6.10 The construction period will last for 18 – 24 months and includes forest clearance, borrow pit creation, construction or upgrade of access tracks, hard standings, turbines, temporary and permanent free-standing wind monitoring (anemometer) masts, and other infrastructure, and site restoration (see **Chapter 2: Proposed Development** for more details). The number of bird breeding seasons potentially disrupted would depend on the month in which construction commences and the

[1] Scottish Natural Heritage. (2010). Survey methods for use in assessing the impacts of onshore windfarms on bird communities. Scottish Natural Heritage.

[2] SNH (2014). Recommended bird survey methods to inform impact assessment of onshore wind farms. Scottish Natural Heritage, May 2014.

[3] Baseline surveys were carried out based on a previous version of the wind farm layout, which was amended for the final version to include turbines and associated infrastructure within open moorland to the north of the site. This means that although the proposed location of all infrastructure was covered by surveys, the buffer zones did not extend full distances in this area. This is not likely to materially affect results in any way however, since the habitat is similar to the adjacent land that was surveyed. Low breeding activity was recorded in this area, and so numbers of territories in adjacent land are likely to be similarly low, comprising similar species.

breeding season of the potentially affected species. The breeding season of most birds at the proposed wind farm extends from April to July although some birds may commence breeding earlier. For the purposes of this assessment it is assumed that, for any given species of bird, construction activities would commence during the breeding season and would therefore potentially affect breeding for a maximum of three breeding seasons (at least in part).

6.11 Forestry within the site is currently undergoing a programme of felling and replanting. The Areas accommodating wind farm infrastructure will require to be felled if they have not already been so. Up to 29.98 ha of forestry will need to be felled to accommodate the infrastructure although following the construction phase some of these areas will be replanted leaving an overall loss of 26.13 ha of mainly sitka spruce forest (see **Chapter 10: Forestry** for further details). The proposed Wind Farm Felling Plan (Figure 10.6) will see only minor modifications in the timings of the existing felling plan (Figure 10.5). Where possible the wind farm infrastructure will be keyholed into existing forestry and where areas of mature forestry is clear felled the restocking will maintain keyhole areas of open ground around the turbines, primarily to protect bats from collision risk.

6.12 Offsite compensatory planting to offset the loss of forest land due to the wind farm infrastructure will occur in accordance with the Policy on the Control of Woodland Removal[4].

6.13 The proposed wind farm would result in the construction of approximately 5.5 km of new track and a further 7.7 km of existing track will also be upgraded. The running width of the track would be 5 m on straight sections, with 0.25 m wide shoulders on each side. Tracks will be wider on bends. It is expected 100% of the on-site tracks would be constructed as excavated track as little or no peat is expected to be met on site.

6.14 It is assumed that a Breeding Bird Protection Plan (BBPP) will be agreed in consultation with SNH in advance of construction under the terms of an appropriate planning condition. This plan will ensure that all necessary measures are taken to avoid disturbance to breeding birds and to avoid damage to, or destruction of, nest sites. This is taken into consideration during the initial assessment of effects.

6.15 All electrical cabling proposed between the turbines and the site substation will be underground and follow tracks wherever possible.

6.16 Routine maintenance of the turbines would be undertaken approximately twice yearly. This would not involve any large vehicles or machinery.

Data Sources and Guidance

6.17 The assessment has been undertaken in line with the following European legislation, policy, and guidance:

- The Environmental Impact Assessment Directive 85/337/EEC (as amended).
- Directive 2009/147/EC on the Conservation of Wild Birds (Birds Directive);
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) (Habitats Directive);
- European Commission (27 October 2010) Natura 2000 Guidance Document *'Wind Energy Developments and Natura 2000*'. European Commission, Brussels.

6.18 The following national legislation, policy and guidance are considered as part of the assessment:

- The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011;
- The Wildlife and Countryside Act 1981 (as amended);
- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (The Habitats Regulations);
- SERAD (Scottish Executive Rural Affairs Department) (2000). Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds ("the Habitats and Birds Directives'). Revised Guidance Updating Scottish Office Circular No 6/1995;
- The UK Biodiversity Action Plan (BAP) and UK Post-2010 Biodiversity Framework;
- Eaton *et al.* (2015). Birds of Conservation Concern 4[5];
- Scottish Natural Heritage (2000) Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action. SNH Guidance Note;
- Scottish Natural Heritage (2006) Assessing significance of impacts from onshore windfarms on birds outwith designated areas;
- Scottish Natural Heritage (September, 2009) Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees;
- Scottish Natural Heritage (2013, revised 2014) Recommended bird survey methods to inform impact assessment of onshore wind farms.
- Scottish Natural Heritage (March 2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments;
- Scottish Natural Heritage (July 2013) Assessing connectivity with Special Protection Areas;
- Natural England (2013). Section 41 Species - Priority Actions Needed (B2020-008). Includes England Biodiversity List.

Desk Study

6.19 The following data sources were considered as part of the assessment:

- SNH SiteLink [http://gateway.snh.gov.uk/sitelink/] - information on designated sites;
- Natural England website [https://designatedsites.naturalengland.org.uk/] and http://www.magic.gov.uk for information on designated sites in England;
- British Trust for Ornithology (BTO) BirdTrack website [http://app.bto.org/birdtrack/main/data-home.jsp] - OS Tiles NT60 and NT50;
- The Wildlife Information Centre (TWIC) (Lothian and Borders);
- The Southern Upland Partnership;
- The Lothian & Borders Raptor Study Group; and
- The Scottish Ornithologists' Club (SOC) including the South-East Scotland Bird Atlas (http://www.the-soc.org.uk/se-atlas/allrecords_index.htm) with records from 2000-06, and the Borders Bird Report No. 29 (2013).

Field Surveys

6.20 All surveys followed contemporary SNH guidance (SNH 2010, 2013 and 2014) and the scope of surveys was considered appropriate by SNH during consultation (email, May 2015 – see Table 6.1).

6.21 Ornithological fieldwork commenced in September 2011 and was completed in July 2015, and comprised the following surveys (**Technical Appendix 6.1, Annexes C and D** and Figures 6.3 to 6.10 for further details):

[4] Forestry Commission Scotland (2009). Control of Woodland Removal. http://www.forestry.gov.uk/pdf/fcfc125.pdf/$file/fcfc125.pdf

[5] Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746.

- Flight activity (Vantage Point) surveys (two non-breeding seasons (2011/12 and 2012/13), and two breeding seasons (2012 and 2013));
- Black grouse surveys (two breeding seasons in 2012 and 2013);
- Scarce breeding bird surveys (three breeding seasons in 2012, 2013 and 2015);
- Breeding bird surveys (two breeding seasons in 2011 and 2012, plus an area covering an extension to the proposed layout 2013);
- Woodland point counts (three breeding seasons in 2011-13, and one non-breeding season in 2012); and
- Winter walkovers (two non-breeding seasons in 2012/13 and 2013/14).

Consultation

6.22 Table 6.1 summarises the consultation responses received with regard to ornithology and provides information on where and how they have been addressed in the assessment.

6.23 A Scoping Report for the site was previously submitted in January 2014 to the Scottish Government Energy Consents and Deployment Unit (ECDU) under Section 36 of the Electricity Act as the proposed wind farm was then expected to be over 50 MW (37 turbines up to a tip height of 150 m). As the capacity of the scheme is now estimated to be under 50 MW (31 – 44 MW) and will now be determined by the local planning authority under the Town and Country Planning (Scotland) Act 1997 (as amended), it was deemed appropriate to re-consult statutory and non-statutory consultees to seek their opinion on assessment work that should be carried out as part of the Environmental Impact Assessment (EIA). A second Scoping Report was submitted in November 2015. Responses to the original Scoping Report that are still applicable have been included here.

Table 6.1: Consultation Responses

Consultee	Scoping/ Other Consultation	Issue Raised	Response/Action Taken
SNH	Scoping Opinion 12/02/2014	Include reference to any designated sites just over the border in England.	These are included in the Designated Sites section (see also Figure 6.1).
		Whilst SNH is not seeking more bird survey work than already proposed for this development, they request that the developer and their consultants should clearly demonstrate in the ES that the chosen duration of survey is robust and appropriate to the location of the development proposed, based on SNH (2013) guidance.	All survey effort fulfilled the requirements of the SNH (2013) and current SNH (2014) guidance, over the period of 2011-15.
SNH	Correspondence email (scope of survey work, 2015) 15/04/2015	SNH agrees with the scope of the surveys proposed for 2015, provided that there has been no significant change in land-use within the development site.	Refresher scarce breeding bird surveys were carried out in 2015 to provide up to date information on site usage. Methods and results are presented in Appendix 6.1 and are included in the assessment of potential impacts.
SNH	Second Scoping Response 27/11/2015	The application should be supported by data adhering to the SNH amended August 2013 guidance. If any of the proposed survey data fall short of the 2013 guidance requirements, the ES should clearly demonstrate that the data remain robust and appropriate to the location of the development proposed.	All survey methods and effort fulfilled the requirements of the SNH (2013) and current SNH (2014) guidance, to allow a robust assessment.
		Some of the survey data already obtained dates from 2011. If any of the data used in the analyses exceed 5 years at the point of EIA submission, justification may be needed for its inclusion.	All baseline data have been included in the impact assessment, including those obtained in 2011, which remains consistent with findings throughout the remainder of the survey period up to 2015.
Royal Society for the Protection of Birds (RSPB)	Scoping Opinion 20/02/2014	Reference should be made to the Borders Birds Report, published annually by the Borders branch of the Scottish Ornithologists' Club (SOC). Atlas work should also be referenced when available.	The Desk Study included data obtained from SNH's referenced sources.
		We note that ornithological survey work has been carried out over two years according to SNH guidelines, and that any on-going or subsequent fieldwork, together with existing results and analysis thereof, will take cognisance of the revised (2013) guidance.	All survey methods and effort fulfilled the requirements of the SNH (2013) and current SNH (2014) guidance, to allow a robust assessment.
		Where removal of plantation trees is undertaken, a schedule of felling should be drawn up that avoids the birds' breeding season (April to July, inclusive). Ornithological survey work should also be carried out immediately prior to felling in other months to determine if crossbill, a Schedule 1 species, are nesting. If breeding activity by crossbills is detected, nests should be located and protected by an appropriate buffer.	See the **Chapter 10: Forestry** for details of felling programme. Pre-construction surveys will be undertaken by an Ecological Clerk of Works or suitably qualified ornithologist to identify and safeguard breeding birds close to construction activities.
		Removal of plantation trees may create habitat suitable for black grouse re-colonisation. Efforts should be made, therefore, to make the habitat attractive to black grouse in appropriate parts of the development site furthest from the turbines.	The only blocks of plantation forestry to be removed will be those already planned within the existing Felling Plan. The only long term additional open ground will be that containing the wind farm infrastructure and would therefore be inherently unsuitable for black grouse habitat creation.

Consultee	Scoping/ Other Consultation	Issue Raised	Response/Action Taken
		Data on black grouse should be obtained from the Southern Uplands Partnership, and raptor data from the Lothian & Borders Raptor Study Group.	Data from the referenced sources have been considered in the Desk Study
		Measures to guard against displacement or loss of any breeding population of curlew and other waders should be presented.	Only one turbine (T6) is located on open ground, of sufficient distance from breeding waders recorded during baseline surveys.
RSPB	Email response to Scoping Request 08/02/2016	We would require the developer to ensure that ornithological information concerning breeding raptors and black grouse is up to date.	Breeding raptor surveys were carried out in 2015, with most recent black grouse surveys carried out in 2013.
ECDU	Scoping Opinion	Survey work should include assessments of the flight lines of breeding birds and birds whose migrations or other seasonal distributions traverse or are in close proximity to the site. Collision risk analyses will be necessary for species which regularly pass through the site at any time of year.	Collision risk modelling was conducted as part of the impact assessment and is detailed in **Technical Appendix 6.1, Annex E**.
Natural England	Scoping Opinion 17/02/2014 Scoping Opinion 12/11/2015	Assess potential impacts of development on designated sites (statutory and non-statutory) and include an Appropriate Assessment if likely significant effects have been identified on designated SPAs.	All designated sites within 20 km have been included in the impact assessment.
		Assess potential impacts (direct and indirect) on species listed as “Habitats and Species of Principal Importance” within the England Biodiversity List.	The England Biodiversity List has been included as a source of guidance for determining Valued Ornithological Receptors.
Scottish Ornithologists’ Club, Borders Branch	Scoping Opinion 12/02/2014	Raptors are potentially important. We consider that a buffer of 2 km is insufficient for considering the impact on golden eagle.	A larger search area was used for historic golden eagle records, as recommended. The species was included in the assessment as a precaution.
		The list of other species is much in line with our expectations with the exception of hawfinch. We would like more detail of this observation as the species is extremely rare.	Hawfinch was recorded on one occasion during a woodland point count survey in April 2011, on the east side of Wolfehopelee Hill, approximately 1.4 km from the nearest infrastructure. No impacts are likely.
		The BTO/SOC-organised National Bird Atlas 2007-11 results are available via The Wildlife Information Centre. This source of information should be listed.	This reference was used for the impact assessment.

Methodology for Assessing Wider-Countryside Ornithological Interests

6.24 The assessment method follows the process set out in the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (the "EIA Regulations").

6.25 In assessing the effects, emphasis is given to the national and NHZ/regional populations of the species as appropriate (or the designated site, where relevant).

6.26 The evaluation for wider-countryside interests (interests unrelated to a SPA, but including a SSSI) involves the following process:

- identification of the potential effects of the proposed wind farm;
- consideration of the likelihood of occurrence of potential effects where appropriate;
- defining the Nature Conservation Importance and Conservation Status of the bird populations present to establish level of sensitivity;
- establishing the Magnitude of the Likely Effect (both spatial and temporal);
- based on the above information, a judgement is made as to whether or not the identified effect is significant with respect to the EIA Regulations;
- if a potential effect is determined to be significant, measures to mitigate or compensate the effect are suggested where required;
- opportunities for enhancement are considered where appropriate; and
- residual effects after mitigation, compensation or enhancement are considered.

Assessing Significance

6.27 This section defines the methods used to assess the significance of effects through the process of an evaluation of Sensitivity (a combination of Nature Conservation Importance and Conservation Status) and Magnitude of impact for each likely effect.

6.28 Determination of the level of sensitivity of a receptor is based on a combination of the receptor's nature conservation value and conservation status, described in the sections below.

Methods Used to Evaluate the Nature Conservation Importance of Bird Populations

6.29 There are three levels of Nature Conservation Importance as detailed below in Table 6.2.

Table 6.2: Determining Factors of a Population’s Nature Conservation Importance

Importance	Definition
High	Populations receiving protection by a SPA, proposed SPA, Ramsar Site, SSSI or which would otherwise qualify under selection guidelines. Species present in nationally important numbers (>1% national breeding or wintering population).
Medium	The presence of species listed in Annex 1 of the Birds Directive (but population does not meet the designation criteria under selection guidelines). The presence of breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The presence of target species noted on the latest Birds of Conservation Concern (BoCC) Red list, designated for their rareness or vulnerability. Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed wind farm. Species present in regionally important numbers (>1% regional breeding population).
Low	All other species’ populations not covered by the above categories.

6.30 Valued Ornithological Receptors (VORs) were taken to be those species of High and Medium Nature Conservation Importance.

Methods Used to Evaluate Conservation Status of Bird Populations

6.31 As defined by SNH (2006[6]), the Conservation Status of a species is

"*the sum of the influences acting on it which may affect its long-term distribution and abundance, within the geographical area of interest (which for the purposes of the Birds Directive is the EU)*" (Para. 14).

6.32 Conservation Status is considered "favourable" under the following circumstances (Para.15):

- *"Population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats; and*
- *the natural range of the species is not being reduced, nor is likely to be reduced for the foreseeable future; and*
- *there is (and probably will continue to be) a sufficiently large habitat to maintain its population on a long-term basis".*

6.33 SNH (2006) states that,

"An impact should be judged as of concern where it would adversely affect the favourable conservation status of a species, or stop a recovering species from reaching favourable conservation status, at international or national level or regionally" (Para. 17).

6.34 In the case of non-designated sites, the relevant scale for breeding species is considered to be the appropriate NHZ which the site falls within. The proposed wind farm falls within the Border Hills NHZ (NHZ 20). For wintering or migratory species, the national UK population is often considered to be the relevant scale for determining effects on the Conservation Status and this approach is applied here.

Methods Used to Evaluate the Magnitude of Likely Effects

6.35 An effect is defined as a change to the abundance and/or distribution of a population as a result of the proposed wind farm. Effects can be adverse, neutral or favourable.

6.36 There can often be varying degrees of uncertainty over effects as a result of limited information. A precautionary approach is adopted where the response of a population to an effect is uncertain.

6.37 In determining the Magnitude of Impacts, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.

6.38 The sensitivity of individual species to disturbance during relevant behaviours is considered when determining spatial and temporal Magnitude of Impact and is assessed using guidance described by Bright et al. (2006[7]), Hill et al. (1997[8]) and Ruddock and Whitfield (2007[9]).

6.39 Effects are judged in terms of magnitude in space and time. There are five levels of spatial effects and temporal effects as detailed in Table 6.3 and Table 6.4 respectively.

[6] Scottish Natural Heritage (2006) Assessing significance of impacts from onshore Wind farms on birds outwith designated areas.

[7] Bright, J. A., Langston, R. H. W., Bullman, R., Evans, R. J., Gardner, S., Pearce-Higgins, J. & Wilson, E. (2006). Bird Sensitivity Map to provide locational guidance for onshore wind farms in Scotland. Royal Society for the Protection of Birds.

[8] Hill, D.A., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. (1997). Bird disturbance: improving the quality of disturbance research. Journal of Applied Ecology 34:275-288.

[9] Ruddock, M. & Whitfield, D. P. (2007). A Review of Disturbance Distances in Selected Bird Species, A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

Table 6.3: Spatial Effect Magnitude

Spatial Magnitude	Definition
Very High	Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of productivity in a bird population due to disturbance. Guide: >80% of population lost through additive mortality.
High	Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 21-80% of population lost through additive mortality.
Medium	Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 6-20% of population lost through additive mortality.
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 1-5% of population lost through additive mortality.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. Guide: < 1% population lost through additive mortality.

Table 6.4: Temporal Effect Magnitude

Temporal Magnitude	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 30 years), except where there is likely to be substantial improvement after this period. Where this is the case, Long-Term may be more appropriate.
Long-term	Approximately 15 - 25 years or longer (see above).
Medium-term	Approximately 5 - 15 years.
Short-term	Up to approximately 5 years.
Negligible	<12 months.

Significance criteria

6.40 The predicted significance of the effect on a VOR (in most cases within the context of a reference population) is determined by considering both sensitivity (i.e. each species population's relative sensitivity to disturbance) and magnitude of change. Major and moderate effects are considered significant in accordance with the EIA Regulations, whereas minor or negligible effects are not considered significant.

Assessment Limitations

6.41 All ornithological survey methods followed contemporary SNH guidance and the scope of surveys was considered appropriate by SNH during consultation (email, April 2015).

6.42 The proposed wind farm design has been an iterative process, resulting in layout changes throughout the baseline survey and pre-application period. In open farmland to the north of the site, the respective survey areas did not extend out to the full, recommended buffer distance of the final

turbine layout in the first year of surveys. These areas were however covered by other surveys in that year, such as flight activity and breeding raptor surveys, and so any breeding species (e.g. waders) would have been noted during these visits.

6.43 When removing periods of poor visibility, total survey effort for vantage points (VPs) 1, 2 and 4 fell below the 36 hours recommended by SNH (2014) during some particular seasons (See **Technical Appendix 6.1**, Table 4.5 for details). Since flight activity surveys covered two breeding seasons and two non-breeding seasons, and viewsheds overlapped across the CRAA, this is however unlikely to have a significant influence on the collision modelling results, particularly as most of the site is of reasonably homogenous habitat.

6.44 Therefore, whilst some information gaps have been identified, it is considered that there is sufficient information to enable an informed decision to be taken in relation to the identification and assessment of likely significant environmental impacts on ornithology.

Baseline Conditions

6.45 This section details:

- Statutory Nature Conservation Designations for birds within 20 km of the proposed wind farm;
- birds recorded during baseline ornithology surveys (**Technical Appendix 6.1**); and
- the Conservation Status of the VORs recorded during bird surveys.

The "Do Nothing" Scenario

6.46 The site is comprised of habitats that are indicative of ongoing anthropogenic influence, namely commercial forestry within the majority of the site, and agriculture in the north. In the absence of the proposed wind farm, the site would continue to be modified by clear-felling and re-planting as part of the Dykeraw Forest Management Plan (Figure 10.4 & 10.5), and ongoing farming operations. It is likely that the existing species composition would prevail but at varying levels, reflecting the effects of current management across the site.

Statutory Nature Conservation Designations

6.47 There are no ornithological statutory nature conservation designations within the site. Information pertaining to designated sites within 20 km of the proposed wind farm, with ornithological qualifying features, is listed in Table 6.5.

Table 6.5: Statutory Nature Conservation Designations within 20 km

Designated Site	Distance from the site boundary	Ornithological Qualifying Features
Kielderhead Moors: Carter Fell to Peel Fell SSSI	1.1 km S	Breeding bird assemblage. Includes golden plover, dunlin, five Schedule 1 raptor species, ring ouzel, wheatear, whinchat, snipe, curlew, redshank and teal.
Kielderhead & Emblehope Moors SSSI	2.6 km SE	The breeding bird community includes golden plover, dunlin, birds of prey and a variety of typical moorland species such as dipper, common sandpiper, ring ouzel, wheatear and whinchat. The lower moors and grasslands also support populations of lapwing, oystercatcher and curlew.
Langholm-Newcastleton Hills SPA	16 km SW	Hen harrier (breeding)
Langholm-Newcastleton Hills SSSI	16 km SW	Hen harrier (breeding) Breeding bird assemblage Includes black and red grouse, nine wader species and six raptor species including hen harrier.
Whitelee Moor NNR	3.6 km SE	Information pertaining to site lists merlin, buzzard, peregrine, hen harrier, golden plover, dunlin, skylark, stonechat and meadow pipit.
Kielderhead NNR	2.6 km SE	Information pertaining to site includes “a variety of upland birds”.

Birds Recorded During Surveys

6.48 The following paragraphs summarise the ornithological survey results. Full details can be found within **Technical Appendix 6.1, Annex D** and Figures 6.5 to 6.10.

Wildfowl

6.49 A small number of **pink-footed goose** (two skeins) were recorded in flight during the 2011/12 non-breeding season. Skein size was 20 and 85 individuals, the former of which flew across the site at risk height. Two flocks of **greylag goose** (two and 42 individuals) were also recorded during surveys.

Black Grouse

6.50 According to the Borders Bird Report 2013 (“BBR”), black grouse is an uncommon resident of hill fringes, especially the Moorfoot-Etterick Hills. It is found in approximately 15% of tetrads at c.200 sites.

6.51 No black grouse were recorded during any of the baseline surveys. The TWIC data did not provide any observations from within the site, although some from the 1990s, and up to 2001 were provided that were in grid squares to the east of the site in forested areas (Forestry Commission Scotland and RSPB data). Some records from 2001 and 2003, to the west of the site around Wolfehopelee Wood and Wauchope Forest were also provided.

6.52 Black grouse records from 1996 to 2012 were obtained from the Southern Uplands Partnership Black Grouse Project. There are few recent records, although there have been populations in the wider area in the past, particularly to the east of the site where leks of up to two males, with a single female present. No records are however within 1.5 km of the site boundary (**Confidential Figure 6.8**).

Raptors and Owls

6.53 During baseline breeding season surveys in 2012 to 2015, two raptor species showed evidence of breeding within the study area: **goshawk** and **peregrine**. Full details of locations can be found in **Confidential Technical Appendix 6.2.**

6.54 Three **goshawk** territories, two of which were within the site, were recorded in 2012 and 2013 (a total of two in 2012 and three in 2013). In each year, one pair was successful in breeding.

6.55 One of the territories within the site appeared to be occupied again in 2015, with a small number of individual observations, but no breeding was confirmed. At the other two locations where activity was previously recorded, there was no evidence of goshawk breeding in 2015. Felling operations have been undertaken within 500 m of the area marked as a potential goshawk site, and this may have affected any breeding attempt in 2015.

6.56 Goshawk was the most frequently recorded raptor species during flight activity surveys, with 19 flights occurring widely across the site, throughout the year.

6.57 A number of historic goshawk records were provided by TWIC within grid squares that overlap with the edge of the site boundary, and within the 2 km buffer. Most are from the 1990s but a small number are from 2004-05. No breeding evidence is provided. Three additional nest sites were provided by the Lothian & Borders Raptor Study Group, but all were located over 2 km from the site boundary (**Confidential Figure 6.9**).

6.58 **Peregrine** was recorded breeding outside of the site boundary, within the 2 km buffer in 2015. This appears to be an established territory location, with adults present, but unconfirmed breeding in 2012 and 2013. The Lothian & Borders Raptor Study Group has previously reported the location as a roost site. Seven peregrine flights were recorded during baseline surveys, with a pair in flight on one occasion.

6.59 The species is well monitored in the local area by the Lothian & Borders Raptor Study Group. Information was provided for a nest site, around 1.7 km south of the site, which may be the main nesting site of the aforementioned pair that bred elsewhere in 2015. The two nest sites are around 6 km apart, which is however close to the maximum alternative nest site separation distance of 6.5 km quoted in SNH (2013[10]). This southern site has been monitored since 2007, and occupation has been continuous from 2007 to 2014, with a minimum of 16 eggs laid in that time. Chicks are known to have been present in at least 2009 and 2013, but none have fledged. Three chicks in 2013 were known to have been predated by a fox. Persecution has been suspected on several occasions at this site.

6.60 **Merlin** was recorded on two occasions during flight activity surveys, in December 2011, and June 2012 (two flights). There was one TWIC historic record of an individual in 2003 adjacent to the western site boundary, although no breeding evidence was indicated. Other historic records provided were from the Kielderhead Moors SSSI to the southeast, from 1989-1992.

6.61 One merlin territory within the study area is monitored annually by the Lothian & Borders Raptor Study Group, around 1.8 km from the site boundary. This territory has been monitored for many years and is normally occupied and rears young.

6.62 A **red kite** was observed on two occasions during a flight activity survey in May 2013.

6.63 Single **hen harrier** and **osprey** flights were recorded during flight activity surveys. There was one historic record of hen harrier within 2 km of the site, provided by TWIC (no breeding evidence given), but the Lothian & Borders Raptor Study Group has no evidence of breeding in the study area. The closest historic osprey record is from the Jed Water, 3 km northeast.

6.64 No **golden eagle** observations occurred during any baseline surveys, although TWIC provided records within grid squares to the south of the site (see **Confidential Technical Appendix 6.2** for details). The most recent evidence provided of breeding occurring within the 6 km buffer zone was from 2004, and birds were known to be present in that area through the previous decade. The Scoping Report of the adjacent proposed Wauchope Newcastleton Wind Farm (see Figure 6.11 and Cumulative Effects section) includes information provided by Forestry Commission Scotland which suggests that it is considered to be a "former" nest site. Conifer plantation has likely matured around the local area since 2004, and this may have affected the viability of the territory. The Lothian & Borders Raptor Study Group provided no data for golden eagle within the study area.

6.65 There were no **barn owl** recorded during baseline surveys, with the closest historic record occurring in a grid square north of the site in 2009. All records provided by the Lothian & Borders Raptor Study Group are over 2 km from the site.

6.66 There are historic records of **short-eared owl** dating from the 1990s within grid squares in the eastern 2 km study area buffer (no breeding evidence), but no observations were made of the species during baseline surveys.

6.67 Successful **long-eared owl** (a green-listed species of low conservation value) breeding attempts were recorded within the site in 2012 and 2013, with a second pair recorded in 2013. **Tawny owl** was present within the site and are likely to have bred there.

6.68 Secondary target species: **buzzard, kestrel, sparrowhawk**, and **raven** were also present within the study area on occasion.

Waders

6.69 The majority of the site is conifer plantation which is generally unsuitable for breeding waders. However, in the open farmland area to the north, curlew, lapwing, golden plover, snipe and oystercatcher were recorded during breeding bird surveys in 2012 and 2013. Maximum estimated territory numbers are shown in Table 6.6. No observations occurred within 500 m of any turbine, although oystercatcher territories were recorded close to the access track where it meets the A6088.

6.70 An incidental record of a flock of 200 golden plover west of VP 2 was made in October 2011. One woodcock sighting was made during a winter walkover in 2013.

Table 6.6: Breeding Wader Territories

Species	Maximum number of pairs
Curlew	2
Lapwing	10
Golden plover	1
Snipe	12
Oystercatcher	2

Other Species

6.71 A number of BoCC Red-listed passerine species were recorded within the study area, including **hawfinch, twite, cuckoo, tree pipit, lesser redpoll, mistle thrush, grasshopper warbler** and **yellowhammer**.

6.72 The hawfinch record was a single individual during a woodland point count survey in April 2011, on the east side of Wolfehopelee Hill, approximately 1.4 km from the nearest infrastructure. Two flocks of twites (30 and nine individuals) were recorded from VP4 in September and October 2012.

[10] Scottish Natural Heritage (July 2013) Assessing connectivity with Special Protection Areas.

6.73 Crossbill were recorded regularly during breeding bird surveys, woodland point counts, and winter walkovers, and are likely to have bred within the site. One record of a great grey shrike, likely migrating in February 2013 was also made.

Design Mitigation

6.74 In general, the low level of breeding evidence from target species within and around the site boundary (particularly the forested areas) meant that there were no ornithological constraints to be considered for the wind farm design. The exception to this was for goshawk, where all known nest sites/territory centres were buffered by at least 500 m from all turbines.

Effects Assessment

6.75 The assessment of effects is based upon the project description outlined in **Chapter 2: Proposed Development** and is structured as follows:

- construction effects;
- operational effects;
- decommissioning effects; and
- cumulative effects.

Scoped in Valued Ornithological Receptors

6.76 The assessment is applied to those 'scoped-in' VORs of Medium or High Nature Conservation Importance (see Table 6.2) that are known to be present within the site or surrounding area (as confirmed through survey results and consultations outlined in para 6.19). These are goshawk, peregrine, merlin and golden plover (Table 6.7). In addition, although there were no baseline records of golden eagle, a historic territory is within ranging distance of the site, and so this species has been included as a VOR on a precautionary basis. All VORs have been classified as being of High conservation status due to the breeding bird assemblage notified interest of the Kielderhead Moors: Carter Fell to Peel Fell SSSI, which includes "five Schedule 1 raptor species" and golden plover. As such, the SSSI as a whole has also been considered as a single VOR.

Table 6.7: Nature Conservation Importance of Recorded Bird Populations

Species	Nature Conservation Importance	Reason
Goshawk	High	SSSI interest; Schedule 1
Peregrine	High	SSSI interest; Schedule 1
Merlin	High	SSSI interest; Annex I, Schedule 1
Golden eagle	High	SSSI interest; Annex I, Schedule 1
Golden plover	High	SSSI interest; Annex I
Kielderhead Moors: Carter Fell to Peel Fell SSSI	High	Species included within breeding bird assemblage found in study area

6.77 In addition, it is necessary to consider the species' Conservation Status when assessing the likely impacts, relevant Conservation Status information for the 'scoped in' Target Species is detailed within Table 6.8.

Table 6.8: Conservation Status of Scoped In VORs

Species	Conservation Status Information	Conservation Status
Goshawk	Green list	The UK population, over recent decades, has increased to around 500 pairs and of these, Scotland has at least 150 pairs. The Scottish Borders holds one of the main areas of population, and in 2014 the Raptor Study Group checked 48 home ranges, of which half were occupied by a pair, and a further 13 were considered to be in use by single birds or had fresh signs. The species can be difficult to track down and monitor, and so the regional population is likely to be more than 48 pairs. The Raptor Study Group could not give an exact number of birds in the area, however a realistic figure was given as 80+ pairs[11]. Based on a comparison with regional population estimates in Forrester et al. (2007[12]) the population is likely to be in **favourable conservation status.**
Peregrine	Green list	The most recent census of peregrine in the UK was in 2014, providing a provisional estimate of 1,505 pairs[13]. This initial figure indicates that the UK peregrine population has remained largely stable since the previous national survey in 2002[14], although the regional estimates are more divergent, and the Scottish population has declined by 11% to 509 pairs in that time. In the Scottish Borders, 96 home ranges were checked in 2014, of which 32 were occupied. In the 2002 census, 44 of 56 home ranges were occupied, suggesting that the regional population may be in **unfavourable conservation status**.
Merlin	Red List (Historical decline in breeding population)	The last national merlin survey carried out in 2008 suggested a national breeding population of around 1,159 breeding pairs with about 733 pairs in Scotland (Ewing et al. 2011[15]). Comparison with the previous 1993-94 survey suggests an overall stable population, albeit with regional differences in success. In 2014 the Raptor Study Group checked 37 home ranges in the Scottish Borders, of which 12 were occupied by pairs. In the last national census it was apparent that estimates of change were more negative for regional populations at southern latitudes than more northerly populations (-69% for Northumbria), and so the regional/NHZ population is likely to be in **unfavourable conservation status**.

[11] http://www.scottishraptorstudygroup.org/goshawk-study.pdf

[12] Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. and Grundy, D.S. (2007). The Birds of Scotland. Scottish Ornithologists Club, Aberlady.

[13] http://www.bto.org/volunteer-surveys/peregrine-survey/results

[14] Alexander N. Banks , Humphrey Q.P. Crick , Rachel Coombes , Stuart Benn , Derek A. Ratcliffe & Elizabeth M. Humphreys (2010) The breeding status of Peregrine Falcons Falco peregrinus in the UK and Isle of Man in 2002, Bird Study, 57:4, 421-436, DOI: 10.1080/00063657.2010.511148

[15] Ewing, S. R., Rebecca, G.W., Heavisides, A., Court, I.R., Lindley, P., Ruddock, M., Cohen, S. and Eaton, M.A. (2011). Breeding status of Merlins Falco columbarius in the UK in 2008. Bird Study 58: 379-389.

Species	Conservation Status Information	Conservation Status
Golden eagle	Green list	The Scottish golden eagle population has been relatively stable over the last few decades, with a total of 442 breeding pairs estimated at the last published national census in 2003 (Eaton et al. 2007[16]). Differences of conservation status do however exist at a regional level. Golden eagle is a rare breeder in the Scottish Borders, with around three home ranges, one of which was occupied in 2014 (Challis et al. 2015[17]). The NHZ population was determined to be in **unfavourable conservation status** due to low territorial occupancy, and there appears to be too few birds in the population to allow a marked recovery of golden eagles (Whitfield et al., 2004[18], 2006[19]).
Golden plover	Green list	The Scottish population of golden plover was estimated by Forrester et al. (2007) to be approximately 15,000 pairs, with 25,000 to 35,000 wintering individuals. The regional breeding estimate for the Lothian & Borders area was 1,600 pairs during 1988-94, but BTO Atlas results from 2007-11 show a decline in abundance since the previous survey, suggesting the regional breeding population is in unfavourable conservation status. The winter Atlas results show a mixed picture across the Borders area, suggesting a relatively stable regional winter population, in comparison with a decline since 2006 in UK numbers (Eaton et al. 2015)..
Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage	n/a	Overall rated as **favourable, maintained** condition in June 2003, although success of breeding raptors has been variable according to the Site Management Statement from 2010.

Scoped Out Designated Sites and Species

6.78 Based on distance to the nearest SPA, and lack of activity within the site of the associated qualifying interest (hen harrier), it is concluded that no Likely Significant Effects on this, or any other Natura 2000 site are predicted as a result of the proposed wind farm, due to a lack of connectivity. No other designated sites' (SSSIs, NNRs) qualifying interests are predicted to have any connectivity with the site.

6.79 Due to the lack, or low numbers of "at-risk" flights or breeding activity recorded during baseline surveys, and lack of habitat suitability within the site, the following target species have also been scoped out:

- Pink-footed goose, greylag goose, black grouse, osprey, hen harrier, red kite, barn owl and short-eared owl.

6.80 Although breeding is likely within the site, long-eared owl and tawny owl have been scoped out as they are not considered to be species of higher conservation concern in a regional or national context.

6.81 All wader species were scoped out of the assessment due to the lack of breeding activity recorded within 500 m of any infrastructure. The possible temporary loss or displacement of up to one pair of oystercatcher adjacent to the access track is not likely to be significant at a regional level.

6.82 It was not considered that the overall breeding bird assemblage within the site, if considered as a single receptor, would reach Medium Nature Conservation Importance within a regional context, as it comprises relatively low numbers of common woodland and open upland species. Although relatively rare, passerine species such as hawfinch, twite and great grey shrike are probably infrequent visitors to the site and are unlikely to be significantly affected.

Construction Effects

Predicted Effects

6.83 The main potential effects of construction activities across the site are the displacement and disruption of breeding and foraging birds as a result of noise and general disturbance over a short-term period (either the duration of a particular construction activity within working hours, or the duration of the whole construction period, <5 years and probably <2 years).

6.84 Effects on breeding birds would be confined to areas in the locality of temporary construction compounds, turbines, tracks and other infrastructure. Few attempts have been made to quantify the effects of disturbance of birds due to activities of this type, and much of the available information is inconsistent. However, as a broad generalisation, larger bird species such as raptors, or those that feed in flocks in the open tend to be more susceptible to disturbance than small birds living in structurally complex habitats (such as woodland, scrub and hedgerow) (Hill et al. 1997[20]).

6.85 Direct habitat loss will also occur due to the development's construction, which will be both short-term (e.g. temporary compounds, laydown areas) and long-term (access tracks and turbines, forestry removal). This may impact on breeding or foraging individuals.

Golden Eagle

6.86 **Impact:** breeding, foraging or wandering golden eagles may be displaced from the site during construction, either by disturbance or direct habitat loss of suitable habitat.

6.87 **Nature Conservation Importance:** as an Annex I and Schedule 1 listed species, and with potential connectivity to an SSSI population, golden eagle is classified as High Nature Conservation Importance.

6.88 **Conservation Status:** The NHZ golden eagle population is considered to be small and in unfavourable conservation status.

6.89 **Magnitude of Impact:** No golden eagle activity was recorded during baseline surveys, although historic data obtained have indicated previous activity around a breeding territory within 6km to the south of the site, albeit beyond any possible direct disturbance distance from a nest site. The predominantly mature conifer plantation, flat topography and low prey abundance of the site is likely to make it sub-optimal for golden eagle and so even if the territory is occupied in future years, the site is unlikely to form part of an important component of it. Unmitigated, the Magnitude of Impact of construction impacts on golden eagle is therefore considered to be **Negligible**.

[16] Eaton, M.A., Dillon, I.A., Stirling-Aird, P. & Whitfield, D.P. (2007). Status of the Golden Eagle Aquila chrysaetos in Britain in 2003. Bird Study, 54, 212-220.

[17] Challis, A., Wilson, m., Holling, M., Roos, S., Stevenson, A., and Stirling-Aird, P. (2015). Scottish Raptor Monitoring Scheme Report 2014. BTO Scotland.

[18] Whitfield, D.P., Fielding, A.H., McLeod, D.R.A. & Haworth, P.F. 2004b. Modelling the effects of persecution on the population dynamics of golden eagles in Scotland. Biological Conservation, 119, 319-333.

[19] Whitfield, D.P., Fielding, A.H., McLeod, D.R.A., Haworth, P.F. & Watson, J. 2006. A conservation framework for the golden eagle in Scotland: refining condition targets and assessment of constraint influence. Biological Conservation, 130, 465-480.

[20] Hill, D.A., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. (1997). Bird disturbance: improving the quality of disturbance research. Journal of Applied Ecology 34:275-288.

6.90 **Significance of Effect:** Even if in future years the territory is occupied by a breeding pair, the effect on the NHZ golden eagle population during construction is considered to be **Negligible** and **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.91 Although any golden eagle nests are highly unlikely to be affected, a Breeding Bird Protection Plan (BBPP) will be produced to ensure that disturbance to breeding birds on the site is avoided. Pre-construction surveys carried out by a suitably qualified ecologist will determine whether any golden eagle breeding activity is taking place within a potential disturbance zone (up to 1.5 km, Whitfield et al. 2008[21]).

Residual Effects

6.92 The residual effects of construction disturbance on golden eagle will be **Negligible** and therefore **Not significant** in the context of the EIA Regulations.

Merlin

6.93 **Impact:** foraging merlin may be displaced from the site during construction, either by disturbance or direct habitat loss.

6.94 **Nature Conservation Importance:** as an Annex I and Schedule 1 listed species, considered to be a component SSSI species, merlin is classified as High Nature Conservation Importance.

6.95 **Conservation Status:** The regional populations is likely to be in unfavourable conservation status.

6.96 **Magnitude of Impact:** Although data obtained suggest that a pair regularly breed within the wider study area, no infrastructure is planned within 500 m, and so no direct effects on breeding attempts are predicted. Individual merlin were only very occasionally recorded during baseline surveys (three flights outside of the site boundary), suggesting that the site is unimportant to breeding birds.

6.97 The site comprises mainly mature conifer plantation with relatively low numbers of small passerine species compared to areas closer to the nest site, and so temporary displacement of movements due to construction activities are unlikely to significantly compromise the integrity of any territory or impact on foraging abilities of any birds. With no individuals significantly affected, the spatial effect is assessed as **Negligible** magnitude.

6.98 **Significance of Effect:** The effect on the regional merlin population during construction is therefore considered to be **Negligible** and **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.99 None required. However, a BBPP will be produced, and will be approved by the planning authority in consultation with SNH prior to implementation. The BBPP will detail the procedures to be followed to ensure reasonable precautions are taken to avoid disturbance to breeding birds on the site. Likely measures may include, but will not be limited to, appropriate buffer distances from any nest sites, and monitoring during construction.

Residual Effects

6.100 The residual effects of construction on merlin remain **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Goshawk

6.101 **Impact:** breeding or foraging goshawk may be displaced from the site during construction, either by disturbance or direct habitat loss of suitable habitat.

6.102 **Nature Conservation Importance:** as a Schedule 1 listed species considered to be a qualifying interest of a nearby SSSI, goshawk is of High Nature Conservation importance.

6.103 **Conservation Status:** The NHZ goshawk population is considered to be in favourable conservation status.

6.104 **Magnitude of Impact:** During the design process, all known goshawk territory centres were buffered by at least 500 m from any proposed infrastructure to minimise the risk of direct habitat loss and construction disturbance. Of the three territories recorded during the baseline period, the closest, which is approximately 550 m from a proposed turbine location and in an area of ongoing forestry activity, was apparently vacant in 2015. The other two territory centres are over 1 km and 2 km respectively from the closest infrastructure, and although within core foraging range of 3km (SNH, 2013), localised habitat loss or disturbance is unlikely to compromise the integrity of any territory. A small loss in available foraging habitat is therefore considered to be of **Low** spatial and **Long-Term** temporal magnitude. Construction disturbance impacts are considered to be **Negligible**.

6.105 **Significance of Effect:** The effect on the goshawk population during construction is therefore considered to be at worst **Minor adverse** and **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.106 None required. However, as outlined in para 6.91 a BBPP will be produced to ensure that disturbance to breeding birds is avoided.

Residual Effects

6.107 The residual effects of construction on goshawk will be **Minor adverse** and therefore Not significant in the context of the EIA Regulations.

Peregrine

6.108 **Impact:** breeding or foraging peregrine may be displaced from the site during construction, either by disturbance or direct habitat loss of suitable habitat.

6.109 **Nature Conservation Importance:** as a Schedule 1 listed species considered to be a qualifying interest of a nearby SSSI, peregrine is of High Nature Conservation importance.

6.110 **Conservation Status:** The NHZ peregrine population is considered to be in unfavourable conservation status.

6.111 **Magnitude of Impact:** The two closest peregrine nest sites are over 2 km from a proposed turbine location, with one around 600 m from the closest infrastructure, and the other 2.2 km distant. These may be two alternative nest sites of the same pair, and so the site is within at least one territory. Peregrine activity was recorded relatively infrequently across the site during baseline surveys, suggesting the habitat is sub-optimal for the species, with much foraging likely to take place over open habitat closer to the nest sites.

6.112 At the given distance of the nest sites from infrastructure, it is considered unlikely that any construction activity will disturb nesting birds. The loss of habitat is unlikely to compromise the integrity of the territory/territories, and foraging will also likely be unaffected. A small loss in

[21] Whitfield, D P, Fielding, A H, McLeod, D R A and Haworth, P F (2008). A conservation framework for golden eagles: implications for their conservation and management in Scotland. Scottish Natural Heritage Commissioned Report No.193 (ROAME No. F05AC306).

available foraging habitat is therefore considered to be of **Low** spatial and **Long-Term** temporal magnitude. Construction disturbance impacts are considered to be **Negligible**.

6.113 **Significance of Effect:** The effect on the peregrine population during construction is therefore considered to be at worst **Minor adverse** and **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.114 None required. However, as outlined in para 6.91 a BBPP will be produced to ensure that disturbance to breeding birds is avoided.

Residual Effects

6.115 The residual effects of construction on peregrine will be **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Golden Plover

6.116 **Impact:** breeding, foraging or migrating golden plover may be displaced from the site during construction, either by disturbance or direct habitat loss of suitable habitat.

6.117 **Nature Conservation Importance:** as an Annex I listed species and a qualifying interest of a nearby SSSI, golden plover is of High Nature Conservation importance.

6.118 **Conservation Status:** The NHZ breeding and UK wintering golden plover populations are considered to be in unfavourable conservation status.

6.119 **Magnitude of Impact**: Golden plover was recorded occasionally in the non-breeding season, in flocks of up to 200 individuals within the open farmland in the north of the site. One possible breeding territory was also potentially in the area, some 700 m north of the closest proposed turbine location.

6.120 Construction activity within the plantation is considered unlikely to affect any breeding individuals to the north, with Highlee Hill screening much of the visual or noise disturbance. It is possible that non-breeding flocks may be temporarily disturbed by construction activity, but these birds are likely to be en route to coastal wintering areas and so will not be significantly impacted. A small loss in available foraging habitat is therefore considered to be of **Low** spatial and **Short-Term** temporal magnitude.

6.121 **Significance of Effect:** The effect on the golden plover population during construction is therefore considered to be at worst **Minor adverse** and **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.122 None required. However, as outlined in para 6.91 a BBPP will be produced to ensure that disturbance to breeding birds is avoided.

Residual Effects

6.123 The residual effects of construction on golden plover will be **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage

6.124 The VORs assessed above are all considered to be component parts of the SSSI. None of their respective populations are predicted to be significantly affected as a result of construction of the proposed wind farm. In most cases, birds present are unlikely to be part of the SSSI population. Taken together as an assemblage, the overall magnitude of impact is considered to be at worst **Low** and **Long-Term** (for habitat loss).

6.125 The overall effect on the breeding bird assemblage of the SSSI during construction is therefore considered to be at worst **Minor adverse** and **Not Significant** in the context of the EIA Regulations.

Operational Effects

Displacement

6.126 The displacement of nesting and foraging birds from the proposed wind farm site has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase. Displacement away from operational turbines has been found to occur in a number of individual wind farm studies, generally over distances of up to 100 m or 200 m from turbines, although the effects vary considerably between sites and species.

6.127 Additional existing information suggests that displacement effects are minimal, with most species affected only slightly, if at all, whilst Drewitt and Langston (2006[22]) highlighted the need for further study in order to accurately quantify displacement effects. Devereux et al. (2008[23]) showed that wind farms had no, or at most a minimal effect, on the local distribution of wintering farmland birds. Considering a range of breeding bird species but predominantly waders and passerines at upland wind farms, Pearce-Higgins et al. (2012[24]) showed that there were no displacement impacts on any bird species from wind farms during the operational phase other than those that had already occurred during construction, and for some species the impacts during construction were reversed during operation with numbers returning to pre-construction numbers. So the overall picture from Pearce-Higgins et al. (2012) is that disturbance is only an issue requiring consideration for the construction phase and not for wind farm operation.

6.128 It is recognised that disturbance may occur due to maintenance activities throughout the operation phase, although since these are likely to be of shorter duration and smaller extent than construction activities, effects will be lower than those predicted for construction impacts (see previous section).

6.129 Those studies mentioned above were focused on direct displacement (i.e. avoidance of areas surrounding wind farm installations); an additional consideration is the displacement of birds from larger areas where the turbines act as a barrier to bird movement. The likelihood of this effect occurring tends to increase with wind farm size, where large turbine arrays can force birds to alter their regular flight-paths, resulting in an increase in distance flown and so energy expended. However, a review of the literature suggests that none of the barrier effects identified so far have significant effects on populations (Drewitt and Langston, 2006). This was also the conclusion from modelling of energy costs to those bird species most likely to be sensitive to barrier effects (large and long-lived breeding birds such as seabirds) by Masden et al. (2010[25]).

6.130 Pearce-Higgins et al. (2009[26]) observed certain species experiencing localised population increases with proximity to wind farm infrastructure installations, so while some birds may be displaced locally,

[22] Drewitt, A.L. and Langston, R.L.H. (2006). Assessing the impacts of wind farms on birds, Ibis 148: 29-42

[23] Devereux, C.L., Denny, M.J.H. and Whittingham, M.J. (2008). Minimal effects of wind turbines on the distribution of wintering farmland birds. Journal of Applied Ecology 45: 1689-1694.

[24] Pearce-Higgins, J.W., Stephen, L., Douse, A. and Langston, R.H.W. (2012). Greater impacts of Windfarms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. Journal of Applied Ecology 49: 386-394.

[25] Masden, E. A., Haydon, D. T., Fox., A.D. and Furness, R.W. (2010) Barriers to movement: Modelling energetic costs of avoiding marine wind farms amongst breeding seabirds. Marine Pollution Bulletin, Vol. 60, issue 7: 1085-1091.

[26] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. Journal of Applied Ecology 46: pp 1323-1331.

others may benefit from the introduction of new structures into the habitat, or some other consequence of construction. This finding was further supported by Pearce-Higgins et al. (2012) who reported significant increases in breeding numbers of skylarks and stonechats at wind farms.

Golden Eagle

6.131 **Impact:** foraging or breeding golden eagles may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

6.132 **Nature Conservation Importance and relevant Conservation Status:** Golden eagle is of High Nature Conservation Importance. The NHZ golden eagle population is considered to be in unfavourable conservation status.

6.133 **Magnitude of Impact:** Evidence from Skye, which relates to non-breeding golden eagles, is that displacement operates at a scale of approximately 500 m around turbines (Haworth and Fielding 2013[27]). The absence of activity recorded during the baseline period, and likely poor quality habitat for the species within the site, suggests that the site forms at best a minor component of a territory, either historic or future. The magnitude of a displacement effect is therefore considered to be **Low** spatial, but **Long Term** temporal.

6.134 **Significance of Effect:** The overall effect on golden eagle is therefore assessed as **Minor adverse** on the territory and NHZ population, and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.135 None required.

Residual Effects

6.136 The residual effects of operational displacement on golden eagle remain **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Merlin

6.137 **Impact:** foraging merlin may be at risk of displacement around turbines or other infrastructure.

6.138 **Nature Conservation Importance and relevant Conservation Status:** Merlin is of High Conservation Importance. The NHZ population is considered to be in unfavourable conservation status.

6.139 **Magnitude of Impact:** Although it is acknowledged that there is a lack of empirical data on displacement of foraging raptors around operational wind farms, distances of any complete displacement are often likely to be lower than the 500 m prescribed by Ruddock and Whitfield (2007) which relate to disturbance caused by human movements near breeding sites.

6.140 No breeding attempts have been located within 2 km of any infrastructure, and the core foraging area of any adults likely to be outside of the site, so foraging within the site (currently unsuitable mature conifer plantation habitat) will be infrequent. The magnitude of a displacement effect is therefore considered to be **Negligible** spatial, but **Long-Term** temporal.

6.141 **Significance of Effect:** The overall effect on merlin is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.142 None required.

Residual Effects

6.143 The residual effects of operational displacement on merlin remain **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Goshawk

6.144 **Impact:** breeding or foraging goshawk may be at risk of displacement from around turbines or other infrastructure.

6.145 **Nature Conservation Importance and relevant Conservation Status:** Goshawk is of High Conservation Importance. The NHZ population is considered to be in favourable conservation status.

6.146 **Magnitude of Impact:** The core foraging range of goshawk from nest site during the breeding season is given by SNH (2013) as 3 km, meaning it is possible that three goshawk territories may be affected by the proposed wind farm. However on closer inspection, for one territory to the west, the closest proposed turbine location is within an area of clearfell over 2 km away, suggesting that this territory will remain unchanged from baseline conditions. A second territory is around 1 km from the nearest proposed turbine location, which is again in clearfell and therefore unlikely to significantly affect the territory. The third territory, unoccupied in 2015, is just over 500 m from a proposed turbine, which would be located in a forest coupe due to be felled prior to 2017 as part of the Dykeraw Forest Plan. It is therefore likely that birds will continue to be absent from this area at the time of construction. As such, the magnitude of a displacement effect is therefore considered to be **Low** spatial, and **Long-Term** temporal.

6.147 **Significance of Effect:** The overall effect on goshawk is therefore assessed as **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.148 None required.

Residual Effects

6.149 The residual effects of operational displacement on goshawk remain **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Peregrine

6.150 **Impact:** breeding or foraging peregrine may be at risk of displacement from around turbines or other infrastructure.

6.151 **Nature Conservation Importance and relevant Conservation Status:** Peregrine is of High Nature Conservation importance. The NHZ peregrine population is considered to be in unfavourable conservation status.

6.152 **Magnitude of Impact:** The core foraging range of breeding peregrine is given by SNH (2013) as 2 km, meaning that the site overlaps with at least one breeding territory. The two recorded nest/roost sites are over 2 km from the closest turbines, and peregrines generally require extensive open habitats to hunt, and so the site is unlikely to form an important component of any territory. No direct displacement of nest sites is likely and so the magnitude of a displacement effect is considered to be **Low** spatial, and **Long-Term** temporal.

6.153 **Significance of Effect:** The overall effect on peregrine is therefore assessed as **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

[27] Haworth, P. F. and Fielding, A. H. (2013). Edinbane Windfarm: Ornithological Monitoring. A review of the spatial use of the area by birds of prey. Haworth Conservation Ltd report for Vattenfall Ltd.

Proposed Mitigation

6.154 None required.

Residual Effects

6.155 The residual effects of operational displacement on peregrine remain **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Golden Plover

6.156 **Impact:** breeding, foraging or migrating golden plover may be at risk of displacement from around turbines or other infrastructure.

6.157 **Nature Conservation Importance and relevant Conservation Status:** Golden plover is of High Nature Conservation importance. The NHZ breeding and UK wintering populations are considered to be in unfavourable conservation status.

6.158 Magnitude of Impact: The closest possible golden plover breeding territory was approximately 700 m from the closest proposed turbine location, and unlikely to be affected by the proposed wind farm. It is unlikely that birds would attempt to breed much closer to the mature plantation, due to edge effects and a perceived increased predation threat. Some occasionally used foraging habitat may be lost to non-breeding birds, but again the outcome of this is expected to be negligible because of its proximity to conifer plantation. The magnitude of a displacement effect is therefore considered to be **Negligible.**

6.159 **Significance of Effect:** The overall effect on golden plover is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.160 None required.

Residual Effects

6.161 The residual effects of operational displacement on golden plover remain **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage

6.162 No VOR is predicted to be significantly affected as a result of operational displacement from the proposed wind farm. In most cases, birds present are unlikely to be part of the SSSI population. Taken together as an assemblage, the overall magnitude of impact is considered to be at worst **Low** spatial and **Long-Term** temporal.

6.163 The overall effect on the breeding bird assemblage of the SSSI during construction is therefore considered to be at worst **Minor adverse** and **Not Significant** in the context of the EIA Regulations.

Collision Risk

6.164 Birds that utilise the airspace within the turbine area at rotor height during the lifetime of the proposed wind farm will be at risk of collision with turbines. The risk of collision with moving wind turbine blades is presumed to be related (although not necessarily linearly) to the amount of flight activity over the site, the topography of the site, the species' behaviour, and the ability of birds to detect and manoeuvre around rotating turbine blades. On this basis, it is clear that collision mortality rates are likely to increase with a wind farm's proximity to large concentrations of birds, whether this is breeding and foraging birds, wintering birds, or those utilising specific areas for local or large-scale migration (Gill et al. 1996[28]).

6.165 The majority of studies of bird collisions with onshore wind turbines have recorded very low levels of mortality. This is perhaps largely a reflection of the fact that many wind farms are located away from large concentrations of birds. It is however important to note that many records are based only on finding corpses, with no correction for corpses that are overlooked or are removed by scavengers. It does also reflect the fact that birds have been found by direct observation to be very efficient at avoiding wind turbines.

6.166 Band et al. (2007[29]) describe a method of quantifying potential bird collisions with onshore turbines, in which: (i) the activity rate per unit area per season is extrapolated; (ii) the likelihood of a collision with a blade for a bird passing through the rotor swept area is calculated; and (iii) an 'avoidance rate' is applied to account for behavioural adaptation of birds to the presence of turbines. This results in a figure for the likely mortality rate at the wind farm which is then assessed within the context of the species' relevant populations to determine the significance of any losses. Collision Risk Modelling (CRM) results are detailed in the accompanying **Appendix 6.1, Annex E**.

Golden Eagle

6.167 **Impact:** Golden eagles flying within the site may be subject to a collision risk with turbines or other infrastructure, thereby almost certainly resulting in the death of the individual.

6.168 **Nature Conservation Importance and relevant Conservation Status:** Golden eagle is of High Nature Conservation Importance. The NHZ population is considered to be in unfavourable conservation status.

6.169 **Magnitude of Impact:** No flights were recorded during the baseline flight activity surveys, and so no collision modelling was run for this VOR. Even if the territory to the south is occupied in future years, the site is unlikely to comprise an important area for foraging, so territorial flights are likely to be infrequent at best. As outlined above, golden eagles are likely to avoid a wind farm as a whole, and so risk of collisions is very low. The magnitude of collision risk is therefore considered to be **Negligible**.

6.170 **Significance of Effect:** The unmitigated effect is classified as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.171 The Wind Farm Restocking Plan (Figure 10.7) will see the restocking of forestry while maintaining keyhole areas of open ground around the turbines. This will minimise the extent of potentially more suitable open habitat for eagle prey surrounding the turbines, and discourage eagles from foraging within the vicinity.

Residual Effects

6.172 The residual effect is considered to remain **Negligible** and therefore **Not Significant i**n the context of the EIA Regulations.

[28] Gill, J.P., Townsley, M. and Mudge, G.P. (1996). Review of the impacts of Windfarms and other aerial structures upon birds. SNH Review 21: 68pp.

[29] Band, W., Madders, M. and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at Windfarms. In: de Lucas, M., Janss, G.F.E. and Ferrer, M. (eds.) Birds and Windfarms: Risk Assessment and Mitigation. Pp. 259-275. Quercus, Madrid.

Merlin

6.173 **Impact:** Merlin flying within the site may be subject to a collision risk with turbines or other infrastructure, thereby almost certainly resulting in the death of the individual.

6.174 **Nature Conservation Importance and relevant Conservation Status:** Merlin is of High Conservation Importance. The NHZ population is considered to be in unfavourable conservation status.

6.175 **Magnitude of Impact:** A total of three merlin flights were recorded during baseline flight activity surveys, all of which occurred to the northwest of the site, around 2 km from the closest proposed turbine location. No collision modelling was therefore conducted for this VOR and it follows that collision risk would be very low.

6.176 Even when accounting for a short-term period post-felling when habitat within the site may be temporarily more attractive to merlin, activity rates will be low, and mortality effects are considered to **Negligible** spatial, but Long Term temporal.

6.177 **Significance of Effect:** The overall effect on the merlin population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.178 None required. The Wind Farm Restocking Plan (Figure 10.7) will minimise the extent of the site which is of potential suitable habitat for foraging merlin, and therefore birds will be at risk of collisions.

Residual Effects

6.179 The residual effects of operational displacement on merlin remain **Negligible** and therefore **Not Significan**t in the context of the EIA Regulations.

Goshawk

6.180 **Impact:** Breeding or foraging goshawk flying within the site may be subject to a collision risk with turbines or other infrastructure, thereby almost certainly resulting in the death of the individual.

6.181 **Nature Conservation Importance and relevant Conservation Status:** Goshawk is of High Conservation Importance. The NHZ population is considered to be in favourable conservation status.

6.182 **Magnitude of Impact:** A total of 19 goshawk flights were recorded during baseline flight activity surveys, of which seven were "at-risk". As SNH (2014) states, "*Whilst this can be a species which is difficult to detect on VP survey primarily due to much flight activity being at low level and in and around forest/woodland cover, the flight activity above the canopy can be surveyed. Given that mature commercial forestry and other woodland often have trees 20-30 m high this above canopy flight will be relevant to the potential collision risk area for turbines*".

6.183 The resultant worst-case collision modelling for this VOR predicted an annual collision rate of up to 0.026, which equates to one collision every 38 years (see **Technical Appendix 6.1, Annex E** for details). Although conditions within the site may alter somewhat because of ongoing forestry operations, and forest removal and replanting associated with the proposed wind farm, this level of risk (unlikely to be one collision during the lifetime of the proposed wind farm) is considered to be representative of the operational period. The magnitude of collision risk is therefore considered to be **Negligible**.

6.184 **Significance of Effect:** The overall effect on the goshawk population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.185 None required.

Residual Effects

6.186 The residual effects of operational displacement on goshawk remain **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Peregrine

6.187 **Impact:** Breeding or foraging peregrine flying within the site may be subject to a collision risk with turbines or other infrastructure, thereby almost certainly resulting in the death of the individual.

6.188 **Nature Conservation Importance and relevant Conservation Status:** Peregrine is of High Conservation Importance. The NHZ population is considered to be in unfavourable conservation status.

6.189 **Magnitude of Impact:** A total of eight individual flights were recorded during baseline flight activity surveys, of which six were "at-risk". The resultant collision modelling for this VOR predicted an annual collision rate of up to 0.009 birds, or one collision every 111 years. The site is currently of low importance for foraging peregrine, and it is likely that this would continue throughout the operational period of the proposed wind farm. The magnitude of collision risk is therefore considered to be **Negligible**.

6.190 **Significance of Effect:** The overall effect on the peregrine population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.191 None required. The Wind Farm Restocking Plan (Figure 10.7) will minimise the extent of the site which is of potential suitable habitat for foraging peregrine, and therefore birds will be at risk of collisions.

Residual Effects

6.192 The residual effects of operational displacement on peregrine remain **Negligible** and therefore **Not significant** in the context of the EIA Regulations.

Golden Plover

6.193 **Impact:** Breeding, foraging or migrating golden plover flying within the site may be subject to a collision risk with turbines or other infrastructure, thereby almost certainly resulting in the death of the individual.

6.194 **Nature Conservation Importance and relevant Conservation Status:** Golden plover is of High Conservation Importance. The NHZ and UK wintering populations are considered to be in unfavourable conservation status.

6.195 **Magnitude of Impact:** A total of three flight events were recorded during baseline flight activity surveys, of which, one flock containing 200 individuals passed within 250 m of a turbine, but above the upper 125 m+ survey height band. With the potential for turbine upper tip height being 150 m or 176 m however, this flight has been included in collision modelling as a precaution. The resultant collision modelling for this VOR predicted an annual collision rate of up to 0.342 birds, or one collision every 2.9 years. This value was obtained when using the 176 m rotor tip height turbines, and is reduced to 0.168 (one collision every 6.0 years) with the 150 m turbines. This latter value is likely to

be more appropriate, since the smaller turbines (T6 and T7) are located to the north, closest to where the golden plover flight activity was recorded.

6.196 Risk to golden plover appears to be confined to wider movements of birds in the non-breeding season, and although the regional wintering golden plover population is unknown, the latest WeBS core count data suggests a Northumberland population of around 10,200 individuals, mainly in estuarine habitats. Using this as a conservative estimate of overall wintering numbers, the loss of one bird every 2.9 years would result in an increase in baseline mortality by 0.01% (assuming an adult survival rate of 0.730, BTO BirdFacts). The magnitude of collision risk is therefore considered to be **Negligible**.

6.197 **Significance of Effect:** The overall effect on the golden plover population is therefore assessed as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Proposed Mitigation

6.198 None required. The Wind Farm Restocking Plan (Figure 10.7) will minimise the extent of the site which is of potential suitable habitat for golden plover, and therefore birds will be at risk of collisions.

Residual Effects

6.199 The residual effects of operational displacement on golden plover remain **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage

6.200 No VOR is predicted to be significantly affected as a result of collisions from the proposed wind farm. In most cases, birds present are unlikely to be part of the SSSI population, even in winter months. Taken together as an assemblage, the overall magnitude of impact is considered to be at worst **Low** and **Long-Term**.

6.201 The overall effect on the breeding bird assemblage of the SSSI during operation is therefore considered to be at worst **Minor adverse** and **Not Significant** in the context of the EIA Regulations.

Decommissioning Effects

Predicted Effects

6.202 Decommissioning effects, because of the long timeframe until their occurrence (>30 years) are difficult to predict with any confidence. They are however considered for the purpose of this chapter to be similar to those of construction effects in nature, but are likely to be of shorter duration. The significance of effects predicted for each VOR in the Construction Effects section are therefore considered appropriately precautionary for assessing decommissioning effects.

Proposed Mitigation

6.203 A Breeding Bird Protection Plan (BBPP), similar to that for the construction phase will be implemented during decommissioning of the proposed wind farm.

6.204 Implementation of other species-specific mitigation measures will occur across the site, similar to those planned for the construction phase.

Cumulative Effects

6.205 This section presents information about the potential cumulative effects of the proposed wind farm combined with other nearby existing or proposed projects or activities that are subject to an EIA process.

6.206 SNH (2012) has provided guidance on assessing the cumulative impacts on birds. This assessment follows the principles set out in that guidance. According to SNH "The key principle for all cumulative impact assessments is to focus on the likely significant effects and in particular those which are likely to influence the outcome of the consenting process".

6.207 Cumulative effects may include cumulative disturbance-displacement, collision mortality, habitat loss or barrier effects. Some cumulative impacts, such as collision risk should be summed quantitatively, but according to SNH (2012) "*In practice some effects, such as levels of disturbance or the barrier effect, may need considerable additional research work to assess impacts quantitatively. A more qualitative process may need to be applied until this quantitative information is available, e.g. from post-construction monitoring or research*".

Scoped in Projects

6.208 For a cumulative assessment, SNH (2012) recommend that a NHZ-level assessment is normally considered appropriate for bird species of wider countryside interest. The proposed wind farm lies at the edge of NHZ 20 Border Hills, which stretches from the Pentland Hills in the north, to the Scotland-England border in the south, which is just over 2 km from the proposed wind farm site. Because of the proximity to the English border, projects in similar habitat in Northumberland (particularly the Cheviot Hills) may also be within a potential zone of influence for VORs.

6.209 The main projects likely to cause similar impacts to those associated with the proposed wind farm are other operational wind farms, or those under construction, consented, or in the planning process (Table 6.9 and Figure 6.11). No other project types or activities subject to EIA have been identified within the search area.

6.210 According to SNH's Onshore Wind Farm Proposals GIS database (version dated 6 Jan 2016), there are over 50 other wind farm projects within the NHZ, the majority of which are in the northern half of the NHZ, in the in the Moorfoot, Lammermuir or Lowther Hills over 30 km from the proposed wind farm. Because of this distance, it is considered unlikely that there is any significant connectivity between VOR populations in the northern and southern halves of the NHZ, with differing species assemblages likely present. As such, a sub-NHZ level assessment, also taking into consideration any projects within Northumberland's Cheviot Hills is considered to be more appropriate.

6.211 There are no operational wind farms within 20 km of the site. Projects that are >5 MW and currently within the planning process are Birneyknowe, Windy Edge, Cummings Hill (application withdrawn - not considered in this cumulative assessment), and the Wauchope East/Wauchope West/ Newcastleton application (scoping) which is adjacent to the site. Further afield in the Cheviot/Liddesdale area are Langhope Rig, Crossdykes, Ewe Hill, Solwaybank and Minsca.

6.212 Across the Border, Redesdale Forest was the only project identified within 20 km in the Cheviot Hills, probably due to the fact that the majority of this area is part of the Northumberland National Park. This project has been scoped out of the assessment as no information is available in its pre-application status. Further afield is Green Rigg, which has been operational since 2012. No information on

ornithology was available for this site because of the age of the assessment (2006), and connectivity between populations is considered unlikely.

6.213 Small projects with three or fewer turbines have been excluded from the cumulative assessment as often these projects are not subject to the same level of detail of ornithological assessment, and so there are no directly comparable data. Because of the small scale of such projects, effects are likely to be negligible on the VORs assessed here, particularly as they are often in different habitats (e.g. farmland).

Table 6.9: Other Projects Considered for Cumulative Effects

Project	Status	Distance	Turbines	Goshawk	Peregrine	Golden plover	Kielderhead Moors SSSI
Wauchope East	Scoping	680 m S	50	✓	✓	✓	-
Wauchope West	Scoping	3.5 km W	20	✓	✓	✓	-
Newcastleton	Scoping	16.8 km SW	20	✓	✓	✓	-
Pines Burn	Pre-application	4.5 km W	Unknown	Scoped out			
Birneyknowe	Decision pending	3.9 km NW	>15	NA	✓	✓	NA
Windy Edge	Revised application following refusal	9.1 km SW	9 (revised)	-	✓	✓	NA
Cummings Hill	Application withdrawn	4.6 km NE	>7	Scoped out			
Redesdale Forest	Pre-application	16 km SE	50-100	Scoped out			
Langhope Rig	Installed	21 km NW	10	✓	✓	✓	-
Crossdykes	Application	37 km SW	15	✓	-	NA	-
Ewe Hill	In-construction	37 km SW	22	-	✓	NA	-
Green Rigg	Operational since 2012	37.8 km SE	18	No information available			
Solwaybank	Consented	39.5 km SW	15	✓	-	✓	-
Minsca	Operational since 2008	44 km SW	16	-	✓	-	-

NA = Recorded, but not assessed within the project's EIA

Scoped in VORs

6.214 Because the predicted effects on golden eagle and merlin due to the proposed wind farm alone were deemed Negligible, no significant cumulative effects will occur when considering the proposed wind farm alongside other projects. These two species have been excluded from the cumulative assessment, leaving **goshawk, peregrine, golden plover** and the **Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage** as the four VORs for consideration.

Goshawk

Disturbance and Displacement

6.215 Four other wind farm projects within the southern half of NHZ 20 considered goshawk as part of their impact assessment. At Langhope Rig, Solwaybank and Crossdykes, the species was recorded infrequently, and no breeding evidence was found within the survey area. The respective wind farm areas appear to be unimportant for breeding or foraging.

6.216 The Wauchope - Newcastleton project identified three nest sites within 2 km of that project, although it is not clear how many of these are the same as those recorded during baseline surveys for the proposed wind farm, which are all within 2 km of the Wauchope site boundary. It is also not known how close these nest sites are to any Wauchope - Newcastleton proposed infrastructure, although the scoping report states that the findings of the survey work will be used to inform the detailed scheme design.

6.217 When considering design layout and mitigation at Wauchope - Newcastleton, it is unlikely that any goshawk nest sites will be directly affected by wind farm projects, although at least three territories may be affected by a loss of foraging habitat. It was already concluded above that none of the three territories would be significantly compromised by the proposed wind farm because of distance from infrastructure, and when considering the location of the Wauchope - Newcastleton project this is again likely to be the case for at least two of the three territories. One territory is located within the Wauchope - Newcastleton site boundary, and so a larger loss of habitat cannot be ruled out.

6.218 The possible resultant loss of one pair out of at least 80 pairs within the Scottish Borders (1.2%) would represent a magnitude of cumulative disturbance-displacement effects of Low Spatial and Long Term temporal within the context of the NHZ population.

6.219 The cumulative effect is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Table 6.10: Predicted cumulative effects relating to goshawk

Project	Disturbance-displacement	Collision mortality
Highlee Hill	Depends on forest clearance before construction	Up to 0.026 per annum (one collision every 38 years)
Wauchope – Newcastleton	Three nests identified within 2 km of the development. At least one may be the same as the territories described in the Existing Conditions section. Moderate levels of activity recorded to date.	None conducted to date
Langhope Rig	Year round use, with a small number of flights and no foraging activity recorded.	One collision every 31.7 non-breeding seasons (0.031) and one collision every 45.4 breeding seasons (0.022) (95% avoidance rate).
Crossdykes	Recorded on three occasions, likely breeding outside of 2 km survey buffer. Considered to be negligible displacement risk.	No CRM – considered to be negligible collision risk.
Solwaybank	10 flights recorded during baseline surveys, but no breeding within 2 km. With abundant forest nearby it was considered to be a negligible displacement risk.	One collision every 71.3 years (approx. 0.014 per annum)

Proposed Mitigation

6.220 No additional mitigation to that outlined above is considered to be required.

Residual Cumulative Effects

6.221 The residual cumulative effects on goshawk remain **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Collision Risk

6.222 Collision mortality was considered for the proposed wind farm to be of negligible magnitude (up to 0.026 per annum), and this is also likely to be the case for the other NHZ projects, with no CRM undertaken at Crossdyke; 0.014 collisions per annum (one collision every 71.3 years) at Solwaybank; 0.053 collisions per annum (one collision every 18.9 years) predicted at Langhope Rig at a precautionary 95% avoidance rate, which is the equivalent of 0.021 collisions per year, or one every 47 years at a 98% avoidance rate recommended by SNH (2010[30]). The total cumulative mortality when including the proposed wind farm is therefore 0.061 collisions per year, or one every 16 years.

6.223 The cumulative effect is therefore at worst, **Minor adverse** and **Not Significant**.

Proposed Mitigation

6.224 No additional mitigation to that outlined above is considered to be required.

Residual Cumulative Effects

6.225 The residual cumulative effects on goshawk remain **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Peregrine

Disturbance and Displacement

6.226 Peregrine was recorded at six other wind farm sites within the cumulative study area, although breeding was recorded at only one of these sites, Wauchope - Newcastleton, which may refer to the same territory as that recorded within the proposed wind farm study area. As this site is only at the Scoping stage it is not clear where in relation to this nest site that infrastructure will be located, but the scoping report states that the findings of the survey work will be used to inform the detailed scheme design, thereby likely avoiding direct disturbance risks.

6.227 For all sites, activity levels were low, and although some loss of foraging habitat may occur, this is not likely to be significant for any pair or individual.

6.228 The magnitude of cumulative disturbance-displacement effects is therefore considered to remain **Low** Spatial and **Long Term** temporal within the context of the NHZ population.

6.229 The cumulative effect is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

Table 6.11: Predicted cumulative effects relating to Peregrine

Project	Disturbance-displacement	Collision mortality
Highlee Hill	No disturbance to nesting, but some loss of (minor importance) foraging habitat.	0.009 collisions per annum, or one every 111 years.
Wauchope – Newcastleton	One nest identified within 2 km of the development. This may be the same as one described in the Existing Conditions section. Low-moderate flight activity recorded to date.	None conducted to date
Birneyknowe	Negligible – no breeding evidence within 10 km	5 flights during VP surveys. 0.175 collisions per year CRM
Windy Edge	Two flights during baseline surveys. The site has in the recent past supported one breeding pair of peregrine and it was considered possible that the nest may be occupied in the future. This scenario was considered in the assessment. All turbines located >800 m from nest site so only small amount of available foraging habitat lost.	No CRM – no at-risk flights. Low theoretical collision risk of birds at nest site, based on distance to turbines.
Langhope Rig	Infrequent usage by at least two birds. May be part of wider territory but does not form part of core range.	One collision every 33.0 non-breeding seasons and one collision every 89.1 breeding seasons (95% avoidance rate). Equates to 0.017 collisions p.a. at 98% avoidance rate
Ewe Hill	Low number of flights recorded, and no breeding evidence in study area.	No CRM undertaken
Minsca	One flight recorded.	4.2×10^{-3} collisions per year (negligible)

Collision Risk

6.230 Collision rates were estimated for peregrine at Birneyknowe, Langhope Rig and Minsca Wind Farms, and when including the rate predicted at the proposed wind farm, a cumulative collision rate of 0.205 per year (one collision every 4.9 years) results. Assuming a regional breeding population of 32 pairs, this would result in an increase in mortality by up to 1.6% (assuming an adult survival rate of 0.8, BTO BirdFacts), although this is likely to be an overestimate of risk, as non-breeding birds have not been considered. The magnitude of cumulative impact is considered to be **Low,** and **Long-term**, and the cumulative effect is therefore at worst, **Minor adverse** and **Not Significant**.

Proposed Mitigation

6.231 No additional mitigation to that outlined above is considered to be required.

Residual Cumulative Effects

6.232 The residual cumulative effects on peregrine remain **Minor adverse** and therefore **Not Significant** in the context of the EIA Regulations.

Golden Plover

Disturbance and Displacement

6.233 Golden plover was recorded at seven other wind farm sites, with no evidence of breeding at any, except for in the wider study area at Wauchope - Newcastleton, which is likely to be beyond potential disturbance distances. Non-breeding birds were present in various flock sizes, but no significant effects were predicted due to the infrequency of presence at each site or in the case of Solwaybank, due to the abundant alternative habitat likely to be nearby.

6.234 The magnitude of cumulative disturbance-displacement effects is therefore considered to be **Low** Spatial and **Long Term** temporal within the context of the NHZ population.

6.235 The cumulative effect is classified as **Minor adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

[30] Scottish Natural Heritage (2010). Use of Avoidance Rates in the SNH Wind Farm Collision Risk Model. SNH Avoidance Rate Information & Guidance Note

Table 6.12: Predicted cumulative effects relating to Golden plover

Project	Disturbance-displacement	Collision mortality
Highlee Hill	No breeding territories likely to be affected. Small loss of foraging habitat possible.	Up to 0.342 collisions per annum, or one collision every 2.9 years.
Wauchope – Newcastleton	Two territories were identified adjacent to, but outside, the 2 km buffer around the development areas.	None conducted to date
Birneyknowe	None – no breeding evidence	5 flights of flocks up to 100 individuals. 0.35 collisions per year CRM
Windy Edge	Four records of single non-breeding individuals and one flock of 36 individuals. Loss of breeding or foraging habitat unlikely	No CRM – no at-risk flights.
Langhope Rig	Two flights during winter surveys	One collision every 9.2 non-breeding seasons (95% avoidance rate). Equates to 0.435 collisions p.a. at a 98% avoidance rate
Crossdykes	Three flights involving large flocks of golden plover were recorded moving through the area in April, with 342 birds the maximum flock size.	No CRM – no at-risk flights.
Solwaybank	Twenty flocks (totalling 804 birds) recorded during the non-breeding season. Birds either were passing through site or using it as an intermittent roost.	1.88 birds per annum (non-breeding).
Ewe Hill	One golden plover heard on one occasion.	No CRM– no at-risk flights

Collision Risk

6.236 Collision rates were estimated for golden plover at Birneyknowe, Langhope Rig and Solwaybank wind farms, and when including the rate predicted at the proposed wind farm, a cumulative collision rate of around 2-3 bird per year results. Collision risk is expected to be restricted to non-breeding birds in winter months. The regional wintering golden plover population is around 10,200 individuals, mainly in estuarine habitat, resulting in an increase in baseline mortality by up to 0.1%, which is of **Negligible** magnitude. The cumulative effect is therefore **Negligible** and **Not Significant**.

Proposed Mitigation

6.237 No additional mitigation to that outlined above is considered to be required.

Residual Cumulative Effects

6.238 The residual cumulative effects on golden plover remain **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage

6.239 The SSSI was not specifically included in any other project's impact assessment, although was mentioned as a relevant designated site in some of the EIAs. The SSSI overlaps in extent with the Wauchope - Newcastleton project, so the highest likelihood for a significant effect would be with that project. Goshawk, peregrine and golden plover were all recorded breeding in the survey area of the Wauchope - Newcastleton project, but as described above, the goshawk and peregrine nest sites may be the same as those recorded for the proposed wind farm, and so no SSSI pairs may be affected.

6.240 No VOR is predicted to be significantly affected as a result of collisions from the wind farm developments. In most cases, birds present are unlikely to be part of the SSSI population, even in winter months. Taken together as an assemblage, the overall magnitude of impact is considered to be at worst **Low** and **Long-Term**.

6.241 The overall effect on the breeding bird assemblage of the SSSI during construction is therefore considered to be at worst **Minor adverse** and **Not Significant** in the context of the EIA Regulations.

Pre-Construction Surveys

6.242 Pre-construction breeding bird surveys will be undertaken as part of the Breeding Bird Protection Plan.

Summary of Effects

6.243 Table 6.13 below summarises the predicted effects of the wind farm on the identified VORs.

Table 6.13: Summary of Effects

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Construction and Decommissioning			
Golden eagle	Negligible	BBPP	Negligible
Merlin	Negligible	BBPP	Negligible
Goshawk	Minor adverse	BBPP	Minor adverse
Peregrine	Minor adverse	BBPP	Minor adverse
Golden plover	Minor adverse	BBPP	Minor adverse
Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage	Minor adverse	BBPP	Minor adverse
Operation: displacement			
Golden eagle	Minor adverse	None	Minor adverse
Merlin	Negligible	None	Negligible
Goshawk	Minor adverse	None	Minor adverse
Peregrine	Minor adverse	None	Minor adverse
Golden plover	Negligible	None	Negligible
Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage	Minor adverse	None	Minor adverse
Operation: collision risk			
Golden eagle	Negligible	Forest Restocking Plan	Negligible
Merlin	Negligible	Forest Restocking Plan	Negligible
Goshawk	Negligible	None	Negligible
Peregrine	Negligible	Forest Restocking Plan	Negligible

Predicted Effect	Significance	Mitigation	Significance of Residual Effect
Golden plover	Negligible	Forest Restocking Plan	Negligible
Kielderhead Moors: Carter Fell to Peel Fell SSSI Breeding Bird Assemblage	Minor adverse	Forest Restocking Plan	Minor adverse

HIGHLEE HILL WIND FARM

FIG 6.1

PROPOSED WIND FARM BOUNDARY AND STUDY AREAS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Infrastructure
- Site Boundary
- 500 m Study Area
- 1.5 km Study Area
- 2 km Study Area

T1 T2 T3 T4 T5 T6 T7 T8 T9 T10 T11 T12 T13

W A U C H O P E F O R E S T

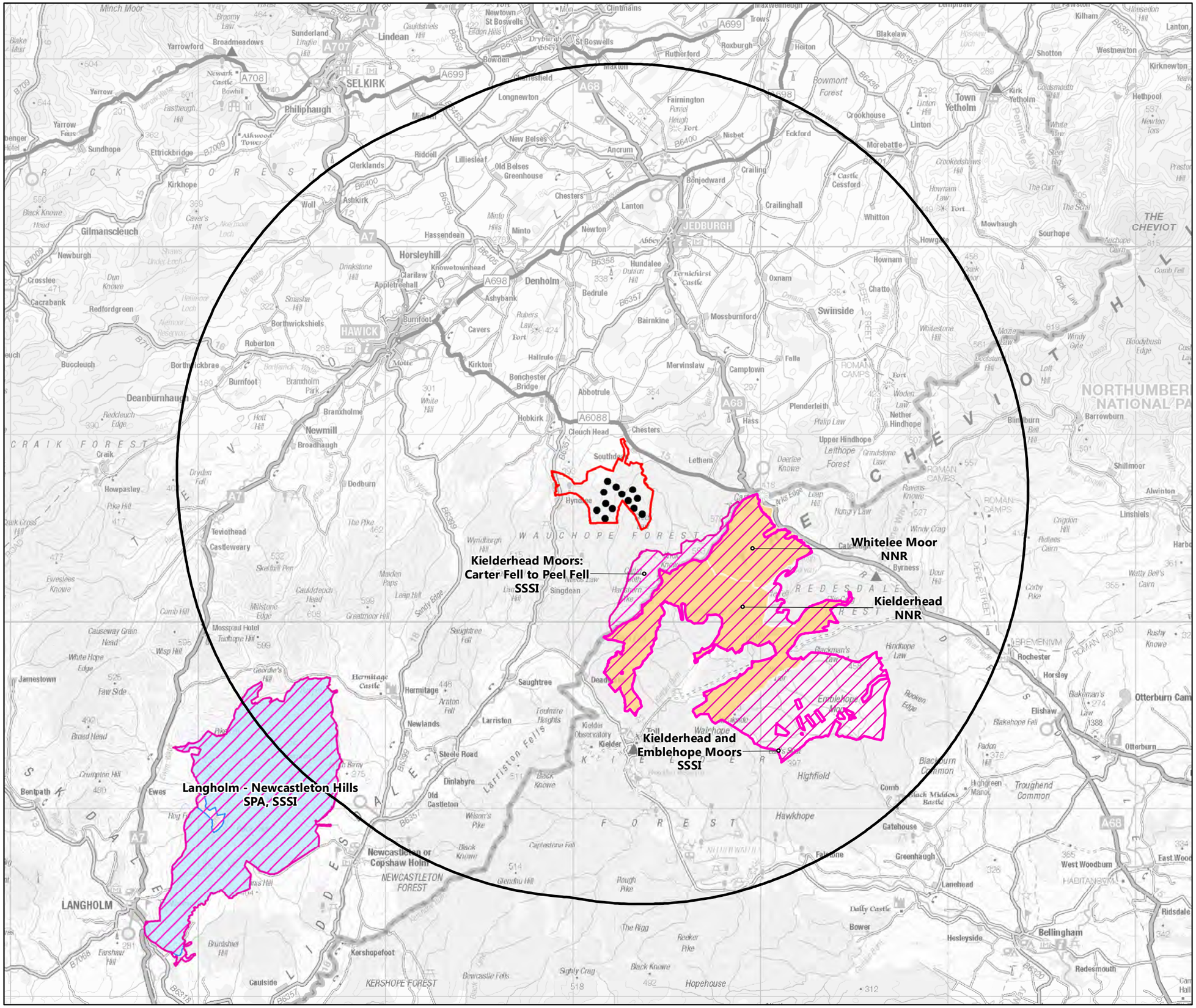
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER: ES_O_Fig6.1_SB_SA_HIH

SCALE - 1:40,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 6.2

DESIGNATED SITES: ORNITHOLOGY WITHIN 20 KM

© SCOTTISH NATURAL HERITAGE. CONTAINS ORDNANCE SURVEY DATA © CROWN COPYRIGHT AND DATABASE RIGHT 2016, CONTAINS ORDNANCE SURVEY DATA © CROWN COPYRIGHT AND DATABASE RIGHT 2016

- Turbine Location
- Site Boundary
- 20 km Distance Band

Designated Sites

- Special Protection Area (SPA)
- National Nature Reserve (NNR)
- Site of Special Scientific Interest (SSSI)

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

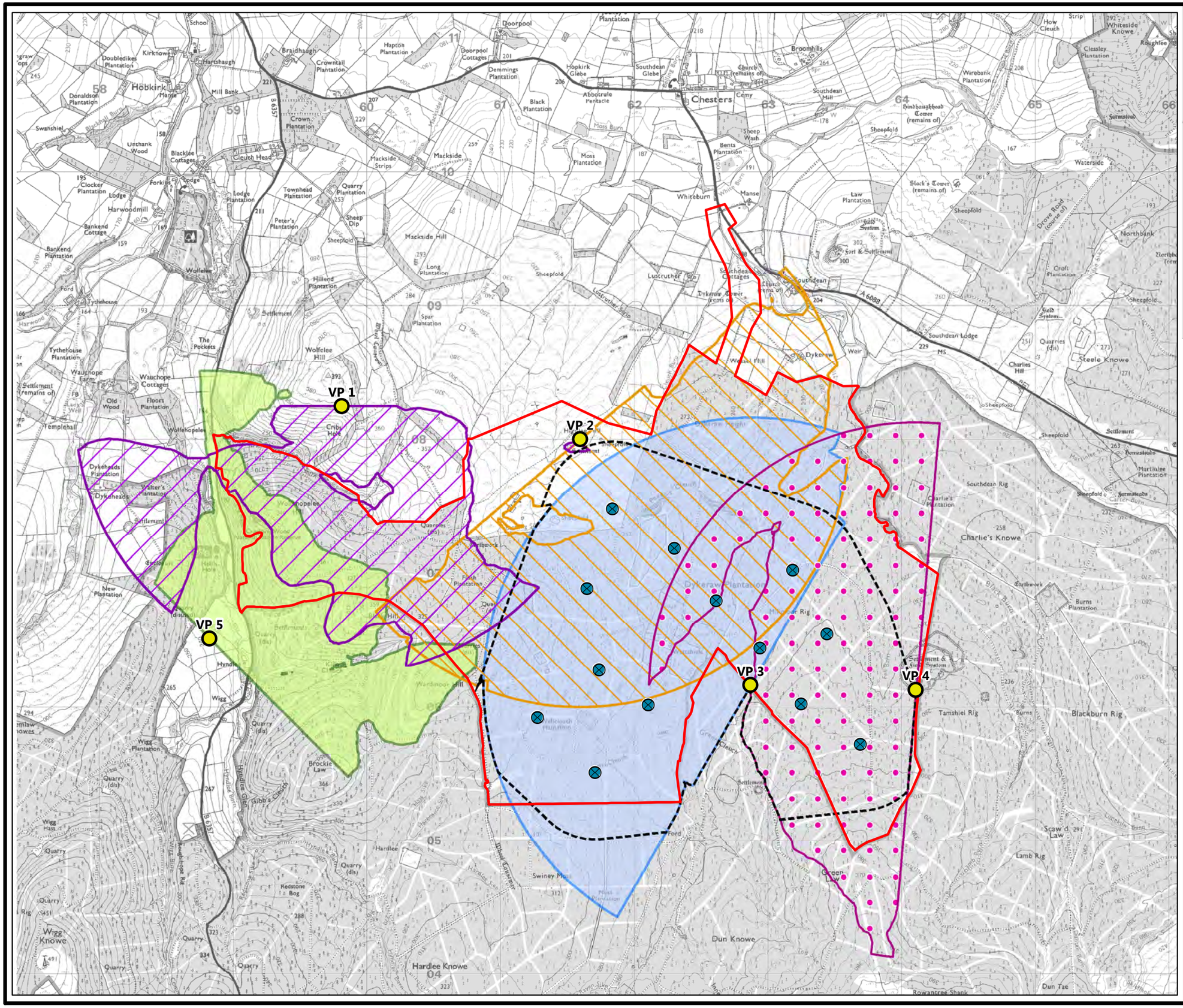
DRAWING NUMBER

ES_O_Fig6.2_DS_HIH

SCALE - 1:200,000 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 6.3

VANTAGE POINTS AND VIEWSHEDS 2011 - 2012

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Site Boundary
- Collision Risk Analysis Area (CRAA)
- Vantage Point
- Area Visible from VP 1
- Area Visible from VP 2
- Area Visible from VP 3
- Area Visible from VP 4
- Area Visible from VP 5

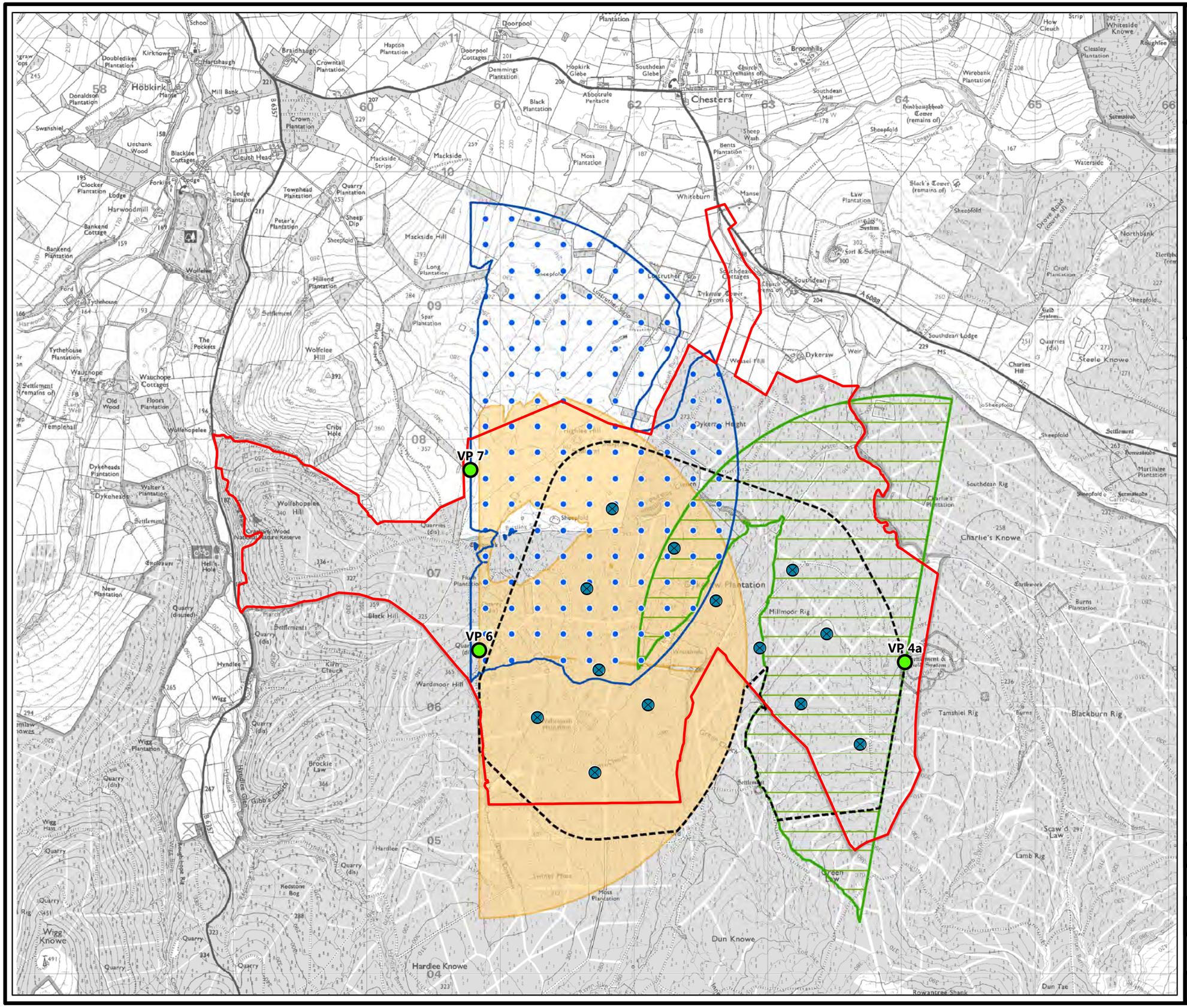
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_O_Fig6.3_VPVS_2011_12_HIH

SCALE - 1:27,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 6.4

VANTAGE POINTS AND VIEWSHEDS 2012 - 2013

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Site Boundary
- Collision Risk Analysis Area (CRAA)
- Vantage Point
- Area Visible from VP 4a
- Area Visible from VP 6
- Area Visible from VP 7

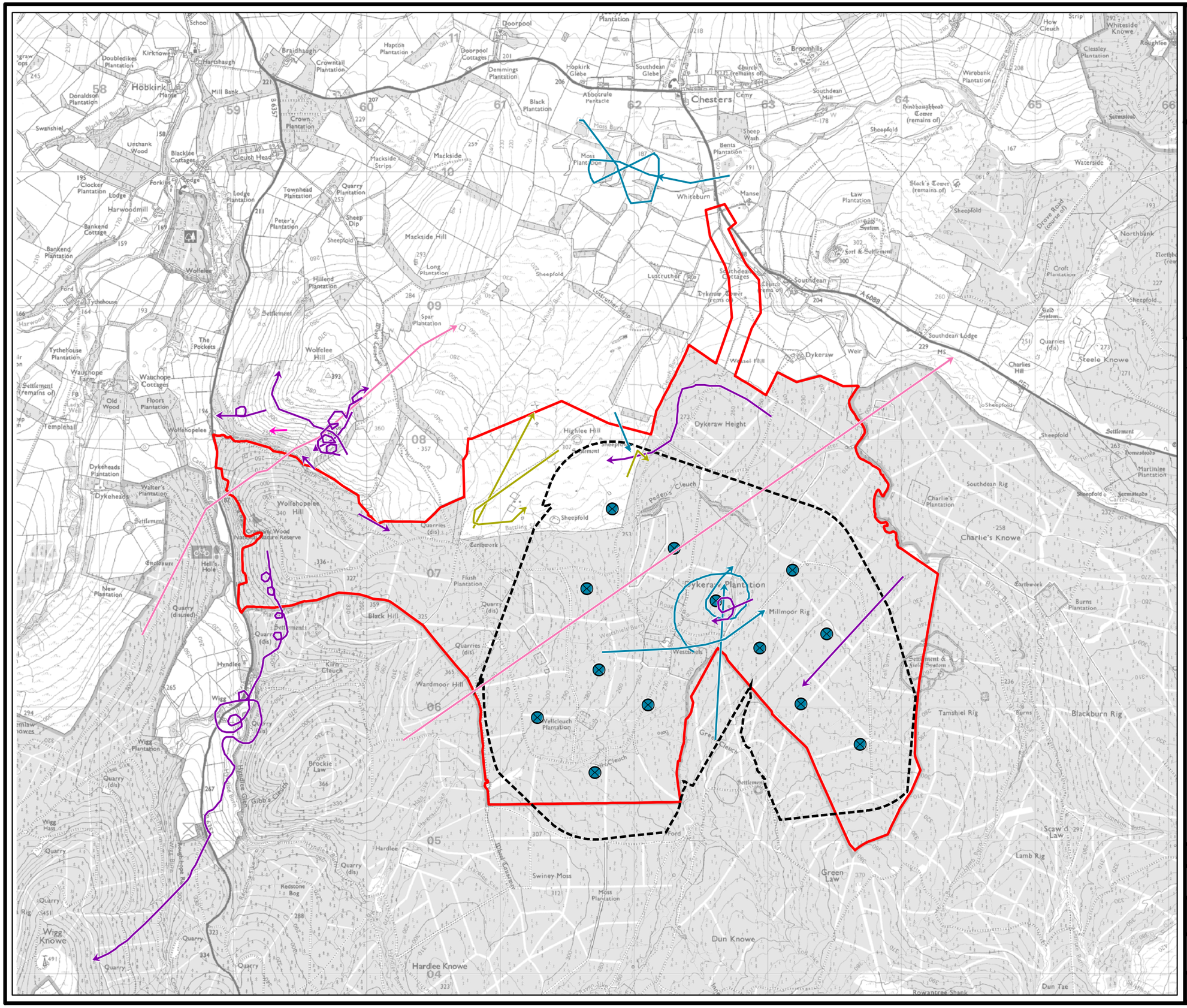
LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_O_Fig6.4_VPVS_2012_13_HIH

SCALE - 1:27,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL WIND FARM

FIG 6.5

FLIGHT ACTIVITY NON-BREEDING SEASON 2011 - 2012

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Site Boundary
- Collision Risk Analysis Area (CRAA)

Non-breeding Season Records 2011/2012

- Golden Plover
- Goshawk
- Merlin
- Peregrine Falcon
- Pink-footed Goose

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_O_Fig6.5_FA_NBR2011_12_HIH

SCALE - 1:27,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 6.6

FLIGHT ACTIVITY BREEDING SEASON 2012

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Turbine Location
- Site Boundary
- Collision Risk Analysis Area (CRAA)

Breeding Season Records 2012

- Curlew
- Goshawk
- Hen Harrier
- Merlin
- Osprey
- Peregrine Falcon

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_O_Fig6.6_FA_BR2012_HIH

SCALE - 1:27,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIG 6.7

FLIGHT ACTIVITY BREEDING SEASON 2013

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Turbine Location

Site Boundary

Collision Risk Analysis Area (CRAA)

Breeding Season Records 2013

Curlew

Red Kite

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

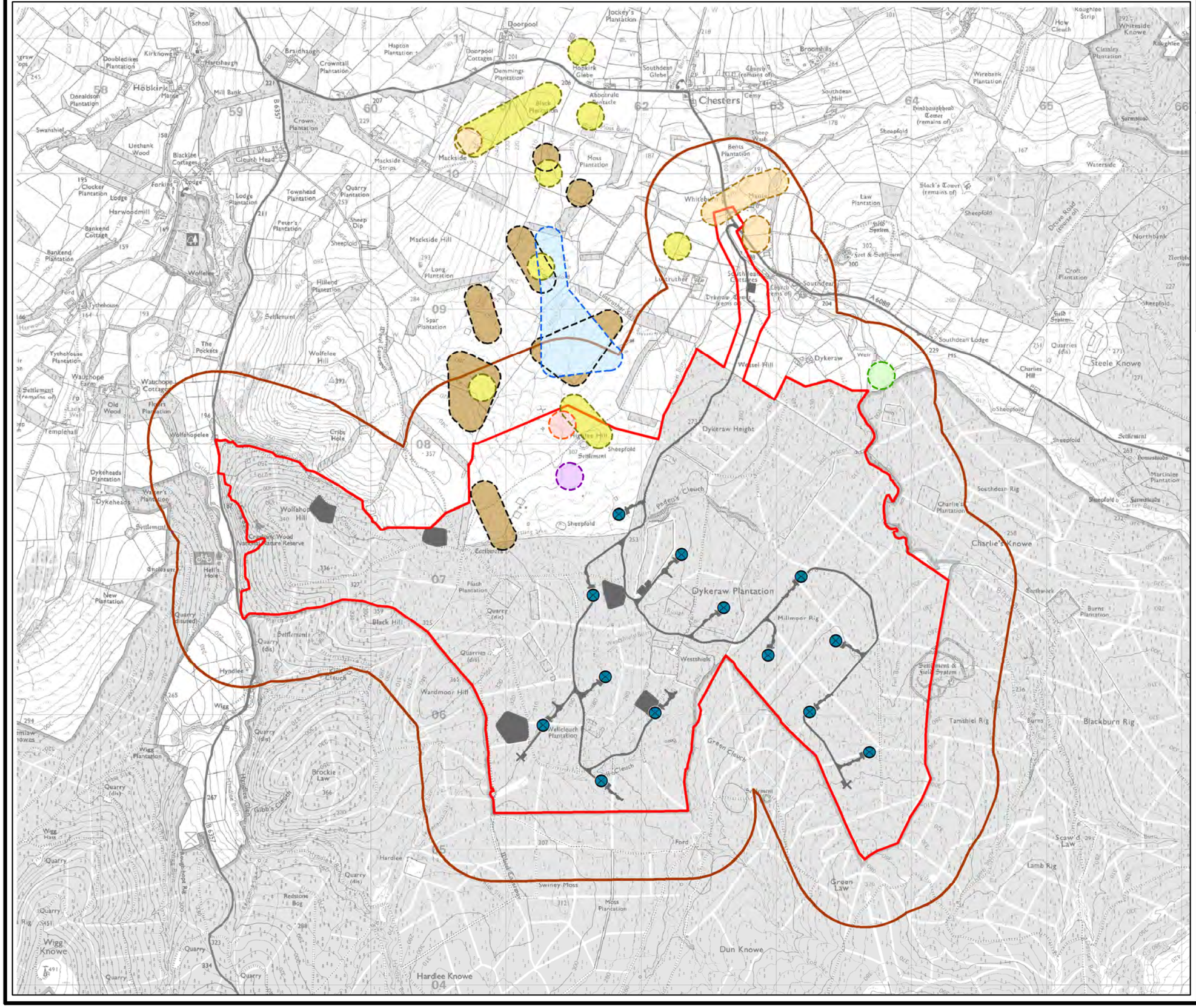
DRAWING NUMBER

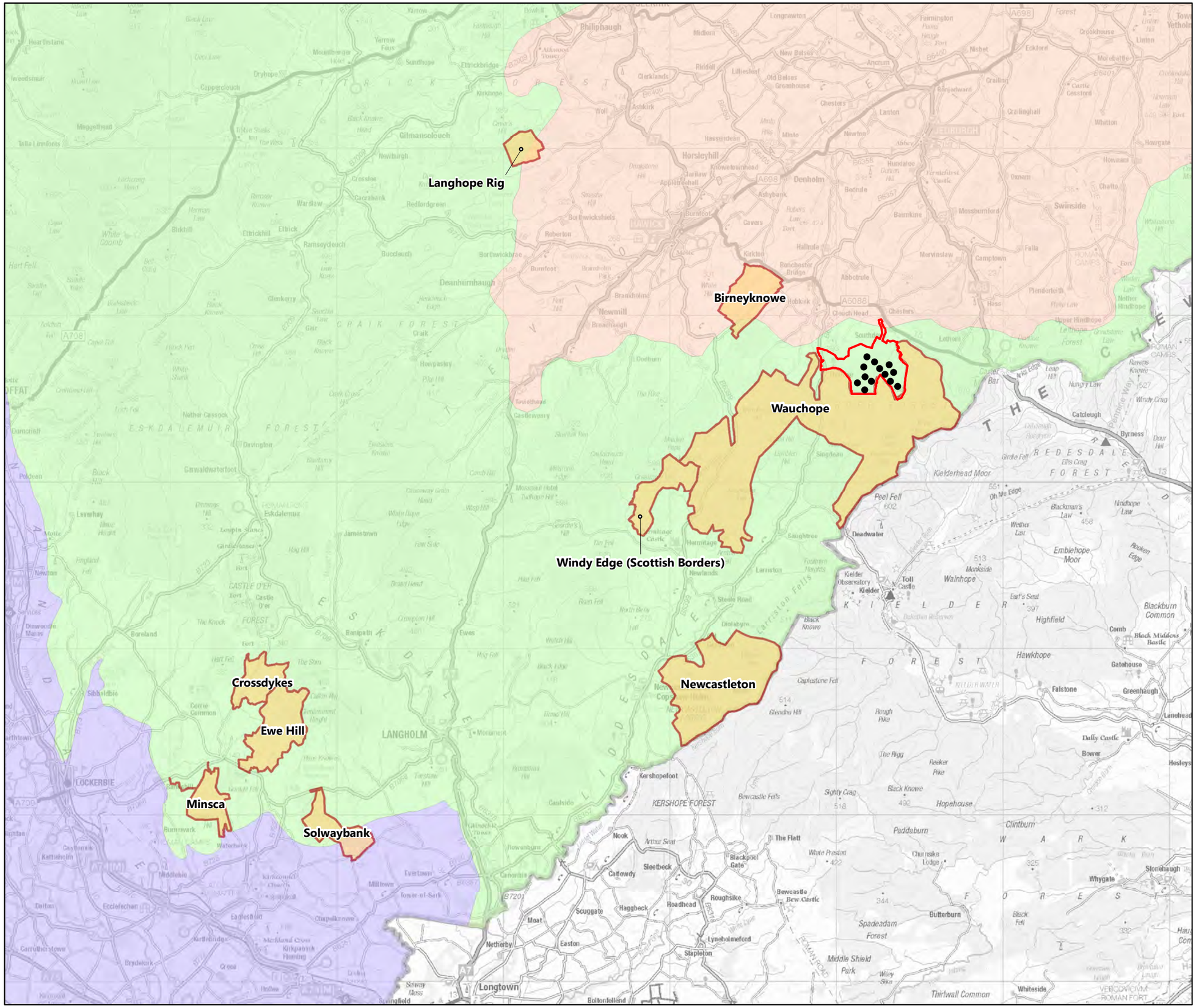
ES_O_Fig6.7_FA_BR2013_HIH

SCALE - 1:27,500 @ A3

ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION


Chesters
Dykeraw Plantation
Dykeraw Height
Dykeraw
Wolfelee Hill
Mackside Hill
Wardmoor Hill
Black Hill
Hardlee Knowe
Dun Knowe
Charlie's Knowe
Steele Knowe
Green Law
Brockie Law
Wigg Knowe
Scaw'd Law
Blackburn Rig
Lamb Rig
Tamshiel Rig
Southdean Rig
Millmoor Rig
Green Cleuch
Gibb's Cleuch
Redstone Bog
Swiney Moss
Wellcleuch Plantation
Dykeraw Plantation
Hopkirk Glebe
Southdean Glebe
Abbotrule Pentacle
Black Plantation
Demmings Plantation
Crowntail Plantation
Hapton Plantation
Doorpool Cottages
Doorpool
Jockey's Plantation
Broomhills
Bents Plantation
Moss Plantation
Law Plantation
Wirebank Plantation
Whiteside Knowe
Clessley Plantation
Rowchlee
Koughlee Strip
How Cleuch
Windbaughhead Corner (remains of)
Slack's Tower (remains of)
Southdean Hill
Southdean Lodge
Southdean Cottages
Church (remains of)
Cemy
Sheepfold
Waterside
Northbank
Croft Plantation
Quarries (dis)
Charlies Hill
Dykeraw Weir
Wetsel Hill
Whitebrae
Westshiels
Lintruther
Lintruther Sike
Mackside Strips
Mackside
Peter's Plantation
Townhead Plantation
Quarry Plantation
Sheep Dip
Long Plantation
Hillend Plantation
Spar Plantation
Crown Plantation
Clerker Plantation
Bankend Plantation
Bankend Cottage
Harwoodmill
Lodge Plantation
Blacklee Cottages
Clouch Head
Urethank Wood
Swanshiel
Donaldson Plantation
Doubledikes Plantation
Kirknowe
Braidshaugh
Hartshaugh
Mill Bank
Höbkirk
Höbkirk Manse
School
Tythehouse
Tythehouse Plantation
Wauchope Farm
Wauchope Cottages
Old Wood
Floors Plantation
Templehall
Wolfehopelee
Wolfehope Hill
The Pockets
Cribs Hole
Dykeheads Plantation
Dykeheads
Warner's Plantation
Hell's Hole
New Plantation
Quarry (disused)
Wigg Plantation
Wigg Hass
Hyndlee
Hyndlee Burn
Hyndlee Glen
Wellcleuch Burn
Hardlee
Pedon's Cleuch
Earlsheck
Burns Plantation
Martinlee Plantation
Sheepfold
Settlement
Quarry (dis)
Ford
Weir
Cairn
Enclosure
Settlement & Field System
Fish Ponds
Ruin
Tumulus
Cairn
Earthwork
Fluth Plantation
Quarry (disused)
Quarry (dis)
Quarries (dis)
Settlement
Sheepfold
Ford
Weir
Cairn
Enclosure
Settlement & Field System
Fish Ponds
Ruin
Tumulus
Earthwork
Burns Plantation
Martinlee Plantation
Sheepfold
Settlement
Quarry (dis)



HIGHLEE HILL
WIND FARM

FIG 6.11

CUMULATIVE
DEVELOPMENTS

© SCOTTISH NATURAL HERITAGE. CONTAINS ORDNANCE SURVEY DATA © CROWN COPYRIGHT AND DATABASE RIGHT 2016, CONTAINS ORDNANCE SURVEY DATA © CROWN COPYRIGHT AND DATABASE RIGHT 2016

- Turbine Location
- Site Boundary
- Wind Farm Project

Natural Heritage Zones

- Border Hills
- Eastern Lowlands
- Western Southern Uplands and Inner Solway

LAYOUT DWG	T-LAYOUT NO.
02836D0002-11	PSCOhhi041

DRAWING NUMBER
ES_O_Fig6.11_Cumulative_HIH

SCALE - 1:225,000 @ A3

ENVIRONMENTAL STATEMENT
2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

7 Cultural Heritage and Archaeology

Introduction

7.1 This Chapter of the Environmental Statement (ES) evaluates the effects of the Highlee Hill Wind Farm, the 'Development' (as described in **Chapter 2: Proposed Development**) on the cultural heritage and archaeological resources of both within the Development boundary and the surrounding area. This assessment was undertaken by Arcus Consultancy Services Limited (Arcus).

7.2 Cultural Heritage and Archaeological resources include designated heritage assets, such as World Heritage Sites, Scheduled Monuments, Listed Buildings, Gardens and Designed Landscapes, Battlefields, and Conservation Areas. Cultural heritage and archaeological resources also include non-designated heritage assets in the Scottish Borders Council Historic Environment Record (HER) and the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) archive via CANMORE[1] as well as previously unknown archaeological features or remains.

7.3 The assessment identifies potential effects arising from the construction, operation and decommissioning of the Development on the cultural heritage resource. The assessment intends to identify the cultural heritage features that may receive direct (e.g., through physical disturbance or damage to the fabric of an asset) and indirect (e.g. through visual changes to the historic and archaeological setting) effects through the construction, operation and decommissioning of the Development.

7.4 This Chapter is supported by **Technical Appendix 7.1: Archaeology Desk-Based Assessment provided in Volume 3**:

7.5 This Chapter includes the following elements:

- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Mitigation and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects; and
- Statement of Significance.

Legislation, Policy and Guidance

7.6 The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (the EIA Regulations)[2] establish in broad terms what is to be considered when determining the effects of development proposals on cultural heritage assets. The assessment is informed by legislation, policy and industry guidance as set out in the following sections.

Legislation

7.7 Statutory protection for archaeology is principally outlined in the Ancient Monuments and Archaeological Areas Act (1979) (as amended)[3] and nationally important sites are listed in a Schedule of Monuments. Scheduled Monument Consent (SMC) is required before any work affecting the fabric of a Scheduled Monument can be carried out.

7.8 The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended)[4] details the duties of National and Local Authorities regarding the desirability of preserving and enhancing settings.

National Guidance and Policy

7.9 This assessment had taken into account the following guidance.

7.10 Scottish Planning Policy (SPP)[5], paragraphs 135-151 set out how all types of historic environment assets are to be dealt with within the planning framework.

7.11 Scottish Historic Environment Policy (SHEP)[6] sets out the Scottish Ministers' policies for the historic environment, provides greater policy direction for Historic Environment Scotland and provides a framework that informs the day-to-day work of a range of organisations that have a role and interest in managing the historic environment. It is a relevant document in the statutory planning, Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) process. This document is regarded as a 'living' document, to be updated as required.

Regional and Local Policy

7.12 The assessment has taken into consideration relevant policies dealing with cultural heritage in the Scottish Borders Local Development Plan (adopted 12th May 2016). This is further discussed in the Planning Statement which accompanies but does not form part of this ES.

Other Guidance and Advice

7.13 The following guidance and advice was also considered:

- Chartered Institute for Archaeologists' (CIfA) *Standards and Guidance for Historic Environment Desk-Based Assessment*[7];
- Historic Scotland's *Managing Change in the Historic Environment: Setting*[8] provides some guidance on assessment of the settings of historic assets; and

1 Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) (as updated) CANMORE Database. Available online at: http://canmore.org.uk/ [Accessed 14/12/2015]

2 The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011. Available online at: http://www.legislation.gov.uk/ssi/2011/139/contents/made [Accessed 14/12/2015]

3 The Ancient Monuments and Archaeological Areas Act (1979) (as amended) Available online at: http://www.legislation.gov.uk/ukpga/1979/46 [Accessed 14/12/2015]

4 The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 (as amended) Available online at: http://www.legislation.gov.uk/ukpga/1997/9/contents [Accessed 14/12/2015]

5 The Scottish Government, (June 2014), Scottish Planning Policy (SPP); Available online at: http://www.gov.scot/Publications/2014/06/5823 [Accessed 14/12/2015]

6 Historic Scotland, (2011), Scottish Historic Environment Policy. Available online at: http://www.historic-scotland.gov.uk/shep-dec2011.pdf [Accessed 14/12/2015]

7 Chartered Institute for Archaeologists, (2014), Standards and guidance for Historic Desk-Based Assessment. Available online at: http://www.archaeologists.net/sites/default/files/CIfAS&GDBA_2.pdf [Accessed 14/12/2015]

- *Planning Advice Note (PAN) 2/2011: Planning and Archaeology*[9] provides advice on the handling of archaeological matters within the planning process and on the separate control over Scheduled Monuments under the Ancient Monuments and Archaeological Areas Act 1979 (as amended).

Assessment Methodology and Significance Criteria

Scoping and Consultation

7.14 In January 2014, a Scoping Report [10] was submitted to the Scottish Government Energy Consents Unit (ECDU) under Section 36 of the Electricity Act as the Development was then expected to be over 50 MW (37 turbines up to a tip height of 150 m). The capacity of the scheme was later revised to be under 50 MW (31 – 44.85MW), and a revised Scoping Report[11] was issued in November 2015.

7.15 All consultation undertaken with the organisations as part of both Scoping exercises is shown in Table 7.1.

Table 7.1: Consultation Responses

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
Historic Scotland (now Historic Environment Scotland)	Scoping 2014 Response, Scoping Opinion Annex 5 24/3/2014	Historic Scotland recommends consultation with relevant LPA conservation and archaeological advisors. Recommend a wider than 5 km search area for indirect effects based upon final ZTV. Should also consider forestry design plan in regards to setting intervisibility. Development could present concerns at national level, especially in regards to cumulative effects. Specifically mentioned the following assets as of concern and considered (by HES) likely to receive indirect impacts (identified by their Index numbers): 3423 Wheel Causeway 3425 Spur earthwork, Westshiels 3848 Dykeraw Tower 7144 Steele Knowe 10605 Tamshiel Rig 2173 Bonchester Hill 2129 Rubers Law 2211 Southdean Law 2319 Black Hill	See response in relation to 2015 scoping exercise
English Heritage (now Historic England)	Scoping 2014 Response, 20/1/2014	Methodology is more than adequate. Development would not have direct or indirect impact on English assets under English Heritage's remit. Recommends consulting with Northumberland Council and Northumberland National Park Authority.	None Required
Borders Council Archaeology Officer	Scoping 2014 Response, 11/2/2014	High archaeological potential within site boundary and direct impacts are probable. Large number of heritage assets beyond the site boundary including a historic landscape. Officer has strong concerns about indirect impacts to setting out to 15 km and suitability of a wind farm at this location. Requests additional work to inform EIA and provides a list of assets requiring assessment.	See response in relation to 2015 scoping exercise
Borders Council Archaeology Officer	Scoping 2015 Response, 6/11/2015	Assessment should be undertaken by CIfA member. Recommends area of 2 km to assess archaeological potential. Support assessment with a gazetteer. Include heritage assets beyond 5 km including Rubers Law. Recommends consulting with Northumberland Council and Northumberland National Park Authority.	The Desk-based assessment considered archaeological assets to a minimum of 1 km of the boundary provided at scoping, which is in many cases at some distance from the proposed infrastructure. Taking into account the distance of proposed turbines from the scoping boundary and adding 1 km, we have taken account of assets out to between 1.2 km and 3.5 km. This is considered to represent an appropriate sample for assessing archaeological potential within the Development site. More distant assets (beyond 5 km) considered where appropriate.
Historic Environment Scotland	Scoping Response 2015	Advice was in line with previous response. Noted need to consider more distant assets and appropriate illustration.	All assets listed in the original response letter have been addressed in the assessment text. All are illustrated, with the exception of 3423 and 3425 where close forestry precludes meaningful representation, and 2319 which has negligible intervisibility with the Development.

[8] Historic Scotland, (2010), Managing Change in the Historic Environment: Setting. Available online at: http://www.historic-scotland.gov.uk/setting-2.pdf [Accessed 14/12/2015]

[9] The Scottish Government (2011), Planning Advice Note 2: Planning and Archaeology: PAN 2/2011. Available online at: http://www.gov.scot/Publications/2011/08/04132003/0 [Accessed 14/12/2015]

[10] Arcus (January 2014) Highlee Hill Wind Farm Scoping Report

[11] Arcus (November 2015) Highlee Hill Wind Farm Scoping Report

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
Northumberland Council	Scoping 2015 Response	No response received.	As no features are likely to receive any significant (indirect) effect (and no Historic England designated assets are within the ZTV), no response is required.
Northumberland National Park	Scoping Response 2015	No concerns raised in relation to Cultural heritage and archaeology	None Required

Scope of Assessment

7.16 The key issues for the assessment of potential Cultural Heritage effects relating to the Development are:

- Temporary effects arising from the construction phase such as signage and higher vehicular and pedestrian activity which may cause reduced access to and / or reduced visibility of the historical environment;
- Permanent effects due to land take by the foundations and access tracks; and
- Indirect effects, including visual effects on the settings of cultural heritage assets which may adversely affect such assets. Such visual effects are likely to occur as a consequence of the height and breadth of the Development. This is especially likely to occur on cultural heritage assets located on high ground where their historical significance lies in the wider landscape setting including long views to and from the asset. Examples of these types of assets are hill forts and Duns.

7.17 The potential for direct affects is established within the Desk-Based Assessment (Technical Appendix 7.1) through the consideration of both designated and non-designated heritage assets within a minimum radius of 1 km from the Development Area.

7.18 The potential for indirect affects used an initial study area of 15 km radius centred on the Development. Consultation of the Zone of Theoretical Visibility (ZTV) for the Development, as defined in **Chapter 4: Landscape and Visual**, further informed this study. However, based on initial assessment (informed by visits and use of wireframes) it was clear that significant effects on heritage assets were unlikely to occur out to this distance. Nevertheless, some more elevated features at ranges between 5 km and 15 km from the Turbines have been considered for further assessment, either at the request of the Consultees or where selected to provide a representative example of potential effects at various ranges. These assets are indicated on Table 7.8, under the "Assessed" column and are considered in the assessment text (paragraphs 7.136 and onwards).

7.19 The assessment of indirect (primarily visual) effects on settings of heritage assets has been informed by site visits and the analysis of the ZTVs and use of visualisations such as wirelines and wirelines over photographs (as well as the formal montages presented in **Chapter 4: Landscape and Visual**. Sites for which visualisations were produced were selected taking into account Consultee responses and requests, so as to present a representative selection based on distance and direction. Of these, only those where visibility of the Development was demonstrated are presented. The wirelines are based on a bare earth terrain models with no allowance for screening from vegetation of settlement. Cumulative developments as shown in Table 7.6 are also shown on the wirelines. Locations were typically selected to show a worst case scenario and may not be representative of the general situation at a given site (this is highlighted in the assessment text where necessary). These visualisations are referenced in the text as appropriate and included as Figures 7.3 to 7.18.

Elements Scoped Out of Assessment

7.20 No detailed consideration of potential indirect effects from noise or shadow flicker has been undertaken for cultural heritage features, since no substantial above-ground or built heritage features exist within, or immediately adjacent to, the Development to receive any such effects.

Study Areas

7.21 The archaeological study areas used to support the assessment are set out below in Table 7.2 and are shown on Figure 7.1 and Figure 7.2a and 7.2b. The archaeological 'core study area' as referred to in the Desk-Based Assessment is equivalent the site as contained within the Development Boundary (note that this is now slightly smaller than the Development boundary which was provided at Scoping, and which was used to inform the Desk-Based Assessment). The archaeological 'wider study area' includes the core study area and land within a minimum 1 km to 3.5 km radius from the turbine envelope. The wider study area covers an area significantly larger than the core study area in order to ensure a full understanding of the archaeological resource. Data was collected within the core and wider study areas to inform the potential for direct effects on known and unknown archaeology within the Development.

7.22 For the assessment of indirect (settings) effects on Designated Heritage Assets data was initially collected on all designated features within 15 km of the Development. Following a review of this data, consultation of the ZTV, and using professional judgement, it was considered that there was no likelihood of significant effects occurring beyond a 5 km range, therefore it was decided that detailed assessment should be given to features lying within a 5 km study area of the Development (here defined by the turbine envelope, as it is the turbines that will give rise to any effect on settings at all but the closest of ranges). These assets within the 5 km study area are shown on Figure 7.2. However (as stated in paragraph 7.18) a number of assets, typically sites in elevated positions, outside of this range have been included in the assessment at the request of the consultees.

Table 7.2: Study Areas

Effect	Name	Range	Description	Figure
Direct	Core Study Area	Development Area	Area within which the Development may have direct effects upon known and unknown archaeological remains. This was based on the Development Boundary provided during Scoping and used for the Desk-Based Assessment.	7.1
Direct	Wider Study Area	1 to 3.5 km surrounding Core Study Area	Area used to ensure a full understanding of the archaeological resource and the potential for unknown archaeology to survive within the Core Study Area.	7.1
Indirect	5 km Study Area	5 km from turbine envelope	Area within which it is considered the Development has potential to cause likely significant indirect (visual) effects upon the settings of heritage assets and hence requiring detailed assessment. A number of assets outside of this range were included for assessment at the request of the Consultees.	7.2
Cumulative	Cumulative Study Area	Variable, up to 15 km	An area in which a potential significant cumulative effect is considered likely if cultural heritage assets within the area lie within the overlapping zones of theoretical visibility of more than one wind development. Consideration has also been given to assets within approximately 15 km of the Highlee Hill Turbines where these appear with other Developments in key views.	

Design Parameters

7.23 The parameters of the design that will influence the archaeological and cultural heritage assessment in relation to physical effects has been based on the most extensive construction footprint, as it is the extent of the footprint that will determine how much of an affected asset is removed (i.e. directly affected) and the likelihood of assets falling within it. No additional design parameters, other than those set out in **Chapter 2: Development Description**, are required for the assessment presented in this Chapter.

7.24 As set out in **Chapter 2: Development Description**, the possibility of micro-siting of the turbines up to 50 m, where constraints allow, may be considered. Such relocations have been considered when undertaking the assessment, and they would not affect the conclusions drawn for any considered effect.

Baseline Survey Methodology

7.25 A Desk-Based Assessment (DBA) was undertaken using available documentary, cartographic and photographic evidence to inform the baseline, based on the Core Study Area and Wider Study Areas set out above. The DBA is provided in **Technical Appendix 7.1**. The DBA has been based on readily available and relevant documentary sources. The following archives were referred to:

- Databases of designated cultural heritage assets maintained by HES;
- National Monuments Record of Scotland (NMRS) including aerial photographs;
- The Scottish Borders Council HER; and
- Maps held by the National Library of Scotland, including historical maps and ordnance survey maps.

7.26 Site visits were undertaken in November 2014, May 2015 and January 2016, to validate the historic environment record of the area and to identify and (where possible) record any previously unrecorded cultural heritage features within the Core Study Area, as well as to visit sites likely to be featured in the assessment of indirect effects.

7.27 Information on the 5 km Study Area and 10 km Cumulative Study Area was also obtained from the same archive sources listed above.

Methodology for the Assessment of Effects

7.28 The assessment of effects is based on the final design of the Development. The appraisal starts with a consideration of the sensitivity of a cultural heritage feature against the magnitude of any potential change, to arrive at the significance of the effect, and is informed by professional judgement.

7.29 The sensitivity of the cultural heritage assets / receptors has been equated with designated status, as shown in Table 7.3.

7.30 Listed Buildings are designated, subject to grading (Category A, B and C) and placed on a list that is maintained by Historic Environment Scotland. For the purposes of this assessment the categorisation of each Listed Building has been used as an indication of a presumed level of sensitivity.

Table 7.3: Sensitivity Criteria

Level of Sensitivity	Description
Very High	World Heritage Sites - these are internationally important.
High	Scheduled Monuments, Category A Listed Buildings, Registered Battlefields, Gardens and Designed Landscapes – these are considered to be nationally important.
Medium	Category B Listed Buildings, regionally important archaeological features and areas (as defined in the Sites and Monuments Record (SMR)), and Conservation Areas – these are considered to be regionally important.
Low	Category C Listed Buildings, locally important sites and archaeological features (as defined in the SMR) – these are considered to be locally important.
Negligible	Badly preserved and/ or damaged or very common archaeological features and buildings of little or no value at local or any other scale.

7.31 Magnitude is the measure of the nature of the expected effect. It has been classified, for both direct and indirect effects, as shown in Table 7.4. For the purpose of visual indirect assessment, proximity to the Development (within the ZTV), and presence within the ZTV, combined with the specific attributes or interests of an asset (e.g. where the importance of an asset derives from its long uninterrupted views and position within a largely unchanged landscape) have been taken as two of the determining attributes.

Table 7.4: Magnitude Criteria

Level of Magnitude	Description
Very Large	Total loss of or major alteration to a site, building or other feature (e.g. destruction of archaeological feature). Blocking or severance of key visual or other relationship.
Large	Major damage to or significant alteration to a site, building or other feature. Extensive change to the setting of a feature (e.g. loss of dominance, intrusion on key view or sightline).
Medium	Damage or alteration to a site, building or other feature. Encroachment on an area considered to have a high archaeological potential for buried remains. Change in the setting of a feature (e.g. intrusion on designed sight-lines and vistas).
Small	Minor damage or alteration to a site, building or other feature. Encroachment on an area where it is considered there is low potential for buried archaeological remains to exist. Minor change in the setting of a feature (e.g. above historic skylines or in designed vistas).
Negligible	No physical impact. Slight or no change in setting.

7.32 The significance of the potential effect is determined by correlating the Sensitivity of the asset against the Magnitude of the expected effect as shown in Table 7.5**.**

Table 7.5: Significance Matrix

	Sensitivity				
Magnitude	Very High	High	Medium	Low	Negligible
Very Large	**Major**	**Major**	**Moderate**	Minor	Minor
Large	**Major**	**Major**	**Moderate**	Minor	Not significant
Medium	**Moderate**	**Moderate**	**Moderate**	Minor	Not significant
Small	Moderate/Minor	Minor	Minor	Not significant	Not significant
Negligible	Minor	Not significant	Not significant	Not significant	Not significant

7.33 Where potential scores of moderate or major significance have been predicted for features using the matrix-based approach shown in Table 7.5 (as indicated in bold text), such features have been selected for a more detailed consideration in the Assessment of Potential Effects Section below. This includes a definition of the setting of each feature, considering its designation status, essential attributes etc. An assessment is made using professional judgement of the extent to which that setting is affected by the Development and an assessment of significance is given. Potential effects that are scored as moderate/minor, minor or not significant are considered to be not significant for purposes of the EIA Regulations and are not discussed in further detail.

7.34 The assessment has taken an approach in which the designation status (sensitivity) of a feature is set against the magnitude of the effect of the Development. For purposes of assessing indirect (visual) effects upon setting, distance to the Development is considered a determinant in the degree of magnitude of any change that might be caused. Simple intervisibility with the Development is not necessarily considered to be harmful, unless this negatively affects the setting so as to diminish its contribution to the significance of the asset. Where considered appropriate, consideration has been given to the effect that the Development will have on the settings of historical assets in views towards the asset which include the Development, as well as in views towards the Development from the asset. Distances given are always from the nearest proposed turbine.

7.35 It is also important to consider that forestry and woodlands, as well as buildings, can provide visual screening to cultural heritage features. However, it is noted that in managed forests the level of screening will alter and views may be opened up over time, which previously did not exist.

Assessment of Cumulative Effects

7.36 A cumulative effect is considered to be an additional effect upon cultural heritage resources arising from the Development in combination with other existing, consented or proposed developments likely to affect the cultural heritage environment. Features that lie at a distance greater than 5 km from a given wind farm are considered unlikely to receive a significant effect and, therefore, for the purposes of the assessment of cumulative effects, only wind farm developments within approximately 10 km of the Development have been initially considered (i.e. where cultural heritage features lie within the overlapping 5 km ranges of specific wind farms). The potential for a significant cumulative effect is considered likely to occur only within the zone where the ZTVs for each wind farm development, included in the cumulative effect assessment, would overlap within this range i.e. where each is theoretically simultaneously visible.

7.37 There is also the potential for cumulative effects to occur where the proposed turbines may be visible together with the proposed turbines of other developments in key views from some (typically elevated) Heritage assets. This assessment has taken the above into account, and consideration has been given to potential for this to occur at particularly sensitive assets within approximately 15 km of the Development. Further detail on cumulative effects on Landscape can be found in **Chapter 4: Landscape and Visual**. Locations of sites considered as part of the Landscape cumulative assessment are shown in Figure 4.6, and those that are relevant to the Cultural Heritage assessment are listed in Table 7.6.

Table 7.6: Cumulative Developments

Development	Summary
Birneyknowe	Approx. 7.5 km north-west. Application
Windy Edge	Approx. 14 .4 km south-west. Appeal
Wauchope Forest East	Approx. 750 m south. Scoping
Wauchope Forest West	Approx. 3.7 km south-west. Scoping

7.38 Although not formally submitted, the two Wauchope Forest schemes have been included at the request of SBC. The assessment should be regarded as indicative only, as the final design of these schemes (including details on final sizes, locations etc. of the turbines) is not known.

Assessment Limitations

7.39 No gaps in knowledge have been identified. It should be noted that the assessment undertaken is a desk-based assessment aided by site walkovers. No intrusive survey has been carried out.

Embedded Mitigation

7.40 As part of the rationale behind the Development evolution, consideration has been given to limiting both direct and indirect effects on heritage assets. The reduction in turbines numbers (albeit using

taller structures) has reduced the physical impact from the footprint of the Development, reducing the potential that unknown buried archaeological remains will be damaged or destroyed. The reduction in turbine numbers, as well as their repositioning to the south (compared to the original Scoping layout) has also helped to reduce the impact of any potential setting effects on cultural heritage receptors such as the hill fort and settlement on Southdean, as well as the church in the valley bottom and on Dykeraw Tower.

7.41 In addition, the design of the layout has sought to avoid any heritage features within the Core Study Area (such as the Wheel Causeway, Highlee Hill enclosure, and the remains of the Westshiels farmstead). A minimum distance of 100 m has been applied to heritage features, where possible, and in most cases distances from turbines to heritage features within the Development boundary are considerable greater, therefore avoiding any direct impacts upon known archaeological features and securing preservation in situ (with one exception as noted in 7.61).

Baseline Conditions

Desk Based Assessment – Core Study Area

7.42 The archaeological core study area (core study area Figure 7.1) is located approximately 11 km south-east of Hawick and immediately south of the village of Chesters. The core study area is bordered to the north by the A6088, to the west by the B6357 and to the east by Jed Water. The core study area is predominantly commercial forestry to the south and arable farmland to the north.

7.43 There are 43 cultural heritage assets within or partially within the Core Study Area, three of which are Scheduled Monuments. Scheduled Monuments are identified by their Index Number, Listed Buildings by their Historic Building (HB) Number and non-designated heritage features by their Sites and Monuments Record number. These are listed in Table 7.7. Many of these are references to features on historic maps, and/or find spots or sites no longer visible (and some are duplications of other designations). The scheduled sites are all discussed in the assessments presented below. The data is more fully treated in the DBA (see Technical Appendix 7.1) and has been used to inform consideration of the archaeological potential of the Development. Highlee Hill enclosure (3220050) has included for assessment in the main assessment text.

Table 7.7: Heritage Assets within the Core Study Area

Reference Number	DBA Site ID	Name	Period	Description
Index 3423	4	Wheel Causeway, section 640 m long on south slope of Wardmoor Hill	Prehistoric	The scheduled area of wheel causeway exists as two hollow tracks either side of a demolished turf dyke. This turf dyke was identified during the site walkover. The causeway survives as a Holloway north of the Scheduled area, often ill-defined but also identified during the site walkover.
Index 3425	5	Spur earthwork 1550 m south-west of Westshiels	Prehistoric	Earthwork
Index 3848	6	Dykeraw Tower, Southdean	Medieval	The remains of Dykeraw tower, no confirmed date. Only a portion of the south gable stands.
3220031	25	West Shiel Farm	Neolithic	Part of axe found 1974. Butt end missing. Retained by finder.
3220034	28	Southdean	Bronze age	Numerous Tumuli near Southdean. Stone chest and Human Bones discovered. No visible evidence. See cards 322/0036 and 322/0038.
3220035	29	Southdean	Neolithic	A number of finds including a Polished greenstone axe, hammer head and whorls.
3220047	36	Wheel Causeway	Unclassified	A branch of Wheel Causeway. Lustruther to Battling Burn/ Wolfhopelee Burn head
3220050	37	Highlee Hill	Iron age/ Roman period	Ditch with earthen bank on either side. The feature is best preserved on its south side. There is an entrance in the east and south-west. Observed during the site visit (Plate 6).
3220072	41	Wardmoor Hill	Unclassified	Wheel causeway, section 640 m long on south side slope of Wardmoor Hill.
3220073	42	West Shiel Farm	Neolithic	Polished stone. Butt end missing. Facet on one side: White Patine.
3220105	45	Black Hill	Unclassified	Cord Rig
3220110	48	Highlee Hill	Unclassified	A cropmark showing a farmstead.
3220116	50	Roadside	Post-medieval	A farmstead or set of cottages called "Roadside" is marked on the 1st Edition OS map.
3220117	51	Highlee Hill	Post-medieval	"Old Quarries" marked on the 1st Edition OS map.
3220118	52	Dykeraw	Post-medieval	"Old Quarry" marked on the 1st Edition OS map.
3220119	53	Battling Sike	Post-medieval	"Sheepfold"" marked on the 1st Edition OS map.
3220120	54	Highlee Hill	Post-medieval	Stock enclosure
3222001	70	Lustruther	Post-medieval	Taken and burned by Sir John Ratcliffe 1513. No trace (1967). Shown on Pont's Map as Lustruther.
3222006	73	Dykeraw	Medieval	Shown on Pont's Map
56818	76	Lustruther	Medieval – Post Medieval	Possible tower house burned in 1513. No trace of a tower was found at the farm.
179595	78	White Burn	Unknown	The site of a former building and rig furrow.
179529	79	Highlee Hill	Post-medieval	Quarry and a possible sheepfold
179592	80	Highlee Hill	Post-medieval	An enclosure, lazy beds and Rig and furrow
180359	83	Dykeraw Tower	Post-medieval	A potential farmstead is depicted on the first edition OS map as a partially roofed long building.

Reference Number	DBA Site ID	Name	Period	Description
56821	84	Southdean	Bronze-Age	Bronze Age artefacts discovered at Southdean, including a Bronze Age flat axe, two Middle Bronze Age flanged axes, art of Middle Bronze Age rapier blade, and a Late Bronze Age ribbed socketed axe as well as a Bronze Age blade.
179599	89	White Burn	Post Medieval	Farmstead, Lazy Beds, Rig And Furrow at White Burn
56819	94	Wolfehopelee Burn	Unknown	The east portion of an earthwork remains at this location. It is thought possible to be part of an old land boundary.
179589	97	Highlee Hill	Post Medieval	Sheepfold on Highlee Hill
179594	99	Lustruther Strip	Unknown	Earthwork bank, field boundaries, plantation banks, quarry and rig and furrow
180021	102	Lustruther Strip	Unknown	Track at Lustruther Strip
Cartographic analysis	103	Sheepfold	Post Medieval	A sheepfold depicted on the first edition OS Map
Cartographic analysis	104	Sheepfold	Post Medieval	A sheepfold depicted on the first edition OS Map
Cartographic analysis	105	Sheepfold	Post Medieval	A sheepfold depicted on the first edition OS Map
Cartographic analysis	106	Sheepfold	Post Medieval	A sheepfold depicted on the first edition OS Map
Cartographic analysis	107	Sheepfold	Post Medieval	A sheepfold depicted on the first edition OS Map
Cartographic analysis	108	Sheepfold	Post Medieval	A sheepfold depicted on the first edition OS Map
Cartographic analysis	109	Sheepfold	Post Medieval	A sheepfold depicted on the first edition OS Map
Cartographic analysis	110	Sheepfold	Post Medieval	A sheepfold depicted on the first edition OS Map
Cartographic analysis	111	Lustruther	Post Medieval	Lustruther Farmstead, still extant
Cartographic analysis	112	Dykeraw Farmstead	Post Medieval	Dykeraw Farmstead identified on cartographic survey
Walkover Survey	113	Westshiels Farmstead	Post Medieval	Westshiels Farmstead identified on cartographic survey and walkover survey
Cartographic analysis	114	Ever Dykeraw	Post Medieval	Ever Dykeraw identified on cartographic survey

7.44 Due to the large area of the site, the geology varies considerably between the hills and the slope towards the valley. The lowland geology is primarily formed by a Sandstone and Argi of the Stratheden and Inverclyde Group. This bedrock was formed approximately 345 to 385 million years ago in the Carboniferous and Devonian Periods. The local environment would have previously been dominated by rivers and alluvial fans[12]. The geology of the higher ground is primarily formed by Wacke and Mudstone of the Riccarton Group formed approximately 423 to 428 million years ago in the Silurian Period. The local environment would have previously been preciously dominated by deep seas[13].

7.45 Where superficial deposits have been recorded for the site these are primarily Devensian till, formed up to 2 million years ago in the Quaternary Period. The local environment was previously dominated by ice age conditions[14].

7.46 The site rises from approximately 188 m AOD in the north of the site, in the valley of the Jed Water near Southdean, where the site access begins, 307 m AOD in the west (on Highlee Hill) and approximately 285 m AOD to the south-east, near the location of the proposed Turbine 13.

Archaeological Potential of the Core Study Area

7.47 The archaeological potential of the Core Study Area is considered to be low to moderate in general, but may be higher around the Highlee enclosure, Tamshiel Rig, Westshiels Farmstead and Dykeraw Tower where buried remains associated with these features may still remain below ground level. The archaeological potential elsewhere within the Development boundary is considered to be reduced where plantation forestry is likely to have caused significant ground disturbance. Unrecorded archaeological remains, if present, are likely to relate to either agriculture or settlement, ranging from the prehistoric through to the post-medieval periods.

Desk Based Assessment – 1 km Wider Study Area

7.48 The majority of the Wider Study Area to the south of (and surrounding) the Development is in use as commercial forestry. To the north, the area is enclosed farmland, with areas of open upland, along with stands of forestry plantation (especially to the north-east). Other than the small settlements at Chesters and Southdean, the nearest substantial settlements are at Bonchester Bridge and Hawick.

7.49 There are 114 heritage features located within this study area. This includes three Listed Buildings, and nine Scheduled Monuments. There are no designated Historic Gardens and Designed Landscapes, Registered Battlefields, Conservation Areas or World Heritage Sites within the Wider Study Area.

7.50 The heritage features in the Wider Study Area come from a wide range of periods and range from agricultural and industrial features to settlement, ritual and burial activity.

Designated Assets within the 5 km Study Area

7.51 There are a total of 24 Scheduled Monuments and 18 Listed Buildings (of all categories) within the 5 km Study Area. There are no World Heritage Sites, Garden and Designed Landscapes, Inventoried Battlefield, or Conservation Areas within the 5 km Study Area. These heritage assets are considered to have the potential to be subject to a significant effect as a result of the Development where they lie within the ZTV and as such have been summarised in Table 7.8 and 7.9 and are subject to a detailed assessment as part of this ES.

[12] British Geological Society (2014) *Geology of Britain viewer*. Available at http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html [Accessed on 18/02/2014]
[13] Ibid
[14] Ibid

7.52 In addition to these, a number of assets beyond this range, but within 15 km have been assessed (as set out in paragraph 7.18) and these are indicated on Table 7.8 (under the "Assessed" Column).

Scheduled Monuments

7.53 There are 129 Scheduled Monuments within 15 km of the Development (114 in Scotland and 15 in England) of which 47 (all in Scotland) fall within the ZTV, as listed in Table 7.8. Of these, 24 Scottish Scheduled Monuments are within the 5 km Study Area; 18 of which fall within the ZTV, as detailed in Table 7.8. All of those within 5 km and within the ZTV have been included in the assessment and are shown on Figure 7.2a. As per 7.52, selected assets beyond 5 km have also been assessed (these are indicated in the Tables, shown on Figure 7.2b and are discussed in paragraphs 7.136 onwards).

Table 7.8: Scheduled Monuments within 15 km

Index No. List Entry	Scheduled Monument	ZTV	Within 5 km Study Area	Assessed in text	Easting	Northing
79	Pyat Knowe, enclosure 150 m N of	-	-	-	348165	605291
1688	Nine Stones, stone circle, Ninestone Rig	-	-	-	351749	597307
1695	Highchesters Hill, fort	-	-	-	345826	614491
1697	Kaim Law, fort	-	-	-	351245	613184
1699	The Law, fort	Yes	-	Yes	371958	615844
1700	Kirkton Hill, fort	Yes	-	-	353669	612379
1702	Hawick Moat Park, motte	-	-	-	349916	614051
1707	Pennymuir, Roman camps	Yes	-	-	375571	614013
1708	Cappuck, Roman fort	-	-	-	369527	621206
1712	Castle Hill, fort	-	-	-	362435	624916
1717	Mervinslaw Tower	Yes	Yes	Yes	367206	611745
1719	Timpendean, tower & earthwork	-	-	-	363528	622604
1720	Ancrum Old Bridge	-	-	-	363866	623745
1721	Jedburgh, Canongate Bridge	-	-	-	365264	620597
1722	Ancrum, market cross	-	-	-	362827	624574
2116	Dykeheads, homestead moat	Yes	Yes	Yes	358223	607343
2125	Woden Law, fort & Roman siege works	Yes	-	Yes	376762	612406
2129	Rubers Law, fort & Roman signal station	Yes	-	Yes	358051	615572
2142	Midshiels, standing stone	-	-	-	353394	617752
2143	Midshiels, mound	-	-	-	353320	617702
2148	Gray Hill, earthwork	-	-	-	346154	607282
2150	Whitcastle Hill and Todshaw Hill, forts, earthworks, linear earthworks	Yes	-	-	344335	612340
2151	Birny Knowe, earthwork	-	-	-	345976	608908
2152	Shaw Craigs, fort	Yes	Yes	Yes	367303	609502
2157	Moat Knowe, fort	-	-	-	377840	613647
2158	Blackhall Hill, cairns	Yes		-	378055	611780
2163	Iron Castle, earthwork	-	Yes	-	363160	612612
2164	Trestle Cairn, cairn	Yes	-	-	375178	616130
2167	Hindhope Hill, fort	Yes	-	-	376838	611261
2168	Brownhart Law, Roman signal station & Roman road, Dere Street	Yes	-	-	379042	609700
2169	Burgh Hill, fort and settlement	-	-	-	346793	606179
2170	Cunzierton, fort	Yes	-	Yes	374384	617505
2172	Bonchester Hill, earthworks	Yes	Yes	Yes	359602	612042
2173	Bonchester Hill, fort	Yes	Yes	Yes	359479	611731
2211	Southdean Law, fort & settlement	Yes	Yes	Yes	363517	609392
2222	Knowesouth Burn, earthwork	-	-	-	360845	619268
2255	Newton Hill, fort	-	-	-	349701	607967
2294	White Hill, fort	-	-	-	347850	605760
2296	Penchrise Pen, fort	Yes	-	Yes	349085	606246
2297	Blakebillend, fort	-	-	-	351512	606298
2319	Black Hill, settlement	Yes	Yes	Yes	359609	606565
2405	Scraesburgh, earthwork	Yes	-	-	367893	619152
2468	Stotfield, cultivation terraces	Yes	-	-	369429	612005
2881	Fatlips Castle	Yes	-	-	358197	620897
2890	Lintalee, earthworks	-	-	-	364621	618276
3294	Dere Street, Roman road & earthworks, Tow Ford to Blackhall Hill	Yes	-	Yes	377189	612401
3353	Dod, earthworks on right bank of Allan Water	-	-	-	346707	605504
3354	Burgh Hill, stone circle	-	-	-	347011	606244
3355	Dod, earthwork	-	-	-	347265	606010
3356	Dod, enclosure on Gray Coat,	-	-	-	347166	605248
3363	Barns Burn, fort 680m NW of Newton Hill	-	-	-	349369	608561
3364	Blakebillend, cairn 335m E of Williams Rig	-	-	-	351419	606226
3365	Penchrise Pen, earthwork 420m E of	-	-	-	349455	606144
3367	Chester Knowe, earthworks 775m ENE of Allanwater Reservoir	-	-	-	347499	609718
3368	Lord's Tree Cairn,520m NNE of The Hero's Grave Cairn	-	-	-	348104	609570

Index No. List Entry	Scheduled Monument	ZTV	Within 5 km Study Area	Assessed in text	Easting	Northing
3372	Denholm Hill, forts 600m NE of Stobs Castle	-	-	-	351106	609145
3373	Mid Hill, fort & settlement 700m NW of Adderstonshiels	-	-	-	351407	609763
3374	Woodfoot Bridge, enclosure 430m NE of Pagton Burn	-	-	-	351069	610183
3386	White Knowe, settlement 180m W of Newton Hill	-	-	-	349408	607934
3389	Ulston Moor, Roman camp 600m N of Overwells	-	-	-	368750	621665
3391	Dod, earthworks on Gray Coat	-	-	-	347238	605153
3396	Berryfell Farm, earthwork and linear earthwork	-	-	-	352523	607055
3412	Pleaknowe, fort & homestead	-	-	-	352058	606836
3413	The Catrail, linear earthwork,350m long, N of Doecleugh Hill	-	-	-	345453	606724
3423	Wheel Causeway, section 640m long on S slope of Wardmoor Hill	Yes	Yes	Yes	360881	605713
3424	Wheel Village, deserted settlement 1400m NE of Wormscleugh	-	-	-	360497	600110
3425	Westshiels, spur earthwork	Yes	Yes	Yes	360998	605432
3428	Pen Sike, earthwork 300m SW of Penchrise Pen	-	-	-	348828	605928
3432	Gray Coat, pele-house	-	-	-	347317	604666
3457	The Catrail, linear earthwork,650m long, on SE slope of White Hill	-	-	-	348002	605834
3458	Tinlee, standing stone 718m SSE of Peelbraehope	-	-	-	348401	603854
3459	Gray Coat, settlement 540m NE of Priesthaugh	-	-	-	347144	605008
3460	Dodburn Hill, earthworks & homestead	-	-	-	348257	607471
3461	Priesthaugh, earthwork	-	-	-	346670	604518
3466	The Catrail, linear earthwork, Robert's Linn Bridge to Leap Burn	-	-	-	353103	602577
3468	The Catrail, linear earthwork, W of Leap Burn to 100m E of Langside Burn	-	-	-	351124	602899
3495	The Catrail, linear earthwork, SE slope of Singley Brae to Barry Sike	Yes	-	-	348976	604725
3496	Hawkhass Linn, earthwork 520m NE of Hawkhass House	-	-	-	349310	602842
3497	Cairn Sike, earthwork 1220m NE of Hawkhass House	-	-	-	349461	603536
3765	Kilnsike Tower	-	Yes	-	363422	613008
3766	Northbank Tower	-	Yes	-	366079	609442
3770	Slack's Tower	-	-	-	364416	609905
3848	Dykeraw Tower, Southdean	Yes	Yes	Yes	362832	609058
3929	Dere Street, Roman road, Whitton Edge to Cunzierton	Yes	-	-	374525	618295
4007	Riccarton Tower	-	-	-	354401	595810
4280	Dere Street, Roman road, Blackhall Hill to Black Halls	Yes	-	-	378582	611153
6599	Martinlee Sike, enclosure bank, field system, cairns & old road	Yes	Yes	Yes	365432	607925
6600	Martinlee Plantation, homestead NW of Martinlee Sike	Yes	Yes	Yes	365617	607947
6601	Martinlee Plantation, homestead SE of Martinlee Sike	Yes	Yes	Yes	365638	607911
6602	Martinlee Sike, farmstead, field system and assart bank.	Yes	Yes	Yes	365790	607574
6636	Martinlee Plantation, enclosure 140m N of	Yes	Yes	Yes	365703	608012
6637	Wattie's Spindles, pele house and associated buildings	Yes	Yes	Yes	366747	609054
6638	Chapel Knowe, farmstead	-	Yes		367052	608912
6833	Overton Tower	Yes	-	-	368498	612844
7033	Fulton Tower	-	-	-	360548	615811
7034	Southdean Church	Yes	Yes	Yes	363137	609164
7144	Steel Knowe, medieval and later settlements and field systems	Yes	Yes	Yes	365173	608725
9858	Jedburgh Franciscan Friary	-	-	-	365035	620789
10605	Tamshiel Rig, fort, settlement and field system	Yes	Yes	Yes	364303	606342
10734	Loddan, fort	Yes	-	Yes	375585	611083
10735	Stony Law, fort	Yes	-	-	373008	611573
10736	Buchtrig, settlement, field system and barrow cemetery	Yes	-	-	377074	613486
10737	Loddan Hill North, palisaded settlement 800 m NNE of summit	Yes	-	-	375715	611906
10739	Pennymuir Bridge, barrow cemetery	-	-	-	376753	615284
10740	Plenderleith, chapel and burial ground	-	-	-	374041	612562

Index No. List Entry	Scheduled Monument	ZTV	Within 5 km Study Area	Assessed in text	Easting	Northing
10741	Plenderleith, scooped settlement 300 m SSW of	-	-	-	373868	611547
10742	Goshen Hill, palisaded settlement	Yes	-	-	372112	610495
10743	Heugh Law, fort	Yes	-	Yes	374526	611770
10744	Loddan, palisaded settlement 350 m NW of summit	Yes	-	-	375310	611299
10746	Hangingshaw Hill, unenclosed settlement, field system and cairn	Yes	-	-	376685	613608
10748	Shank End, scooped settlement	-	-	-	376739	615723
13126	Jedburgh Abbey, 50 m ESE of Abbey House	-	-	-	365016	620443
13324	Mantle Walls, Ancrum, bishop's palace	-	-	-	363193	624621
90161	Hermitage Castle and chapel	-	-	-	349504	596065
1002913	Kielder Viaduct	-	-	-	363215	592422
1009665	Two round cairns 870 m south east of Butteryhaugh Bridge including Deadman Cairn	-	-	-	363779	592212
1009666	Devil's Lapful Long Cairn, 1 km east of Butteryhaugh Bridge	-	-	-	364193	592866
1009667	Romano-British enclosed settlement, 290 m south east of Butteryhaugh Bridge	-	-	-	363465	592736
1009668	Midfell round cairn	-	-	-	363642	598419
1009669	Romano-British enclosed settlement, 720 m north east of Catcleugh	-	-	-	362049	594259
1009670	Bran's Walls Romano-British enclosed settlements, 400 m SSE of Kielder Head	-	-	-	366752	597639
1009671	Round cairn, 330 m SSW of Deadman's Cairn	-	-	-	363648	591915
1009672	Defended settlement 580 m north west of Gowanburn and associated medieval buildings	-	-	-	364273	591768
1014078	Round cairn, 240 m east of Ravens Pike	-	-	-	378275	606247
1014079	Gibbie's Knowe defended settlement and later rectangular building	-	-	-	364744	595076
1015525	The Three Kings four poster stone circle and round cairn	-	-	-	377425	600922
1015847	Roman fort, two Roman fortlets, two Roman camps, a section of Roman road and a medieval settlement and chapel at Chew Green	-	-	-	378865	608525
1018938	Round cairn on Ravens Pike	-	-	-	378022	606214
1018956	Kershope Castle	-	-	-	361446	595957

Listed Buildings

7.54 There are 559 Scottish Listed Buildings and 16 English Listed Buildings within 15 km of the Development. Of these, only 21 of the Scottish Listed Buildings fall within the ZTV; seven of which are within the 5 km Study Area. Due to the large number of listed buildings, only those within the ZTV are detailed in Table 7.9. Those within 5 km have been assessed (and are shown on Figure 7.2a): note that those listed below and marked with an asterisk (*) are included in the assessment due to proximity to the 5 km Study Area boundary, despite being just beyond 5 km from the nearest proposed Turbine. They are discussed at the end of the Listed Building assessment or, in the case of Mervinslaw Pele, in the section dealing with assets at Greater than 5 km (paragraphs 7.136 onwards). They are shown on Figure 7.2b.

Table 7.9: Listed Building within 15 km and the ZTV

HB No.	Listed Building	Category	Within 5 km Study Area	Easting	Northing
13886	Mervinslaw Pele-House	A	*	367177	611754
4180	Bedrule Church	B		359922	617925
8370	Wells House, Lodge And Gates	B		359778	617678
8371	Harwood House	B	Yes*	356530	608320
13358	Edgerston, Manse	B		368377	611885
13398	Overton Tower	B		368482	612846
15235	Fatlips Castle	B		358198	620891
15390	Oxnam Parish Church	B		370118	618994
15391	Louping-On-Stane	B		370104	618944
15456	Southdean Church And Kirkyard	B	Yes	363141	609164
15457	Abbotrule Church	B	Yes*	361162	612749
15458	Abbotrule Kennels, Stables	B	Yes*	360974	612891
19748	Chesters Church	B	Yes	362647	610704
50000	Cleughhead, Minto Estate Former Dairy	B		357398	620900
50000	Cleughhead, Minto Estate Former Dairy, Boundary Walls	B		357416	620884
8409	1 Easter Ulston Cottages	C		367058	621987
8409	2 Easter Ulston Cottages	C		367064	621992
8409	3 Easter Ulston Cottages	C		367073	621998
8409	4 Easter Ulston Cottages	C		367080	622001
13356	Edgerston House, Stotfield	C		369402	612205
49195	Chesters, Southdean Parish Church	C	Yes	362415	610896

7.55 Note that Listed Buildings marked with an asterisk (*) are included in the assessment due to proximity to the 5 km Study Area boundary. They are discussed at the end of the Listed Building assessment (or, in the case of Mervinslaw Pele, in the section dealing with assets at Greater than 5 km (paragraphs 7.135 onwards).

Other Designated Assets within the 15 km Study Area

7.56 There are no World Heritage Sites or further English designated heritage assets within 15 km. In Scotland, there is one Garden and Designed Landscape (GDL), one Inventoried Battlefield and five Conservation Areas within the 15 km Study Area, with only a small portion of the GDL and Battlefield falling within the ZTV. These are detailed in Table 7.10 and those within the ZTV have been assessed.

Table 7.10: Other Designated Assets within 15 km and the ZTV

Name	Category	In ZTV	Approximate Distance and Direction
Montevoit	Garden and Designed Landscape	Yes	12 km to the north
Ancrum Moor	Inventoried Battlefield	Yes	14 km to the north
Ancrum	Conservation Area	-	13.5 km to the north
Denholm	Conservation Area	-	9 km to the northwest
Hawick	Conservation Area	-	10 km to the west-northwest
Jedburgh	Conservation Area	-	10 km to the north
Minto	Conservation Area	-	10.5 km to the northwest

7.57 Discussions with SBC have also identified one locally designated, potentially of national importance. This is the enclosure at Highlee Hill (Figure 7.1).

Assessment of Potential Effects

Potential Construction Effects

Direct Effects

7.58 Heritage assets within the Core Study Area have been avoided where possible. However, there is some potential that undiscovered, buried remains may be affected during construction. However, as noted in Archaeological Potential section (paragraph 7.47), this potential is considered to be low. Re-use of the existing tracks where possible further reduces the Development footprint below ground level. The area around the Highlee Hill settlement (SMR reference 3220050) has been avoided to reduce potential effects upon any associated (buried) archaeological remains).

7.59 Although the access route to the wind farm will pass close to the Scheduled Dykeraw Tower (Index 3848), it will use the line of the existing track. The Tower itself will not be directly affected, and no works will take place within the scheduled area. There is a potential that trackside cabling works and any groundworks required for the proposed construction compound (approximately 100 m north of the Tower) may affect unknown, buried remains associated with the Tower.

7.60 In addition, the proposed new access track between Turbines 9 and 11 on Millmoor Rig may affect any remains associated with a droveway or route (SMR reference 3220109, Figure 7.1) passing north-east/southwest though that area. The area has been under commercial forestry so any remains are likely to have already been damaged. The proposed access track will pass over the historic route at approximately 90 degrees, minimising the amount subject to damage through construction. Only a very limited section of the historic route that will be affected by the proposed new access track (approximately 10 m including allowance for associated cabling), compared to the total length of the feature (and the fact it is but one part of a substantially larger resource). Taking the above into account, the effect of the construction of the access track across this section of the historic route is considered to be of small magnitude upon a feature of medium sensitivity (regionally important as part of the overall droveway network), and the overall affect is therefore assessed as minor in significance (and can be mitigated to further reduce the significance of any effect). This is **not significant** for purposes of the EIA regulations.

7.61 Direct effects may occur through ground disturbance from trenching for cables and preparation of access tracks, excavations for turbine base formations and laydown areas. Whilst the likelihood of encountering significant archaeological remains is considered to be low, where it occurs the effect is likely to result in damage to, if not destruction of, any such remains. As surviving remains are likely to be related to post-medieval farming practice, they are considered to be of lower importance. In this case the effect would be of large or very large magnitude upon assets of low sensitivity, resulting in an effect of "minor" significance. Should remains associated with Dykeraw Tower be encountered, these may be of higher importance, leading to a potentially significant effect (depending on the remains, and the extent of disturbance). A programme of archaeological work leading to preservation by record could be undertaken by way of mitigation (as set out in the Mitigation section (paragraph 7.173). Any residual effect, after the implementation of such mitigation would be negligible (in that a record has been made) and not significant for purposes of the EIA regulations.

Indirect Effects

7.62 Indirect effects during the construction of the Development will occur in the form of the visual appearance of cranes during turbine erection and associated traffic activities, as well as through the temporary presence of the construction compound. These effects are short term, and will cease once the Development has been constructed. As these effects are in general of a similar nature to the indirect effects likely to occur during the operational phase of the Development, the indirect effects on the settings of cultural heritage features resultant from the operational phase are discussed fully in paragraphs 7.63 to 7.172.

Potential Operational Effects

Direct Effects

7.63 Any direct effects will be incurred during the construction phase of the Development; therefore, no direct effects will occur on the archaeological record during the operational phase of the Development.

Indirect Effects-Scheduled Monuments

7.64 This section considers the potential for likely significant indirect effects on heritage assets within 5 km of the proposed turbines (and falling within the ZTV). They are identified by their Index or Historic Building number etc, as appropriate.

7.65 In consultation with SBC and HES, concerns were identified regarding potential effects on heritage assets at greater ranges, given the number of scheduled hill forts etc., on elevated positions to the north of the Development. Having undertaken the assessment (as presented in paragraph 7.68 and onwards below) of assets within 5 km, it is considered that there is negligible potential for likely significant effects on the settings of such assets at greater distances, and this likelihood decreases even further with distance.

7.66 There are quite a few scheduled hill forts within 15 km of the Development. The distribution of these assets across the landscape is best appreciated via a mapping exercise, as many of the upstanding visible features no longer exist, just the landform on which they were located. These are likely related features for which intervisibility of nearby and adjacent hill forts would have been important though the greater the distance between the hill forts (i.e. beyond a few kilometres), the less important intervisibility becomes.

7.67 Nevertheless, limited assessment has been undertaken in relation to a number of key assets beyond 5 km and these are considered at the end of this section (paragraph 7.136 and following).

7.68 Assets have been grouped for assessment where this is considered appropriate (based on location and/or physical or other association).

2116 Dykeheads homestead moat

7.69 Dykeheads homestead moat is located 3.5 km west of Turbine 5. The moated settlement is on the north slope of small knoll overlooking Catlee Burn to the east and Wauchope Burn to the west. Forestry surrounds the monument to the east with smaller strips of forestry to the north and south of the monument. The asset is scheduled due to its potential to contribute to the understanding of medieval settlement and defences contained within its surviving remains.

7.70 The monument was deliberately positioned along the ridge overlooking the burns to the east and west. The immediate setting of the asset comprises the small knoll on which it is located, and this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. Due to the rise in elevation to the south, views of the more open land to the north were also likely important to its placement upon this knoll. As such, the asset also has a wider setting, considered to comprise the immediately surrounding landscape views to the north. These views contribute to the experience of the asset and the understanding of the monuments place within the landscape.

7.71 The ZTV indicates that only one turbine is theoretically visible from this asset. As the turbines will be to the east of the monument on the higher elevations on the opposite site of Catlee Burn and only marginally visible, the Development will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.72 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

2152 Shaw Craigs Fort

7.73 Shaw Craigs Fort is a prehistoric hill fort, located 4.6 km northwest of Turbine 10. The fort is located at elevation overlooking Shaw Burn to its south, positioned to take advantage of view between the hill passes to the south. Forestry surrounds the hill's lower elevations to the north, east and west with further forestry located to the south opposite Leetham Farm. The asset is scheduled due to its potential to contribute to the understanding of prehistoric settlement/defence and land-use contained within its surviving remains and position in the landscape.

7.74 The fort was deliberately positioned on a hill top to enable views to and from the asset. The immediate setting of the asset comprises the cleared hilltop in which it is located, and this is where it's historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the surrounding landscape over which it has views. These views contribute to the experience of the asset and the understanding of the monuments place within the landscape.

7.75 Key views from the asset would likely have included views to and from the south and other nearby hill forts, like White Fort to the north as well as the numerous other hill forts generally situated to the east.

7.76 A wireframe visualisation showing the Development from the south-western edge of the Scheduled area is shown at Figure 7.15. However this is not representative of the centre and north-eastern end of the monument, which lie further along the ridge, so that the ridge itself reduces the visibility of the proposed Turbines. The Development will feature in, but not impede, key open views to the south from the southern edge of the monument. However, the visibility of the turbines would recede the further north and east the viewer is within the monument. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.77 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

2172 Bonchester Hill earthworks and 2173 Bonchester Hill fort

7.78 Bonchester earthworks and fort are located 4.8 km northwest of Turbine 6. The prehistoric fort is located along the summit of Bonchester Hill with the earthworks located along its north facing slope, overlooking Rule Water to the west and Fodderlee Burn to the north and east. The assets are scheduled due to their potential to contribute to the understanding of prehistoric settlement/defence and land-use contained within its surviving remains and position in the landscape.

7.79 The fort and earthworks are deliberately positioned on a hill top to enable views to and from the asset. The immediate setting of the assets comprises the hilltop on which they are located, as this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the surrounding landscape over which it has views. These views contribute to the experience of the asset and the understanding of the monuments place within the landscape.

7.80 Key views from the asset would likely have included views to and from the north and west along the Rule Water and other nearby hill forts, like White Fort to the north as well as the numerous other hill forts generally situated to the north (Rubers Law), east (Shaw Craigs) and west (Kirkton Hill). A view to the southeast towards the Development is shown as a wireline over photograph at Figure 7.5 and a wireframe as Figure 7.10 of this Chapter and a montage is provided at as Viewpoint 5, Figure 4.12f of the Landscape and Visual Assessment Chapter.

7.81 Whilst the turbines will be visible to the southeast of the monument, the Development does not impede upon the key open views over the Rule Water to the east and Fodderlee Burn to the west of the monument. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.82 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

2211 Southdean Law fort and settlement

7.83 Southdean Law fort (and associated settlement) are located 2.3 km northeast of Turbine 10. The prehistoric fort is located along the summit of a hill overlooking a bend in the Jed Water which loops around the asset from the west to the north. The assets are scheduled due to their potential to contribute to the understanding of prehistoric settlement/defence and land-use contained within its surviving remains and position in the landscape.

7.84 The fort and settlement are deliberately positioned on a hill top to enable views to and from the asset. The immediate setting of the assets comprises the hilltop on which they are located, as this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the surrounding landscape over which it has views. These views contribute to the experience of the asset and the understanding of the monuments' place within the landscape.

7.85 Key views from the assets would likely have included views to and from the north and west along the Jed Water and other nearby hill forts, like Shaw Craigs and White Hill to the east as well as the Bonchester Hill to the northwest. A wireline over photograph visualisation is provided at Figure 7.4 of this Chapter along with a wireframe as Figure 7.9 and a montage at Figure 4.10f of the Landscape and Visual Assessment.

7.86 Whilst the turbines will be visible to the southwest of the monuments, the Development does not impede upon the key open views over the Jed Water to the east and south or to the east/west towards and from other nearby hill forts, or the settlements at Martinlee Sike. The turbines will not affect the ability to appreciate the assets, nor their function and position in the wider landscape. However, the proposed turbines of the Development will constitute a new feature and introduce modern infrastructure in views to the south where no such infrastructure is currently visible, and this may change the way in which the fort (and settlement) are currently experienced (in aesthetic terms). This does not prevent an appreciation and understanding of the physical remains of the fort nor its linkage to other similar features to east and north-west, and the proposed turbines occupy only a relatively small section of the available horizon and so the magnitude of the change in relation to the fort's setting is considered small.

7.87 It is considered that the Development would have an effect of small magnitude on an asset of high sensitivity, resulting in an effect of Minor significance. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

2319 Black Hill settlement

7.88 Black Hill settlement is a prehistoric domestic and defensive scoop settlement located on the southwest facing slope of Black Hill, 1.7 km northwest of Turbine 2. The asset is located amongst managed forestry, though historically would have had views overlooking Hyndlee Burn to the west. The asset is scheduled due to its potential to contribute to the understanding of prehistoric settlement/defence contained within its surviving remains and position in the landscape.

7.89 The settlement is deliberately positioned on a hill slope to enable westerly views over the burn. The immediate setting of the asset comprises the slope on which it is located, as this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the surrounding south-westerly landscape over which it has views. These views contribute to the experience of the asset and the understanding of the monument's place within the landscape.

7.90 Only one turbine is predicted to be theoretically visible from the eastern extremity of the scheduled area to the east from the monument, but in reality no visibility is likely, given the current plantation covering Black Hill. In any case, the Development does not impede upon the key open views over the south and west. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape, even were no plantation present.

7.91 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

3423 Wheel Causeway, section 640 m long on S Slope of Wardmoor Hill and 3425 Westshiels spur earthwork

7.92 The Wheel Causeway and Westshiels spur earthworks are listed as prehistoric domestic and defensive linear earthworks, though may also be associated with a medieval road route along the Jed Water (and may thus be part of the wider pattern of routes and droveways in the region). The assets are located 400 m from Turbine 2, to the west and southwest, respectively. The assets are scheduled due to their potential to contribute to the understanding of prehistoric settlement/defence and/or medieval transportation and land-use.

7.93 The earthworks are located amongst managed forestry, on the south facing slope of Wardmoor Hill, with unscheduled portions of the causeway extending to the south. The immediate setting of the assets comprises the slope which they are located, and this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The placement of the assets on the southern slopes of Wardmoor Hill with the Causeway running vertically north/south up the slope and the spur extending to the east indicates that its setting did not comprise long distance views, supporting the assertion that this is likely a road feature for which its placement is functional rather than aesthetic.

7.94 Whilst turbines will be visible to the east and northeast of these monuments, the Development does not impede or bisect the remaining portions of the Wheel Causeway and associated earthworks in the area. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.95 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

3848 Dykeraw Tower, Southdean

7.96 Dykeraw Tower is a located 1.8 km northeast of Turbine 6 on the north facing slope of Dykeraw Height, overlooking the Jed Water. The asset is scheduled due to its potential to contribute to the understanding of late-medieval settlement, defence and construction methods contained within its surviving remains.

7.97 The monument was deliberately positioned on the northern slopes of Dykeraw Height to take advantage of views overlooking Jed Water to the north and east and Cleuch Burn to its west. The immediate setting of the asset comprises the slope on which it is located, and this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the surrounding landscape views to the north and east. These views contribute to the experience of the asset and the understanding of the monuments place within the landscape. A wireline visualisation is provided at Figure 7.7.

7.98 Whilst up to 11 turbines may be visible above the forestry ridgeline to the south from the monument, the wireline indicates that only five of these would include the hub (and in some cases, the hub is likely to be hidden by the currently existing forestry). The rest would be parts of blades only, and likely to be hidden behind the current forestry. The turbines would constitute new (and mobile) modern features in views towards the monument. However, the Development does not impede on key open views to the north from the monument. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape. Taking the above into account, the effect on setting is considered to be small in magnitude upon an asset of High sensitivity, the effect of which is of minor significance (but **not significant** for purposes of the EIA Regulations).

7.99 However, the presence of the proposed construction compound to the north of the monument (and within approximately 100 m) will cause a significant change in the current setting of the remains albeit only temporary, reversible and lasting for 2 years. This effect is considered to be of very large magnitude upon an asset of high sensitivity, producing a Major effect on setting for the duration of the period that the construction compound is operational.

7.100 Upon the removal of the construction compound, it is considered that the proposed turbines would continue to have an effect of small magnitude on an asset of high sensitivity. The potential effect on the setting of the Tower for the lifetime of the Development is therefore assessed as "minor" and **not significant** in terms of the EIA Regulations.

6599 Martinlee Sike enclosure bank, field system, cairns and old road,

6636 Martinlee Plantation enclosure

6600 Martinlee Plantation homestead NW of Martinlee Sike

6601 Martinlee Plantation homestead SE of Martinlee Sike

6602 Martinlee Sike farmstead, field system and assart bank

7.101 The scheduled assets associated with Martinlee are located 2.3 km northeast of Turbine 11 and represent prehistoric and medieval settlement along Carter Burn to the southwest and its associated sikes. The assets are scheduled due to their potential to contribute to the understanding of prehistoric settlement/defence and medieval land-use contained within its surviving remains and position in the landscape.

7.102 The assets are located amongst managed forestry, on the southwest facing slope of Crink Law. The immediate setting of the assets comprises the slope on which they are located, and this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The placement of the assets on the south-westerly facing slope above Carter Burn is likely twofold: being functionally placed near a water source whilst being at a slightly raised elevation enabling views across, up and down the burn. As such, the setting includes Carter Burn and the views of Charlies Know to the southwest, opposite the settlement and burn.

7.103 Whilst turbines will be visible to the southwest beyond Charlie's know, the Development does not impede upon the immediate setting along the slope of Crink Law or the wider setting over Carter Burn and Charlie's Know. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.104 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

6637 Wattie's Spindles, pele house and associated buildings

7.105 Wattie's Spindles constitutes the remains of a settlement and Pele house fort, located 4 km northeast of Turbine 10. The asset is scheduled due to its potential to contribute to the understanding of medieval settlement/defence and land-use contained within its surviving remains and position in the landscape.

7.106 The asset is located at the foot of Shaw Craigs along a ridge to the south of Shaw Burn; both of which are located to the northeast of the asset. Whilst the asset itself is within a clearing it is surrounded by forestry on all sides. The immediate setting of the asset comprises the cleared area and ridgeline on which it is located, as this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the immediately surrounding landscape that includes contemporaneous settlement and for which the Pele house would have likely served as a signalling tower (e.g. the medieval settlement at Martinlee and Steel Knowe, located to the south and west, respectively). These views contribute to the experience of the asset and the understanding of the monuments place within the landscape.

7.107 Whilst the turbines will be visible to the southwest of the monument, there are intervening managed forestry operations between. The Development does not impede upon the key views over the setting nor does it impede upon the association with other nearby medieval settlements. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.108 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

7034 Southdean Church

7.109 Southdean Church (also a Category B Listed Building LB15456) comprises the remains of a medieval church and its kirkyard, located 2.1 km northeast of Turbine 6. The church is associated with the Battle of Otterburn in 1388. The asset is scheduled as an example of a 13th century parish church, possibly overlying an earlier site, later altered in the 15th century. Additionally, the archaeology has the potential to contribute to the understanding of medieval art, architecture, religious practices and material culture as well as being associated with the Battle of Otterburn.

7.110 The asset is located along the northeastern banks of the Jed Water at Southdean, at the foot of Southdean Law. The immediate setting of the asset comprises the kirkyard in which it is located, as this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the immediately surrounding communities which the church would have served and for which the church would have served as a landmark.

7.111 Whilst upper parts of up to eleven turbines (including five hubs, but mostly blades only) are predicted to be visible to the southwest from the monument (above the other side of the ridge), the Development does not impede upon the immediate setting of the church along the Jed Water in the village of Southdean nor does it impede upon the association with other nearby medieval settlements to its southeast (Martinlee Sike and Steel Knowe). The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape. A wireline over photograph is presented at Figure 7.3 and a wireline as Figure 7.8. This is taken from the roadside immediately above the scheduled area, so that turbines are likely to be more visible than if the Development is viewed from within the Kirkyard itself and adjacent to the ruins. It is clear that existing vegetation

along the roadside, and on the higher ground to the south will further reduce the visibility of the turbines and hence limit any effect on setting.

7.112 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

7144 Steel Knowe farmstead

7.113 Steel Knowe farmstead comprises the remains of a settlement, likely of medieval date, located 1.8 km northeast of Turbine 10. The asset is scheduled due to its potential to contribute to the understanding of rural architecture, economy and land-use.

7.114 The asset is located along Jordan Sike on the north side of Carter Burn. The asset is surrounded by managed forestry, encompassing both sides of Jordan Sike extending to the higher elevations of Steel Knowe (hill) to the east and Charles Hill down to Carter Burn to the south. The immediate setting of the assets comprises this area, and this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The placement of the assets on along the sike and Carter Burn is likely twofold: being functionally placed near a water source whilst being at a slightly raised elevation to reduce the risk of flooding and enabling views across, up and down the burn. As such, the setting includes the visible portions of Carter Burn and extends to encompass neighbouring medieval settlements like Martinlee to the southeast and Southdean to the northwest. A wireline visualisation is presented at Figure 7.14.

7.115 Whilst turbines will be visible to the southwest beyond Charlie's Knowe, the Development does not impinge upon the immediate setting of the settlement along the sike or the wider setting over Carter Burn and neighbouring settlements. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.116 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

10605 Tamshiel Rig fort, settlement and field system

7.117 Tamshiel Rig fort, settlement and field system are located 600 m to the east of Turbines 11 and 13. The prehistoric settlement is located along the north facing slope of Tamshiel Rig, overlooking Black Burn. Only the eastern portion of the monument is scheduled, as the western portion has been heavily damaged by forestry operations. The asset is scheduled due to its potential to contribute to the understanding of prehistoric settlement, economy and social organisation contained within its surviving remains and position in the landscape, with the differential settlement phases of particular interest.

7.118 The fort and associated earthworks are deliberately positioned on the northern slope of Tamshiel Rig to enable views from the asset over the junction of Black Burn and the Jed Water. The immediate setting of the assets comprises the slope on which it is located, as this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated, especially with the history of previous afforestation which has disturbed the remains. The asset also has a wider setting, considered to comprise the surrounding landscape to the north over which it has views. These views contribute to the experience of the asset and the understanding of the monument's place within the landscape. A visualisation (wireline over photograph) is presented at Figure 7.6 and a wireline as Figure 7.13.

7.119 Whilst the turbines will be visible to the west of the monument, the Development does not greatly impede upon the key open views over the Jed Water to the northwest and Black Burn to the east. The turbines will not affect its function and its position in the wider landscape, though the placement of the turbines within the view shed from the monument of the Jed Water may have a minor effect on its appreciation.

7.120 It is considered that the Development would have an effect of small magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

Indirect Effects-Listed Buildings

13886 Mervinslaw Pele-House (Category A)

7.121 This is a dual listing and is assessed in the Assets at Greater than 5 km and within 15 km section, below.

15456 Southdean Church and Kirkyard (Category B - assessed in Scheduled Monuments)

7.122 This is a dual listing and is assess in the Scheduled Monuments section.

19748 Chesters Church (Category B) and

49195 Chesters, Southdean Parish Church (Category C)

7.123 Chesters Church and nearby Parish Church are located 3.3 km north of Turbine 6. Chesters Church consists of the remains of an old church yard of medieval date. It is listed for its remaining fabric which incorporates medieval features. Southdean Parish Church is a post-medieval church located to the north of the village. It, along with Chesters Church, are likely associated with the Church at Southdean to the south, an early medieval meeting place about 1 mile south of the village. The churches are listed in part due to this association.

7.124 The assets are located in the village of Chesters. The immediate setting of the assets comprises the kirkyard in which they are located, as this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The Chesters Church kirkyard is tree lined whilst the Parish Church has trees adjacent to the south limiting long-distance views; however, the assets also have a wider setting, considered to comprise the immediately surrounding community of Chesters which the church would have served and for which the church would have served as a landmark.

7.125 Whilst the turbines will be visible to the south of the monument amongst the forestry, the Development does not impede upon the immediate or wider setting of the church and its association with Chesters. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.126 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

8371 Harwood House (Category A)

7.127 This building lies approximately 5.3 km to the northwest of Turbine 2. Analysis of the ZTV indicates that is theoretically intervisible with only 1 turbine. The House itself lies near the head of a small valley of the Harwood Burn, and has woodland in close proximity, with views to north-east and south-east. It is approached from the north. The predicted effect is unlikely to be realised due to tree cover on the intervening high ground. Any effect on the setting of this building is considered to be negligible in magnitude, upon a feature of high sensitivity. The potential effect is therefore assessed as **not significant**.

15458 Abbotrule Stables and Kennels (Category B)

7.128 This historic asset lies approximately 5.4 km north of Turbine 6. Its setting is considered to be related to the adjacent house and spaces of the Abbotrule settlement and the banks of the Fodderlee Burn. It is noted that plantation exists to the south of Abbotrule (between the settlement and the Development). It is considered that the proposed turbines (of which only the upper parts of 5 are theoretically visible) would not affect the setting of the structure, and it is further considered that long views to or from the building are not important in understanding or appreciating its significance or setting (even were such views available). Any potential effect is considered to be of negligible magnitude, upon an asset of High sensitivity. The final effect is therefore assessed as **not significant**.

15457 Abbotrule Church

7.129 The ruined remains of the church lie approximately 5.2 km north of Turbine 6 of the proposed Development. The church lies in open ground above the Rule Burn, and south of the settlement of Abbotrule – these relationships are considered to define the ruin's setting. The Church is predicted to have theoretical visibility of only 2 turbines, and this is likely to be blade tips only. In reality, the presence of screening on and around higher ground at Doorpool and Doorpool Hill will result in the turbines being a negligible component of views to the south from the asset, and the Development will not intrude into the church's setting nor affect the way in which it is experienced. The effect is considered to be of negligible magnitude upon an asset of high sensitivity, and therefore this is assessed as **not significant**.

Indirect Effects-Battlefields and Parks and Designed Landscapes

Montevoit Garden and Designed Landscape (GDL) and Ancrum Moor Inventoried Battlefield

7.130 Montevoit GDL and Ancrum Moor Battlefield are located between 15 and 18 km from Turbine 6. The ZTV indicates that there is minimal visibility (i.e. 1-2 turbines at most, and likely to be blade tips only) from limited areas such as Penial Heugh and Down Law. Given the intervening distance between these assets and the Development, a significant effect in terms of EIA regulations is unlikely, and no further assessment has been undertaken.

Indirect Effects-Locally Designated Assets of potential Regional Importance

Highlee Hill Enclosure

7.131 One locally designated feature considered to be of at least regional importance survives within the Development area. This is the Highlee Hill enclosure (SMR 3220050, NMR NT60NW4), which survives as low earthworks in open ground on Highlee Hill. Whilst not directly impacted by the Development it will be subject to an indirect effect on its setting by virtue of its proximity to the proposed infrastructure. It lies approximately 560 m northwest of the closest of the proposed turbines (Turbine 2).

7.132 The remains are likely to be of Iron Age or Roman date and consist of traces of a ditch with earthen banks to either side with entrances on the east and southwestern sides. No traces of internal occupation have been found. The site doesn't appear to have been subject to significant disturbance (such as from forestry) and may still retain archaeological evidence for its past use. The site lies on the crest of a hill with the Cleugh Burn to its east and a tributary of the White Burn to its west. The ground slopes away to its north towards the modern settlements of Chesters and Southdean.

7.133 It is likely to have formed a part of the wider late prehistoric settlement of the area but it is not clear whether it was contemporary with some of the more prominent local features such as the Southdean Fort, or with the larger settlement at Tamshiel rig. Its position suggests that the availability of views to the north was important, but views to west and south in particular less so (due to higher ground at Wolflee Hill, Wolfhopelee Hill and Wardmoor Hill).

7.134 Views from the site to the north are not affected by the turbines, so this aspect of its setting is unaffected. The physical remains are only readily appreciable in relatively close proximity to the site, and the presence of the nearest turbines over 500 m away will not affect an ability to understand the form and topographic location of the earthworks. Given the limited physical presence of the remains within the landscape, views towards the site are not considered essential to its understanding.

7.135 Nevertheless, the presence of Turbine 6 in particular (located as it is within the open ground off the south-eastern flank of Highlee Hill) may alter the way in which a visitor to the site appreciates the remains as part of a wider rural background. As this does not prevent an understanding of the nature, form and function of the site, and given the limited above ground presence of the remains, any effect on setting is considered to be small in magnitude only. An effect of small magnitude upon an asset of high sensitivity is considered to constitute an effect of "**minor significance**" and this is not significant for purposes of the EIA regulations.

Assets at greater than 5 km and within 15 km

7.136 The following assets are included in the assessment at the request of the Consultees. They lie within 15 km of the turbines, and have been selected to illustrate the degree of visibility and any potential effect on the settings of these typically more elevated assets (see Figure 7.2b). Reference is also made to them in the subsequent cumulative assessment as appropriate.

1717 Mervinslaw Tower

7.137 Mervinslaw Tower is a Scheduled bastle (also Category A Listed Building), located 6.1 km northwest of Turbine 10 (within 5 km of the redline boundary). The bastle is on the south slope of Mervin's law, and the monument also includes the remains of a small semi-fortified estate dating to the 16th century.

7.138 The monument overlooks the Jed Water to the east and Peel Burn to its south. Forestry surrounds the monument to the south, east and northwest. The asset is scheduled due to its potential to contribute to the understanding of late-medieval settlement, defence and construction methods contained within its surviving remains.

7.139 The monument was deliberately positioned on the southern slopes of Mervins Law overlooking Jed Water to enable southern views of the passes between the hills. The immediate setting of the asset comprises the southern slopes in which it is located, and this is where the historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the surrounding landscape views to the south.

These views contribute to the experience of the asset and the understanding of the monuments place within the landscape.

7.140 Whilst the turbine tips may be visible above the forestry ridgeline to the southwest of the monument, the Development does not impede on key open views to the south from the monument. The turbines will not affect the ability to appreciate the asset, its function and its position in the wider landscape.

7.141 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as **not significant** in terms of the EIA Regulations.

1699 The Law

7.142 The Law Fort is a prehistoric hill fort, located 12.5 km northwest of Turbine 10. The fort is located at elevation overlooking Oxnam Water to its north and Newbigging Burn to the west. Forestry surrounds the hill's lower elevations to the south, east and west with a road to the north. The asset is scheduled due to its potential to contribute to the understanding of prehistoric settlement/defence and land-use contained within its surviving remains and position in the landscape.

7.143 The fort was deliberately positioned on a hill top to enable views to and from the asset. The immediate setting of the asset comprises the cleared hilltop in which it is located, and this is where its historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the surrounding landscape over which it has views. These views contribute to the experience of the asset and the understanding of the monuments place within the landscape.

7.144 Key views from the asset would likely have included views to and from other nearby hill forts, like Cunzierton Fort to the northeast, the numerous hill forts to the south along the Kale Water, and Shaw Craigs Fort to the southwest. The turbines would be located beyond Shaw Craigs Fort to the southwest.

7.145 Whilst the turbines will be visible to the southwest from the fort, the Development does not impede on immediate views to and from the fort due to the distance and intervening hills and landscape character. The turbines will appear behind Shaw Craigs Fort, likely to appear so small as to be insignificant, and therefore not affect the ability to appreciate both the asset itself as well as its position in the wider landscape.

7.146 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

2125 Wodens Law

7.147 This monument is a hill fort with associated remains of Roman siege works. It lies on elevated ground approximately 14.3 km east- northeast of the Development. The turbines will be in views to the south-west at distance and as part of the wider landscape only, and only from the western edge of the Scheduled area. A wireline visualisation is presented at Figure 7.17.

7.148 It is not considered that their presence will affect or impair the ability to appreciate the earthworks and remains of the fort and associated Roman activity, nor prevent an understanding of the form and function of those remains, nor their topographical location and relation to similar elevated hill forts (such as Heugh Fort, which lie closer to it and in front of the distant turbines).

7.149 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

2129 Rubers Law

7.150 Rubers Law is a prehistoric hill fort with later Roman signal station, located 8.7 km northwest of Turbine 6. The fort is located at elevation overlooking Rule Water to its southeast. The asset is scheduled due to its potential to contribute to the understanding of prehistoric settlement/defence and Roman defence contained within its surviving remains and position in the landscape.

7.151 The fort was deliberately positioned on a hill top to enable views to and from the asset, likely in relation to the fort opposite it on Bonchester Hill. The immediate setting of the asset comprises the hilltop in which it is located, and this is where its historical and archaeological value of the archaeological remains is currently best understood and appreciated. The asset also has a wider setting, considered to comprise the surrounding landscape over which it has views. These views contribute to the experience of the asset and the understanding of the monument's place within the landscape. However, taking into account the defensive function of the Fort, it is the availability of the all-round views that is important (rather than simply what is in the views).

7.152 Nevertheless, extensive views are available from the asset and this includes views to other nearby hill forts, and in this respect the view towards Bonchester Hill to the southeast is considered important. In this view, the turbines would be located beyond Bonchester Hill further to the southeast. A wireline visualisation is presented at Figure 7.11, and a montage is presented as Viewpoint 12 at Figure 4.19f of the Landscape and Visual Assessment.

7.153 Whilst the turbines will be visible to and from the fort in views to the southeast, the Development does not impede on immediate views to and from the fort due to the distance and intervening hills and landscape character. The turbines will appear behind Bonchester Hill, but as small and distant features of the wider landscape, and therefore not affect the ability to appreciate both the asset itself as well as its position in the wider landscape.

7.154 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

2170 Cunzierton Fort

7.155 Although just outside of the 15 km study range, this asset is included as it was raised in consultation with SBC. This hill fort occupies an elevated position approximately 15.2 km northeast of the proposed Development. It overlooks the valley containing the Cowhill Burn, with Harker's Burn and Cunzierton Burn to its south. Its setting also includes Five Stanes stone circle to its southeast, and a scheduled section of the Roman Dere Street (index number 3929) to its north and northeast.

7.156 The Development is likely to be visible at distance and only as part of the wider landscape. Its presence in such views will not intrude into the immediate setting of the Fort, nor into the visual linkages with neighbouring forts. The Development is not considered to affect the ability to appreciate the physical remains of the fort, not its relationship to those neighbouring assets nor the wider landscape. A wireline view point is included at Figure 7.18.

7.157 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

2296 Penchrise Pen

7.158 This Hill fort lies approximately 12.9 km west of the Development. Whilst the ZTV indicates that most of the proposed turbines will be visible from the summit of the fort in views to the east, they will be distant and partial, above intervening high ground at Fanna Hill, Wolfehope Hill and Wolfehopelee Hill. A wireline visualisation is presented at Figure 7.12.

7.159 The Fort has an immediate setting which includes numerous scheduled features such as settlement remains, enclosure and forts within some 5 km of its location. Its relationship with these will not be affected by distant visibility of the proposed turbines, and most of the assets within its "hinterland" are also not within the ZTV of the Development. This includes elevated features such as Blakebillend Fort (index 2296) and Midhill Fort (Index 3373) which lie within 5 km of Penchrise Pen, but are some 9 km and 10 km distant from the Development

7.160 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

3294 Dere Street

7.161 This monument consists of the remains of the major Roman Road running north through this part of the Borders. Only very limited sections of it are predicted to be inter-visible with the Development. At approximately 14 km to the southwest at its closest point, the turbines are likely to be a very limited presence in the distance and as part of the wider landscape. It is not considered that the Development will adversely affect the setting of the remains, nor impair any appreciation of its construction, function, and relationship to the landscape through which it passes.

7.162 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

10734 Loddan Fort

7.163 The remains of this hill fort occupy an elevated position on Loddan Hill approximately 13 km east of the Development, overlooking the Tod Burn, and with visual linkages to surrounding hill top settlements and forts such as at Hirdhope Hill, Wodens Law, Heugh Law and Stoney Law.

7.164 The Development is likely to be visible at distance and only as part of the wider landscape. Its presence in such views will not intrude into the immediate setting of the Fort, nor into the visual linkages with neighbouring forts. The Development is not considered to affect the ability to appreciate the physical remains of the fort, not its relationship to those neighbouring assets nor the wider landscape.

7.165 It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

10743 Heugh Fort

7.166 Heugh Fort lies a little closer to the Development at approximately 12.3 km distant, on elevated ground overlooking the Henfield Burn. As with Loddan Hill fort, the distant views of some of the turbines to the south-west is not considered to affect the ability to appreciate the physical remains of the fort, not its relationship to those neighbouring assets nor the wider landscape.

7.167 As a result no adverse effect is predicted to occur to its setting. It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

Five Stanes Stone Circle

7.168 This non-designated asset represents the remains of a poorly preserved stone circle, adjacent to the former line of Dere Street on higher ground approximately 15.5 km to the northeast of the nearest of the proposed turbines. It setting is considered to relate to the ridge on which it is situated, which may have provided a routeway through the landscape before the use of Dere Street in the Roman period. It may also have been visually related to the Trestle Cairn to its south (Index number 2164,) on a rise on the same ridge, and to an undesignated cairn to the north, closer to Cunzierton Fort (Index 2170, which is also within the ZTV at some 15.2 km from the Development). A wireline visualisation from the Stones is presented as Figure 7.16 and a montage is presented as Viewpoint 13 at Figure 4.20d of the Landscape and Visual Assessment.

7.169 Although all of the turbines are predicted to be visible from this location, they will be a part of the wider landscape only. Primary views of the circle are from north and south along Dere Street, and these views will be unaffected, as will the linkage with the monuments (cairns and Hill Fort) within its immediate vicinity.

7.170 The monument no longer has a strong presence in the landscape so that long views towards it will not be affected by the distant development.

7.171 As a result no adverse effect is predicted to occur to its setting. It is considered that the Development would have an effect of negligible magnitude on an asset of high sensitivity. The potential effect is therefore assessed as not significant in terms of the EIA Regulations.

Summary

7.172 The assessments in paragraphs 7.137 to 7.171 are not meant to be exhaustive, but are representative of the likely effects at heritage assets within the ZTV but lying at some distance from the Development. It demonstrates that the potential effect on the more elevated heritage assets such as the hill forts along the fringes of the Cheviots and high ground to the east and northeast of the Development is by and large negligible, even where the turbines may be distantly visible. This is in part due to the distance but also due to the fact that the settings of these assets are more related to each other and the ground they occupy and valleys they overlook, rather than the more distant land to the south and west.

Mitigation and Residual Effects

7.173 Although any potential direct effects on known and unknown (buried) heritage assets have been minimised by avoidance, some mitigation is proposed as set out below.

7.174 The Scheduled Monument (Index 3848), Dykeraw Tower will be temporarily fenced off (along the existing access tracks) to prevent accidental trespass onto that site. Should the existing access track require upgrading and widening, a preference for limiting any such work to the western side of that track (i.e. on the opposite side from the monument) will be incorporated into design arrangements (this preference will also extend to any associated cabling works). In the event that this is not possible, a programme of preconstruction investigation leading to preservation by record will be agreed with SBC (and HES).

7.175 Recognising the proximity of the proposed construction compound to the Monument (within approximately 100 m), it is considered there is potential that buried archaeological remains associated with the Tower may survive at that in the vicinity (and outside of the Scheduled area). A programme of archaeological work will be carried out at the construction compound location (and along the western side of the access track where it passes the Monument) in order to establish whether any such remains survive, and if so, to permit their investigation and recording. It is suggested that such a programme could begin with evaluation trenching, to be carried out in advance of construction, with time for further detailed works to be carried out, if the results of the evaluation warrant it. The result would be the preservation of any identified remains by record.

7.176 Any such programme of work will be agreed in the form of a Written Scheme of Investigation, the scope and extent to be agreed with SBC (and HES as appropriate), and secured by an appropriately worded planning condition.

7.177 An archaeological watching brief should be carried out over locations proposed for access track widening/cabling in open ground, where not previously disturbed by forestry activities. Limited watching brief is proposed at the location of SMR reference 3220109 at Millmoor Rig, a part of the historic droveway/track network across the wider area, where construction of the proposed new access track between Turbines 9 and 11 bisects the historic route and may affect any surviving traces of it in an approximately 10 m wide section. Although the area has been affected by commercial forestry activities, a limited archaeological attendance will allow any surviving remains to be identified and recorded if appropriate.

7.178 After the implementation of the proposed mitigation, any residual effects on currently unknown buried archaeological remains (should they exist to be encountered during construction) will be considered to be "negligible" in that an appropriate record will have been made, leading to preservation by record.

Cumulative Effect Assessment

7.179 This assessment considers the potential additional effect of the Development in a scenario in which Birneyknowe (approximately 8 km to the northwest) and Windy Edge (approximately 12 km to the south-west) exist. These two sites are in application or at appeal.

7.180 At the request of the Consultees, consideration is given to the Wauchope Forest East and Wauchope Forest West schemes, although these have not been submitted and final details are unknown (normally it would be expected that these developments would need to consider their cumulative effect with Highlee Hill as a proposed development in planning in their ES's).

7.181 Although the LVIA assessment identifies additional similar developments, these are considered to be at sufficient distance from the proposed Development that no potential for significant additional cumulative effects on individual heritage assets arise.

7.182 The effect considered here is whether the Development causes any significant additional indirect (visual) effect on the settings of heritage assets taking into account the presence of similar operational and consented Developments, or such developments currently in the planning system (at application or in appeal).

7.183 In undertaking the assessment, consideration has been given to the cumulative ZTVs produced as part of the LVIA.

Windy Edge

7.184 Windy Edge lies approximately 12 km to the south west of the closest turbine of the proposed Development (T1). Review of the cumulative ZTV showing for both the Development and Windy Edge (see Figure 4.7g) indicates that both developments are likely to be visible together in limited areas to the south and southwest of Highlee Hill.

7.185 There are very few designated heritage assets between these two developments, and none appear to lie within the cumulative ZTV.

7.186 The proposed Development is therefore not considered to give rise to any additional significant cumulative effect on the settings of any heritage assets in combination with Windy Edge.

Birneyknowe

7.187 This development lies approximately 8 km to the northwest of Highlee Hill. The cumulative ZTV (see Figure 4.7g) indicates that Birneyknowe will be visible together with Highlee Hill over a wide area to the north and west of both developments, albeit largely on the higher ground, as well as across the forested areas of Wauchope Forest to the south of Highlee Hill.

7.188 By and large, visibility of both developments is restricted to heritage assets at higher elevations, such as from Ruber's Law, Bonchester Hill and Southdean. From these assets, the two developments are clearly separated, although Highlee Hill will increase the numbers of turbines visible (albeit not always in the same direction of view). For example, from Bonchester Hill, Highlee Hill and Birneyknowe are separated by some 90 degree or more. The visibility of the two schemes does not prevent an understanding of the nature of the Fort, nor its archaeological associations with similar heritage features occupying elevated topographic positions, notwithstanding that more turbines may be visible. Whilst the addition of Highlee Hill is a change in setting, in this respect it does not fundamentally cause any fundamental adverse effect on the appreciation and understanding of the fort. The same is considered to apply to views from Rubers Law (at an even greater distance).

7.189 However, Highlee Hill will bring turbines much closer to Southdean Fort, but as this does not prevent an appreciation of the archaeological remains, nor the visual relationship to Bonchester Hill, Rubers Law, nor the archaeological relationship to the settlement at Southdean and the remains of settlement at Steel Knowe and Martinlee Sike, the effect is considered minor.

7.190 In more distant views (such as from the higher ground to the north and north-east, the wind farms will be visible only as part of a wider landscape, as the hill forts and other assets tend to fade from view, becoming topographic or landscape features.

7.191 There are a few designated assets between the two developments, and that theoretically have visibility of both. The Scheduled settlement and moat site of Dykeheads (Index 2116) will have views towards both, but at effectively 180 degrees apart. The settlement on Black Hill (Index 2319) lies within forestry on Black Hill, and where views from it are obtainable these will tend to be to the west, overlooking the Hyndlee Burn (and towards Birneyknowe), so that the presence of the Highlee turbines, although closer, will not significantly alter the current setting.

7.192 Birneyknowe is likely to have a greater influence on the settings of assets such as Penchrise Hill settlement (Index 2296) and Mid Hill Fort (Index 3373), which are closer to it (to its immediate south and west). Similarly, Highlee Hill will have a greater influence on the assets to its immediate north (such as Dykeraw Tower). The north-south aligned higher ground between the two developments around Wolflee Hill and Wolfhopelee Hill serves to differentiate the main areas of visual effect for

both developments (at least so far as potential significant effects on the settings of heritage assets is concerned).

7.193 The proposed Development is not considered to cause any significant cumulative visual effect on the settings of any heritage assets in combination with Birneyknowe.

Wauchope Forest

7.194 This development has not yet been submitted and the final extent and numbers are not yet known. The following is indicative only, based on the layout provided with scoping.

7.195 The Eastern (and larger) part of the Wauchope Forest development lies approximately 1-2 km to the south of the Highlee Hill Development. The Western part lies approximately 4 km to the south-west.

7.196 Consideration of the cumulative ZTV presented at Figure 4.7j indicates that there are only limited areas to the south of the immediate environs of Wauchope Forest East, where all three schemes will be theoretically visible (and there are fewer designated assets in that direction in any case).

7.197 Where viewed from heritage assets to the south and south-west, Highlee Hill is likely to be visible in the background and behind the turbines of Wauchope Forest. Whilst more individual turbines are likely to be visible (in whole or in part), the additional effect of the Highlee turbines is considered to be minimal, as any effect on setting of assets in these directions will have already largely occurred as a result of the placement of the intervening Wauchope turbines.

7.198 There are a few features where there will be a greater sense of enclosure or surrounding as a result of the Highlee Hill turbines being added to the Wauchope Forest scenario. By and large, this is limited to the non-designated settlement in Coblaw Plantation (SMR reference 3220021) along with associated features which lies immediately south of the Highlee Hill development. However, this site lies within commercial plantation and it is unlikely that any of the turbines would have a strong visual influence on it (although it is recognised that this would change should all of the surrounding forestry be felled).

7.199 The Scheduled settlement on Black Hill (Index 2319) would also lie between Highlee Hill and the Wauchope turbines. Its setting is more influenced by its position on a west facing slope, so that the Wauchope West turbines will be more visible from it. It is currently surrounded by commercial forestry, limiting the extent to which the Highlee Hill turbines would be visible in any case. No significant additional effect from Highlee Hill is predicted here.

7.200 The earthworks of the Wheel Causeway and associated remains (Index numbers 3423 and 3425) along the southern edge of the Highlee Hill Development would similarly have theoretical visibility of all three developments. However, they are currently set within commercial plantation, and in any case, their archaeological, and historic value would not be compromised. Whilst they represent former route ways, intentional visibility is not considered a key element of their design or function, nor essential to their appreciation. In this instance also, Highlee Hill is not considered to cause any significant additional impact on setting.

7.201 Of more interest are the potential effects on views from elevated heritage assets to the north of Highlee Hill, in which the Development turbines would be seen in front of the Wauchope turbines (where such views are considered important to the appreciation and understanding of those assets). In this regard, views from Southdean Fort and Shaw Craigs Fort are worth consideration.

7.202 In the case of Southdean, the Highlee Hill turbines would clearly be closer than those of the more distant Wauchope East. Whilst this would be a distinct change in the setting, it is not considered to have a significant (adverse) effect on the fort. This is in part because the Wauchope turbines would form an existing part of the setting, and the essential attributes of the fort would not be fundamentally changed and hence an appreciation and understanding of its topographical position, the form and preservation of its remains, its association with potentially contemporary settlements its east and south would not be harmed.

7.203 The same is considered to be the case for the Scheduled Fort on Shaw Craigs (Index 2152), and its visual relationship in terms of sight lines to Southdean, White Hill, Bonchester and forts to the north and north-east, are all similarly unaffected. The presence of more turbines in a view to the south is not considered to cause significant adverse effects on the setting of these assets.

7.204 A similar situation occurs in views from the more elevated heritage assets (such as Hill forts) further to the east and north at Woden's Law etc. The Highlee Hill Development would introduce more turbines in view, and slightly closer to some assets, but the turbines would not cause a significant change in the view (as they would already contain turbines), and hence no additional significant adverse cumulative effect is predicted at these distances.

7.205 In no case, taking into account current afforestation, and given the unknown final arrangements for the Wauchope Forest turbines, is the addition of Highlee Hill Wind Farm considered to cause any significant cumulative harm so as to affect (or prevent or fundamentally alter) an appreciation or understanding of any heritage assets.

Summary of Effects

7.206 This section summarises predicted significant effects, mitigation and remaining residual affects after the implementation of mitigation.

Table 7.11: Summary of Effects

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Significance
Construction				
Known Archaeological Remains	Damage or destruction though ground works or accidental trespass	Negligible to Major	Avoidance by design and Fencing off	Negligible
SMR reference 3220109 Routeway passing over Millmoor Rig	Damage or destruction of any surviving remains within a 10 m section where a new access track between Turbines 9 and 11 passes of the supposed line of the routeway.	Minor (not Significant for purposes of the EIA regulations)	Watching Brief and recording if remains identified.	Negligible
Unknown (buried) archaeological remains	Damage or destruction though ground works or accidental trespass	Negligible to Major	Implementation of a programme of archaeological mitigation to enable identification and investigation, leading to Preservation by Record	Negligible
Operation				
Dykeraw Tower (Index 3848)	Indirect effect on Setting from Construction Compound	Major	None – effect temporary for 2 years and reversible on removal of Compound	Minor effect on setting (from the Development turbines for the remainder of the consented Development life)
Decommissioning				
None	None	None	None	None

Statement of Significance

7.207 No significant cumulative effects have been identified arising from the addition of the Proposed Development to a background scenario in which the currently applied for (or scoped) Developments were to exist.

7.208 No direct effects are considered to be significant after the application of proposed mitigation. Mitigation is proposed consisting of the implementation of a programme of archaeological works to allow the identification and appropriate investigation of archaeological remains in the vicinity of Dykeraw Tower, the fencing off of Dykeraw Tower itself and the undertaking of a watching brief on ground disturbance in previously undisturbed areas (i.e., outwith the areas of commercial forestry), and on one section of proposed access track on Millmoor Rig (to ensure identification and recording of a section of a historic route which may pass over this area).

7.209 A significant indirect effect has been found on the setting of one heritage asset within the Development site. This is upon the setting of Dykeraw Tower (Index 3848), and this derives from the presence of the proposed construction compound in close proximity to the monument. The effect of the presence of temporary construction compound will be removed after approximately 2 years, leaving only a residual effect on setting caused by the presence of some turbines visible to the south, which is not considered significant at this asset.

HIGHLEE WIND FARM

FIGURE 7.1

SITE LOCATION WITH HERITAGE FEATURES CONSIDERED WITHIN 1 KM STUDY AREA

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Proposed Turbine Location
- Site Boundary
- 1 km Study Area

Listed Building

- Category B
- Category C

- Scheduled Monument
- Non-Designated Heritage Features
- Non-Designated Linear Heritage Features
- Zone of Theoretical Visibility

LAYOUT DWG	T-LAYOUT NO.
FINAL	PCCCacc002

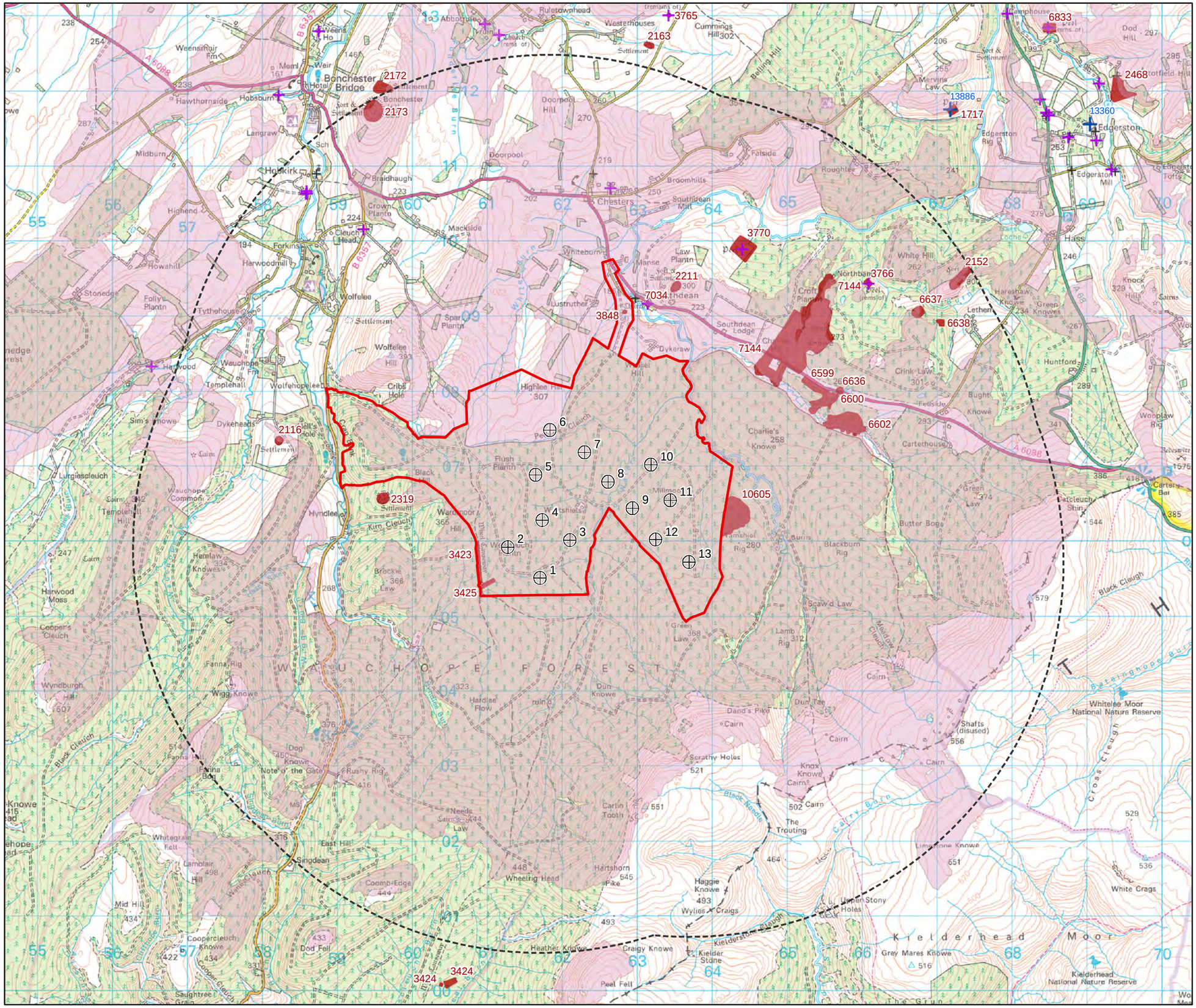
DRAWING NUMBER

2053/REP/010

SCALE - 1:30,000 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE WIND FARM

FIGURE 7.2A

CULTURAL HERITAGE DESIGNATIONS WITHIN 5 KM

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Proposed Turbine Location
- Site Boundary
- 5 km Study Area

Listed Building

- Category A
- Category B
- Category C
- Scheduled Monument

LAYOUT DWG	T-LAYOUT NO.
FINAL	PCCCacc002

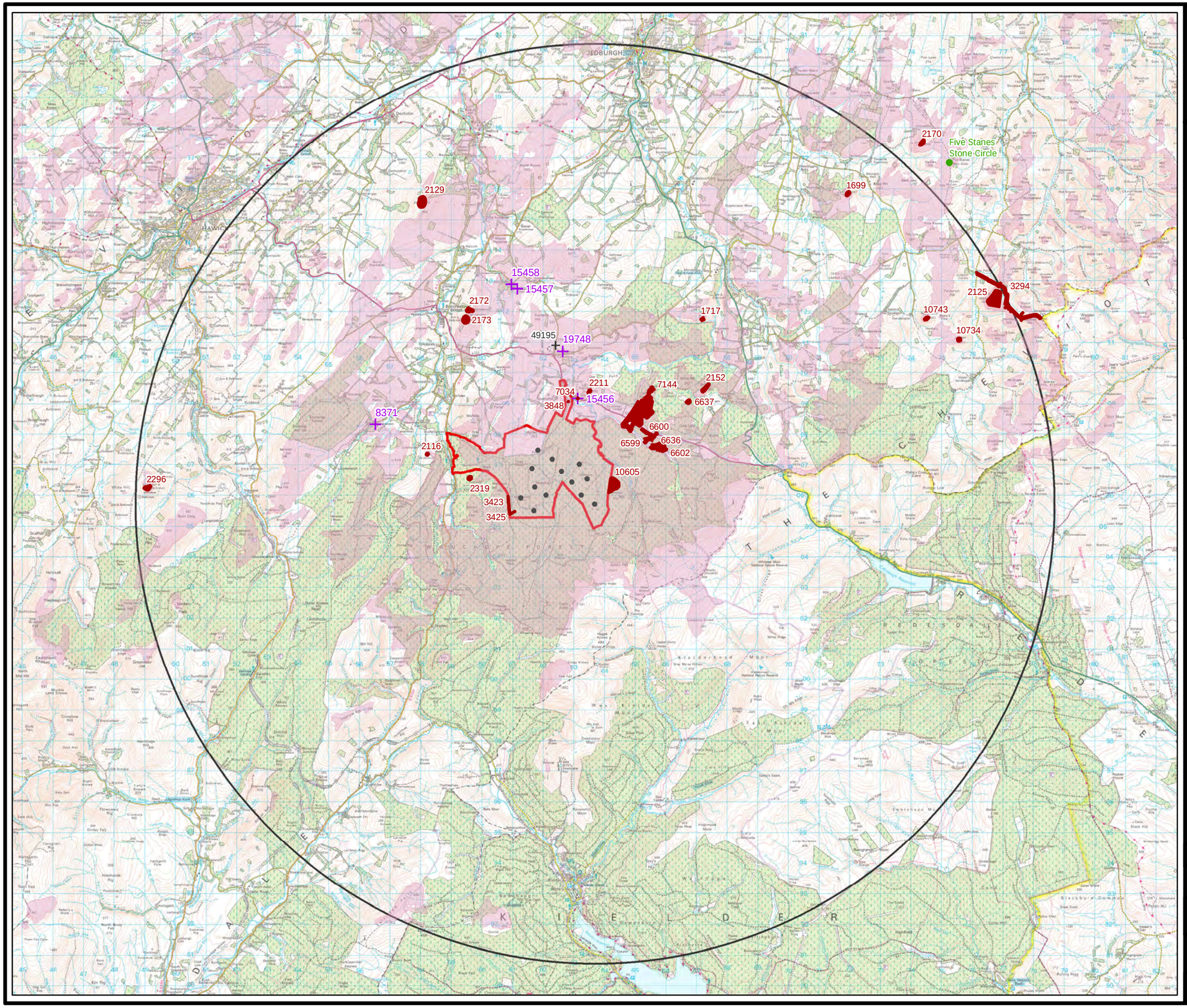
DRAWING NUMBER

2053/REP/011

SCALE - 1:50,000 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE WIND FARM

FIGURE 7.2B

SELECTED CULTURAL HERITAGE DESIGNATIONS WITHIN 15 KM AND ZTV

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Proposed Turbine Location
- Site Boundary
- 15 km Study Area
- Zone of Theoretical Visibility
- Locally Designated Archaeological Site
- Scheduled Monument

Listed Building

- \+ Category B
- \+ Category C

LAYOUT DWG	T-LAYOUT NO.
FINAL	PCCCacc002

DRAWING NUMBER

2053/REP/016

SCALE - 1:120,000 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

Figure: 7.3
Cultural Heritage Viewpoint 2: Southdean Church. On Roadside Northeast of Scheduled Ancient Monument

OS reference:	363149 E 609184 N	Horizontal field of view:	110° (cylindrical projection)	Camera:	Nikon D600
Eye level:	198.5 m AOD	Principal distance:	812.5 mm	Lens:	50mm (Nikon AF 50mm f/1.4)
Direction of view:	194.51°	Paper size:	841 x 297 mm (half A1)	Camera height:	1.5 m AGL
Nearest turbine:	2.14 km	Correct printed image size:	820 x 198 mm	Date and time:	16/11/2015 10:25

Figure: 7.4
Cultural Heritage Viewpoint 3: Southdean Hill Fort

OS reference:	363538 E 609394 N	Horizontal field of view:	110° (cylindrical projection)	Camera:	Nikon D600
Eye level:	293 m AOD	Principal distance:	812.5 mm	Lens:	50mm (Nikon AF 50mm f/1.4)
Direction of view:	200.43°	Paper size:	841 x 297 mm (half A1)	Camera height:	1.5 m AGL
Nearest turbine:	2.40 km	Correct printed image size:	820 x 197 mm	Date and time:	16/11/2015 10:54

Figure: 7.5
Cultural Heritage Viewpoint 4: Bonchester Hill Fort

Bonchester Bridge
Bonchester
Bonchester Hill
Dunion Hill
Dunion
Hill Fort
Howpark
Howpark Hill
Hill Fort
Mid Burn
Hill Fort
Hill Fort
Hill Fort

Figure: 7.6
Cultural Heritage Viewpoint 7: Tamshiel Rig Settlement (Eastern Edge)

OS reference:	364309 E 606359 N	Horizontal field of view:	110° (cylindrical projection)	Camera:	Nikon D600
Eye level:	252 m AOD	Principal distance:	812.5 mm	Lens:	50mm (Nikon AF 50mm f/1.4)
Direction of view:	272.75°	Paper size:	841 x 297 mm (half A1)	Camera height:	1.5 m AGL
Nearest turbine:	0.86 km	Correct printed image size:	820 x 197 mm	Date and time:	16/11/2015 12:23

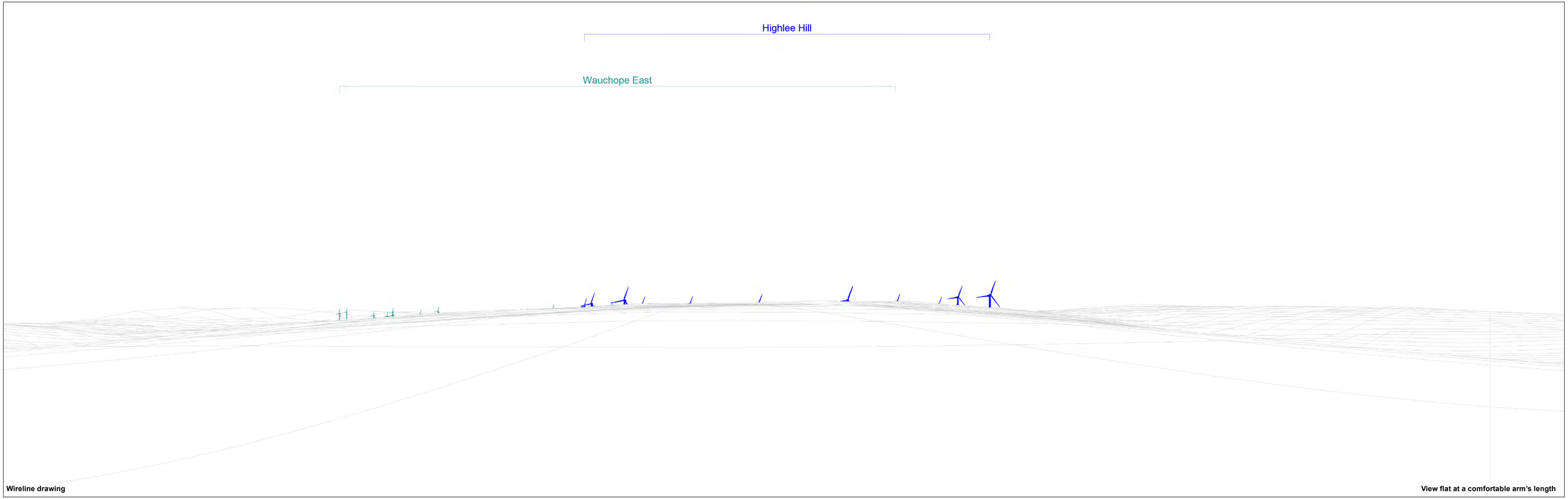


Figure: 7.7
Cultural Heritage Viewpoint 1: Dykeraw Tower (Scheduled Ancient Monument)

OS reference:	362834 E 609060 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	208 m AOD	Principal distance:	812.5 mm
Direction of view:	188.56°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	1.87 km	Correct printed image size:	820 x 260 mm

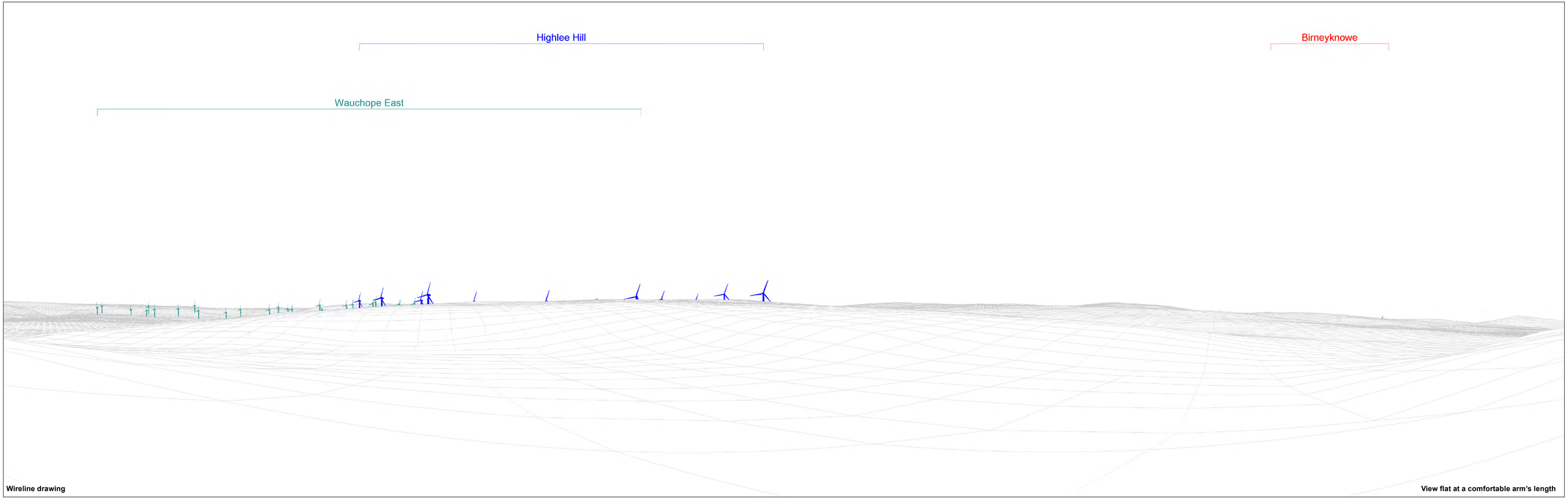


Figure: 7.**8**
Cultural Heritage Viewpoint 2: Southdean Church. On Roadside Northeast of Scheduled Ancient Monument

OS reference:	363149 E 609184 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	198.5 m AOD	Principal distance:	812.5 mm
Direction of view:	194.51°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	2.14 km	Correct printed image size:	820 x 260 mm

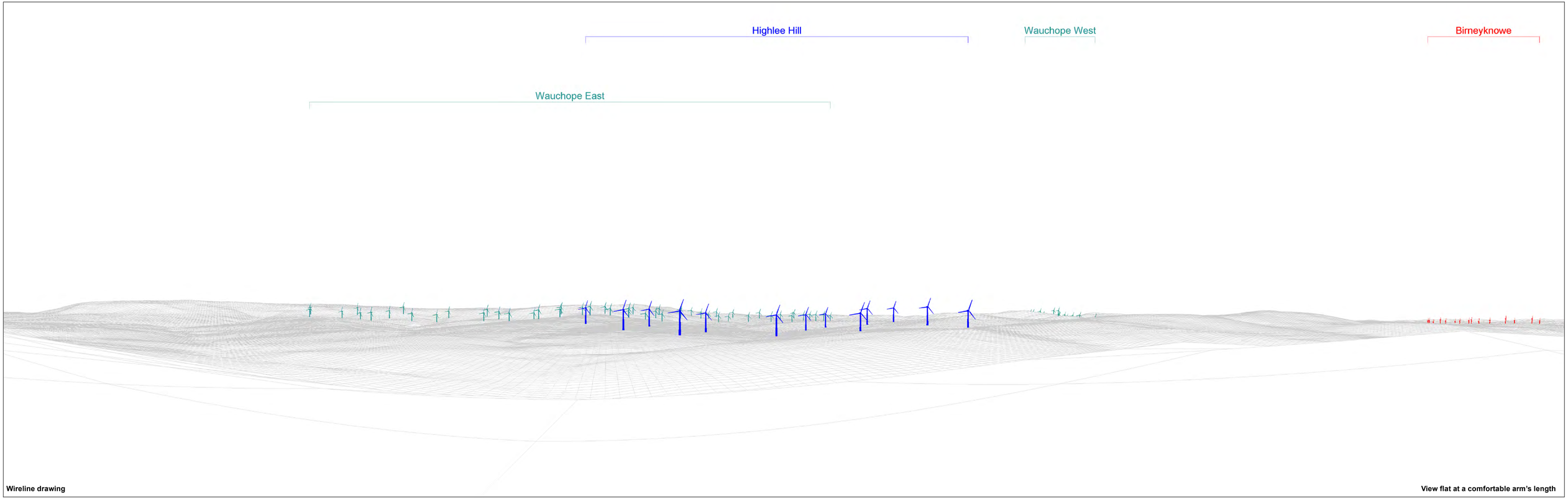


Figure: 7.9
Cultural Heritage Viewpoint 3: Southdean Hill Fort

OS reference:	363538 E 609394 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	293 m AOD	Principal distance:	812.5 mm
Direction of view:	200.43°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	2.40 km	Correct printed image size:	820 x 260 mm

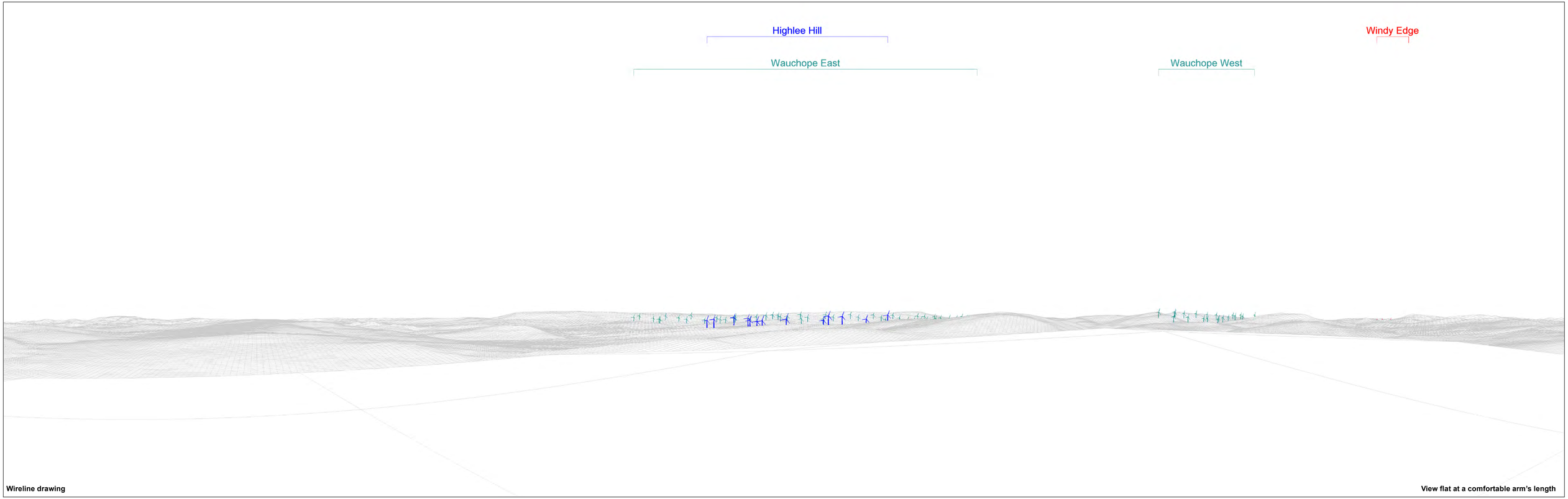


Figure: 7.10
Cultural Heritage Viewpoint 4: Bonchester Hill Fort

OS reference:	359466 E 611783 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	320.27 m AOD	Principal distance:	812.5 mm
Direction of view:	150.85°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	4.91 km	Correct printed image size:	820 x 260 mm

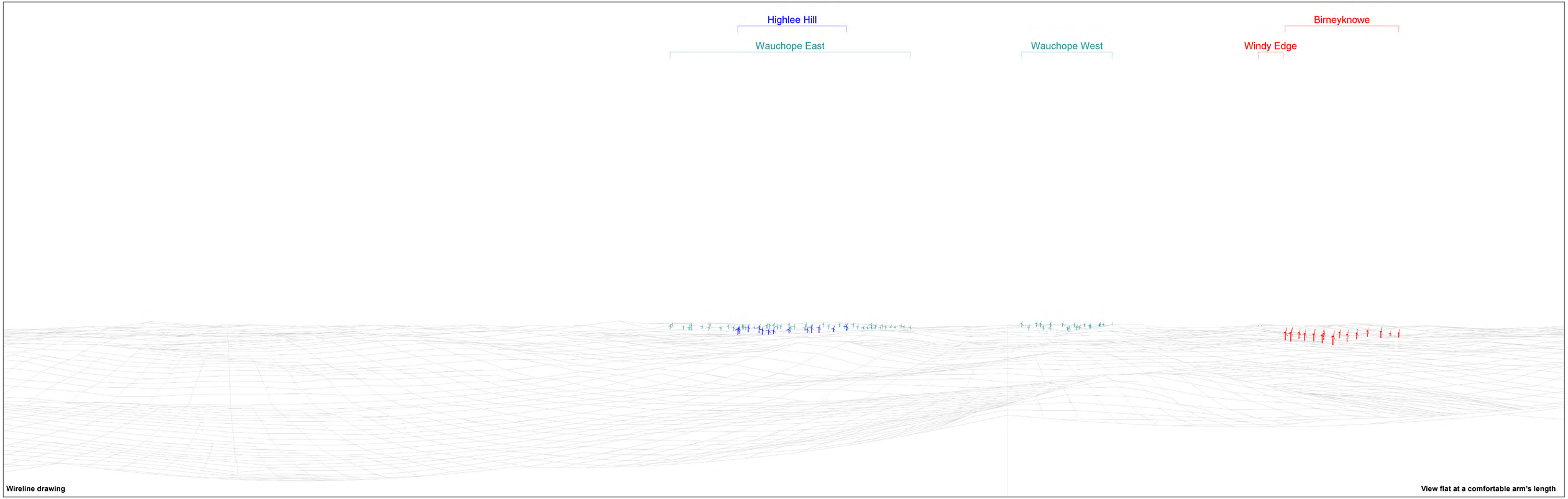
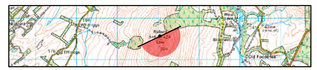


Figure: 7.11
Cultural Heritage Viewpoint 5: Rubers Law Hill Fort Centre at Trig-point



OS reference:	358040 E 615553 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	419 m AOD	Principal distance:	812.5 mm
Direction of view:	154.20°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	8.92 km	Correct printed image size:	820 x 260 mm

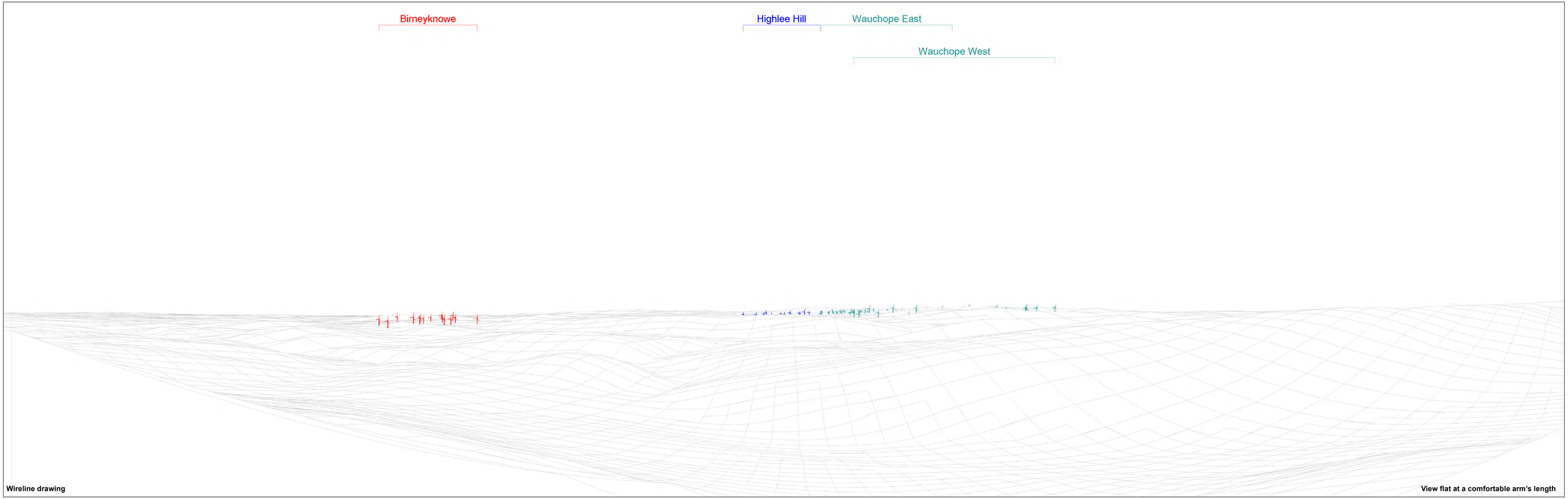


Figure: 7.12
Cultural Heritage Viewpoint 6: Penchrise Pen Fort and Settlement

OS reference:	351490 E 606275 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	428 m AOD	Principal distance:	812.5 mm
Direction of view:	89.06°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	9.79 km	Correct printed image size:	820 x 260 mm

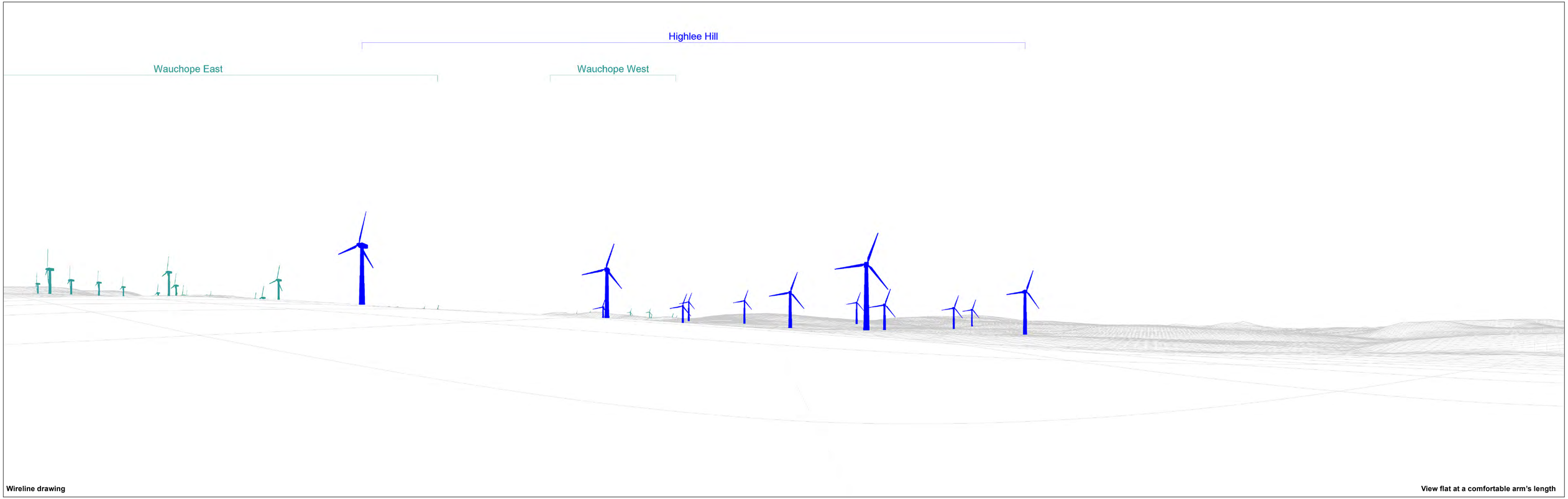


Figure: 7.13
Cultural Heritage Viewpoint 7: Tamshiel Rig Settlement (Eastern Edge)

OS reference:	364309 E 606359 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	252 m AOD	Principal distance:	812.5 mm
Direction of view:	272.75°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	0.86 km	Correct printed image size:	820 x 260 mm

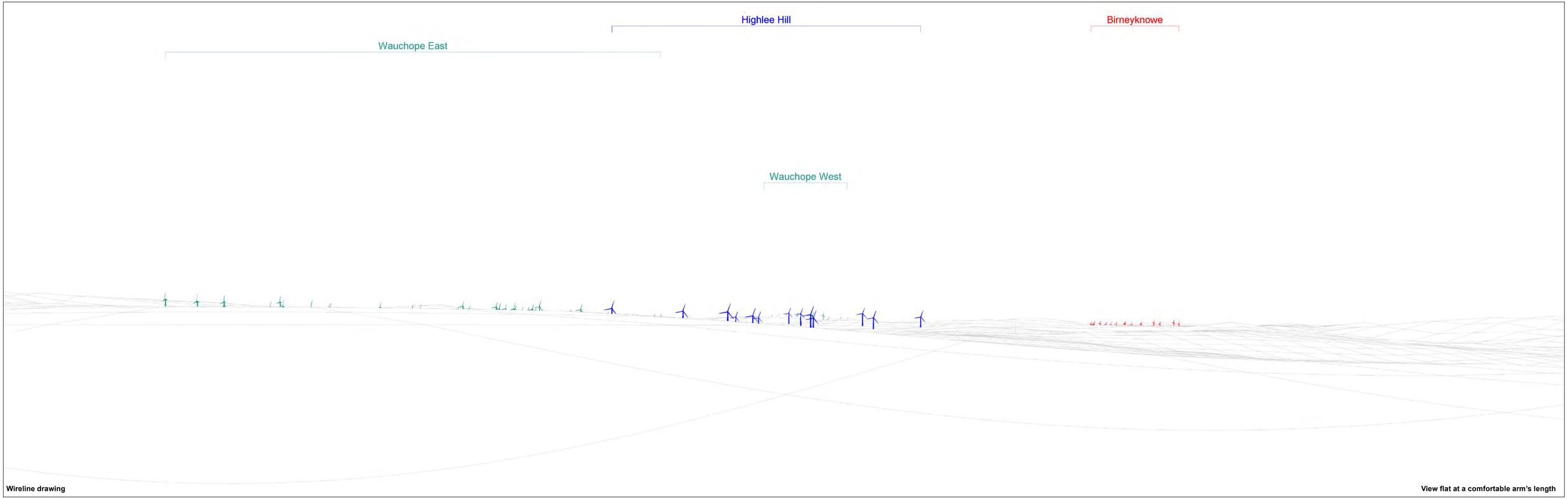


Figure: 7.14
Cultural Heritage Viewpoint 8: Steele Knowe Settlement

OS reference:	366150 E 608325 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	275 m AOD	Principal distance:	812.5 mm
Direction of view:	243.17°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	3.24 km	Correct printed image size:	820 x 260 mm

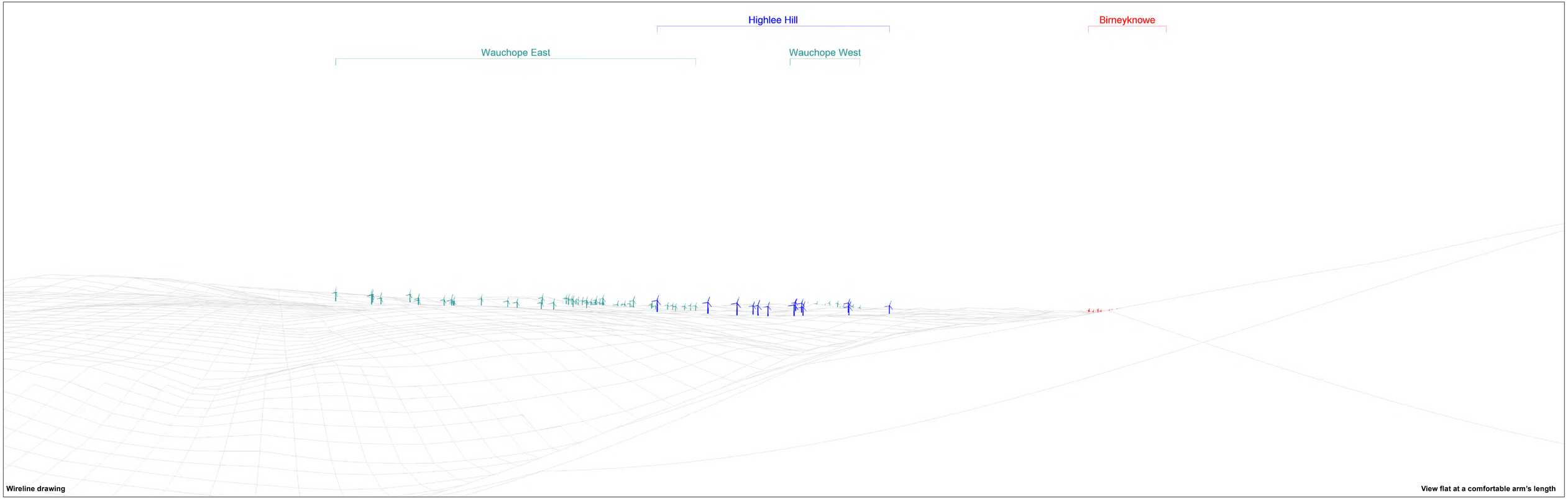
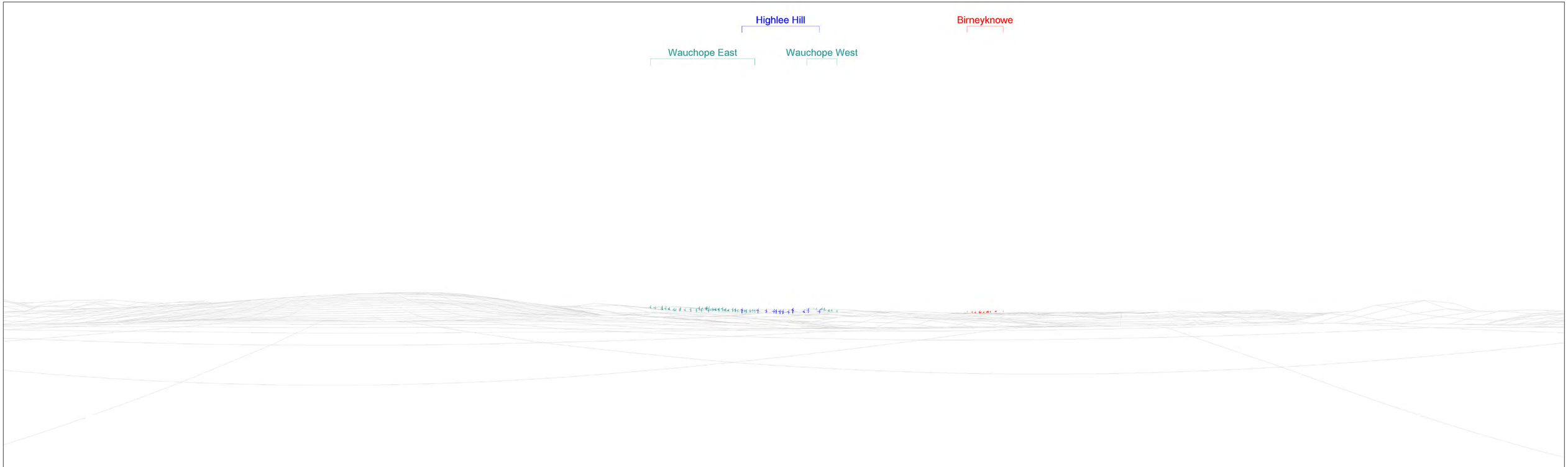


Figure: 7.15
Cultural Heritage Viewpoint 9: Shaw Craigs Fort (Southwestern End)

OS reference:	367325 E 609505 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	300 m AOD	Principal distance:	812.5 mm
Direction of view:	238.34°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	4.65 km	Correct printed image size:	820 x 260 mm



Wireline drawing

View flat at a comfortable arm's length

Figure: 7.16
Cultural Heritage Viewpoint 10: Five Stanes (Circle)

OS reference:	375315 E 616875 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	300 m AOD	Principal distance:	812.5 mm
Direction of view:	231°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	15.63 km	Correct printed image size:	820 x 260 mm

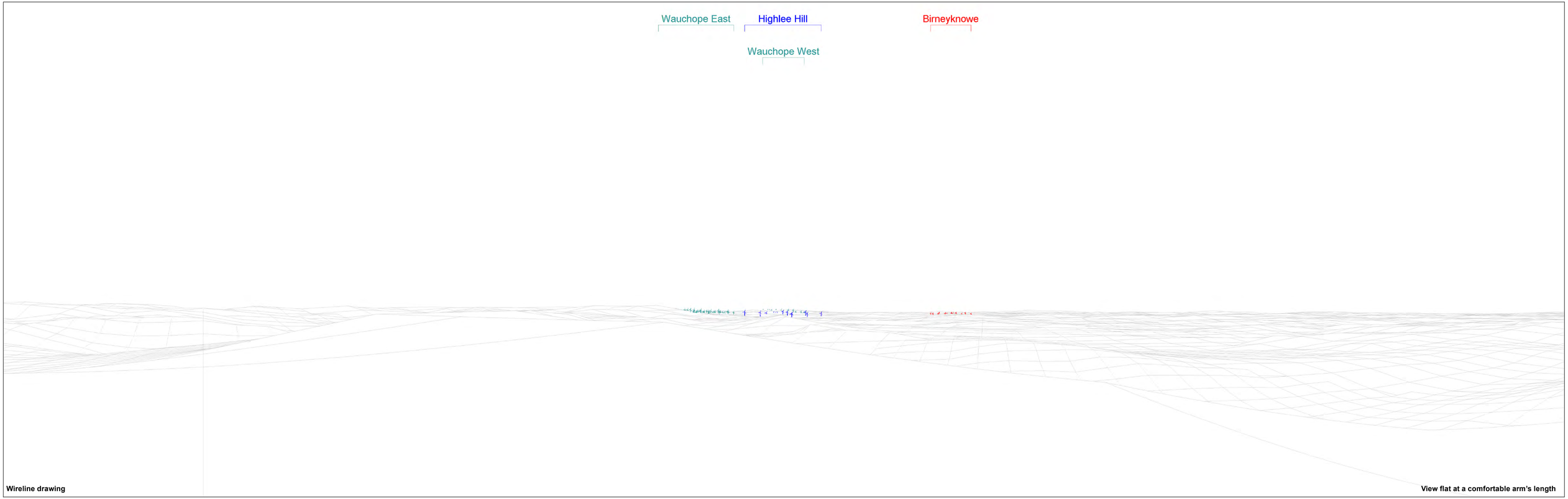


Figure: 7.17
Cultural Heritage Viewpoint 11: Woden Law Fort

OS reference:	376780 E 612555 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	417 m AOD	Principal distance:	812.5 mm
Direction of view:	246.93°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	14.63 km	Correct printed image size:	820 x 260 mm

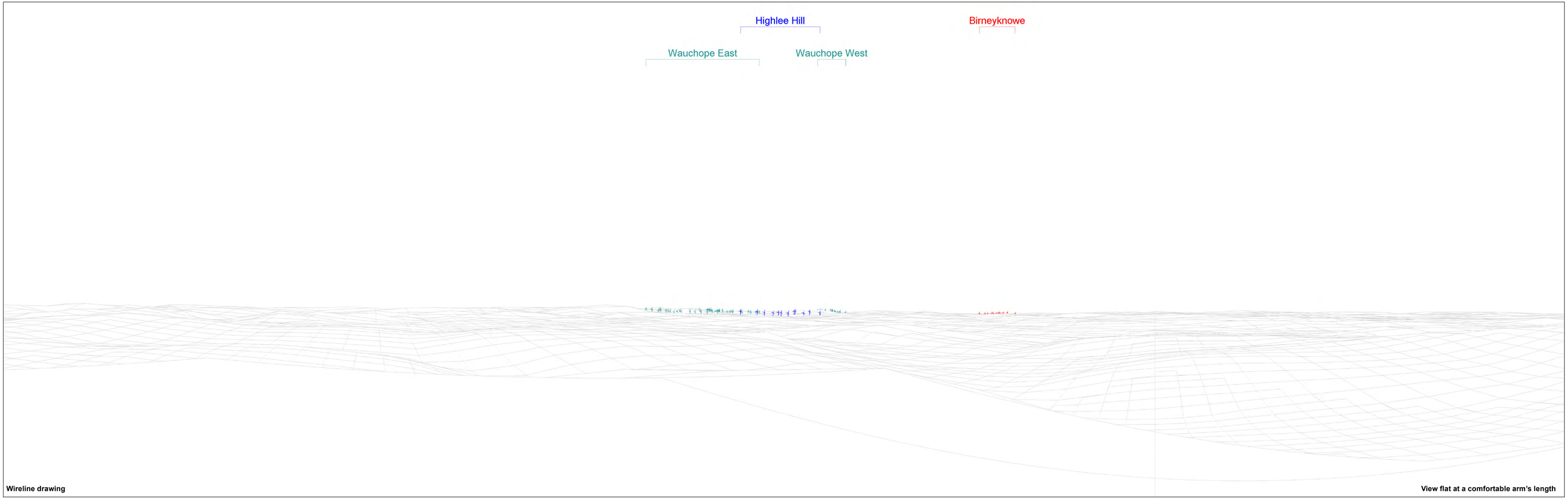
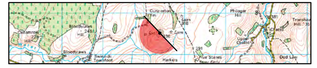


Figure: 7.18
Cultural Heritage Viewpoint 12: Cunzierton Fort



OS reference:	374393 E 617520 N	Horizontal field of view:	180° (cylindrical projection)
Eye level:	336 m AOD	Principal distance:	812.5 mm
Direction of view:	227.19°	Paper size:	841 x 297 mm (half A1)
Nearest turbine:	15.36 km	Correct printed image size:	820 x 260 mm

8 Hydrology, Hydrogeology and Geology

Introduction

8.1 This Chapter of the Environmental Statement (ES) evaluates the effects of the proposed Highlee Hill Wind Farm as described in **Chapter 2: the Proposed Development** (the Development) on the hydrology, hydrogeology, geology and peat resource. This assessment was undertaken by Arcus Consultancy Services Limited (Arcus).

8.2 This Chapter is supported by the following Technical Appendix documents provided in Volume 4 of this ES:

- **Appendix 8.1**: Draft Construction Method Statement (CMS).

8.3 This Chapter of the ES is supported by the following Figures:

- Figure 8.1 Hydrology Study Areas;
- Figure 8.2 Solid Geology;
- Figure 8.3 Superficial Geology; and
- Figure 8.4 Hydrological Catchments.

8.4 This Chapter includes the following elements:

- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Mitigation and Residual Effects;
- Cumulative Effect Assessment;
- Summary of Effects;
- Statement of Significance;
- References; and
- Glossary.

Legislation, Policy and Guidance

8.5 The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (the EIA Regulations)[1] establish in broad terms what is to be considered when determining the effects of development proposals on hydrology, hydrogeology, geology and peat resources. The following legislation, guidance and information sources have been considered in carrying out this assessment.

Legislative Background

8.6 The Water Framework Directive (WFD) (2000/60/EC)[2] establishes a framework for the protection, improvement and sustainable use of all water environments. It is transposed within Scotland by The Water Environment and Water Services (Scotland) Act 2003[3] and subsidiary Regulations.

8.7 Other relevant legislation includes:

- The Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003[4];
- The Private Water Supplies (Scotland) Regulations 2006[5]; and
- The Water Supplies (Water Quality) (Scotland) Regulations 2014[6].

Scottish Planning Policy and Guidance

Scottish Planning Policy 2014 (SPP)

8.8 The Scottish Planning Policy (SPP)[7] was published in 2014, and replaces the previous SPP (published in 2010). SPP is a non-statutory document which sets out the Scottish Government's policy on how nationally important land use planning matters should be addressed.

8.9 In paragraphs 255 to 268, the SPP sets out guidance for development within areas of flood risk, including the responsibilities of planning authorities in regulating and controlling development in such areas, in order to prevent increased risk of flooding in the future. SPP emphasises the need to apply sustainability principles to the prevention of flooding and the control of future development.

Pollution Prevention Guidelines (PPGs)

8.10 Produced by the Scottish Environment Protection Agency (SEPA), Pollution Prevention Guidelines (PPGs)[8] give advice on statutory responsibilities and good environmental practice. Each PPG addresses a specific industrial sector or activity. The following are of relevance principally to surface water, however as surface water has the potential to affect groundwater, they are also of relevance to the assessment of groundwater:

- PPG1: Understanding Your Environmental Responsibilities;

[1] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011. Available online at: http://www.legislation.gov.uk/ssi/2011/139/contents/made [Accessed 06/02/2016].

[2] European Commission, The Water Framework Directive (2000/60/EC). Available online at: http://ec.europa.eu/environment/water/water-framework/index_en.html. [Accessed 02/03/2016].

[3] Water Environment and Water Services (Scotland) Act 2003. Available online at: http://www.legislation.gov.uk/asp/2003/3/contents. [Accessed 16/03/2015].

[4] Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003. Available online at: http://www.opsi.gov.uk/legislation/scotland/acts2003/asp_20030015_en_1. [Accessed 06/03/2016]

[5] The Private Water Supplies (Scotland) Regulations 2006. Available online at: http://www.legislation.gov.uk/ssi/2006/209/contents/made [Accessed 06/03/2016].

[6] The Water Quality (Scotland) Regulations 2014. Available online at: http://www.gov.scot/Publications/2014/06/1397 [Accessed 06/03/2016].

[7] The Scottish Government, (2014), Scottish Planning Policy. Available online at: http://www.gov.scot/Publications/2014/06/5823 [Accessed 06/03/2016].

[8] SEPA, (various), Pollution Prevention Guidelines. PPG 1 to 21 [online]. Available online at: http://www.sepa.org.uk/about_us/publications/guidance/ppgs.aspx. [Accessed 06/03/2016].

- PPG2: Above ground oil storage tanks;
- PPG4: Disposal of sewage where no mains drainage is available;
- PPG5: Works and maintenance in or near water;
- PPG6: Working at construction and demolition sites;
- PPG18: Managing fire water and major spillages; and
- PPG21: Pollution incident response planning.

Other Guidance

8.11 Other relevant guidance comprises the following:

- The Scottish Government (2001), PAN 61: Planning and Sustainable Urban Drainage Systems[9];
- Scottish Water (2015), Sewers for Scotland, 3rd Edition[10];
- Conservation (Natural Habitats, & c.) Regulations 1994 (as amended 2012);
- SEPA (2010),Engineering in the water environment: good practice guide: River crossings[11];
- SEPA (2013), Aquifer and Vulnerability Maps[12];
- SEPA and Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) (2004) Groundwater Vulnerability Maps;
- SEPA (2006) Culverting of Watercourses: Policy Statement and Supporting Guidance[13];
- SEPA (2014), Land Use Planning System Guidance Note 31, Version 2, (LUPS-GN31)[14];
- SEPA (2002), Managing River Habitats for Fisheries[15];
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (the CAR Regulations)[16];
- SEPA (2015), CAR - A Practical Guide, Version 7.2[17];
- The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013[18];
- SEPA (2009), River Basin Management Plan[19];
- Scottish Natural Heritage (SNH) (2015), Good Practice During Wind Farm Construction[20];
- The Scottish Government (2006),Peat Landslide Hazard and Risk Assessments - Best Practice Guide for Proposed Electricity Generation Developments[21];
- The Scottish Government (2009), The Scottish Soil Framework[22];
- The Construction Industry Research and Information Association (CIRIA) (2015), Environmental Good Practice on Site (C741)[23]; and
- CIRIA (2001), Control of Water Pollution from Construction Sites (C532)[24].

Assessment Methodology and Significance Criteria

8.12 This assessment has involved the following elements, further details of which are provided in the sections:

- Consultation with relevant statutory and non-statutory bodies;
- Desk study, including review of available maps and published information;
- Site walkover;
- Input to design process to minimise effects;
- Identification and evaluation of potential effects;
- Evaluation of the significance of these effects;
- Identification of measures to avoid and mitigate potential effects;
- Assessment of residual effects;
- Evaluation of potential cumulative effects;
- Proposed monitoring; and
- Statement of significance.

Scoping Responses and Consultations

8.13 Information has been provided by a range of organisations during the assessment, and this is summarised in Table 8.1. The response to each point raised by consultees is also presented within the table, demonstrating where the design of the Development has changed in response to specific issues indicated by SEPA, SNH and Scottish Borders Council (SBC).

[9] The Scottish Government, (2001), PAN61 Planning and Sustainable Urban Drainage Systems. Available online at: http://www.scotland.gov.uk/Publications/2001/07/pan61. [Accessed 06/03/2016].

[10] Scottish Water, (2015), Sewers for Scotland 3rd Edition. Available online at: http://www.scottishwater.co.uk/business/connections/connecting-your-property/sewers-for-scotland-and-suds/sewers-for-scotland-v3[Accessed 06/03/2016].

[11] SEPA, (2010), Engineering in the water environment good practice guide: River Crossings, WAT-SG-25. Available online at: http://www.sepa.org.uk/regulations/water/engineering/engineering-guidance/. [Accessed 06/03/2016].

[12] SEPA, (2013), Aquifer and Vulnerability Maps. Available online at: http://www.sepa.org.uk/water/river_basin_planning.aspx. [Accessed 14/03/2016].

[13] SEPA, (2006), Culverting of Watercourses: Position Statement and Supporting Guidance, WAT-PS-06-02,Version 2.0.Available online athttp://www.sepa.org.uk/media/150919/wat_ps_06_02.pdf.[Accessed 06/03/2016].

[14] SEPA, (2014). Land Use Planning System Guidance Note 4.Planning Guidance on on-shore windfarm developments. Version 7. Available online at: http://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf [Accessed 07/03/2016].

[15] SEPA, (2002), Managing River Habitats for Fisheries: a guide to best practice. Available online at: http://www.sepa.org.uk/media/151323/managing_river_habitats_fisheries.pdf [Accessed 06/03/2016].

[16] The Water Environment (Controlled Activities) (Scotland) Regulations 2011. Available online at: http://www.legislation.gov.uk/ssi/2011/209/pdfs/ssi_20110209_en.pdf [Accessed 06/03/2016].

[17] SEPA, (2015a), Controlled Activities Regulations - A Practical Guide, Version 7.2. Available online http://www.sepa.org.uk/media/34761/car_a_practical_guide.pdf [Accessed 06/03/2016].

[18] The Water Environment (Drinking Water Protected Areas) (Scotland) Order 2013, Available online at: http://www.legislation.gov.uk/ssi/2013/29/introduction/made [Accessed 06/03/2016].

[19] SEPA, (2009), River Basin Management Plan. Available online at: http://www.sepa.org.uk/water/river_basin_planning.aspx [Accessed 06/03/2016].

[20] SNH (2015b), Good practice during windfarm construction, 3rd Edition, Available online at: http://www.snh.gov.uk/docs/A1168678.pdf. [Accessed 06/03/2016].

[21] The Scottish Government, (2006), Peat Landslide Hazard and Risk Assessments - Best Practice Guide for Proposed Electricity Generation Developments Guidance. Available online at: http://www.gov.scot/Publications/2006/12/21162303/0 [Accessed 06/03/2016].

[22] The Scottish Government, (2009), The Scottish Soil Framework. Available online at: http://www.gov.scot/Publications/2009/05/20145602/0 [Accessed 06/03/2016].

[23] The Construction Industry Research and Information Association (CIRIA), (2015), Environmental Good Practice on Site Guide (C741), CIRIA: London.

[24] CIRIA, (2001), Control of Water Pollution from Construction Sites (C532), CIRIA: London.

Table 8.1: Consultation Responses

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
SEPA	Scoping response 10/11/2015	SEPA made the following comments of relevance to the Hydrology, Hydrogeology and Geology Chapter.	
		1.1 The ES or planning submission should include a) a summary demonstrating how the development has been designed with regards to layout and mitigation to minimise release of CO_2 and b) preventative/mitigation measures to avoid significant drying or oxidation of peat through, for example, the construction of access tracks, drainage channels, cable trenches, or the storage and re-use of excavated peat.	Measures to prevent the drying of peaty soils are considered within the **Technical Appendix 8.1: CMS** and paragraph 8.138.
		2.4 In order to assess the potential risk to GWDTE a Phase 1 habitat survey must be carried out within the following distances of development as a minimum: a) within 100 m radius of all excavations shallower than 1 m b) within 250 m of all excavations deeper than 1 m.	A Phase 1 NVC survey has been undertaken within the Core Study Area and is presented within **Technical Appendix 5.1**. An assessment of the potential hydrological and hydrogeological effects arising from the Development on habitats and ecological communities (such as GWDTEs) is provided in paragraph 8.88-8.97 and 8.144-8.149 .
		3.1 Where the proposed infrastructure will impact upon peatlands it is important to limit the volume of peat being disturbed so that commonly experienced difficulties in dealing with extracted surplus peat are reduced. The submission must include: a) A detailed map of peat depths (this must be to full depth) with all the built elements (including peat storage areas) overlain so it can clearly be seen how the development avoids areas of deep peat and other sensitive receptors such as GWDTE. b) A table which details the quantities of acrotelmic, catotelmic and amorphous peat which will be excavated for each element and where it will be re-used during reinstatement. Details of the proposed widths and depths of any peat to be re-used and how it will be kept wet must be included.	Detailed map of peat depths (to full depth) and infrastructure overlain is provided in **Technical Appendix 5.6** and associated figures. No areas of peat with a depth greater than 2 m were recorded within the Core Study Area. Given the minimal quantity of peat onsite, a table which details the quantities of acrotelmic, catotelmic and amorphous peat which will be excavated is not considered necessary.
		4.4 Material used on site should not have any negative impact on the water environment or other sensitive receptors (e.g. protected species).	Measures outlined in the CMS detail how forestry materials will be stored and used to protect the water environment.
		5.3 All groundwater abstractions within the following distances of development need to be identified, in order to assess potential risk: a) within 100 m radius of all excavations shallower than 1 m b) within 250 m of all excavations deeper than 1m.	Details of groundwater abstractions and the distances to excavations are presented in paragraphs 8.101 to 8.105 and Table 8.7. No groundwater abstractions exist within 250 m of infrastructure.
		6.1 developments should be designed to avoid engineering activities in the water environment wherever possible.	The Development has been designed to avoid engineering works in the water environment, where possible, by the use of the existing forestry track onsite and the minimisation of watercourse crossings.
		6.2 If the engineering works proposed are likely to result in increased flood risk to people or property then a flood risk assessment should be submitted in support of the planning application and we should be consulted…	Only one crossing is located within an area of medium to high likelihood of flooding. The upgrade to existing crossing will not reduce flows.
		6.3 A site survey of existing water features and a map of the location of all proposed engineering activities in the water environment should be included in the ES or planning submission. A systematic table detailing the justification for the activity and how any adverse impact will be mitigated should also be included. The table should be accompanied by a photograph of each affected water body along with its dimensions.	The locations of watercourse crossings are shown on Figure 2.1. Section 13 of the CMS details the crossing types along with photographs and dimensions of the watercourses.

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
		7.1 Where water abstraction is proposed we request that the ES, or planning submission, details if a public or private source will be used. Identify site work that might impact upon the environment, potential pollution risks and identify the principles of preventative measures and mitigation. A draft Schedule of Mitigation should be produced as part of this process; Recommend principles of CMS are set out in the ES outlining how the draft Schedule of Mitigation will be implemented;	No water abstraction is planned as part of the Development. Potential effects of the hydrological and hydrogeological environment from all aspects of the Development are assessed within this Chapter. Measures within the CMS, provided as **Technical Appendix 8.1**, will safeguard watercourses and subsurface water. The principles of CMS are set out in within the **Technical Appendix 8.1**.
		9.2 A map of all proposed borrow pit must be submitted along with a site specific plan of each borrow pit.	The locations of borrow pits is provided in Figure 2.1. Detailed drawings of the proposed borrow pit search areas are found in Figures 2.14a - 2.14e
Scottish Natural Heritage (SNH)	Scoping response 12/02/2014	Consideration must be given to potential effects of construction, operation and decommissioning of the proposed development in relation to the qualifying features of the (River Tweed) SAC. The qualifying interests are sensitive to disturbance to the river habitat, including silt and sediment entering the watercourse and smothering gravel beds, suspended solids in the water column, pollution events, and changes in water quality and in water chemistry. Due to its location, scale, and connectivity with the River Tweed SAC, we consider that this proposal is likely to have a significant effect on the qualifying interests of the SAC, particularly during the construction phase of the proposal, and an appropriate assessment will be required. Sufficient information should be provided by the EIA to inform the appropriate assessment.	A consideration of potential effects on the River Tweed SAC is outlined in paragraph 8.123 and specifically in paragraphs 8.207 to 8.252. The existing forestry track has been used where possible, minimising the requirement for new watercourse crossings and engineering works within the water environment. Measures to control suspended solids in the water column, pollution events, and changes in water quality and in water chemistry are outlined in **Technical Appendix 8.1: CMS**. A consideration of potential effects on the River Tweed SAC is outlined in paragraph 8.123 and specifically in paragraphs 8.207 to 8.252.
SNH	Scoping response 27/11/2015	Made no specific comment regarding hydrology.	Comments made by SNH in 2014 are considered relevant and are addressed within this Chapter.
Scottish Borders Council (SBC) Flood Risk and Coastal Management	Scoping response 25/11/2015	There is minimal flood risk to the site so I would have no objections to the proposal on the grounds of flooding as long as the following is adhered to: 1. Runoff from newly formed hard surfaces should be attenuated to existing Greenfield runoff rates so that there is no increased flood risk to downstream receptors. 2. Any discharges from SUDS and other drainage should be kept to existing Greenfield runoff rates. 3. Watercourse and silt management processes should also be put in place. 4. If there are to be any culverts, watercourse crossings or alterations to crossings, these should not reduce the flow conveyance of the watercourse and full details should be submitted to the Council. 5. Details of the silt traps and any other functions that the applicant proposes to minimise the amount of sediment entering the water course should be submitted.	1. Run-off from new areas of hardstanding will be restricted to Greenfield rates via SuDS (outlined in paragraphs 8.127 to 8.128). 2. Outline SuDS measures are provided in **Technical Appendix 8.1**. SuDS will be designed to release surface water at Greenfield rates. 3. Measures to protect watercourses and manage construction activities are presented in Sections 2 and 6.4 of **Technical Appendix 8.1**. 4. Only two new watercourse crossings are proposed as part of the Development. 14 upgrades to existing forestry track watercourse crossings may be required for the Development. A Watercourse Crossing Inventory (WCI) is presented in Section 13 of **Technical Appendix 8.1**. 5. Measures to protect watercourses and manage construction activities are presented in Sections 2 and 6.4 of **Technical Appendix 8.1**.
Scottish Water	Other – Data requests 24/11/2015	Provided data on Scottish Water infrastructure in proximity to the site entrance.	The site entrance has been designed to avoid Scottish Water infrastructure.

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
SBC Environmental Health Department	Other – Data requests PWS request 04/02/2014 PWS request 23/11/2015 Contaminated Land Officer 20/11/2015	Provided information relating to private water supplies: a) Seven PWS were identified within the Study Area in 2014. b) The same PWS were identified from the subsequent data request. *c)* Scottish Borders Council have not identified any land as Contaminated Land (as defined by Environmental Protection Act 1990) within the development boundary.	a) and b) Private Water Supplies are considered in paragraph 8.101 to 8.105. c) Contaminated land has been scoped out of this assessment.

Scope of Assessment

8.14 The key issues for the assessment of potential effects on the hydrological and hydrogeological resources relating to the Development include:

- Potential chemical pollution effects on the hydrological environment;
- Potential erosion and sedimentation effects on the hydrological environment;
- Potential impediments to stream flow;
- Potential effects on private water supplies;
- Potential changes in soil and peat interflow patterns;
- Potential for the compaction of soils;
- Potential effects on the hydrological function of Ground Water Dependant Terrestrial Ecosystems (GWDTEs);
- Potential for peat destabilisation; and
- Potential for an increase in runoff and flood risk.

8.15 Effects during construction, operation and decommissioning have been assessed, as well as potential cumulative effects.

Elements Scoped Out of Assessment

8.16 The SEPA Waste Map and consultation with SBC has not identified any areas of contaminated land within the Core Study Area and no effects are anticipated. Should potentially contaminated land be encountered during excavations, however, this would be tested and appropriate action taken in accordance with The Environmental Protection Act 1990. Potential effects arising from contaminated land have, therefore, been scoped out of this assessment.

Study Area

8.17 The hydrology and hydrogeology Core Study Area is based on the Development application boundary, and a wider study area of 10 km from the proposed wind turbine locations. Both study areas are shown in Figure 8.1. At distances greater than 10 km within upland catchments, it is considered that schemes are unlikely to contribute to a hydrological impact, in terms of chemical or sedimentation impacts, due to attenuation and dilution over distance of potentially polluting chemicals.

8.18 A smaller 1 km study area is used to assess private water supplies.

8.19 These study areas are based on professional judgement and experience assessing similar scale developments within commercial forestry and similar hydrological catchments in Scotland.

Baseline Survey Methodology

Desk Study

8.20 The desk study included:

- Identification of underlying geology and hydrogeology;
- Collation of data provided through consultations;
- Identification of groundwater vulnerability;
- Assessment of topography and slope characteristics;
- Identification of catchments, watercourses, springs and water features;
- Collation of data provided through consultations; and
- Collation of flood plain information and water quality data.

8.21 Reference was also made to the following sources of information:

- The Ordnance Survey (OS) 1:50,000 Landranger Map (Sheet 80);
- OS 1:25,000 Map (Digital);
- National River Flow Archive (NRFA)[25];
- SEPA Flood Map 2014[26];
- Meteorological Office Rainfall Data[27]; and
- The British Geological Survey (BGS) Geology Map (Digital[28]).

Site Walkover

8.22 A site walkover was undertaken on 11th to 14th February 2014 to visually inspect surface water features and to obtain an understanding of the local topography and hydrological regime. The site walkover covered the Core Study Area, and an area of 300 m to the north and east of the application boundary. Weather conditions during the site walkover were changeable with precipitation and extended periods of dry weather, whilst the preceding week had persistent rainfall.

8.23 Visits to properties served by Private Water Supplies were undertaken on 10th to the 14th February 2014.

8.24 Engineers from MacArthur Green also conducted peat probing and site recognisance visits in September 2013. Information from these visits has been used to inform this assessment and is detailed in **Technical Appendix 5.6**.

[25] Centre for Ecology and Hydrology (undated), National River Flow Archive. Available online at: http://nrfa.ceh.ac.uk/ [Accessed 06/032016].

[26] SEPA, (2014), Flood Maps. Available online at: http://map.sepa.org.uk/floodmap/map.htm [Accessed 06/03/2016].

[27] Met Office. Available online at: http://www.metoffice.gov.uk/public/weather/climate [Accessed 06/03/2016].

[28] Available for purchase from BGS at http://www.bgs.ac.uk/products/onshore/home.html?src=topNav [Accessed 06/03/2016].

Methodology for the Assessment of Effects

8.25 The following methodology has been developed by Arcus in consultation with SEPA, SNH, Marine Scotland and The Scottish Government. The assessment is based on a source-pathway-receptor methodology, where the sensitivity of the receptors and the magnitude of potential change upon those receptors identified within the study areas.

Sensitivity

8.26 The sensitivity of the receiving environment is defined as its ability to absorb an effect without perceptible change and can be classified as high, moderate or low. These classifications are dependent on factors such as the quality of the subsurface water within the receptor, their purpose (e.g. whether used for drinking, fisheries, *etc*.) and existing influences, such as land-use.

8.27 These criteria are outlined in Table 8.2 and are based on professional judgement and experience.

Table 8.2: Receptor Sensitivity Criteria

Receptor Sensitivity	Sensitivity Description
High	▪ A large, medium or small waterbody with a SEPA water quality classification of 'High' or 'Good'. ▪ The hydrological receptor and downstream environment has limited capacity to attenuate natural fluctuations in hydrochemistry and cannot absorb further changes without fundamentally altering its baseline characteristics / natural processes. ▪ The hydrological receptor is of high environmental importance or is designated as national or international importance, such as a Special Area of Conservation (SAC) or a Site of Special Scientific Interest (SSSI). ▪ The receptor acts as an active floodplain or other flood defence. ▪ The receptor is located within an active flood plain, in accordance with SPP 2014. ▪ GWDTEs which are classified by SEPA as "highly groundwater dependent" have no functional impairment by man-made influence (such as drainage or forestry). ▪ The hydrological receptor will support abstractions for public water supply or private water abstractions for more than 25 people. ▪ Abstractions used for the production of mass produced food and drinks. ▪ Areas containing geological or geomorphological features considered to be of national importance (e.g. geological SSSIs). ▪ Local groundwater constitutes a valuable resource because of its high quality and yield. Aquifer(s) of local or regional value. Statutorily designated nature conservation sites (e.g. SACs and SSSIs) dependent on groundwater.
Moderate	▪ A large, medium or small waterbody with a SEPA water quality classification of 'Moderate'. ▪ The hydrological receptor and downstream environment will have some capacity to attenuate natural fluctuations in hydrochemistry but cannot absorb certain changes without fundamentally altering its baseline characteristics / natural processes. ▪ The hydrological receptor is of regional environmental importance (such as Local Nature Reserves), as defined by SEPA. ▪ The hydrological receptor does not act as an active floodplain or other flood defence. ▪ The hydrological receptor supports abstractions for public water supply or private water abstractions for up to 25 people. ▪ GWDTEs which are classified by SEPA as "highly groundwater dependent" but have functional impairment by man-made influence (such as drainage or forestry). ▪ GWDTEs which are classified by SEPA as "moderately groundwater dependent" have no functional impairment by man-made influence (such as drainage or forestry). ▪ Areas containing geological features of designated regional importance including Regionally Important Geological/geomorphological Sites (RIGS), considered worthy of protection for their historic or aesthetic importance. ▪ Aquifer of limited value (less than local) as water quality does not allow potable or other quality sensitive uses. Exploitation of local groundwater is not far-reaching. Local areas of nature conservation known to be sensitive to groundwater effects.
Low	▪ A large, medium or small waterbody with a SEPA water quality classification of 'Poor' or 'Bad'. ▪ The hydrological receptor and downstream environment will have capacity to attenuate natural fluctuations in hydrochemistry but can absorb any changes without fundamentally altering its baseline characteristics / natural processes. ▪ The hydrological receptor is not of regional, national or international environmental importance. ▪ The hydrological receptor is not designated for supporting freshwater ecological interest. ▪ GWDTEs which are classified by SEPA as "moderately groundwater dependent" but have functional impairment by man-made influence (such as drainage or forestry). ▪ GWDTEs which are classified by SEPA as "highly or moderately groundwater dependent" but are ombrotrophic. ▪ The hydrological receptor does not act as an active floodplain or other flood defence. ▪ The hydrological receptor is not used for recreational use. ▪ The hydrological receptor does not support abstractions for public water supply or private water abstractions. ▪ Geological features or geology not protected and not considered worthy of specific protection. ▪ Poor groundwater quality and / or very low permeability make exploitation of groundwater unfeasible. Changes to groundwater not expected to affect local ecology.

Magnitude

8.28 The magnitude is determined by the timing, scale, size and duration of the potential effect resulting from the Development. The magnitude of potential effects can be classified as major, moderate, minor or negligible, as outlined in Table 8.3.

Table 8.3: Criteria for Determining Magnitude

Magnitude of Effect	Magnitude Description
High	▪ A short or long term major shift in hydrochemistry or hydrological conditions sufficient to negatively change the ecology of the receptor. This change will equate to a downgrading of a SEPA water quality classification by two classes e.g. from 'High' to 'Moderate'. ▪ A sufficient material increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with SPP). ▪ A major (greater than 50 %) or total loss of a geological receptor or peat habitat site, or where there will be complete severance of a site such as to fundamentally affect the integrity of the site (e.g. blocking hydrological connectivity). ▪ A major loss of (greater than 50 % of study area) or total loss of highly dependent and high value GWDTE, or where there will be complete hydrological severance which will fundamentally affect the integrity of the feature. ▪ A major permanent or long term negative change to groundwater quality or available yield. ▪ A major permanent or long term negative change to geological receptor, such as the alteration of pH or drying out of peat. ▪ Changes to groundwater quality or water table level that will negatively alter local ecology or will lead to a groundwater flooding issue.
Moderate	▪ A short or long term non-fundamental change to the hydrochemistry or hydrological environment, resulting in a change in ecological status. This change will equate to a downgrading of a SEPA water quality classification by one class e.g. from 'High' to 'Good.' ▪ A moderate increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with SPP). ▪ A loss of part (approximately 5 % to 50 %) of a geological receptor or peat habitat site, major severance, major effects to its integrity as a feature, or disturbance such that the value of the site will be affected, but could still function. ▪ A loss of part (approximately 10 % to 50 % of study area) of a moderately dependent and moderate value GWDTE – significant hydrological severance affects the integrity of the feature, but it could still function. ▪ Changes to the local groundwater regime that may slightly affect the use of the receptor. ▪ The yield of existing supplies may be reduced or quality slightly deteriorated. ▪ Fundamental negative changes to local habitats may occur, resulting in impaired functionality.
Low	▪ A detectable non-detrimental change to the baseline hydrochemistry or hydrological environment. This change will not result in a downgrading of the SEPA water quality classification. ▪ A marginal increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with SPP). ▪ A detectable but non-material effect on the receptor (up to 5 %) or a moderate effect on its integrity as a feature or where there will be a minor severance or disturbance such that the functionality of the receptor will not be affected.
	▪ A detectable effect on a GWDTE (loss of between 5 % - 10 % of study area) or a minor effect on a GWDTE's integrity as a feature or where there will be a minor severance or disturbance such that the functionality of the receptor will not be affected. ▪ Changes to groundwater quality, levels or yields do not represent a risk to existing baseline conditions or ecology.
Negligible[29]	▪ No perceptible changes to the baseline hydrochemistry or hydrological environment. ▪ No change to the SEPA water quality classification. ▪ No increase in the probability of flooding onsite and offsite. ▪ A slight or negligible change from baseline condition of geological resources. ▪ Change hardly discernible, approximating to a 'no change' in geological condition. ▪ Minimal detectable effect on a GWDTE (between to 0.1 % - 5 % of study area) or no discernible effect on its integrity as a feature or its functionality.

Significance

8.29 The predicted significance of the effect is determined through a standard method of assessment and based on professional judgement, considering both the sensitivity of receptor and the magnitude of the potential effect as defined in Table 8.4. Effects of moderate significance or greater are considered significant in terms of the EIA Regulations.

Table 8.4: Significance Matrix

Magnitude of Effect	Sensitivity of Resource or Receptor		
	High	**Moderate**	**Low**
High	Major	Major	Minor
Moderate	Major	Moderate	Minor
Low	Moderate	Minor	Negligible
Negligible	Negligible	Negligible	Negligible

8.30 As a result of the consultation responses outlined in Table 8.1, information is provided within this Chapter to inform a Habitats Regulations Assessment (an "Appropriate Assessment") for the purposes of the Conservation (Natural Habitats, & c.) Regulations 1994 (as amended). For the purposes of assessing the effect of the proposed Development on the European sites identified by the consultees, this Chapter contains the information to enable a competent authority to determine whether the proposal (either alone or in combination with other plans or projects) is likely to have a significant effect on the integrity of a European site and, accordingly, whether or not an appropriate assessment should be undertaken. Sufficient information is also provided in the event that a competent authority determines that an appropriate assessment should be undertaken. However, the conclusion of this assessment is that the amendments made to the design of the

[29]Negligible magnitude of change includes magnitude of effects that would be assessed as no change to the baseline scenario.

proposed Development are such that the potential for likely significant effects on any European site have been avoided.

8.31 The relevant catchments for potential effects on the designated area of the River Tweed SAC are considered to be the primary catchment of the Jed Water. The River Tweed SAC also covers Rule Water to the west of the Development. No Development infrastructure is located within the immediate catchment of Rule Water and therefore this Chapter focuses on potential effects within the catchment of Jed Water.

8.32 It is considered that there are no limitations to the assessment method used to identify potential hydrological effects arising from the Development. Baseline conditions were ascertained through site visits undertaken during a variety of weather conditions.

Cumulative Assessment Methodology

8.33 A cumulative effect is considered to be an additional effect on hydrological resources arising from the Development in combination with other proposed developments (either under construction, consented but not built or at application stage) likely to affect the hydrological environment. At distances greater than 10 km, it is considered that schemes are unlikely to contribute to a cumulative hydrological effect due to attenuation and dilution over distance of potentially polluting chemicals. Therefore, for the purposes of the assessment of potential cumulative effects on the immediate catchment and hydrological regime, only proposed developments within approximately 10 km of the Development have been considered. These developments have been identified through consultation with the relevant local authorities and statutory consultees, and are discussed in more detail in paragraphs 8.194 to 8.195.

8.34 The methodology followed to assess the cumulative effects is the same as that used for the Development in isolation.

Assessment Limitations

8.35 All data considered necessary to identify and assess the potential significant effects resulting from the Development was available and was used in the assessment reported in this Chapter.

Embedded Mitigation

8.36 Embedded mitigation measures are set out within the CMS (provided as **Technical Appendix 8.1**) which sets out specific mitigation which relates to this Development. They comprise good practice methods and works that are established and effective measures to which the Developer will be committed through the development consent. Although the CMS is draft and will evolve to take account of consultee feedback and detailed design, there is sufficient confidence in the effectiveness of the measures set out in the CMS for them to be treated as part of the Development for the purposes of this assessment. Measures and procedures outlined in the CMS will be adopted and incorporated into a single working document to be agreed with statutory consultees and the planning authority following consent by way of an appropriately worded planning condition. For ease of reference through this Chapter, reference to specific sections in the CMS, detailing the appropriate embedded mitigation measures, are provided.

8.37 Accordingly, the identification of likely significant effects from the Development is considered following implementation of the measures in **Technical Appendix 8.1**.

8.38 A buffer zone distance of 100 m has been established for turbine bases from Jed Water. A buffer zone distance of 70 m has been established for turbine bases and ancillary structures / infrastructure around the minor watercourses (natural) at the Development. Beyond this, the separation of construction ground-works from watercourses has been maximised, particularly from the Jed Water. Only three turbines are located within 75 m of a watercourse in the primary catchment of the Jed Water, however none of these is within 60 m of a watercourse in the primary catchment of the Jed Water (T1 – 71 m, T3 – 71 m and T6 – 65 m).

8.39 The existing network of access tracks which serve the forestry operations within Dykeraw Forest have been utilised, where possible, limiting the requirement to disturb peaty soils and limit felling operations to access the Development. Where new access tracks are required they have been designed to avoid crossing watercourses, where possible. Further description of this is provided in **Chapter 3: Design Evolution Considerations and Alternatives**.

8.40 The CMS describes water management measures to control surface water run-off and drain hardstandings and other structures during the construction and operation of the Development. This will form part of a Pollution Prevention Plan (PPP) to be implemented for the Development.

8.41 The 100 m buffer of Jed Water and the 70 m buffer zone of secondary watercourses, in conjunction with the measures set out in the CMS will be sufficient to avoid potential effects on the hydrological and hydrogeological resource, as their effectiveness has been demonstrated on several wind farm construction sites for which Arcus have provided technical advice for.

8.42 The measures discussed in the CMS are inherently part of all wind farm development design and should be treated as embedded mitigation. The Arcus hydrology team has provided services for a large number of onshore wind farm developments and have worked closely with statutory agencies such as the SEPA, SNH and The Scottish Government to develop appropriate survey and assessment methods.

8.43 This approach has withstood legal review on all hydrology EIA work undertaken by Arcus and has received positive comments from consultees for proposing appropriate embedded mitigation on a project specific basis.

8.44 Conclusions, therefore, state whether the residual significance will be major, moderate, minor or negligible, once appropriate mitigation (beyond that specified in the CMS) has been implemented. This assessment relies on professional judgment to ensure that the effects are appropriately assessed.

8.45 A residual effect is considered to be a likely significant effect in accordance with the EIA Regulations if assessed as moderate or major following the preceding methodology.

Good Practice

8.46 Good practice will be followed in all aspects of construction, operation and decommissioning, specifically through a PPP, which will be incorporated into a full CMS, to be agreed with SEPA prior to the construction phase.

8.47 The PPP will set out measures to be employed to avoid or mitigate potential effects for all phases of the Development, and will also include an Incident Plan to be followed should a pollution event occur. This plan will be produced following consultation and agreement with SEPA and all appropriate personnel working on the construction site will be trained in its use. The Construction Project Manager will have specific responsibility for implementation of the PPP.

8.48 Method statements will also be applied, which will follow the principles laid out in relevant SEPA Pollution Prevention Guidelines.

Baseline Conditions

Topography and Land Use

8.49 Topography within the Development Area is varied, with shallow slopes, plateau and fells comprising steep-faced rock outcrops. The 1:50,000 Ordnance Survey Landranger Map (Sheet 76) indicates the levels across the Core Study Area vary between 250 m Above Ordnance Datum (AOD), at the southwest perimeter, and 320 m AOD, at the highest point of Millmoor Rig in the southern section of the Core Study Area. Habitats are described in detail in **Chapter 5: Ecology**.

8.50 The Development is bounded on all sides by either open moorland or forestry. The central and southern sections of the Development are situated entirely within forested land. Much of the unforested area of the Development is occupied by a mixture of pastoral land (in proximity to Turbine 6) or forestry that has been felled, including areas in the southeast in proximity to Turbines 12 and 13.

8.51 There are a number of existing access tracks within the Core Study Area, the majority being within the forested areas of the Development Area. These access tracks extend from the edge of the Development Area in the north, east and west.

8.52 The principal land use at the Development Area is commercial forestry, of which several areas have been clear felled. The remaining land within the Development Area is open moorland, used for rough grazing.

8.53 Watercourses and associated catchments are illustrated in Figure 8.1 and 8.4.

Climate

8.54 The National River Flow Archive (NRFA) reports Average Annual Rainfall (AAR) at the Teviot at Hawick gauging station, approximately 13 km north west of the Development, reporting 1,151 mm. This is a typical value for the region, with the Ale Water at Ancrum gauging station approximately 17 km north of the Development, reporting 926 mm AAR.

8.55 As monthly long term climate data is not freely available from the NRFA, long term average rainfall data (1981 to 2000) obtained by the Meteorological Office at the Galashiels gauging station, approximately 30 km northeast of the Development, are presented in Table 8.5.

Table 8.5: Long term average rainfall data (1981 to 2000), Galashiels gauging station

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	83.8	58.3	61.6	49.3	54.6	60.8	64.2	67.0	65.2	85.6	78.3	80.3

Solid Geology

8.56 An illustration of the solid geology is shown in Figure 8.2. Information from the British Geological Survey (BGS) mapping indicates three main rock types within the Development boundary, mainly Wenlock aged Riccarton Group comprising grits, grey wackes, mudstones and carboniferous aged Ballagan Formation comprising sandstones, siltstones and dolomitic limestones.

8.57 Areas in the north are also shown to be underlain by Stratheden and Inverclyde Group comprising undifferentiated rock types of sandstone and sub-equal/subordinate Argillaceous rocks interbedded.

8.58 Generally to the south-east that the underlying geology across the majority of the Development comprises sandstone, siltstone and dolomitic limestone (cementstone) of the Ballagan formation.

8.59 Turbines 5 and 6 are underlain by wacke and mudstone of the Riccarton group, while Turbines 1 to 4 and 7 to 13 are underlain by sandstones, siltstones and dolomitic limestones.

8.60 Localised faulting exists within the central site area at varying dip angles. No Development infrastructure is sited within 600 m of the fault lines.

Superficial Geology

8.61 An illustration of the superficial geology is shown in Figure 8.3.

8.62 BGS superficial data shows that the majority of the Development is underlain by Glacial Till. Several areas of exposed glacial deposits were evident during the site walkover, with soils only extending to 0.1 m depth, as shown by Plate 1.

Plate 1: Thin soils overlying glacial deposits north of T6.

8.63 Areas either side of Jed Water, and its unnamed headwaters are underlain by Alluvium, as shown by Plate 2.

Plate 2: Alluvium adjacent to Jed Water

8.64 BGS data is absent across elevated sections of the core Study Area, on the northern slope of Green Law and on Wellcleuch Plantation, indicating that bedrock is close to the surface.

8.65 Observations onsite and the peat probing exercise indicate that the majority of the Development Area is overlain by thin peaty soils. However, the peat depths are recorded to be shallow the majority of the probes recording a depth of less than 0.5 m depth.

Hydrogeology

8.66 Data on hydrogeology was obtained from the SEPA and SNIFFER Groundwater Vulnerability Map (2004). The Vulnerability Map represents the strata overlying the aquifer ('vertical pathway'). These maps provide the following information for the Core Study Area:

- Vulnerability Class: variable (4a to 4c).

8.67 Vulnerability classes range from 1 to 5, with 5 being most vulnerable. Class 4 is subdivided into 4a, 4b, 4c and 4d. It is the hydrogeological characteristics within the pathway rather than the 'importance' of a particular aquifer that results in the final vulnerability classification. The methodology behind the classification assumes that where contaminants move through unsaturated fractured bedrock, no attenuation of pollutants can take place. Large parts of Scotland show areas of Classes 4 and 5, reflecting the widespread occurrence of rocks dominated by fracture flow located exposed at the surface where the potential for attenuation of contaminants, from overlying strata, in the pathway is very limited.

8.68 The Hydrogeological Map of Scotland, 1:625,000 Series indicated the region to be underlain by impermeable rocks, generally without groundwater except at shallow depths. More specifically the area is underlain by both intrusive and extrusive rocks generally of Palaeozoic or earlier in age. They are all well indurated and only contain appreciable groundwater locally in sub-surface weathered zones and joint systems.

8.69 Within the wider Study Area, aquifer vulnerability is similar to that underlying the Development, showing areas of Classes 5 to 4d.

8.70 The SEPA River Basin Management Plan (RBMP) map classes the groundwater body underlying the Development (Liddlesdale bedrock and localised sand and gravel aquifers) as having a 'Good' chemistry status and 'Good' quantitative class with the data sheet for this groundwater body citing no pressures (such as abstraction and farming) identified on this water body.

Surface Hydrology

8.71 The majority of the Development lies within the catchment of Jed Water, which originates from the convergence of several burns which issue within the Core Study Area. Two potential borrow pit locations lie within the catchment of Catlee Burn.

8.72 There are several smaller watercourses within the Core Study Area (shown in Figure 8.4):

- Pedens Clough is located approximately 215 m to the east of Turbine 6 and drains from west to east before joining Jed Water at 362950, 607275. Pedens Clough is a shallow watercourse with a gravel bed and is fed by Battling Sike which originates from headwaters converging from Flush Plantation approximately 450 m to the west of Turbine 6.
- Rough Sike and Westshiels Burn originate in the centre of the Development and drain from west to east before their confluence with Jed Water at 362618, 606622 and 362606, 606438 respectively. Both watercourses have been modified by forestry operations and are restricted in their canalization by the presence of trees, as shown in Plate 3. Due to prolonged precipitation during the site walkover, both watercourses were observed to be turbid, possibly due to the presence of alluvium in the adjacent forestry ditches.

Plate 3: Westshiels Burn

- Well Cleuch originates on the foot of Swiney Moss in the southern section of the Development and flows from west to east before joining the upper reaches of Jed Water. As with most minor watercourses within the site, Well Cleuch has been modified by forestry and is restricted in migration by the presence of trees, as shown by Plate 4. Due to prolonged precipitation during the site walkover, Well Cleuch was observed to be turbid, possibly due to the presence of alluvium in the forestry ditches adjacent to the watercourse.

Plate 4: Well Cleuch at 361803, 605572.

- Fell Burn originates on the toe of Green Law in the southeast of the Development by the convergence of four unnamed tributaries, and flow from south to northeast before joining Black Burn at 364007, 607184. Despite bash in the watercourse, Fell Burn was free flowing and clear during the site walkover, as shown by Plate 5.

Plate 5: Fell Burn

- Wolfhopelee Burn drains the western section of the Development and discharges into Catlee Burn beyond the B637, approximately 200 m west of the existing forestry access point. Wolfhopelee Burn is located in a steeply sided ravine and is fed by Cross Sike.

8.73 Within the Core Study Area, only Jed Water has a SEPA water quality classification under the RBMP:

- Jed Water/Raven Burn (source to Kaim Burn confluence) – overall status of Good with High confidence in 2008 with overall ecological status of Good and overall chemical status of Pass.

8.74 Jed Water flows from south-west to north-east before a confluence with Black Burn, approximately 1.1 km to the northeast of Turbine 10 and is classified by SEPA as a Fresh Water Fish Directive Salmonid Water.

8.75 Jed Water varies in width within the Development, getting progressively wider downstream towards the confluence with Black Burn. Jed Water was observed to be moderately fast flowing during the site walkover and ran turbid, as shown in Plate 6.

Plate 6: Jed Water at Site boundary

8.76 At the confluence of Jed Water and Black Burn, the watercourse appeared to be fast flowing and appeared dark in colour, possibly due to precipitation flushing the surrounding peat deposits, as shown by Pate 7.

Plate 7: Jed Water / Black Burn confluence

8.77 Beyond the west of the Development, Catlee Burn has a SEPA water quality overall status of Poor with Low confidence in 2008 with overall ecological status of Poor and overall chemical status of Pass.

8.78 To the west of the Core Study Area, Hass Burn, Harecairn Burn and March Syke drain into Hyndlee Burn. No Development infrastructure is located within the catchments of these watercourses and, therefore, they have not been considered further within this assessment.

8.79 Figure 8.4 shows the main surface watercourses and their associated catchments within the Study Area.

Site Drainage

8.80 The majority of the Development is drained by a series of forestry ditches which run parallel and discharge into the minor watercourses onsite.

8.81 Higher ground in the southern section of the Development drains initially by overland flow and small incised streams. Drainage across the non-forested areas of the Development is characterised by channels in the peaty soils and very occasional flushes within eroded peat / soil channels.

8.82 Peaty deposits may act as a store of water and release rainwater for a considerable time after significant rainfall. Observations made during the site walkover noted that no areas of the Development were heavily saturated following the precipitation events preceding and during the site visit. This is due to the gently sloping topography of the Development and due to the extensive coverage of forestry drainage grips and agricultural drains.

8.83 The forestry tracks are drained by minor man made drains which run parallel to the tracks and are linear and stone lined. The stone lined drainage generally discharge into minor tributaries onsite.

Hydrological Regime and Surface Water Morphology

8.84 Morphology is typical of upland watercourses, which (as described in paragraphs 8.71 to 8.77) are generally evenly dispersed through flat boggy ground from their upper reaches, becoming increasingly steep and faster flowing as they progress downstream to the primary rivers.

8.85 Site observations in the east and south of the Development Area indicate that morphology is relatively typical of dendritic drainage network watercourses, which are steeper in their upper reaches and become increasingly flatter as they progress down slope.

Surface Water Continuity

8.86 Surface watercourses in the north of the Development Area appear to be relatively continuous and free from blockages.

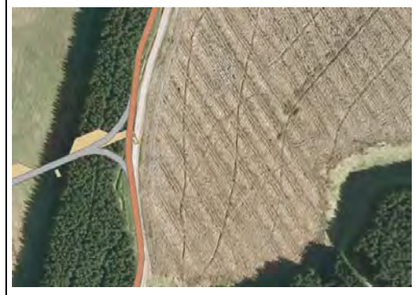
8.87 Minor rock and natural brash blockages were observed on the headwaters of Jed Water, on Well Cleuch (Plate 15 in **Technical Appendix 8.1**).

Groundwater Dependent Terrestrial Ecosystems (GWDTEs)

8.88 In accordance with SEPA guidance a Phase 1 habitat survey was undertaken to identify wetland habitats occurring within the Core Study Area and surrounding environment. Wetland habitats were identified in line with the criteria outlined in 'A Functional Wetland Typology for Scotland' (SNIFFER, 2009) where wetland habitats were confirmed through Phase 1 survey, further detailed habitat assessment was undertaken, with identification of National Vegetation Classification (NVC) communities. The survey methods employed for this assessment are outlined in **Chapter 5: Ecology**.

8.89 Figure 5.4 shows the location of wetland habitats in relation to the Development infrastructure, as identified from the Phase 1 Habitat and National Vegetation Classification (NVC) surveys, in accordance with SNIFFER guidance and as required by SEPA. Potential GWDTEs have been identified through application of the wetland typology and relevant SEPA guidance to the Phase 1 and NVC data, as outlined in Table 8.6.

Table 8.6: Identification of GWDTEs

Recorded NVC Communities within Core Study Area	Recorded NVC communities identified with potential for groundwater dependence (SEPA, 2014)	Potential for impact from the Development?
M23a:M25b	M23a: potential for high groundwater dependence. M25b: potential for moderate groundwater dependence. This area has been modified by linear man-made drainage: 	Yes: proposed access tracks and Turbine 6 are located within a mosaic of M23a:M25b, on the southern toe of Highlee Hill.
MG9:U4b:FC:OV27	MG9: potential for moderate groundwater dependence. This area has been modified by linear man-made drainage and forestry: 	Yes: Turbine 2, the met mast and associated infrastructure are located within an area of MG9, on the toe of Wardmoor Hill. Turbine 1 is located approximately 185 m south east of this community.
MG9:OV27	MG9: potential for moderate groundwater dependence. This area has been heavily modified by linear man-made drainage and forestry: 	Yes: Upgraded access track within 100 m of the community.
MG10a:OV27:FC/U4:MG9	MG10a and MG9: potential for moderate groundwater dependence. This area has been heavily modified by linear man-made drainage and forestry: 	Yes: Turbine 13 located within 250 m of an area of MG9, south of Milloor Rig. Access track and crane hardstanding encroaches upon this area.

Recorded NVC Communities within Core Study Area	Recorded NVC communities identified with potential for groundwater dependence (SEPA, 2014)	Potential for impact from the Development?
U4b:MG9	MG9: potential for moderate groundwater dependence. This area has been heavily modified by linear man-made drainage and forestry: 	Yes: Turbine 10 located within 250 m of an area of MG9, on the toe of Dykeraw Height. Turbine 10 is located approximately 135 m south west of this community.

8.90 It should be noted that minor areas either side of the existing forestry tracks and within forestry rides / fire breaks which have been identified as MG10:MG9 mosaics. Given the heavily modified nature of these communities they have been discounted from the assessment.

8.91 As outlined in Table 8.6, application of the wetland typology has identified habitats within the Core Study Area with potential for high and moderate groundwater dependence.

8.92 The marshy grassland habitats identified with potential for groundwater dependence are located on fairly steep upland slopes ranging from approximately 307 m AOD to 205 m AOD, over a distance of approximately 500 m. The location and topography in which the grassland habitats are situated strongly suggests that the vegetation communities are ombrogenous in nature, being dependent on surface water run-off and precipitation, rather than groundwater. As shown in Figures 8.2 and 8.3, the underlying geology in proximity to Turbine 5 and 6 is dominated by mudstones and glacial till, with an absence of fissures or fractures in the locality, while the rest of the Development is underlain by sandstones, siltstone and cementstone (dolomite/limestone) and glacial till, which also supports the conclusion that the identified habitats are not connected with groundwater and having limited potential to interact with the groundwater, which infiltrates from the surface to enter the thin fractured zones, likely to be present in the upper layers of the mudstones and sandstones siltstone and cementstone (dolomite/limestone).

8.93 The grassland habitats identified as potential GWDTEs are located within the catchment of Pedens Cleuch, with surface water drainage provided by the unnamed tributary of Pedens Cleuch, in the north of the Development, likely to dominate the hydrological setting. When examined in detail, the majority of vegetative communities identified in the marshy grassland and occur on well-drained soils with shallow peat. There are no surface water features such as pools or flush habitats within the identified habitats to suggest that the groundwater level may be near the surface.

8.94 Peat probing undertaken in the Core Study Area confirms the presence of shallow peaty soil deposits of 0 - 0.5 m across the area of marshy grassland, with localised areas of slightly deeper peat (0.5 - 1 m) to the south-east of Turbines 12 and 8.

8.95 Habitats surrounding the marshy grassland and mesotrophic grassland comprise dry modified bog and dry heath with extensive stands of continuous bracken, suggesting that the existing peat deposits may be remnants of historical bog habitats, with peat-forming communities largely absent from the Core Study Area.

8.96 As discussed, the limited potential for marshy grassland to actively interact with the underlying groundwater in the upper layers of the mudstone bedrock, along with the topography and underlying geology; strongly suggests that the marshy grassland and mesotrophic grassland habitats are not groundwater dependent, but ombrogenous. It is therefore concluded that the M23:M25 and MG9:MG10 communities within the Core Study Area are not groundwater dependent.

8.97 Although not considered as GWDTEs, the sensitivity of the identified wetland habitats is acknowledged, with further consideration of the potential for effects on the hydrological function of the identified wetland habitats provided in paragraphs 8.144-8.154. Potential for effects on all identified wetland habitats in relation to their ecological and nature conservation value, are also discussed in **Chapter 5: Ecology**.

Flooding

8.98 The Flood Map (2014) produced by SEPA shows the areas of Scotland with a 0.5% (1:200) or greater chance of flooding, identified as medium to high risk areas for flooding. No turbines, transformers, temporary construction compounds or borrow pits are located in areas classed as a medium to high risk for flooding from pluvial, fluvial or groundwater sources.

8.99 A minor section of new access track near the site entrance is located adjacent to an area classed as medium to high risk of flooding from Jed Water.

8.100 Only one existing watercourse crossing is located in a medium to high risk area for flooding from fluvial sources.

Public and Private Water Supplies

8.101 The Private Water Supplies (Scotland) Regulations 2006 defines supplies as either:

- Type A - Supplies providing 10 m^3 of water a day or serving 50 or more persons; and supplies to commercial or public activities irrespective of their size; or
- Type B - Supplies serving only domestic premises with less than 50 persons supplied.

8.102 Scottish Water provided infrastructure / assets maps showing their potable water infrastructure in proximity to the Development.

8.103 Scottish Water has not highlighted any potable water pipework within the Core Study Area.

8.104 During consultation at the scoping stage, SBC identified six Type B abstractions for private water supply within 1 km of the turbine locations and potential borrow pit locations. Table 8.7 outlines private water supplies and their sources within 1 km of the turbine locations and potential borrow pit locations.

Table 8.7: Private Water Supplies within 1 km of the Development

Receptor	Source of supply	In / outwith Development catchment	Distance from Development infrastructure	Comment
Southdean Cottages	Mains supply	n/a	105 m north east of compound	Source and infrastructure confirmed with resident of Southdean Farm.
Dykeraw Farm Cottage	Spring - Dykeraw Height	Outwith Catchment	220 m north east of upgraded access track	Outwith SEPA buffer distance for PWS assessment (100 m from excavations less than 1 m depth). Source and infrastructure confirmed with resident of Dykeraw Farm Cottage by letter.
Dykeraw Farm	Spring - Dykeraw Height (same supply as Dykeraw Farm Cottage)	Outwith Catchment	220 m north east of upgraded access track	Outwith SEPA buffer distance for PWS assessment (100 m from excavations less than 1 m depth). Source and infrastructure confirmed with resident of Dykeraw Farm by letter.
Southdean Farm	Spring – north of A6088	Outwith Catchment	425 m east of compound	Outwith SEPA buffer distance for PWS assessment (250 m from excavations more than 1 m depth). Source and infrastructure confirmed with resident of Southdean Farm.
Lustruther	Spring – Highlee Hill	Outwith Catchment	440 m northwest of upgraded access track	Outwith SEPA buffer distance for PWS assessment (100 m from excavations less than 1 m depth). Source and infrastructure confirmed with resident of Lustruther.
Wolfhopelee	Three springs – Wolfelee Hill	Outwith Catchment	775 m north of potential borrow pit location on Wolfehopelee Hill	Outwith SEPA buffer distance for PWS assessment (250 m from excavations more than 1 m depth). Source and infrastructure confirmed with resident of Wolfhopelee.

8.105 As all private water supplies are located outwith the surface and near surface water catchment the supplies are considered to be hydrologically disconnected from the Development (in terms of surface and sub-surface water effects, as development is proposed in areas that are hydrologically up-gradient) or are of sufficient distance to remain unaffected by the Development.

Designations and Fisheries

Designations

8.106 There are seven statutory designations relating to water within the wider 10 km Study Area, identified through the use of SNH[30] and SEPA[31] GIS datasets, as shown in Table 8.8.

Table 8.8: Designations within Study Area

Designation	Distance from Development infrastructure	Qualifying interest	Hydrologically Linked to Development?
River Tweed SAC	Approximately 125 m north of the construction compound and 725 m northeast of Turbine 10	Supporting Atlantic salmon, otter, three species of lamprey and water crowfoot (Ranunculus)	Yes, via minor watercourses which drain into Jed Water, which in turn is designated as it exits the Development. Additionally, should the existing borrow pit on Wolfehopelee Hill be reopened then connectivity to the River Tweed SAC exists via Catlee Burn.
Kielderhead Moors: Carter Fell to Peel Fell SSSI	Approximately 1.7 km south of Turbine 1	Supporting Blanket bog and subalpine dry heath	No – the Development is located downhill from the designation.
Borders Woods SAC and SSSI	Approximately 1.8 km west of Turbine 2	Supporting mixed woodland on base-rich soils associated with rocky slopes	No – outwith surface water catchment.
Jedwater Woodlands SSSI	Approximately 6.6 km northeast of site entrance	Supporting beetle assemblage and Upland oak woodland	No – hydrologically separated by Jed Water.
Buckstruther Moss SSSI	Approximately 8.9 km northwest of Turbine 6	Supporting basin fen - Schwingmoor type and beetle assemblage	No – outwith surface water catchment.
Adderstonlee Moss SSSI	Approximately 9.4 km northwest of Turbine 6	Supporting basin fen	No – outwith surface water catchment.
Kirkton Burn Meadow SSSI	Approximately 9.9 km northwest of site entrance	Supporting lowland neutral grassland	No – outwith surface water catchment.

8.107 The hydrological designations are considered to be hydrologically disconnected from the Development Area (in terms of surface and sub-surface water effects, as development is proposed in areas that are hydrologically up-gradient) or are of sufficient distance to remain unaffected by

[30] SNH datasets available at http://gateway.snh.gov.uk/natural-spaces/index.jsp [website address checked 17/09/2015, datasets checked for updates as of 17/03/2016].

[31] SEPA datasets available at http://map.sepa.org.uk/rbmp/ [website address checked 17/09/2015, datasets checked for updates as of 17/03/2016].

the Development, with the exception of the River Tweed SAC. Potential effects on the River Tweed SAC are considered in paragraphs 8.207 to 8.252.

Fisheries

8.108 A fish survey was undertaken in July 2012 by the Tweed Foundation and the report is provided as **Technical Appendix 5.5** to **Chapter 5: Ecology**.

8.109 The majority of watercourses within the Development are too small to support fish populations. Of the five monitoring locations selected for electrofishing surveys, three are located on Jed Water, one on Pedens Cleuch and one on Black Burn, which is outwith the Core Study Area.

8.110 The survey concluded that the watercourses in the survey area offered semi-quantitative values[32] outlined in Table 8.9.

Table 8.9: Semi-quantitative Electrofishing Results

Watercourse	Salmon Fry	Trout Fry	Salmon Parr	Trout Parr
Jed Water (L01)	Moderate	Low	Absent	Absent
Black Burn (L02)	Moderate	Low	Absent	Absent
Jed Water (L04)	Moderate	Very Low	Absent	Absent
Jed Water (L05)	Moderate	High	Absent	Absent
Peden's Cleuch (L06)	Absent	Absent	Absent	Absent

8.111 Salmon and Trout Parr were either absent or only present as single fish.

8.112 Lamprey were recorded at 4 out of the 5 sampling sites and the likelihood is that that the sampled Lamprey were resident Brook Lamprey rather than the migratory River and Sea Lamprey which are typically found in larger watercourses.

8.113 The watercourses further downstream the catchment from the survey area will however provide good habitat for fish (e.g. Jed Water further downstream of the Development is valued for its salmon, approximately 15 km to the north of the Development).

Information gaps

8.114 All data considered necessary to identify and assess the potential significant effects resulting from the Development were available and used in the assessment reported in this Chapter.

Sensitivity of Receptors to Construction Effects

8.115 The sensitivities of the identified receptors, and their relationship to the potential effects from the construction of the Development, are outlined in Table 8.10.

Table 8.10: Sensitivity of Hydrological Receptors

Receptor	Potential Effects	Sensitivity	Comment
Watercourses	Increased run-off, erosion and sedimentation, stream flow impediments and pollution as a result of construction groundworks and chemical handling / storage.	High	Considered High sensitivity as Jed Water (overall receiving watercourse) discharges into Black Burn and is designated as an SAC for Atlantic salmon, otter, three species of lamprey and water crowfoot. Jed Water / Black Burn is noted to support fish populations, such as salmon and sea trout. Jed Water also has a "Good ecological status" under the RBMP.
Groundwater	Pollution as a result of erosion and sedimentation from construction activities and uncontained spills from chemical handling / storage.	High	Considered High sensitivity as hydrocarbon pollution in bedrock fissures has a lengthy attenuation period. Groundwater vulnerability is classed as 4a to 4c (high to medium). The groundwater unit underlying the Development ((Liddlesdale bedrock and localised sand and gravel aquifers) has a 'Good' chemistry status and 'Good' quantitative class.
Near-surface water	Diversion of near-surface flows as a result of track construction and the installation of turbine foundations / hardstanding.	High	Considered High sensitivity as near-surface water supplies flow to the watercourses within the Core Study Area, which in turn discharge into Jed Water (classed as a High sensitivity receptor).
Soils / Superficial geology (excluding peat)	Pollution as a result of track construction and chemical handling / storage.	Moderate	Considered Medium sensitivity as the receptor has some capacity to filter and attenuate most potentially polluting chemicals and sediment over time.
Solid Geology (bedrock)	Loss of strata as a result of stone winning from borrow pits or turbine excavations.	Low	Considered low sensitivity as the receptor is not designated or of limited resource across Scotland and can function normally throughout all phases of the Development.
GWDTEs	Pollution as a result of track construction and uncontained spills from chemical handling / storage. Drying out or destabilisation of peat as a result of construction activities.	Moderate	Considered Moderate sensitivity as the GWDTE communities identified within the Core Study Area are classed as high to moderately groundwater dependant, however are ombrotrophic in nature or have been heavily modified by forestry and man-made drainage.

Assessment of Potential Effects

8.116 The effect of the Development on hydrological receptors has been considered for the construction, operation and decommissioning phases of the Development. Effects occurring during construction and decommissioning are considered to be short term effects, with those occurring as a result of the operational phase of the Development being considered to be long term effects.

[32] Categories defined from data collected from the Tweed District

Potential Construction Effects

8.117 The nature and magnitude of effects that could result from construction activities, as described in **Chapter 2: Proposed Development**, are assessed in the following paragraphs, which includes:

- The upgrade of access tracks from the operational forestry for the construction of the Development;
- Potentially extending use of borrow pits from forestry operations and potentially using new borrow pits for the construction of the Development. A search area of five locations has been identified, although it is not intended that all of these locations are utilized. Only the most suitable locations will be selected following detailed site investigation; and
- Construction of new access tracks, turbines and associated infrastructure, hardstandings and two temporary construction compounds for the Development.

Chemical Pollution

8.118 Potential effects involved with the management of construction are more a risk management issue, with the effects being assessed should the risk be realised. Should the Development proceed as described in **Chapter 2: Proposed Development** *i.e.* with no spills, there would be no effects.

8.119 Potential risks include the spillage or leakage of chemicals, fresh concrete, foul water, fuel or oil, during use or storage onsite. These pollutants have the potential to adversely affect soils, subsurface water quality, peat, surface water quality, and groundwater, and hence effects on the biodiversity of receiving watercourses.

Surface Hydrology

8.120 Watercourses could be at risk from a pollution incident during construction. All surface watercourses and surface water bodies are considered to be of high sensitivity.

8.121 Buffer distances between proposed construction works and watercourses have been maximised to reduce the potential for chemical pollutants to be transferred to the water environment.

8.122 Measures such as absorbent spill pads / kits and other measures highlighted within Sections 3 and 4 of the CMS found in **Technical Appendix 8.1** will effectively limit the uncontained release of chemicals to minor fugitive releases. These would be minimised through best practice construction methods such as vehicle speed limits and regular vehicle and machine maintenance.

8.123 Therefore, effects on these watercourses and lochs, of high sensitivity, have the potential to be of negligible magnitude and therefore (in accordance with Table 8.4) of negligible significance. As such there will be no effect on the River Tweed SAC. This is not significant in terms of the EIA Regulations.

Groundwater, Near-surface water and Bedrock

8.124 Pollutants coming into contact with bedrock also have the potential to indirectly alter the pH of the groundwater resource. pH and chemical alterations to bedrock are difficult to rectify due to the fractured nature of the rock and the lengthy attenuation and dispersal of chemicals. As noted previously, due to the underlying geology consisting of glacial till, groundwater is unlikely to be present near the surface, meaning there is limited potential for pollutants to come into contact with groundwater. Measures such as spill pads, impermeable geotextile membranes and measures described within the CMS Appendix will effectively limit the uncontained release of chemicals to minor fugitive releases. Therefore, effects on bedrock and groundwater have the potential to be of negligible magnitude for a receptor of high sensitivity and therefore (in accordance with Table 8.4) of negligible significance. This is not significant in terms of the EIA Regulations.

Erosion and Sedimentation

Surface Hydrology

8.125 Erosion and sedimentation can occur from excavations, stone winning, de-watering, ground disturbance and overburden stockpiling. Sediment entering watercourses has the potential to affect water quality, ecology and flood storage capacity.

8.126 Given the overland distance between construction areas and watercourses, any silt or other materials carried by overland flow as a result of construction are likely to be entrained in vegetation and forestry drainage ditches (in the absence of intervening good practice measures) before reaching watercourses, with the exception of the two new watercourse crossings. Plate 16 of **Technical Appendix 8.1** shows the intervening rough vegetation and linear drainage ditches between areas to be worked in proximity to Turbine 10 and Jed Water.

8.127 Measures such as check dams, silt traps, settlement lagoons and buffer strips will minimise sedimentation and erosion; further details of these measures are outlined in Sections 2, 6 and 8 of **Technical Appendix 8.1**.

8.128 Other Sustainable Drainage System (SuDS) measures, such as the use of settlement lagoons, swales and interception bunds, will effectively prevent sediment entering watercourses via drainage ditches adjacent to access tracks. As such, there will be limited potential for sediment or erosion effects on watercourses in the Development Area, including the hydrology and water quality of onsite watercourses, and therefore Jed Water.

8.129 For these reasons, the magnitude of this effect will be negligible. Given the high sensitivity of the watercourses and negligible magnitude of effects, the significance of effects associated with erosion and sedimentation is assessed as being negligible. This is not significant in terms of the EIA Regulations.

Sub-surface Hydrology

8.130 Sediment also has the potential to change near-surface water flow in superficial geology deposits and peaty soil characteristics by creating a physical barrier within naturally occurring drainage micropores. Sediment entering near-surface water in superficial deposits also has the potential to impact on groundwater quality within bedrock deposits / fissures.

8.131 Measures described in **Technical Appendix 8.1**, such as impermeable ground membrane layers and bunded areas, will effectively prevent sediment entering sub-surface water in superficial deposits (and groundwater) and peat. For these reasons, the magnitude of this effect will be negligible. Given the high sensitivity of near-surface water and groundwater and negligible magnitude of effect, the significance of the effect associated with erosion and sedimentation is considered to be negligible. This is not significant in terms of the EIA Regulations.

Impediments to Flow

8.132 The access tracks will only require the installation of 2 new watercourse crossings across all sections of the Development. Additionally, the use of the existing access track which serves the

forestry operations has eliminated the requirement to upgrade existing watercourse crossings, therefore minimising the potential for impediment to flow.

8.133 The minimisation of the number of proposed watercourse crossings and the re-use of the existing watercourse crossings reduces one of the main activities that could give rise to impediment of flows. Additionally, measures described in Section 6.4 of **Technical Appendix 8.1**, such as the use of a wide bottomless-arched culverts, where appropriate, are likely to prevent impediments to flow being created. The indicative culvert design is shown in Section 13 of the CMS, detailed design will be carried out at the construction phase and will be agreed with SEPA.

8.134 In addition to watercourse crossings, felling of trees can increase surface water run-off and cause impediments to river flow through accumulation and transfer of brash. Brash build up within watercourses has the potential to impede the passage of waterborne ecology and divert / concentrate flow to river banks. In the long-term, however, it is generally accepted that, the removal of plantation forestry in proximity to watercourses can improve surface water conditions due to increased growth of bankside vegetation, improved ground level lighting and reduced potential for the introduction of impediments to flow.

8.135 Measures described in the CMS, such as brash matting, not stockpiling brash and not allowing brash to block drainage ditches or enter watercourses, verified by visual inspections, further reduce the potential for this effect to occur.

8.136 Therefore, the effects on watercourses of high sensitivity are considered to be of negligible magnitude and, therefore of negligible significance. This is not significant in terms of the EIA Regulations.

Changes in Soil and Peaty Soil Interflow Patterns

8.137 Some turbine base excavations may need temporary sub-surface water controls, such as physical cut-offs or de-watering. These temporarily divert flows away from the excavation, and temporarily lower the local water table and sub-surface water levels in peat. Localised temporary changes to soil and peat interflow patterns may therefore arise. Turbine foundations and crane hardstandings also have the potential to change sub-surface water flow by creating physical barriers within naturally occurring drainage macropores in soil or peat.

8.138 The drying out of peaty soil can result from alterations to the natural drainage regime. Measures set out in the Section 8 of **Technical Appendix 8.1**, such as the rewetting of peat through controlled irrigation techniques, are considered sufficient, and sufficiently reliable, to avoid substantial alterations to the natural drainage regime, particularly given the shallow nature of soils and absence of peat at turbine locations. As a result, peat is not expected to dry out, beyond what would be the case in the baseline scenario. No substantial impediments to near-surface water flow will be created as the detailed site drainage design will take into account any severance of saturated areas to ensure hydrological connectivity is maintained, in accordance with SEPA / SNH 'Good practice during wind farm construction'.

8.139 Consequently, effects on soil (medium sensitivity receptor) are considered to be of negligible magnitude and therefore negligible significance. This is not significant in terms of the EIA Regulations.

Compaction of Soils

8.140 Construction of access tracks and movement of construction traffic, in the absence of construction good practice, can lead to compaction of the soil. This can reduce soil permeability, potentially leading to increased run-off and increased erosion. The superficial geology underlying the Development is generally of low permeability, so the effects of compaction would not result in a significant increase in runoff from existing conditions. Access tracks for the Development have been designed to avoid impinging on areas of heavily saturated ground. In order to maintain the current level or improve the drainage, it is necessary to ensure that construction methods do not seriously disrupt the established drainage and that no areas are surcharged, either by water discharge or spoil.

8.141 Maintenance of existing drainage is critical to avoid compaction of soils, therefore all existing drainage network channels, such as those draining the substation / compound of the Operational Scheme, will be maintained and where necessary, channelled below the proposed road construction, as described in Section 6 of **Technical Appendix 8.1**. Drainage ditches on the upslope of the road are likely to be required on side-long ground. If required, the ditches will be constructed with small dams and cross drains where necessary in order for water to drain below the road at regular intervals and that concentrated discharges to soil / peat on the down slope side of the road are avoided, as outlined in Section 6 and 8 of **Technical Appendix 8.1**.

8.142 Existing access tracks have been used in the design where practicable, further reducing the potential for soil compaction. Furthermore, the percentage of the Core Study Area proposed for the construction of new infrastructure is small (approximately 0.8 %[33]).

8.143 For these reasons, the magnitude of this effect will be negligible. Given the moderate sensitivity of soils and negligible magnitude of effect, the significance of effects associated with the compaction of soils is considered to be negligible. This is not significant in terms of the EIA Regulations.

Effects on the Hydrological Function of Wetland Habitats

8.144 Wetland habitats supporting grassland communities are present within the Core Study Area, with areas of marshy grassland and unimproved acid grassland identified with potential for hydrological impact from the Development.

8.145 A mosaic of M23:M25 marshy grassland is located on the toe of Highlee Hill, occurring within the footprint of the proposed access track and Turbines 6. Excavations for access tracks are likely to be less than 1 m in depth and restricted to the footprint of the access track, while the footprint of the proposed turbines where excavations may reach up to 3 m in depth with potential for direct impact (i.e. habitat loss) to wetland habitats in these areas. Indirect impacts of disturbance to surrounding wetland habitats may also occur. Near-surface water through superficial deposits may be disrupted by the cut and fill access track to Turbine 6, as the installation of aggregate may cause a physical blockage to water flow in micro and macropores within the M23:M25 community, where the access track runs perpendicular to natural flow.

8.146 Approximately 147.4 ha of M23, M25 or mosaics containing either community exists within the Development. Approximately 0.12 ha of M23:M25 will be directly lost as a result of infrastructure at the Development being located within this community. Therefore, approximately 0.08 % of this community will be directly lost as a result of the Development. As such, direct hydrological effects

[33] Approximately 8 ha of new infrastructure in 1,097 ha total Development Area.

will equate to a 'minimal detectable effect on a GWDTE (between to 0.1 % - 5 % of study area) or no discernible effect on its integrity as a feature or its functionality' in accordance with Table 8.3. Therefore the magnitude of the loss M23:M25 will result in a negligible effect. Given the moderate sensitivity (as set out in Table 8.4) and negligible magnitude of effect, the significance of effects associated with the loss of M23:M25 is negligible. This is not significant in terms of the EIA Regulations.

8.147 Some infiltration of surface water through the access tracks is expected in this habitat, but the majority of the water will enter the surface water drainage system and will be discharged downslope of the access track at specified points. It is also likely that there will be temporary localised lowering of the water levels within the soil layers downslope of the access track and turbine foundations immediately after construction, due to a reduction in the quantity of near-surface water into this area. It is anticipated that this will replenish with rainwater.

8.148 Where the MG9 mosaic occurs in the vicinity of Turbines 1 and 2, potential exists for direct impacts of habitat loss both within the footprint of the proposed turbines and access tracks. Localised areas of habitat loss will occur, particularly in the footprint of the proposed turbines where excavations may reach up to 3 m in depth. Approximately 133.5 ha of MG9 or mosaics containing MG9 exists within the Development. Approximately 0.06 ha of MG9 or mosaics containing MG9 will be directly lost as a result of infrastructure at the Development being located within this community. Therefore, approximately 0.05 % of this community will be directly lost as a result of the Development. As such, direct hydrological effects will equate to a 'slight or negligible change from baseline condition of geological resources. Change hardly discernible, approximating to a 'no change' in geological condition' in accordance with Table 8.3. Therefore the magnitude of the loss MG9 or mosaics containing MG9 will result a negligible effect. Given the moderate sensitivity (as set out in Table 8.4) and negligible magnitude of effect, the significance of effects associated with the loss of MG9 or mosaics containing MG9 is negligible. This is not significant in terms of the EIA Regulations.

8.149 Some infiltration of surface water through the access tracks and turbine foundation hardstanding is expected in this habitat, but the majority of the water will enter the surface water drainage system and will be discharged downslope of the access track at specified points. It is also likely that there will be temporary localised lowering of the water levels within the soil layers downslope of the access track and turbine foundations immediately after construction, due to a reduction in the quantity of near-surface water into this area. It is anticipated that this will replenish with rainwater.

8.150 The embedded design measures outlined in Section 8.2 of **Technical Appendix 8.1** will also minimise the indirect effects on wetland habitats. As such, indirect hydrological effects will equate to a 'slight or negligible change from baseline condition of geological resources. Change hardly discernible, approximating to a 'no change' in geological condition' in accordance with Table 8.3.

8.151 Good practice design and construction (outlined in paragraph 8.153) and measures outlined in Section 8 of **Technical Appendix 8.1** will minimise potential indirect effects of the Development on wetland habitats, particularly marshy grassland and mesotrophic grassland.

8.152 Prior to access track construction, site operatives will identify flush areas, depressions or zones which may concentrate water flow. These sections will be spanned with plastic pipes or drainage matting to ensure hydraulic conductivity under the road, and reduce water flow over the road surface during heavy precipitation.

8.153 Additionally, the following design measures will ensure that effects on wetland habitats are minimised:

- A PPP is implemented to ensure good practice working methods are followed throughout construction works.
- Silt traps will be deployed to trap and filter sediment-laden run-off throughout the construction phase of the Development.
- Settlement lagoons will be constructed and actively managed to control water levels and ensure that any run-off is contained, especially during times of rainfall.
- Turbine foundations are constructed in holes in the ground that will be de-watered, and hence water flow is typically into the foundation area. This will prevent concrete leaching into groundwater or surface water in the event of shutter collapse.
- All excavations will be sufficiently dewatered before concrete pours begin and that dewatering continues while the concrete cures. However, construction good practice will be followed to ensure that fresh concrete is isolated from the dewatering system.
- If required turbine foundations may be dewatered, temporarily lowering water levels in the superficial deposits and near-surface groundwater. The dewatering process would involve the treatment of any extracted water to remove any sediment and redistributing the water onto a vegetated surface in proximity to the excavation. This process would not involve any net loss of water from the hydrological system and would ensure that the water being treated is of the same (or similar) quality to what was extracted. Hence, there would not be an unacceptable effect on groundwater or near-surface water supplying GWDTEs.

8.154 In accordance with Table 8.10 wetland habitats are defined as moderate sensitivity. The magnitude of indirect effects is considered to be negligible. As such, there will be negligible predicted significance on the hydrological function of GWDTEs. This is not significant in terms of the EIA Regulations.

Bedrock Excavation

8.155 A volume of excavated material required for the Development will be obtained from excavations for new access tracks, hardstandings and blade laydown areas, for the substation, and from onsite borrow pits. Five borrow pit search areas have been identified for the Development.

8.156 Three new borrow pits areas will be considered during the site investigation stage. The total proposed area of the borrow pits will be a small percentage of the larger bedrock area underlying the Core Study Area.

8.157 Additionally, two borrow pits used during the existing forestry operations may be opened to win stone, if required

8.158 In the context of the geological resource of wacke and mudstone / sandstone, siltstone and dolomitic limestone, the extraction volumes are small.

8.159 For this reason, the magnitude of the loss of bedrock will be a negligible effect. Given the low sensitivity (as set out in Table 8.2) and negligible magnitude of effect, the significance of effects associated with the loss of bedrock is negligible. This is not significant in terms of the EIA Regulations.

Peat Destabilisation

8.160 Peat instability is generally the result of a combination of causative factors.

8.161 Construction activities that have the potential to increase the likelihood of peat slides or bog bursts include placing infrastructure or turbines on the break of a slope, infrastructure altering naturally occurring drainage channels, the removal of surface vegetation and forestry in areas of peat and peat excavation at the base of a slope.

8.162 The results of all the peat probing exercises indicate that much of the area on which the Development is located has minimal deposits of peat.

8.163 Table 8.11 shows the depth at each turbine.

Table 8.11: Peat Depth

Turbine	Peaty Soil Depth (m)
1	0.5 - 1
2	< 0.5
3	< 0.25
4	< 0.25
5	< 0.25
6	0
7	< 0.5
8	< 0.5
9	< 0.25
10	< 0.25
11	< 0.5
12	< 0.5
13	<0.5

8.164 In addition to the minimal peaty soil depth, no Development infrastructure is located on peaty soil greater than 0.5 m and on a 10 % slope within Core Study Area.

8.165 Notwithstanding this, infrastructure should be checked on site and micrositing adopted if required, in order to maintain the design objective of avoiding peat risk. In conclusion, the study area is considered to be developable in terms of potential peat slide as a constraint.

8.166 As such, the magnitude of potential effects without mitigation is considered to be negligible, which, combined with the high sensitivity of the receptor, leads to a significance of negligible significance. This is not significant in terms of the EIA Regulations.

Migration of Pollutants from Contaminated Land

8.167 Desk studies have not identified any areas of contaminated land within the Development and no effects are anticipated. Should potentially contaminated land be encountered during excavations, however, this would be tested and appropriate action taken in accordance with The Environmental Protection Act 1990. Effects associated with contaminated land are therefore considered to be of negligible magnitude for receptors of high sensitivity in accordance with Table 8.4, and not significant in terms of the EIA Regulations.

Acidification of Watercourses

8.168 Large scale felling of forestry and the storage of brash could potentially result in a short-term increase in the acidity of watercourses within the immediate catchment and have an effect on water quality and ecology. This can result from two possible processes:

- Nitrate leaching of stockpiled brash, if stored close to watercourses; and
- Disturbance of the ground due to felling activities very close to watercourses could lead to flushing of acid from groundwater, if measures to prevent run-off from entering the watercourses directly are not achieved.

8.169 Felling will also involve the movement of heavy machinery across a soft ground surface, and hence will lead to soil disturbance which could have the potential to lead to acidification and sedimentation.

8.170 Forestry good practice measures are set out in the **Technical Appendix 8.1**, including specific measures for felling and for forestry activities within 100 m of a tributary of the Jed Water. These measures will be implemented and maintained, and this will be carried out during the construction phase under supervision of an ECoW, whose role is described in **Technical Appendix 8.1**.

8.171 The adoption of these measures would mean that the magnitude and significance of resulting effects would be negligible.

8.172 Consultation responses on applications of a similar nature[34] have noted that leaving some open ground in or adjacent to the riparian zone, would greatly benefit rivers. The forest felling required for the 'with wind farm' scenario is set out in **Chapter 10: Forestry**. If the current acidification of the upper reaches of Jed Water has been caused by current and previous forest and drainage management, then the measures outlined in Section 7 of the CMS should help to limit or reduce this in the long term, leading to an improvement in water quality in the River Tweed catchment. While this may also happen in the future baseline scenario in the next forest rotation, the timescales for restructuring would be longer than in the proposed 'with wind farm' scenario.

Increase in Runoff and Flood Risk

8.173 The increase in hardstanding area associated with construction and operation of the Development could increase the volume and rate of localised surface run-off, although a large proportion of the proposed infrastructure hardstanding, including access tracks and crane hardstandings, would be permeable to some extent. The impermeable nature of the thin soils onsite and the underlying geology, however, means that, in the baseline scenario, there will be relatively low infiltration and relatively high run-off rates, and hence the addition of the Development would have minimal effect on the existing run-off scenario.

8.174 The design of the Development layout has incorporated a buffer zone between watercourses and turbine bases of 100 m of Jed Water and 70 m to other watercourses.

8.175 Measures, including SuDS measures, to attenuate run-off and intercept sediment prior to run-off entering watercourses are described in Section 2 of **Technical Appendix 8.1** and form a part of the

[34] Galloway Fisheries Trust consultation response to planning application for Kilgallioch Windfarm. April 2010.

Development. Furthermore, the area of new hardstanding, in terms of the percentage of the relevant catchments that may be affected, is small (approximately 0.08%[35]).

8.176 No turbines, construction compounds, substations or meteorological masts are located within areas described as having a 0.5 % or greater annual risk of flooding. However, one small area of access track (approximately 60 m in length) from the A6088 to the northern site compound is located adjacent to an area described as having a 0.5 % or greater annual risk of flooding. Whilst the access track does not encroach upon the area of medium to high risk of flooding, the track will be design to be flush to the existing ground level to ensure that flood waters, during extreme flood events, are prevented from backing up and possibly extending into areas that previously would not have flooded.

8.177 The Forests and Water Guidelines document reports that, due to rainfall interception losses:

"Research suggests there may be a 1.5–2.0% reduction of potential water yield [watercourse flow] for every 10% of a catchment under mature conifer forest".

8.178 It is assumed, therefore, that felling of mature forest may result in an average increase in water yield of up to 1.5 to 2 % for every 10 % of the catchment area that is subject to clear felling. It should be noted that, as interception loss has limited effect during the latter stages of periods of heavy rain, when the trees surfaces are saturated, this is likely to have a potential effect on average run-off, but not flood risk. As set out in **Chapter 2: Proposed Development**, the existing Forest Management Plan states that the remaining areas of mature forest are to be felled within the 2018 to 2022 timeframe. This coincides with the predicted start of the wind farm construction (currently programmed for 2019). Several forest 'coupes' which are identified to be felled in that timeframe contain the wind farm infrastructure. Depending on when the wind farm construction begins, these areas will have already been felled or they will be felled as part of the wind farm construction. As such, the Development will not lead to a net increase in forestry felling compared to the existing Forest Management Plan.

8.179 The large majority of areas of relatively mature trees that will be clear felled will be subsequently replanted, and the majority of the proposed clear felling is of semi-mature trees, rather than mature trees as referred to in the Guidelines. Clear felling of these areas will not lead to substantial increases in water yield. The majority of any effect that proposed clear felling will have on water yield is therefore temporary, and would reduce with time as the planted trees grow. As a worst-case approach, potential increases have been assessed by considering all felling proposed during the construction period, and by assessing these initially as mature trees.

8.180 This will result in a maximum potential increase in average water yield of less than 2 % for the primary catchments in which the Development is located. This is a worst case, and effects during prolonged heavy rain would be less than during average rainfall, because the proportion of rainfall intercepted and the attenuating effects of bog vegetation would be less during prolonged heavy rain. Consequently, the magnitude of the effect of clear felling on watercourse flow would be negligible.

8.181 For these reasons, effects on watercourses of high sensitivity are considered to be of negligible magnitude and therefore negligible significance. This is not significant in terms of the EIA Regulations.

[35]Approximately 8.5 ha area of area soil stripped, and potentially compacted in 13,900 ha catchment area (catchment of Jed Water).

Potential Operational Effects

8.182 Potential effects associated with the operation of the Development are:

- Increased run-off rates and volume;
- Continued erosion and sedimentation from runoff from areas of hardstanding;
- Alterations to natural flow pathways from runoff from areas of hardstanding; and
- A risk of a pollution event from minor spills from maintenance vehicles.

8.183 The nature of these effects has been discussed in relation to the construction phase. As there would be substantially less activity during operation, and as there is unlikely to be any significant ground disturbance during operation, the magnitude of these effects is similarly reduced.

8.184 There will be a minor reduction in the potential for increased surface water run-off during the operational phase due to the reduction in hardstanding areas used during the construction phase, such as the removal of the construction compounds.

8.185 Whilst alterations to natural flow pathways will not be introduced during the operational phase, any changes during construction will continue through operation, as the majority of infrastructure will remain in place. Alterations to natural flow pathways will be reduced through adopting good practice design and construction, as set out in the CMS, such as cross drainage, use of shallow drainage ditches, prevention of blockages, as discussed in paragraph 8.141, and adherence to the wider PPP.

8.186 As a result, the magnitude and significance of all effects associated with operation of the Development are assessed as being negligible, and not significant in terms of the EIA Regulations.

Potential Decommissioning Effects

8.187 Potential effects of decommissioning the Development are similar in nature to those during construction, as some ground-work would be required to remove turbine foundations and hardstandings to 1 m below ground level. These effects would be substantially lesser in magnitude than during construction, and would be controlled by a PPP, as discussed previously. Where infrastructure would be left in place, drainage features would also be left in place, where this is compatible with the PPP.

8.188 As a result, the magnitude and significance of all effects associated with decommissioning are assessed as being negligible, and not significant in terms of the EIA Regulations.

Mitigation and Residual Effects

8.189 Embedded design and construction good practice measures are included in **Technical Appendix 8.1**. The embedded design and construction good practice measures are based on experience of providing detailed site design for several wind farm developments across Scotland, in consultation with SEPA.

8.190 With the embedded design measures described in **Technical Appendix 8.1** and PPP in place, all identified potential effects have been assessed as being of negligible significance. The embedded design measures proposed are established measures that are widely used in construction projects and which RES and its contractors are well used to undertaking. Given the levels of certainty in the success of application of the mitigation measures and their effectiveness it is appropriate that the mitigation measures are taken into account and assumed to be fully effective in the determination of this application.

8.191 No residual effects are predicted for all phases of Development, and are therefore not significant in terms of the EIA Regulations.

Cumulative Effect Assessment

8.192 The methodology followed to assess the cumulative impacts is the same as that used for the Development in isolation.

8.193 A cumulative effect is considered to be an additional effect on hydrological resources (within the same hydrological catchment) arising from the Development in addition to the combination of other developments likely to affect the hydrological environment. At distances greater than 10 km, it is considered that schemes are unlikely to contribute to a cumulative hydrological effect due to attenuation and dilution over distance of potentially polluting chemicals. Therefore, for the purposes of the assessment of potential cumulative effects on the immediate catchment and hydrological regime, only proposed developments, which require large scale construction / excavation, within approximately 10 km of the Development have been considered.

Cumulative Developments within 10 km (In planning, consented or under construction)

8.194 The following cumulative developments have been identified within 10 km of the Development:

- Birneyknowe Wind Farm, located 8.8 km away, is within a separate surface water hydrological catchment, the River Teviot, to the Development and is considered to be hydrologically disconnected from the Development Area (in terms of surface and sub-surface water effects, as development is proposed in areas that are hydrologically up-gradient) and is not considered further in this assessment.
- Wauchope / Newcastleton Wind Farm (scoping), approximately 1 km south of the Development. 90 turbines – located in the catchment of the Jed Water. It should be noted that for the purposes of this assessment only the 70 turbine layout from Wauchope Wind Farm will be used, as 20 turbines from the Newcastleton Wind Farm are over 20 km from the Development;

8.195 There are no operational wind farms within 10 km to take into consideration as part of the baseline for the purposes of cumulative assessment.

Predicted Cumulative Effects

8.196 The greatest potential for cumulative effects arises when the construction phase of another development overlaps with the construction phase of the Development. Cumulative effects are considered to have the potential to be significant only where such an overlap may exist, as activities that could be potentially detrimental to the hydrological environment are greatly reduced during the operational phase of developments (e.g. excavation works, concrete pouring etc.).

8.197 Assuming commencement of the construction of the Development in 2019, lasting for approximately 18 months, this is unlikely to coincide with the construction phase of Wauchope Wind Farm and therefore there is unlikely to be potential for cumulative effects between the developments.

8.198 Given their respective locations, the primary cumulative impact is likely to be an increase in flow rates associated with increased run-off from new hardstanding areas of the two wind farm developments.

Construction Phase

8.199 The increase in flow rates is considered to be of negligible magnitude for the Development. It is assumed that water management measures will be implemented at Wauchope Wind Farm, similar to those described in the CMS for the Development, as these are in line with standard practice as required by SEPA. Given this, the magnitude of cumulative impacts during the construction phase will be negligible and, therefore, of negligible significance.

8.200 This is not significant in terms of the EIA Regulations.

Operational Phase

8.201 It is anticipated that there will be a minor reduction in the potential for increase in flow rates during the operational phase of both wind farm developments, when compared to the construction phase, due to the reduction in overall hardstanding areas post-construction. Therefore, the magnitude of cumulative effects during the operational phase will be negligible, and the significance of these effects will also be negligible, being not significant in terms of the EIA Regulations.

Residual Cumulative Effects

8.202 No significant residual cumulative effects are predicted.

Summary of Effects

8.203 This Chapter identified no likely significant effects, following the embedded measures (outlined in **Technical Appendix 8.1**) in the design of the Development.

8.204 Table 8.12 summarises the predicted effects of the Development on the hydrology and hydrogeology resources.

Table 8.12: Summary of Effects

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Significance
Construction				
Watercourses and Near-surface water	Chemical Pollution	Negligible	None	Negligible
Watercourses and Near-surface water	Erosion and Sedimentation	Negligible	None	Negligible
Watercourses	Impediments to Flow	Negligible	None	Negligible
Soils and near-surface water	Changes in Soil Interflow Patterns	Negligible	None	Negligible
Soils	Compaction of Soil	Negligible	None	Negligible
GWDTE	Effects on the Hydrological Function of GWDTEs	Negligible	None	Negligible
Peat	Peat Destabilisation	Negligible	None	Negligible
Watercourses and Near-surface water	Migration of Pollutants from Contaminated Land	Negligible	None	Negligible
Watercourses	Increase in Run-off	Negligible	None	Negligible

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Significance
Operation				
Watercourses and Near-surface water	Increased Run-off Rates / Volume	Negligible	None	Negligible
Watercourses and Near-surface water	Erosion and Sedimentation	Negligible	None	Negligible
Soils and near-surface water	Alterations to natural flow pathways	Negligible	None	Negligible
Watercourses and Near-surface water	Risk of a Pollution Event from Minor Spills from Maintenance Vehicles	Negligible	None	Negligible
Decommissioning				
Watercourses and Near-surface water	Chemical Pollution	Negligible	None	Negligible
Watercourses and Near-surface water	Erosion and Sedimentation	Negligible	None	Negligible
Soils and near-surface water	Changes in Soil Interflow Patterns	Negligible	None	Negligible
Soils	Compaction of Soil	Negligible	None	Negligible
GWDTE	Effects on the Hydrological Function of GWDTEs	Negligible	None	Negligible

Statement of Significance

8.205 This Chapter has assessed the likely significance of effects of the Development on hydrology, hydrogeology and soils. The Development has been assessed as having the potential to result in effects of negligible significance.

8.206 Given that only effects of moderate significance or greater are considered significant in terms of the EIA Regulations, the potential effects on hydrology, hydrogeology and geology are considered to be not significant.

Potential Effect on the River Tweed SAC

The Need For and Form of Assessment

8.207 The Habitats Regulations provide that an assessment of the possible effects of a proposed Development on a SAC (an 'Appropriate Assessment') is the responsibility of the competent authority. The following section of this Chapter provides information on the potential effect of the Development on the SAC to help inform the competent authority's assessment.

8.208 The Development is in a location where it may influence the qualifying interest of the River Tweed SAC.

8.209 European Directive 92 / 43 / EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (the Habitats Directive) is relevant. This Directive was transposed into UK legislation through The Habitats Regulations. Guidance for the implementation of the Directive in Scotland is provided in Scottish Executive Circular No. 6/1995 (revised June 2000).

8.210 Article 6 of the Habitats Directive refers to conservation measures and assessment procedures for plans or projects affecting Natura 2000 sites (including SACs), and the steps for assessment are outlined in Article 6 (2) and (3). Part IV of the Habitats Regulations transposes these steps into domestic legislation, with Regulations 48 and 49 being relevant.

8.211 Regulation 48 of the Habitats Regulations refers to three assessment steps. The outcome of the first two steps determines whether or not the third step needs to be implemented. The three steps, set out as the following questions, are:

- Step 1: Is the proposal directly connected with or necessary to the management of the site?
- Step 2: Is the proposal, alone or in combination, likely to have a significant effect on the site? If a significant effect is likely, then an Appropriate Assessment is necessary; and
- Step 3: Can it be demonstrated in light of the conservation objectives that the proposal will not adversely affect the integrity of the site?

8.212 It is important to note that Step 2 applies only to the qualifying species of the SAC and the decision is informed by the SAC's conservation objectives. The European Court of Justice (ECJ) ruling of 7 September 2004 (C-127 / 02) on the Waddenzee mechanical cockle fishery clarified that Article 6 (3) of the Habitats Directive should be interpreted as meaning that any plan or project (other than those directly concerned with the management of the SAC) should be subject to Step 3 if under Step 2

"it cannot be excluded, on the basis of objective information, that it will not have a significant effect on that site, either individually or in combination with other plans or projects".

Further, if a plan or project

"*is likely to undermine the site's conservation objectives it must be considered likely to have a significant effect. The assessment of risk must be made in light of, amongst others, the characteristics and specific environmental conditions of the site concerned.*"

8.213 Under Step 3 there is an onus on demonstrating that there will be no adverse effect on integrity, in light of best scientific knowledge, and the 2004 ECJ ruling has clarified that the consenting authority can only consent a plan or project if it is confident that a plan or project will not adversely affect site integrity, that is, when there is no reasonable scientific doubt as to the absence of such effects.

8.214 In order to determine the implications for the interest protected within the Natura 2000 site, the steps referred to by Regulation 48 of the Habitats Regulations potentially extend to plans or projects outside the boundary of the site. Scottish Executive Circular No. 6/1995 (revised June 2000). makes clear that it is a proposal's potential effect on a Natura site's interest which is relevant, rather than its location with respect to the Natura site's boundary per se. Thus in this case, the assessment steps need to be considered for the Development, partly because there exists the potential for impact on Atlantic salmon, the qualifying interest of the SAC, from activities outside the SAC boundary.

8.215 Step 1. The Development is not directly connected with or necessary to conservation management of the SAC, and therefore the next step needs to be considered.

8.216 Step 2. The qualifying interest of the SAC, Atlantic salmon, otter, three species of lamprey and water crowfoot, are vulnerable to some of the potential hazards of the Development if there were an absence of effective management and control measures. However, integral to the proposal, as presented in the CMS, are design measures, control measures and management measures, including construction best practice, that are considered sufficient to reduce the potential for effect on Atlantic salmon to a not significant level.

8.217 The site's conservation objectives (relevant to both Steps 2 and 3 of an assessment) are designed to achieve the obligations set out in Article 6.2 of the Habitats Directive (which applies to SACs) by using the components of favourable conservation status for species as set out within Article 1(i) of the Habitats Directive. This approach is recommended by the EC in their Guidance on Managing Natura 2000 Sites, Section 2.3.2. The conservation objectives for the SAC are[36]:

"To avoid deterioration of the qualifying species [Atlantic salmon, otter, three species of lamprey and water crowfoot] thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and
To ensure for the qualifying species that the following are maintained in the long term:

- *Extent of the habitat on site;*
- *Distribution of the habitat within site;*
- *Structure and function of the habitat;*
- *Processes supporting the habitat;*
- *Distribution of typical species of the habitat;*
- *Viability of typical species as components of the habitat; and*
- *No significant disturbance of typical species of the habitat"*

8.218 The first of these objectives is considered to be met if the seven itemised objectives are met for the qualifying species, and hence these seven are considered to represent the objectives for the SAC.

8.219 Step 3. As recorded under Step 2, it is unlikely that the Development would give rise to a significant effect on the qualifying interest of the SAC. Accordingly, no Appropriate Assessment is required to be undertaken by a competent authority under the Conservation (Natural Habitats &c.) Regulations 1994.

8.220 The developer and consultee experience (SNH, SEPA and Marine Scotland) of the effectiveness of the proposed design measures, control measures and management measures, including construction best practice, on similar sites elsewhere, give sufficient confidence in the assessment undertaken to corroborate the finding that no Appropriate Assessment is required. Rather than omit this material from this ES on the basis that it is not considered necessary for an Appropriate Assessment to be undertaken, the material has been applied and is presented in **Technical Appendix 8.1**, as it would be considered in a three-stage Appropriate Assessment. Paragraphs 8.229 to 8.252 assess the Development's potential effects on site integrity, utilising evidence gathered from the Development Area and its environs, and with explicit reference to the relevant conservation objectives of the River Tweed SAC.

8.221 As a first action in this detailed consideration, however, it is necessary to establish the nature of the Atlantic salmon 'interest' of the SAC as this determines the scope of an assessment.

The River Tweed SAC Interest

8.222 The River Tweed SAC qualifies under Article 3 of the EC Habitats Directive for its population of an Annex 2 species of European interest, the Atlantic salmon, according to Stage 1.2.2 of the SAC selection guidelines.

8.223 Given that the site is designated for Atlantic salmon, the approach to Development design has been to include a comprehensive set of measures to avoid disturbance and safeguard the quality of water entering the SAC and therefore to ensure there are no significant effects on the interests of the SAC with regard to this species. In order to provide baseline data on current fish populations, electrofishing surveys were undertaken both within, the SAC as part of the EIA process. Surveys of fish and fish habitat at the SAC and its tributaries within the Development Area were undertaken and reported by the Tweed Foundation and presented in **Technical Appendix 5.5**. These surveys identified only a single Atlantic salmon Parr within Jed Water and watercourses adjacent to the Development Area, including in Black Burn, part of the SAC. The absence was suggested to be as a result of existing poor water quality due to acidification. Such surveys cannot be exhaustive however. It is known that there are Atlantic salmon in the River Tweed and lower reaches of the Jed Water[37], although other survey data are not available, and, given the suitable habitat for Atlantic salmon in places in upper reaches of the Jed Water within the Development Area, it should be assumed that the SAC interest could be present in these areas, especially if there were improved water quality conditions. It should also be assumed that water quality changes in tributaries of the SAC within the Development Area could lead to effects on the SAC interest downstream, although these may be lessened by dilution, dispersion and absorption or buffering.

8.224 The SNH site condition record[38], dated 2011, indicates that the SAC is in a condition categorised as "*Favourable Maintained".*

Assessment of Effects on Conservation Objectives

8.225 Potential effects on Atlantic salmon are:

- Physical loss of habitat or disturbance;
- Chemical pollution (including acidification) of watercourses, which may have a direct toxic effect on the Atlantic salmon, their food sources and habitats;
- Siltation of watercourses, via the generation of silt laden run-off. This may also have direct effects on Atlantic salmon, such as inhibiting of respiration through affecting gill function. Silt also affects the watercourse habitats, such as the infill of salmon redds spawning grounds. Siltation may also result in increased nutrient status, leading to the eutrophication of the aquatic protected species' habitat.

8.226 Given the SAC's designation for Atlantic salmon, the approach to Development design has been to include a comprehensive set of measures and buffers to avoid disturbance and safeguard the quality of water entering the SAC and therefore to ensure there are no significant effects on the interests of the SAC with regard to these species.

8.227 Aspects of construction of the Development with the potential to lead to effects on the SAC interest are:

[36] SNH (undated). Conservation Objectives for River Tweed Special Area of Conservation. Available from: https://gateway.snh.gov.uk/sitelink/documentview.jsp?p_pa_code=8369&p_Doc_Type_ID=29 [accessed on 13/04/2016].

[37] http://www.jedforest-angling.co.uk/.

[38] http://gateway.snh.gov.uk/sitelink/siteinfo.jsp?pa_code=8369

- Construction: Watercourse crossing installation (new and possible upgrade of existing crossings) upstream of the SAC designation (chemical pollution and siltation);
- Construction: The construction of access tracks, crane hardstandings, a meteorological mast, a substation/control compound and a construction compound within the SAC catchment (acidification and siltation);
- Construction: The construction of turbine foundations within the SAC catchment (chemical pollution, acidification and siltation);
- Construction: The opening, use and restoration of borrow pits within the SAC catchment (acidification and siltation);
- Construction (principally): Forestry activities within the SAC catchment (acidification and siltation); and
- Construction (principally): Accidental and fugitive spills of chemicals within the SAC catchment (chemical pollution).

8.228 The assessment of effects on the conservation objectives of the SAC are considered in paragraphs 8.229 to 8.252, against potential effects on the SAC interest from each aspect of the construction of the Development in turn.

Watercourse Crossings

8.229 It will be necessary to upgrade existing forestry track crossings to facilitate carriage of the length and weight of wind farm components. A design of watercourse crossings and control measures incorporated are described in the CMS, provided as **Technical Appendix 8.1**. This design and the measures it incorporates have been chosen to minimise the risk of disturbance to the watercourse bed, to minimise the risk of sedimentation caused by erosion of the banks of the watercourse and to minimise the risk of any fresh concrete entering the watercourse. The design and the incorporated control measures are based on construction best practice and the design team's experience of watercourse crossing construction. The adoption of this design including the control measures would mean that the magnitude and significance of resulting effects would be negligible.

8.230 Additionally, the short-term and localised nature of the construction of the crossings would lead to only local, short-term, reversible effects.

The Construction of Access Tracks, Crane Hardstandings, a Meteorological Mast, a Substation and a Construction Compound

8.231 Construction of the Development will require the following, within the Jed Water catchment:

- 5.5 km of new access track, including two new watercourse crossings;
- 13 sets of crane hardstandings;
- 2 temporary meteorological mast;
- 1 control building compound; and
- 2 temporary construction compounds.

8.232 Construction of these elements will involve disturbing the peat and/or mineral soil and placing of stone, and hence could have the potential to lead to acidification and sedimentation. The number of watercourse crossings has been minimised, and the distance between infrastructure and watercourses has been maximised, where possible within other design parameters for the Development. In addition, construction best practice measures set out in the CMS (provided as **Technical Appendix 8.1**) will be implemented and maintained, and this will be carried out under supervision of an ECoW, as set out in the CMS.

8.233 The adoption of this design including the control measures would mean that the magnitude and significance of resulting effects would be negligible.

8.234 Additionally, the short-term and localised nature of the construction of the crossings would lead to only local, short-term, reversible effects.

The Construction of Turbine Foundations

8.235 Construction of the Development will require the construction of 13 turbine foundations within the Jed Water catchment.

8.236 Construction of these elements will involve disturbing the peat and/or mineral soil and placing of fresh concrete and stone, and the temporary local storage of peat, and hence could have the potential to lead to chemical pollution, acidification and sedimentation. The distance between wind turbines and watercourses has been maximised, where possible within other design parameters for the Development. Turbines have been sited a minimum of 70 m from watercourses (with one being 65 m) and 100 m from the Jed Water (closest to Jed Water is Turbine 8 – 144 m). In addition, construction best practice measures set out in the CMS will be implemented and maintained, and this will be carried out under supervision of an ECoW, as set out in the CMS.

8.237 The adoption of this design including the control measures would mean that the magnitude and significance of resulting effects would be negligible.

The Opening, Use and Restoration of Borrow Pits

8.238 Construction of the Development will require the excavation of borrow pits on site. Five borrow pit search areas, three within the Jed Water catchment, and two within the catchment of Catlee Burn have been established. The precise requirements for site won material will be determined during detailed design, and it is considered possible at this stage that only 2/3 of the proposed borrow pits might be required.

8.239 Construction of these elements will involve disturbing the peaty soil and/or mineral soil and excavation of stone, and the temporary local storage of peaty soil, and hence could have the potential to lead to acidification and sedimentation. The distance between borrow pits and watercourses has been maximised, where possible within other design (including environmental) parameters for the Development. All new proposed borrow pits will be located least 70 m from a tributary of the Jed Water or Catlee Burn. In addition, construction best practice measures set out in the CMS, including specific measures for borrow pits, will be implemented and maintained, and this will be carried out under supervision of an ECoW, as set out in the CMS.

8.240 The adoption of this design including the control measures would mean that the magnitude and significance of resulting effects would be negligible.

Forestry Activities

8.241 Construction of the Development will require the felling of commercial forest within the Jed Water catchment during the construction phase, however this will be at a rate similar to the existing plans to fell forestry in the absence of the Development.

8.242 Felling will involve the movement of heavy machinery across a soft ground surface, and hence will result in soil disturbance which could have the potential to lead to acidification and sedimentation.

Forestry good practice measures are set out in the CMS, including specific measures for felling and for forestry activities within 100 m of a tributary of Jed Water. These measures will be implemented and maintained, and this will be carried out during the construction phase under supervision of an ECoW, whose role is described in the CMS.

8.243 The adoption of these measures would mean that the magnitude and significance of resulting effects would be negligible.

Accidental and Fugitive Spills of Chemicals

8.244 The transportation, storage and use of potentially polluting chemicals at a wind farm is limited. The greatest use of such chemicals is of fresh concrete, used in foundations and hardstandings, which will be transported onto site, within the SAC catchment.

8.245 Construction best practice control and management measures, relating to the transportation and storage of chemicals during all phases of the Development, including fresh concrete, and containment measures in the event of any incident, are set out in the CMS. These measures will be implemented and maintained, and this will be carried out during the construction phase under supervision of an ECoW, as set out in the CMS.

8.246 The adoption of these control and management measures would mean that the magnitude and significance of resulting effects would be negligible.

Combination Effects

8.247 As noted earlier (paragraph 8.207) it is necessary that the competent authority considers within the assessment steps the potential effect of the Development alone or "in combination" with other development projects.

8.248 As the greatest potential for effects exists during the construction phase of a wind farm, only proposed or consented but not constructed projects need be considered here. Other proposed large scale construction sites within the SAC catchment at the consented or application stage include:

- Birneyknowe Wind Farm - located in a separate hydrological catchment to the Development.
- Wauchope Wind Farm - The only proposed development that has potential to lead to combined effects. Currently only at the Scoping stage.

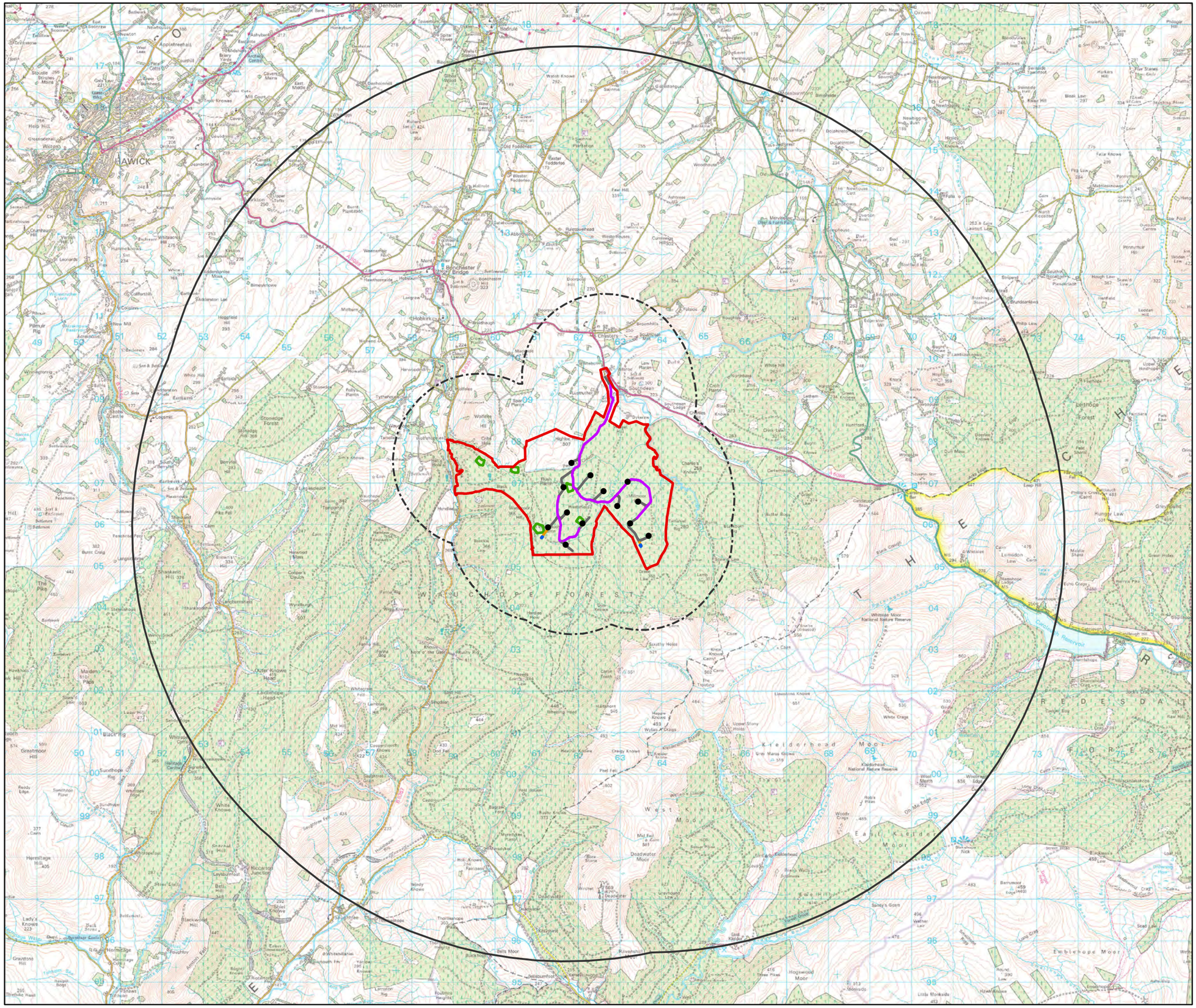
8.249 Measures proposed at Wauchope Wind Farm to protect water quality should be similar to those proposed for the Development. Potential effects from both sites have therefore been assessed as negligible in magnitude and significance, and local, short-term and reversible. This should be ensured by the fulfilment of the requirements of the Habitats Regulations prior to granting consent for Wauchope Wind Farm. It is therefore considered that there will be no 'in combination' effect on the SAC interest in the long term.

Overall Conclusion on Effects of the Development on the SAC Interest

8.250 The Development proposal includes several activities that have the potential to affect the SAC interest, Atlantic salmon. An examination of the main issues which may affect Atlantic salmon as a result of the Development led to the conclusion that the conservation objectives for the SAC would not be adversely impacted by the Development.

8.251 Fish surveys within and closely downstream of the Development, within the SAC catchment, identified the presence of one Atlantic salmon Fry. Given the single recording of a qualifying interest, careful planning of turbine locations, the distance of infrastructure from tributaries of the SAC and carefully designed control and management measures, including best practice, has resulted in effects being assessed as negligible. Therefore, none of the SAC's conservation objectives should be compromised by the Development alone or in combination with other developments.

8.252 Overall, therefore, it is reasonable to conclude that the Development will not have an adverse effect on the integrity of the SAC, either alone or in combination with other developments. On the contrary, it is considered possible that there would be a long term improvement in water quality, and therefore the SAC interest, if current levels of acidification are being caused by current and historic forestry practices. The restocking plans will introduce areas of open ground and replanting will be carried out in accordance with the latest forest guidance, and should improve the management of drainage at the site.



HIGHLEE WIND FARM

FIGURE 8.1

HYDROLOGY STUDY AREAS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Proposed Turbine Location
- Core Study Area
- Private Water Supply Study Area
- Wider Study Area
- New Track
- Upgraded Track
- Temporary Track
- Crane Hardstanding
- Permament Meteorological Mast Hardstanding
- Borrow Pit Search Area

LAYOUT DWG	T-LAYOUT NO.
FINAL	PCCCacc002

DRAWING NUMBER

2053/REP/012

SCALE - 1:90,000 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE WIND FARM

FIGURE 8.2

SOLID GEOLOGY

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Proposed Turbine Location
- Site Boundary
- New Track
- Upgraded Track
- Temporary Track
- Crane Hardstanding
- Permanent Meteorological Mast Hardstanding
- Borrow Pit Search Area

- Fault
- Basaltic-Andesite (TAS)
- Basanite, Nepheline
- Mudstone
- Sandstone and [Subequal/Subordinate] Argillaceous Rocks, Interbedded
- Sandstone, Siltstone and Dolomitic Limestone
- Wacke and Mudstone

LAYOUT DWG	T-LAYOUT NO.
FINAL	PCCCacc002

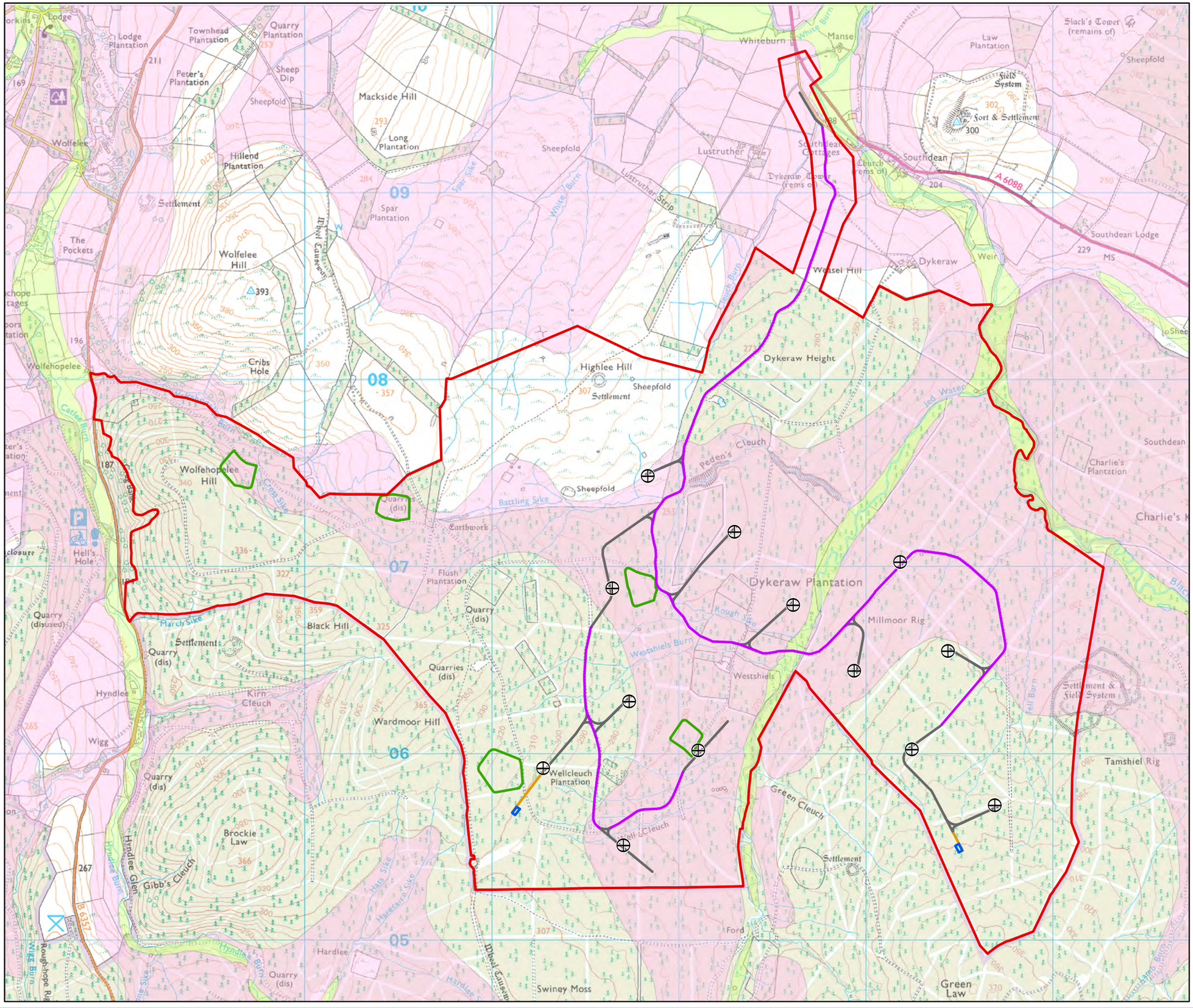
DRAWING NUMBER

2053/REP/013

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Proposed Turbine Location
- Site Boundary
- New Track
- Upgraded Track
- Temporary Track
- Crane Hardstanding
- Permament Meteorological Mast Hardstanding
- Borrow Pit Search Area
- Diamicton
- Silt, Sand and Gravel [Unlithified Deposits Coding Scheme]

HIGHLEE WIND FARM

FIGURE 8.3

SUPERFICIAL GEOLOGY

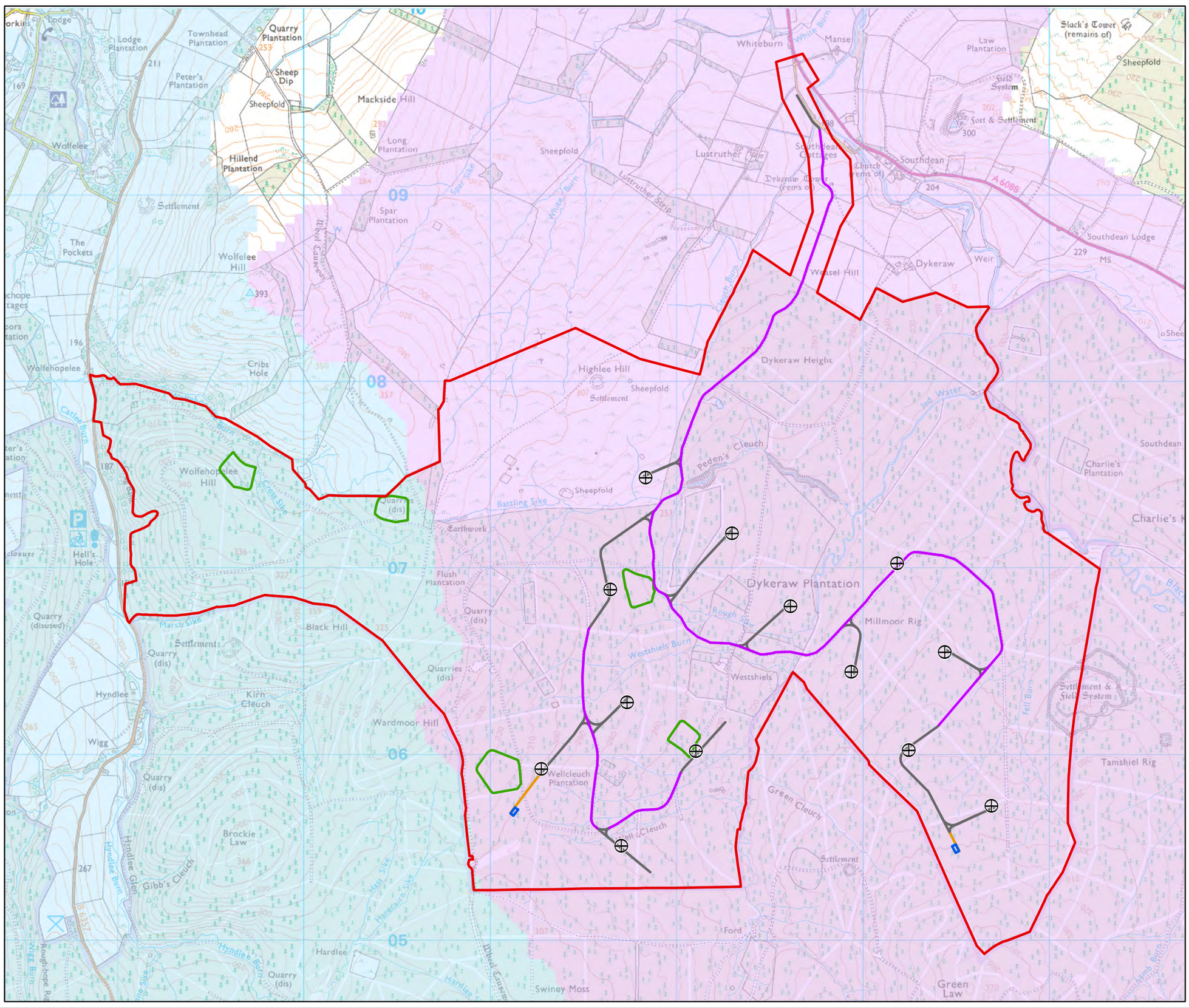
LAYOUT DWG	T-LAYOUT NO.
FINAL	PCCCacc002

DRAWING NUMBER: 2053/REP/014

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE WIND FARM

FIGURE 8.4

HYDROLOGICAL CATCHMENTS

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

- Proposed Turbine Location
- Site Boundary
- New Track
- Upgraded Track
- Temporary Track
- Crane Hardstanding
- Permament Meteorological Mast Hardstanding
- Borrow Pit Search Area
- Catlee Burn Catchment
- Jed Water Catchment

LAYOUT DWG	T-LAYOUT NO.
FINAL	PCCCacc002

DRAWING NUMBER

2053/REP/015

SCALE - 1:20,000 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

9 Noise

Introduction

9.1 This report contains an assessment of the acoustic impact of the proposed Highlee Hill Wind Farm. The report assesses wind farm operational noise and construction noise upon the most acoustically sensitive residential properties.

Statement of Authority

9.2 This assessment has been undertaken by RES, with at least one in-house Member of the Institute of Acoustics involved in its production. RES has undertaken acoustic impact assessments in every single one of its UK wind farm development applications since 2000. RES have also carried out noise assessments and reported to several local planning authorities on wind energy projects including taking measurements on newly constructed wind farms to ensure compliance with planning conditions.

9.3 Additionally, RES have been project co-ordinators for several Joule[1] projects, leading European research into wind turbine noise, were involved in producing the guideline 'The Assessment and Rating of Noise from Wind Farms'[2] for the DTI in 1996, acted as peer reviewer for the 'Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise'[3], and contributed to the RenewableUK work on Amplitude Modulation[4]. Publications include:

- 'An Investigation of Blade Swish from Wind Turbines', P Dunbabin, Proceedings of the 1996 International Congress on Noise Control Engineering (Internoise '96), 30 July – 2 August 1996, Book 1, pp 463 – 469;
- 'An Automated System for Wind Turbine Tonal Assessment', R Ruffle, Proceedings of the 1996 International Congress on Noise Control Engineering (Internoise '96), 30 July – 2 August 1996, Book 6, pp 2997 – 3002;
- 'Wind Turbine Measurements for Noise Source Identification', ETSU W/13/003914/00.REP, 1999, Dr P Dunbabin, RES et al;
- 'A Critical Appraisal of Wind Farm Noise Propagation', ETSU W/13/00385/REP, 2000 Dr J Bass, RES;
- 'Aerodynamic Noise Reduction for Variable Speed Turbines', ETSU/W/45/00504/REP, 2000, Dr P Dunbabin, RES;
- 'Fundamental research in amplitude modulation - a project by RenewableUK', Dr J Bass et al, Fourth International Meeting on Wind Turbine Noise, Rome, April 2011;
- 'Investigation of the 'Den Brook' Amplitude Modulation methodology for wind turbine noise', Dr J Bass, Acoustics Bulletin Vol 36 No 6 November/December 2011;
- 'How does noise influence the design of a wind farm?', Dr M Cassidy, Fifth International Conference on Wind Turbine Noise, Denver, 2013;
- 'Propagation of Noise from Wind Farms According to the Good Practice Guide', A Birchby, Sixth International Conference on Wind Turbine Noise, Glasgow, 2015; and
- 'Addressing the Issue of Amplitude Modulation', Dr M Cassidy, Sixth International Conference on Wind Turbine Noise, Glasgow, 2015.

Wind Turbine Noise

9.4 In the context of other sources of environmental noise, the noise levels produced by wind turbines are generally low and have greater dependence upon wind speed. The combination of these two factors implies that a degree of masking would often be provided by background noise.

9.5 As described by Scottish Government Planning Advice for Onshore Wind Turbines[5]:

"Technically, there are two quite distinct types of noise sources within a wind turbine - the mechanical noise produced by the gearbox, generator and other parts of the drive train; and the aerodynamic noise produced by the passage of the blades through the air. There has been significant reduction in the mechanical noise generated by wind turbines through improved turbine design".

Construction Noise

9.6 The sources of construction noise, which are temporary, will vary both in location and duration as the different elements of the wind farm are constructed and will arise primarily through the operation of large items of plant.

9.7 Noise will also arise due to the temporary increase in construction traffic near the site. This level also depends on the different elements of the wind farm being constructed.

Scope of Assessment

9.8 Noise can have an effect on the environment and on the quality of life enjoyed by individuals and communities. The effect of noise, both in the construction and operational phase, is therefore a material consideration in the determination of planning applications.

Operational Noise

9.9 The main focus of the acoustic impact assessment of operational noise presented here is based on the most relevant type of noise emission for modern wind turbines: aerodynamic noise, which is broadband in nature. Mechanical noise, which can be tonal in nature, is also considered albeit less relevant to modern wind turbines. Implicitly incorporated within this assessment is the normal character of the noise associated with wind turbines (commonly referred to as 'blade swish') and consideration of a range of noise frequencies, including low frequencies.

9.10 Low frequency content of the noise from wind farms shall be considered through the use of octave band specific noise emission and propagation modelling, however it is considered that specific and targeted assessment on low frequency content of noise emissions from the proposed wind farm is unjustified. Details for scoping out low frequency noise from the acoustic assessment, as well as infrasound, sleep disturbance, vibration, amplitude modulation and wind turbine syndrome can be found in **Technical Appendix 9.1**.

[1] DGXII European Commission funded projects in the field of Research and Technological Development in non-nuclear energy

[2] 'The Assessment and Rating of Noise from Wind Farms', The Working Group on Noise from Wind Turbines, ETSU Report for the DTI, ETSU-R-97

[3] 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise', Institute of Acoustics, May 2013

[4] 'Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effects', RenewableUK, 2013

[5] 'Onshore wind turbines', The Scottish Government, 2013, www.scotland.gov.uk

Construction Noise

9.11 The acoustic impact assessment of construction noise from the wind farm presented here is based on RES's experience of constructing wind farms and calculated for the operation of the primary large items of construction equipment. Additionally, consideration is given to the increased noise levels due to increased traffic flows during the construction phase to and from the site.

9.12 Whilst noise will also arise during decommissioning of the wind farm (through turbine deconstruction and breaking of the exposed part of the concrete bases) this is not discussed separately as noise levels resulting from it are expected to be lower than those from the construction activity.

Legislative Framework & Guidance

Operational Noise

9.13 Within Scotland, noise is defined within the planning context by 'Planning Advice Note 1/2011: Planning and Noise'[6]. This Planning Advice Note provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise. The Planning Advice Note 1/2011 states that:

"Good acoustical design and siting of turbines is essential to minimise the potential to generate noise."

9.14 Planning Advice Note 1/2011 refers to the use of the Department of Trade and Industry's 'The Assessment and Rating of Noise from Wind Farms' (ETSU-R-97), noting that further guidance is provided in the web based planning advice on renewable technologies for onshore wind turbines[5]. In relation to noise from wind farms the web-based renewables advice states:

"The Report, 'The Assessment and Rating of Noise from Wind Farms' describes a framework for the measurement of wind farm noise, which should be followed by applicants and consultees, and used by planning authorities to assess and rate noise from wind energy developments, until such time as an update is available."

9.15 It is therefore considered that the use of ETSU-R-97, as criteria for assessment of wind farm noise, fulfils the requirements of Planning Advice Note 1/2011.

9.16 The methodology described in ETSU-R-97 was developed by a working group comprised of a cross section of interested persons including, amongst others, environmental health officers, wind farm operators and independent acoustic experts.

9.17 The guidance makes it clear from the outset that any noise restrictions placed on a wind farm must balance the environmental impact of the wind farm against the national and global benefits that arise through the development of renewable energy resources. The principle of balancing development needs against protection of amenity may be considered common to any type of noise control guidance.

9.18 The basic aim of ETSU-R-97, in arriving at the recommendations contained within the report, is the intention to provide:

"Indicative noise levels thought to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."

9.19 ETSU-R-97 provides a robust basis for assessing the noise impact of a wind farm and has been applied at the vast majority of wind farms currently operating in the UK and is proposed as adequate for use in this assessment. Based on planning policy and guidance, as outlined above, a wind farm which can operate within the noise limits which have been derived according to ETSU-R-97 is considered to be acceptable. This approach has been agreed with Scottish Borders Council.

9.20 An article published in the Institute of Acoustics Bulletin (IoA Bulletin) Vol. 34 No. 2, March/April 2009[7], recommends a methodology for addressing issues not made explicit by, or outside the scope of, ETSU-R-97, such as in relation to wind shear or noise propagation modelling. Whilst this article does not represent formal legislation or guidance it was authored by a group of independent acousticians experienced in wind farm noise issues who have undertaken work on behalf of wind farm developers, local planning authorities and third parties and as such is a good indicator of best practice techniques. The assessment presented herein adopts the recommendations made within this article.

9.21 A Good Practice Guide (IoA GPG) to the application of ETSU-R-97 for the assessment and rating of wind turbine noise3, issued by the Institute of Acoustics in May 2013 and endorsed by the Department of Energy and Climate Change (DECC), Northern Ireland Executive, Scottish Executive and the Welsh Assembly Government, provides guidance on all aspects of the use of ETSU-R-97 and reaffirms the recommendations of the Acoustics Bulletin article with regard to propagation modelling and wind shear. The assessment presented herein adopts the recommendations of the Good Practice Guide.

9.22 Supplementary guidance notes were published by the Institute of Acoustics in July and September 2014, and these provide further details on specific areas of the IoA GPG[8]. The assessment presented herein adopts the recommendations made within these supplementary guidance notes.

Construction Noise

9.23 In the web based Scottish Government technical advice on construction noise assessment in 'Appendix 1: Legislative Background, Technical Standards and Codes of Practice'[9] it is stated that:

"However, under Environmental Impact Assessments and for planning purposes i.e. not in regard to the Control of Pollution Act 1974, the 2009 version of BS 5228 is applicable."

9.24 Given that BS 5228-1:2009 'Code of practice for noise and vibration control on construction and open sites - Part 1: Noise'[10] is identified as being suitable for the purpose of giving guidance on appropriate methods for minimising noise from construction activities, it is adopted herein.

9.25 The Control of Pollution Act 1974 provides information on the need for ensuring that the best practicable means are employed to minimise noise[11].

Consultation

9.26 Details of the consultation undertaken are outlined in Table 9.1.

[6] 'Planning Advice Note 1/2011: Planning and Noise', Scottish Government policy, March 2011

[7] 'Prediction and Assessment of Wind Turbine Noise', Bowdler et al, Acoustics Bulletin Vol 34 No 2 March/April 2009

[8] IoA GPG SGN, Institute of Acoustics, July & September 2014, http://www.ioa.org.uk/publications/good-practice-guide

[9] 'Appendix 1: Legislative Background, Technical Standards and Codes of Practice', Scottish Government, 2011, www.scotland.gov.uk

[10] 'Code of Practice for Noise and vibration control on construction and open sites - Part 1: Noise', British Standards Institution, BS 5228-1:2009

[11] 'Control of Pollution Act', Control of Pollution Act, published by Her Majesty's Stationary Office, 1974

Table 9.1: Acoustic Assessment Consultation

Consultees	Date of Consultation	Nature and Purpose of Consultation
Scottish Government, Energy Consents and Deployment Unit (ECDU)	6th December 2013	A scoping opinion request for the proposed Highlee Hill Wind Farm was sent to Scottish Government, Energy Consents and Deployment Unit (ECDU).
Scottish Government (ECDU)	27th December 2013	Response to scoping opinion request received from Scottish Government (ECDU) outlining required assessment methodology.
Scottish Borders Council	16th January 2014	Report 'Acoustic Assessment at the Proposed Highlee Hill Wind Farm' (ref. 02836-000469) sent to Scottish Borders Council Environmental Health Officer (EHO), to review methodology and locations for background noise survey.
Scottish Borders Council	16th January 2014	Email response from EHO reviewing the proposed acoustic assessment for Highlee Hill Wind Farm and agreement of background noise survey locations.
Scottish Borders Council	6th February 2014	Email to rearrange the date for the survey set up on 12/02/2014 at 10:00.
Scottish Borders Council	11th February 2014	Email from the EHO at Scottish Borders Council confirming their attendance at the Noise survey set up.
Scottish Borders Council	26th February 2014	Updated report 'Noise Surveys for the Acoustic Assessment at the Proposed Highlee Hill Wind Farm' (ref. 02836-000518) sent to EHO. This report provided details of actual survey locations after setting up the background noise survey.
Scottish Borders Council	26th February 2014	Email response from EHO confirming the receipt and acceptance of the report 'Noise Surveys for the Acoustic Assessment at the Proposed Highlee Hill Wind Farm'.
Scottish Borders Council	4th November 2015	A scoping opinion request for the proposed Highlee Hill Wind Farm was sent to Scottish Borders Council
Scottish Borders Council	8th December 2015	Response to scoping opinion request received from Scottish Borders Council outlining required assessment methodology.
Public	7th January 2016	Public Exhibition held at Southdean Hall, Chesters

Methodology

Operational Noise

9.27 To ensure adequate assessment of the potential impacts of the operational noise from the proposed wind farm the following steps have been taken, in accordance with relevant guidance detailed above:

- The baseline noise conditions at each of the nearest residential properties to the wind farm are established by way of representative background noise surveys;
- The noise levels incident at the nearest residential properties due to the operation of the wind farm are predicted using a sound propagation model considering: the locations of the wind turbines; the locations of the nearest, or most noise sensitive residential properties; the intervening terrain; and the likely noise emission characteristics of the wind turbines;
- With due regard to relevant guidance or regulations the acoustic assessment criteria are derived; and
- The evaluation of the acoustic impact is undertaken by comparing the predicted noise levels with the assessment criteria.

Establishing Baseline Conditions

9.28 Similar to other assessments of noise impacts (most notably BS 4142, 'The Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas' which ETSU-R-97 identifies as forming the basis of its recommendations), the ETSU-R-97 methodology requires the comparison of predicted noise levels due to turbine emissions (which vary with hub height wind speed) with noise limits based upon the noise levels already existing under those same conditions (i.e. the baseline conditions).

9.29 Since background noise levels depend upon wind speed, as indeed do wind turbine noise emissions, it is important when making reference measurements to put them in that context. Thus, the assessment of background noise levels at potentially sensitive residential properties requires the measurement of not only noise levels, but concurrent wind conditions, covering a representative range of wind speeds. These wind measurements are made at the wind turbine site rather than at the residential properties, since it is this wind speed that will subsequently govern the wind farm's noise generation. Often the residential properties themselves will be sheltered from the wind and may consequently have relatively low background noise levels.

9.30 To establish the baseline conditions, sound level meters and associated apparatus are set-up to record the required acoustic information at a selection of the most noise sensitive residential properties geographically spread around the proposed wind farm site and which are likely to be representative of other residential properties in the locale.

9.31 Wind speed and direction are recorded as 10 minute averages for the same period as for the noise measurements, and are synchronised with the acoustic data to allow correlations to be established. The wind speed that is adopted for use is the same wind speed as that which drives the turbine noise levels.

9.32 The adoption of this wind speed was presented as appropriate within the article published in the IoA Bulletin and the subsequent IoA GPG. The methodology used to calculate standardised 10 m wind speed is described in **Technical Appendix 9.2**.

9.33 Prior to establishing the baseline conditions the acoustic data is filtered as follows:

- For each background noise measurement location, the measured noise data is divided into two sets, as specified by ETSU-R-97 and shown in Table 9.2.

Table 9.2: Definition of Time of Day Periods

Time of Day	Definition
Quiet daytime	18:00 - 23:00 every day 13:00 - 18:00 Saturday 07:00 - 18:00 Sunday
Night-time	23:00 - 07:00 every day

- Rainfall affected data is systematically removed from the acoustic data set. To facilitate this, a rain gauge is deployed at site to record 10 minute rainfall data and identify potentially affected noise data. Both the 10 minute period containing the bucket tip and the preceding 10 minute period are removed from the dataset as recommended in the IoA GPG to account for the time it takes for the rain gauge tipping bucket to fill.

- Periods of measured background noise data thought to be affected by extraneous, i.e. non-typical, noise sources are identified and removed from the data set. Whilst some 'extraneous' data may actually be real, it tends to bias any trend lines upwards so its removal is adopted as a conservative measure.
- In practice this means close inspection of the measured background noise levels, comparison with concurrent data measured at nearby locations and consideration of both directional and temporal variation.

Modelling Noise Propagation

9.34 Whilst there are several sound propagation models available, the ISO 9613 Part 2 model has been used[12], this being identified as most appropriate for use in such rural sites[13]. The specific interpretation of the ISO 9613 Part 2 propagation methodology recommended in the aforementioned IoA Bulletin and the subsequent IoA GPG has been employed.

9.35 To make noise predictions it is assumed that:

- the turbines are identical;
- the turbines radiate noise at the power specified in this report;
- each turbine can be modelled as a point source at hub-height;
- each residential property is assigned a reference height to simulate the presence of an observer.

9.36 The sound propagation model takes account of attenuation due to geometric spreading and atmospheric absorption. The assumed temperature and relative humidity are 10 ˚C and 70 % respectively, as recommended in the IoA Bulletin and IoA GPG. Ground effects are also taken into account by the propagation model with a ground factor of 0.5 and a receiver height of 4 m used as recommended in the IoA Bulletin and IoA GPG.

9.37 The barrier attenuations predicted by ISO 9613 Part 2 have been shown to be significantly greater than those measured in practice under downwind conditions[13]. Therefore, barrier attenuation according to the ISO 9613 Part 2 method has been discounted. In lieu of this, where there is no direct line of sight between the residential property in question and any part of the wind turbine, 2 dB attenuation has been assumed as recommended in the IoA Bulletin and the IoA GPG.

9.38 Additionally, verification studies have also shown that ISO 9613 Part 2 tends to slightly underestimate noise levels at nearby dwellings in certain exceptional cases, notably in a valley type environment where the ground drops off between source and receiver. In these instances an addition of 3 dB(A) has been applied to the resulting overall A-weighted noise level as recommended by the IoA GPG. Further detail is provided in **Technical Appendix 9.3**.

9.39 To generate the ground cross sections between each turbine and each dwelling necessary for reliable propagation modelling, ground contours at 5 m intervals for the area of interest have been generated from 50 m grid resolution digital terrain data.

9.40 The predicted noise levels are calculated as L_{Aeq} noise levels and changed to the L_{A90} descriptor (to allow comparisons to be made) by subtraction of -2 dB, as specified by ETSU-R-97.

9.41 It has been shown by measurement based verification studies that the ISO 9613 Part 2 model tends to slightly overestimate noise levels at nearby dwellings[13]. Examples of additional conservatism modelled are:

- properties are assumed to be downwind of all noise sources simultaneously and at all times. In reality, this is not the case and additional attenuation would be expected when a property is upwind or crosswind of the proposed wind turbines;
- although, in reality, the ground is predominantly porous (acoustically absorptive) it has been modelled as 'mixed', i.e. a combination of hard and porous, corresponding to a ground absorption coefficient of 0.5 as recommended by the IoA Bulletin and IoA GPG;
- receiver heights are modelled at 4 m above local ground level, which equates roughly to first floor window level, as recommended by the IoA Bulletin and IoA GPG. This results in a predicted noise level anything up to 2 dB(A) higher than at the typical human ear height of 1.2-1.8 m;
- trees and other non-terrain shielding effects have not been considered;
- an allowance for measurement uncertainty has been included in the sound power levels for the presented turbine.

Significance Criteria

9.42 Noise is measured in decibels (dB) which is a measure of the sound pressure level, i.e. the magnitude of the pressure variations in the air. Measurements of environmental noise are usually made in dB(A) which includes a correction for the sensitivity of the human ear.

9.43 In accordance with the recommendations of ETSU-R-97, the acceptance of the proposed wind farm is established by comparing the noise levels produced by the combined operation of the wind turbines with appropriate noise limits at nearby residential properties.
Whilst ETSU-R-97 presents a comprehensive and detailed assessment methodology for wind farm noise, it also states a simplified methodology:
"if the noise is limited to an $L_{A90,10min}$ of 35 dB(A) up to wind speeds of 10 m/s at 10 m height, then these conditions alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary".

9.44 In the detailed methodology, ETSU-R-97 states that different limits should be applied during daytime and night-time periods. The daytime limits, derived from the background noise levels measured during quiet daytime periods, are intended to preserve outdoor amenity, while the night-time limits are intended to prevent sleep disturbance. The general principle is that the noise limits should be based on existing background noise levels, except for very low background noise levels, in which case a fixed limit may be applied. The suggested limits are given in Table 9.3, where L_B is the background $L_{A90,10min}$ and is a function of wind speed. During daytime periods and at low background noise levels, a lower fixed limit of 35–40 dB(A) is applicable. The exact value is dependent upon a number of factors: the number of nearby dwellings, the effect of the noise limits on energy produced, and the duration and level of exposure.

Table 9.3: Permissible Noise Level Criteria

Time of Day	Permissible Noise Level
Daytime	• 35-40 dB(A) for L_B less than 30-35 dB(A) • L_B + 5 dB, for L_B greater than 30-35 dB(A)
Night-time	• 43 dB(A) for L_B less than 38 dB(A) • L_B + 5 dB, for L_B greater than 38 dB(A)

[12] 'Acoustics - Attenuation of Sound During Propagation Outdoors, Part 2: General Method of Calculation', International Organisation for Standardisation, ISO 9613-2:1996

[13] 'A Critical Appraisal of Wind Farm Noise Propagation', ETSU Report W/13/00385/REP, 2000

9.45 Note that a higher noise level is permissible during the night than during the day as it is assumed that residents would be indoors. The night-time criterion is derived from sleep disturbance criterion referred to in ETSU-R-97, with an allowance of 10 dB for attenuation through an open window.

9.46 The wind speeds at which the acoustic impact is considered are less than or equal to 12 ms^{-1} at a height of 10 m and are likely to be the acoustically critical wind speeds. Above these wind speeds, as stated in ETSU-R-97, reliable measurements of background and turbine noise are difficult to make. However, if a wind farm meets the noise criteria at the wind speeds presented, it is most unlikely that it will cause any greater loss of amenity at higher wind speeds due to increasing background noise levels masking wind farm generated noise.

9.47 It is important to note that, since reactions to noise are subjective, it is not possible to guarantee that a given development will not result in any adverse comment with regard to noise as the response to any given noise will vary from person to person. Consequently, standards and guidance that relate to environmental noise are typically presented in terms of criteria that would be expected to be considered acceptable by the majority of the population.

Method for Construction Noise Assessment

9.48 To ensure adequate assessment of the potential impacts of the construction noise from the proposed wind farm the following steps have been taken:

- Baseline noise criteria are established from the appropriate guidance BS 5228-1:2009;
- Noise levels due to on-site construction activities are predicted at the most sensitive residential properties in accordance with the BS 5228-1:2009 standard;
- Predicted noise levels due to construction traffic at the same residential properties are made using the BS 5228-1:2009 standard;
- The combined effect of on-site construction activities with construction traffic is compared with the target level specified by BS 5228-1:2009.

Baseline Conditions

Operational Noise

9.49 The proposed Highlee Hill Wind Farm is located approximately 3.5 km south of Chesters, Scottish Borders. The surrounding area is predominantly rural in nature and used for grazing sheep and cattle with an A-class road running to the north and east of the site. The general noise character is typical of a rural environment with noise from farm machinery, sheep, cattle, and birds, with the occasional overhead aircraft.

9.50 Background noise measurements were undertaken at four residential property locations in accordance with ETSU-R-97 as detailed in Table 9.4. The duration of the surveys for H4 and H63 are 12 days longer due to the relocation of the noise apparatus due to evidence of watercourse noise after analysis of early data.

Table 9.4: Background Noise Survey Details

House ID	Measurement Period		
	Start	End	Duration (days)
H4	12/02/2014	09/04/2014	57
H21	12/02/2014	28/03/2014	45
H35	12/02/2014	28/03/2014	45
H63	12/02/2014	09/04/2014	57

9.51 The background noise monitoring equipment was housed in weather-proof enclosures, and powered by lead-acid batteries. The microphones are placed at a height of approximately 1.5 m above ground, and equipped with all-weather wind shields which also provide an element of water resistance.

9.52 The proprietary wind shields used are designed to reduce the effects of wind-generated noise at the microphone and accord with the recommendations of the IoA GPG in that they are the appropriate size and, in combination with the microphone, are certified by the manufacturer as meeting Type 1 / Class 1 precision standards.

9.53 Noise levels are monitored continuously, and summary statistics stored every 10 minutes in the internal memory of each meter. The relevant statistic measured is the $L_{A90,10min}$ (The A-weighted sound pressure level exceeded for 90 % of the 10 minute interval).

9.54 The sound level meters were placed away from reflecting walls and vegetation. Photos of the equipment, in situ, may be seen in **Technical Appendix 9.4**. The apparatus were calibrated before and after the survey period and the maximum drift detected was 0.2 dB, which is within the required range recommended in the IoA GPG. All instrumentation has been subject to laboratory calibration traceable to national standards within the last 24 months, as recommended in the IoA GPG. Details of the instrumentation used are provided in **Technical Appendix 9.4**.

9.55 **Chart 1 & Chart 2** in **Technical Appendix 9.5** show the measured wind roses at Highlee Hill over the background noise survey periods, as measured by the meteorological mast located on-site.

9.56 For illustrative purposes, **Technical Appendix 9.5 Chart 3** shows the measured wind rose over an extended period 27/07/2012 – 23/01/2015 from the meteorological mast located on the proposed wind farm site. As previously discussed, the noise prediction model employed is likely to overestimate the real noise immission levels for locations not downwind of the turbines. **Technical Appendix 9.5 Chart 3** therefore may aid the reader as to the likelihood of over-estimation due to this factor.

9.57 The noise data has been cross-referenced with rainfall data measured at the on-site met mast using a rain gauge. Any noise data identified as having been affected by rainfall has been removed from the analysis as shown in **Technical Appendix 9.5 Charts 4 to 11.**

9.58 Short-term periods of increased noise levels considered to be atypical have been removed from the dataset. The excluded data is shown in **Technical Appendix 9.5 Charts 4 to 11.**

9.59 It was identified during the background noise survey that there were influences of noise from nearby watercourses at both H4 and H63. Consequently the background noise monitoring equipment at both locations was relocated further from the watercourses on 11/03/2014 and all data prior to the relocation removed from the analysis. The excluded data is shown in **Technical Appendix 9.5 Charts 4, 7, 8 and 11.**

9.60 **Technical Appendix 9.5 Chart 4, Chart 5, Chart 6 and Chart 7** show $L_{A90,10min}$ correlated against wind speed for quiet daytime periods at each survey location. In each case, a 'best fit' line has been fitted to the data and the noise limits added. The equation of the regression polynomial has been provided in the charts.

9.61 **Technical Appendix 9.5 Chart 8, Chart 9, Chart 10 and Chart 11** show $L_{A90,10min}$ correlated against the wind speed for night-time periods at each survey location. In each case, a 'best fit' line has been

fitted to the data and the noise limits added. The equation of the regression polynomial has been provided in the charts.

9.62 Table 9.5 and Table 9.6 detail the $L_{A90,10min}$ background noise levels calculated from the derived 'best fit' lines, as described above:

Table 9.5: Quiet Daytime Noise Levels (dB(A) re 20 µPa)

House ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H4	32.3	32.8	33.3	34.0	34.7	35.5	36.4	37.4	38.5	39.7	41.1	41.1
H21	24.1	24.1	24.8	26.2	28.1	30.4	33.1	35.9	38.7	41.5	44.1	46.3
H35	28.2	28.2	28.5	29.3	30.8	32.6	34.8	37.2	39.8	42.5	45.1	47.7
H63	27.3	27.7	28.7	30.3	32.3	34.7	37.4	40.3	43.3	46.4	49.4	49.4

Table 9.6: Night-time Noise Levels (dB(A) re 20 µPa)

House ID	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H4	30.4	31.4	32.1	32.6	33.1	33.6	34.2	35.0	36.2	37.7	39.8	42.4
H21	23.8	23.8	24.1	25.2	26.9	29.1	31.6	34.3	37.1	39.9	42.5	44.7
H35	28.0	28.0	28.0	28.5	29.5	30.9	32.7	34.8	37.3	40.0	42.9	46.1
H63	24.9	25.8	26.7	27.9	29.2	30.9	32.9	35.3	38.3	41.8	46.0	51.0

Construction Noise

9.63 For the on-site construction noise assessment, Annex E of BS 5228-1:2009 provides guidance on setting environmental noise targets. Several methods of assessing the significance of noise levels are presented in Annex E and the most applicable to the construction of the proposed wind farm development is the ABC method. The ABC method sets threshold noise levels for specific periods based on the ambient noise levels.

Potential Impacts

Potential Operational Impacts

Noise Propagation Modelling

9.64 The locations of the proposed Highlee Hill Wind Farm turbines are provided in Table 9.7 and shown in Figure 9.1.

Table 9.7: Location of Proposed Turbines

Turbine	Co-ordinates		Elevation (m)
	X (m)	Y (m)	
T1	361706	605510	252
T2	361276	605923	298
T3	362105	606015	235
T4	361736	606280	278
T5	361647	606885	277
T6	361837	607484	264
T7	362300	607186	251
T8	362613	606794	219
T9	362941	606443	235
T10	363186	607023	233
T11	363442	606548	250
T12	363248	606022	268
T13	363692	605723	284

9.65 The locations of the nearest residential properties to the turbines have been determined by inspection of relevant maps and through site visits. More residential properties may have been identified but have not been considered critical to this acoustic assessment or may be adequately represented by another residential property. The locations considered are listed in Table 9.8 and are also shown in Figure 9.1.

9.66 The distances from each residential property to the nearest turbine are given in Table 9.8. It can be seen that the minimum house-to-turbine separation is 1,595 m.

Table 9.8: Location of Residential Properties and Distances to Nearest Proposed Turbine

House ID	Co-ordinates		Elevation (m)	Distance (m)	Nearest Turbine
	X (m)	Y (m)			

House ID	Co-ordinates		Elevation (m)	Distance (m)	Nearest Turbine
	X (m)	Y (m)			
H1	358581	605736	226	2701	T2
H2	358922	605900	221	2354	T2
H3	358930	605911	221	2346	T2
H4	359083	606332	205	2231	T2
H5	367191	607237	305	3812	T11
H6	357967	607618	223	3718	T2
H7	358848	608065	192	3038	T5
H8	357747	608142	185	4098	T5
H9	357747	608142	185	4098	T5
H11	356322	608304	191	5496	T2
H12	356272	608305	193	5542	T2
H14	356536	608325	177	5310	T5
H16	356592	608359	177	5266	T5
H17	358240	608360	196	3702	T6
H18	358074	608401	199	3873	T6
H19	364915	608404	234	2213	T10
H20	358224	608453	191	3741	T6
H21	363265	608616	223	1595	T10
H22	363203	608628	227	1605	T10
H23	364149	608789	231	2011	T10
H24	364052	608803	228	1979	T10
H25	357752	608921	166	4330	T6
H26	357888	609019	162	4237	T6
H29	363282	609076	197	2055	T10
H31	358820	609109	165	3427	T6
H32	358870	609122	174	3389	T6
H33	363078	609192	190	2111	T6
H35	362459	609209	210	1834	T6
H36	358927	609230	185	3394	T6
H37	362938	609237	188	2070	T6
H38	358936	609246	186	3394	T6
H40	358106	609511	162	4246	T6
H41	359098	609628	206	3478	T6
H42	359650	609696	255	3111	T6
H43	358440	609721	152	4067	T6
H44	356456	609723	254	5828	T6
H45	356597	609781	247	5721	T6
H46	362607	609796	183	2437	T6
H47	356540	609861	254	5806	T6
H48	358855	609891	170	3832	T6
H49	358572	609920	152	4074	T6
H50	358836	609955	168	3887	T6
H53	358687	610008	154	4036	T6
H55	358741	610048	159	4020	T6
H63	360336	610105	210	3020	T6
H65	358917	610110	177	3927	T6
H69	359205	610173	212	3763	T6
H71	359089	610247	202	3897	T6
H73	360074	610265	231	3293	T6
H74	357739	610304	201	4975	T6
H75	357329	610343	215	5338	T6
H76	357234	610455	223	5479	T6
H77	363424	610462	181	3374	T6
H78	362381	610534	203	3098	T6
H79	362328	610569	203	3124	T6
H80	359790	610594	221	3723	T6
H91	362673	610621	218	3246	T6
H96	358592	610637	147	4525	T6
H97	361743	610655	201	3172	T6
H101	361610	610664	206	3188	T6
H108	362356	610692	209	3250	T6
H109	361961	610711	204	3229	T6
H111	359308	610716	222	4104	T6
H114	362691	610749	229	3375	T6
H115	360774	610773	190	3457	T6
H117	363273	610815	263	3627	T6
H118	360934	610830	199	3466	T6
H120	358734	610837	144	4569	T6
H121	359408	610839	230	4142	T6
H130	361037	611028	198	3633	T6
H132	364371	611176	282	4319	T10
H135	364384	611288	286	4430	T10

9.67 Although not finalised, the candidate turbine type for the proposed Highlee Hill Wind Farm is the Vestas V117-3.3MW turbine. This report uses the acoustic data from the manufacturer's general

specification from this machine for all analysis[14]. The manufacturer has identified these values as warranted and comparison with the results of an independent test report suggests that some margin has already been incorporated. However, should the levels be tested it may be that the level of uncertainty in the test measurement would also need to be accounted for. Accordingly, as a conservative measure within the assessment presented here, a further 1 dB has been added to the warranted turbine noise levels to allow for this given that a typical uncertainty of 0.9 dB can be expected according to IEC 61400-11. Details used in this analysis are as follows:

- a hub height of 116.5 m for turbines T1 to T5 and T8 to T13;
- a hub height of 91.5 m for turbines T6 & T7
- a rotor diameter of 117.0 m;
- sound power levels, L_{WA}, for standardised 10 m height wind speeds (v_{10}) as shown in Table 9.9;
- octave band sound power level data, at the wind speeds where it is available, as shown in Table 9.10;
- tonal emission characteristics such that no clearly audible tones are present at any wind speed.

Table 9.9: A-Weighted Sound Power Levels (dB(A) re 1 pW) for the Vestas V117-3.3 MW Wind Turbine

Standardised 10 m Height Wind Speed,	Warranted 91.5 m hub height	Plus Uncertainty 91.5 m hub height	Warranted 116.5 m hub height	Plus Uncertainty 116.5 m hub height
1	93.6	94.6	94.0	95.0
2	93.6	94.6	94.0	95.0
3	93.6	94.6	94.0	95.0
4	97.8	98.8	98.5	99.5
5	102.7	103.7	103.4	104.4
6	106.6	107.6	107.2	108.2
7	108.3	109.3	108.3	109.3
8	108.3	109.3	108.3	109.3
9	108.3	109.3	108.3	109.3
10	108.3	109.3	108.3	109.3
11	108.3	109.3	108.3	109.3
12	108.3	109.3	108.3	109.3

Table 9.10: Octave Band A-Weighted Sound Power Levels (dB(A) re 1 pW) at Standardised 10 m Height Wind Speeds for the Vestas V117-3.3 MW Wind Turbine

Octave Band (Hz)	8 ms^{-1} 91.5 m hub height	8 ms^{-1} 116.5 m hub height
63	86.8	86.7
125	94.9	94.6
250	99.1	98.8
500	102.1	102.0
1000	104.1	104.3
2000	100.4	100.6
4000	93.5	93.3
8000	77.6	76.9
OVERALL	108.3	108.3

Predictions of Noise Levels at Residential Properties

9.68 Table 9.11 shows the predicted noise immission levels at the nearest residential properties at each wind speed considered, calculated from the operation of the proposed wind farm. The properties with the highest predicted noise immission level of 35.9 dB(A) are H21 and H22.

9.69 Figure 9.1 shows an isobel (i.e. noise contour) plot for the site at a 10 m height wind speed of 8 ms^{-1}. Such plots are useful for evaluating the noise 'footprint' of a given development.

[14] 'V117-3.3/3.45 MW Third Octaves according to General Specification', Vestas, Document ID: DMS 0049-4888_V01, 2015-09-02

Table 9.11: Predicted Noise Levels At Nearby Residential Properties, dB(A)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H1	12.5	12.5	12.5	17.0	21.9	25.7	26.9	26.9	26.9	26.9	26.9	26.9
H2	14.3	14.3	14.3	18.8	23.7	27.5	28.7	28.7	28.7	28.7	28.7	28.7
H3	14.4	14.4	14.4	18.8	23.7	27.5	28.7	28.7	28.7	28.7	28.7	28.7
H4	14.8	14.8	14.8	19.3	24.2	28.0	29.2	29.2	29.2	29.2	29.2	29.2
H5	12.3	12.3	12.3	16.8	21.7	25.5	26.7	26.7	26.7	26.7	26.7	26.7
H6	10.2	10.2	10.2	14.7	19.6	23.4	24.6	24.6	24.6	24.6	24.6	24.6
H7	12.2	12.2	12.2	16.6	21.5	25.4	26.6	26.6	26.6	26.6	26.6	26.6
H8	8.8	8.8	8.8	13.2	18.1	22.0	23.2	23.2	23.2	23.2	23.2	23.2
H9	8.8	8.8	8.8	13.2	18.1	22.0	23.2	23.2	23.2	23.2	23.2	23.2
H11	6.1	6.1	6.1	10.6	15.5	19.3	20.5	20.5	20.5	20.5	20.5	20.5
H12	6.2	6.2	6.2	10.7	15.6	19.4	20.6	20.6	20.6	20.6	20.6	20.6
H14	6.6	6.6	6.6	11.0	15.9	19.7	21.0	21.0	21.0	21.0	21.0	21.0
H16	6.7	6.7	6.7	11.1	16.0	19.8	21.1	21.1	21.1	21.1	21.1	21.1
H17	10.2	10.2	10.2	14.7	19.6	23.4	24.6	24.6	24.6	24.6	24.6	24.6
H18	9.7	9.7	9.7	14.2	19.1	22.9	24.1	24.1	24.1	24.1	24.1	24.1
H19	18.3	18.3	18.3	22.8	27.7	31.5	32.7	32.7	32.7	32.7	32.7	32.7
H20	10.3	10.3	10.3	14.7	19.6	23.5	24.7	24.7	24.7	24.7	24.7	24.7
H21	21.5	21.5	21.5	25.9	30.8	34.6	35.9	35.9	35.9	35.9	35.9	35.9
H22	21.5	21.5	21.5	25.9	30.8	34.7	35.9	35.9	35.9	35.9	35.9	35.9
H23	19.0	19.0	19.0	23.4	28.3	32.1	33.3	33.3	33.3	33.3	33.3	33.3
H24	18.8	18.8	18.8	23.3	28.2	32.0	33.2	33.2	33.2	33.2	33.2	33.2
H25	8.3	8.3	8.3	12.8	17.7	21.5	22.7	22.7	22.7	22.7	22.7	22.7
H26	8.1	8.1	8.1	12.5	17.4	21.3	22.5	22.5	22.5	22.5	22.5	22.5
H29	18.9	18.9	18.9	23.4	28.3	32.1	33.4	33.4	33.4	33.4	33.4	33.4
H31	10.4	10.4	10.4	14.8	19.7	23.5	24.8	24.8	24.8	24.8	24.8	24.8
H32	10.5	10.5	10.5	14.9	19.8	23.6	24.9	24.9	24.9	24.9	24.9	24.9
H33	18.6	18.6	18.6	23.0	27.9	31.7	33.0	33.0	33.0	33.0	33.0	33.0
H35	19.1	19.1	19.1	23.5	28.4	32.3	33.6	33.6	33.6	33.6	33.6	33.6
H36	10.4	10.4	10.4	14.9	19.8	23.6	24.8	24.8	24.8	24.8	24.8	24.8
H37	18.4	18.4	18.4	22.8	27.7	31.5	32.8	32.8	32.8	32.8	32.8	32.8
H38	10.4	10.4	10.4	14.8	19.7	23.6	24.8	24.8	24.8	24.8	24.8	24.8
H40	8.2	8.2	8.2	12.6	17.5	21.3	22.6	22.6	22.6	22.6	22.6	22.6
H41	9.9	9.9	9.9	14.3	19.2	23.0	24.3	24.3	24.3	24.3	24.3	24.3
H42	12.5	12.5	12.5	16.9	21.8	25.6	26.9	26.9	26.9	26.9	26.9	26.9
H43	8.4	8.4	8.4	12.8	17.7	21.5	22.8	22.8	22.8	22.8	22.8	22.8
H44	6.4	6.4	6.4	10.8	15.7	19.5	20.8	20.8	20.8	20.8	20.8	20.8
H45	6.5	6.5	6.5	10.9	15.8	19.6	20.9	20.9	20.9	20.9	20.9	20.9

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H46	16.2	16.2	16.2	20.6	25.5	29.4	30.7	30.7	30.7	30.7	30.7	30.7
H47	6.5	6.5	6.5	10.9	15.8	19.6	20.9	20.9	20.9	20.9	20.9	20.9
H48	8.8	8.8	8.8	13.2	18.1	22.0	23.2	23.2	23.2	23.2	23.2	23.2
H49	8.2	8.2	8.2	12.6	17.5	21.3	22.6	22.6	22.6	22.6	22.6	22.6
H50	8.6	8.6	8.6	13.1	18.0	21.8	23.1	23.1	23.1	23.1	23.1	23.1
H53	8.2	8.2	8.2	12.7	17.6	21.4	22.6	22.6	22.6	22.6	22.6	22.6
H55	8.3	8.3	8.3	12.7	17.6	21.4	22.7	22.7	22.7	22.7	22.7	22.7
H63	11.3	11.3	11.3	15.7	20.6	24.4	25.7	25.7	25.7	25.7	25.7	25.7
H65	8.5	8.5	8.5	12.9	17.8	21.6	22.9	22.9	22.9	22.9	22.9	22.9
H69	8.9	8.9	8.9	13.3	18.2	22.1	23.3	23.3	23.3	23.3	23.3	23.3
H71	8.5	8.5	8.5	13.0	17.9	21.7	22.9	22.9	22.9	22.9	22.9	22.9
H73	10.2	10.2	10.2	14.7	19.6	23.4	24.7	24.7	24.7	24.7	24.7	24.7
H74	6.2	6.2	6.2	10.7	15.6	19.4	20.6	20.6	20.6	20.6	20.6	20.6
H75	6.6	6.6	6.6	11.0	15.9	19.7	21.0	21.0	21.0	21.0	21.0	21.0
H76	6.2	6.2	6.2	10.6	15.5	19.4	20.7	20.7	20.7	20.7	20.7	20.7
H77	12.7	12.7	12.7	17.1	22.0	25.8	27.1	27.1	27.1	27.1	27.1	27.1
H78	13.4	13.4	13.4	17.8	22.7	26.6	27.8	27.8	27.8	27.8	27.8	27.8
H79	13.3	13.3	13.3	17.7	22.6	26.4	27.7	27.7	27.7	27.7	27.7	27.7
H80	9.6	9.6	9.6	14.0	18.9	22.7	24.0	24.0	24.0	24.0	24.0	24.0
H91	13.3	13.3	13.3	17.7	22.6	26.4	27.7	27.7	27.7	27.7	27.7	27.7
H96	6.8	6.8	6.8	11.3	16.2	20.0	21.2	21.2	21.2	21.2	21.2	21.2
H97	12.9	12.9	12.9	17.3	22.2	26.0	27.3	27.3	27.3	27.3	27.3	27.3
H101	12.8	12.8	12.8	17.2	22.1	25.9	27.2	27.2	27.2	27.2	27.2	27.2
H108	12.9	12.9	12.9	17.3	22.2	26.0	27.3	27.3	27.3	27.3	27.3	27.3
H109	12.8	12.8	12.8	17.2	22.1	25.9	27.2	27.2	27.2	27.2	27.2	27.2
H111	9.0	9.0	9.0	13.4	18.3	22.1	23.4	23.4	23.4	23.4	23.4	23.4
H114	13.3	13.3	13.3	17.8	22.7	26.5	27.7	27.7	27.7	27.7	27.7	27.7
H115	9.7	9.7	9.7	14.2	19.1	22.9	24.2	24.2	24.2	24.2	24.2	24.2
H117	14.9	14.9	14.9	19.3	24.2	28.0	29.3	29.3	29.3	29.3	29.3	29.3
H118	9.7	9.7	9.7	14.2	19.1	22.9	24.2	24.2	24.2	24.2	24.2	24.2
H120	6.7	6.7	6.7	11.1	16.0	19.8	21.1	21.1	21.1	21.1	21.1	21.1
H121	9.4	9.4	9.4	13.8	18.7	22.5	23.8	23.8	23.8	23.8	23.8	23.8
H130	11.3	11.3	11.3	15.7	20.6	24.4	25.7	25.7	25.7	25.7	25.7	25.7
H132	13.0	13.0	13.0	17.5	22.4	26.2	27.4	27.4	27.4	27.4	27.4	27.4
H135	12.7	12.7	12.7	17.2	22.1	25.9	27.1	27.1	27.1	27.1	27.1	27.1

9.70 Noise levels at 70 of the 72 nearest residential properties are below 35 dB(A), indicating that the noise immission levels would be regarded as acceptable and the residents amenity as receiving 'sufficient protection' without further assessment requiring to be undertaken.

9.71 There are only two properties that have predicted noise levels greater than this simplified noise criteria as indicated in Table 9.11. Therefore the 'full' acoustic assessment need only be considered at these. However, as background noise measurements were carried out at H4, H35, and H63, as agreed with the local authority, these properties have also been considered in the full acoustic assessment so as to provide a more comprehensive description of the acoustic impact of the proposed wind farm.

Acoustic Acceptance Criteria

9.72 As stated previously, during daytime periods and at low background noise levels, a lower fixed limit of 35-40 dB(A) is applicable with the exact value dependent upon a number of factors: the number of noise affected residential properties; the potential impact on the power output of the wind farm and the likely duration and level of exposure. Through consideration of these factors RES have adopted a 35.0 dB(A) level. The resulting criteria are shown in Table 9.12.

Table 9.12: Permissible Noise Level Criteria in Vicinity of Proposed Highlee Hill Wind Farm

Time of Day	Permissible Noise Level
Daytime	• 35.0 dB(A) for L_B less than 30.0 dB(A) • L_B + 5 dB, for L_B greater than 30.0 dB(A)
Night-time	• 43.0 dB(A) for L_B less than 38.0 dB(A) • L_B + 5 dB, for L_B greater than 38.0 dB(A)

Calculation of Acceptable Noise Limits from Baseline Conditions

9.73 The 'best-fit' lines of **Technical Appendix 9.5 Chart 4, Chart 5, Chart 6, Chart 7, Chart 8, Chart 9, Chart 10 and Chart 11** have been used to calculate the acceptable noise limits at the background noise measurement locations. Table 9.13 shows the daytime noise limits and Table 9.14 the night time noise limits.

Table 9.13: Recommended Daytime Noise Limits (dB(A) re 20 µPa)

House Name	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H4	37.3	37.8	38.3	39.0	39.7	40.5	41.4	42.4	43.5	44.7	46.1	46.1
H21	35.0	35.0	35.0	35.0	35.0	35.4	38.1	40.9	43.7	46.5	49.1	51.3
H35	35.0	35.0	35.0	35.0	35.8	37.6	39.8	42.2	44.8	47.5	50.1	52.7
H63	35.0	35.0	35.0	35.3	37.3	39.7	42.4	45.3	48.3	51.4	54.4	54.4

Table 9.14: Recommended Night-time Noise Limits (dB(A) re 20 µPa)

House Name	Standardised 10 m Wind Speed (ms^{-1})											
	1	2	3	4	5	6	7	8	9	10	11	12
H4	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.8	47.4
H21	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	44.9	47.5	49.7
H35	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	45.0	47.9	51.1
H63	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.3	46.8	51.0	56.0

9.74 The recommendations of ETSU-R-97 state that where there are groups of properties that are likely to have a similar background noise environment, it is appropriate to use data from one representative location as the basis for assessment at the other properties. The survey results inferred to be representative for each property is shown in Table 9.15. The specific choice of noise survey chosen has been made considering the distance to the nearest survey location and the likelihood of experiencing a broadly similar exposure as the survey. It is noted that the surveys at H4 and H63 have only been used at these properties due to the influence of the nearby watercourses potentially not being representative of other properties.

Table 9.15: Assumed Representative Background Noise Survey Locations

House ID	Survey Location
H1	H21
H2	H21
H3	H21
H4	H4
H5	H21
H6	H21
H7	H21
H8	H21
H9	H21
H11	H21
H12	H21
H14	H21
H16	H21
H17	H21
H18	H21
H19	H21
H20	H21
H21	H21
H22	H21
H23	H21
H24	H21
H25	H21
H26	H21
H29	H21
H31	H21
H32	H21
H33	H35
H35	H35
H36	H21
H37	H35
H38	H21
H40	H21
H41	H21
H42	H21
H43	H21
H44	H21
H45	H21
H46	H21
H47	H21
H48	H21
H49	H21
H50	H21
H53	H21
H55	H21
H63	H63
H65	H21
H69	H21
H71	H21
H73	H21
H74	H21
H75	H21
H76	H21
H77	H35
H78	H35
H79	H35
H80	H21
H91	H35
H96	H21
H97	H21
H101	H21
H108	H35
H109	H35
H111	H21
H114	H35
H115	H21
H117	H35
H118	H21
H120	H21
H121	H21
H130	H21
H132	H35
H135	H35

9.75 As recommended in ETSU-R-97, the absolute lower noise limits may be increased up to 45 dB(A) if the occupant has a financial involvement in the wind farm. However, whilst some of the nearby properties may qualify for such an increase, these limits have not been adopted in the presented results.

Acoustic Assessment

9.76 Table 9.16 shows a comparison of the predicted noise levels with the recommended daytime noise limits for each residential property where the full assessment procedure is being applied. The predicted noise levels at 1 ms^{-1} and 2 ms^{-1} have been assumed as equal to 3 ms^{-1} as a conservative measure as noise levels at these wind speeds would typically be less. The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit. A negative value indicates that the predicted noise level is within the limit. Table 9.17 shows a comparison with the recommended night-time noise limits.

9.77 Noise levels at all locations are within both the daytime and night-time noise limits at all wind speeds considered. The minimum margin of predicted noise levels below the daytime noise limits is -0.7 dB(A). The minimum margin during night-time periods is -7.1 dB(A).

Table 9.16: Comparison of Predicted Noise Levels and Daytime Noise Limits - (dB(A) re 20 µPa)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H4	14.8	37.3	-22.5	14.8	37.8	-23.0	14.8	38.3	-23.5	19.3	39.0	-19.7
H21	21.5	35.0	-13.5	21.5	35.0	-13.5	21.5	35.0	-13.5	25.9	35.0	-9.1
H22	21.5	35.0	-13.5	21.5	35.0	-13.5	21.5	35.0	-13.5	25.9	35.0	-9.1
H35	19.1	35.0	-15.9	19.1	35.0	-15.9	19.1	35.0	-15.9	23.5	35.0	-11.5
H63	11.3	35.0	-23.7	11.3	35.0	-23.7	11.3	35.0	-23.7	15.7	35.3	-19.6

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H4	24.2	39.7	-15.5	28.0	40.5	-12.5	29.2	41.4	-12.2	29.2	42.4	-13.2
H21	30.8	35.0	-4.2	34.6	35.4	-0.8	35.9	38.1	-2.2	35.9	40.9	-5.0
H22	30.8	35.0	-4.2	34.7	35.4	-0.7	35.9	38.1	-2.2	35.9	40.9	-5.0
H35	28.4	35.8	-7.4	32.3	37.6	-5.3	33.6	39.8	-6.2	33.6	42.2	-8.6
H63	20.6	37.3	-16.7	24.4	39.7	-15.3	25.7	42.4	-16.7	25.7	45.3	-19.6

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H4	29.2	43.5	-14.3	29.2	44.7	-15.5	29.2	46.1	-16.9	29.2	46.1	-16.9
H21	35.9	43.7	-7.8	35.9	46.5	-10.6	35.9	49.1	-13.2	35.9	51.3	-15.4
H22	35.9	43.7	-7.8	35.9	46.5	-10.6	35.9	49.1	-13.2	35.9	51.3	-15.4
H35	33.6	44.8	-11.2	33.6	47.5	-13.9	33.6	50.1	-16.5	33.6	52.7	-19.1
H63	25.7	48.3	-22.6	25.68	51.4	-25.7	25.68	54.4	-28.7	25.68	54.4	-28.7

The term L_p is used to denote the predicted noise level due to the operation of the proposed wind farm
The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit

Table 9.17: Comparison of Predicted Noise Levels and Night Time Limits - (dB(A) re 20 µPa)

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})

	1			2			3			4		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H4	14.8	43.0	-28.2	14.8	43.0	-28.2	14.8	43.0	-28.2	19.3	43.0	-23.7
H21	21.5	43.0	-21.5	21.5	43.0	-21.5	21.5	43.0	-21.5	25.9	43.0	-17.1
H22	21.5	43.0	-21.5	21.5	43.0	-21.5	21.5	43.0	-21.5	25.9	43.0	-17.1
H35	19.1	43.0	-23.9	19.1	43.0	-23.9	19.1	43.0	-23.9	23.5	43.0	-19.5
H63	11.3	35.0	-23.7	11.3	35.0	-23.7	11.3	35.0	-23.7	15.7	35.3	-19.6

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	5			6			7			8		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H4	24.2	43.0	-18.8	28.0	43.0	-15.0	29.2	43.0	-13.8	29.2	43.0	-13.8
H21	30.8	43.0	-12.2	34.6	43.0	-8.4	35.9	43.0	-7.1	35.9	43.0	-7.1
H22	30.8	43.0	-12.2	34.7	43.0	-8.3	35.9	43.0	-7.1	35.9	43.0	-7.1
H35	28.4	43.0	-14.6	32.3	43.0	-10.7	33.6	43.0	-9.4	33.6	43.0	-9.4
H63	20.6	37.3	-16.7	24.4	39.7	-15.3	25.7	42.4	-16.7	25.7	45.3	-19.6

House ID	Reference Wind Speed, Standardised v_{10} (ms^{-1})											
	9			10			11			12		
	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL	L_p	Limit	ΔL
H4	29.2	43.0	-13.8	29.2	43.0	-13.8	29.2	44.8	-15.6	29.2	47.4	-18.2
H21	35.9	43.0	-7.1	35.9	44.9	-9.0	35.9	47.5	-11.6	35.9	49.7	-13.8
H22	35.9	43.0	-7.1	35.9	44.9	-9.0	35.9	47.5	-11.6	35.9	49.7	-13.8
H35	33.6	43.0	-9.4	33.6	45.0	-11.4	33.6	47.9	-14.3	33.6	51.1	-17.5
H63	25.7	48.3	-22.6	25.68	51.4	-25.7	25.68	54.4	-28.7	25.68	54.4	-28.7

The term L_p is used to denote the predicted noise level due to the operation of the proposed wind farm
The term ΔL is used to denote the difference between the predicted wind farm noise level and the recommended limit

Potential Construction Impacts

Construction Noise Assessment

9.78 Primary activities for which noise arises during the construction period are upgrading site tracks, constructing new site tracks and constructing the temporary site compound. Noise from vehicles on local roads and access tracks will also arise due to the delivery of turbine components and construction materials, notably aggregates, concrete and steel reinforcement.

9.79 It should be noted that the exact methodology and timing of construction activities cannot be predicted at this time, this assessment is therefore based on assumptions representing a worst-case approach.

Construction Noise Predictions

9.80 The plant assumed for each construction activity is shown in Table 9.18. The number of items indicates how many of each plant are required for the specified activity, and the duration of activity is a percentage of a given 12 hour day period needed for that plant to operate. Overall sound power levels are based upon the data in Annex C of BS 5228-1:2009.

Table 9.18: Construction Phases and Sound Power Levels

Activities	Plant	Sound Power (L_{WA})	No. Items	Activity Duration (%)	Effective Sound Power (L_{WA})
Construction site compound	Tracked excavator	113	2	100	120
	Dump truck	113	2	100	
	Tipper lorry	107	4	50	
	Vibratory roller	102	1	75	
	Lorry	108	1	75	
Construct Temporary site compound	Tracked excavator	113	2	100	119
	Dump truck	113	2	100	
	Tipper lorry	107	2	50	
	Vibratory roller	102	1	75	
	Lorry	108	1	75	
Construct site tracks	Tracked excavator	113	3	100	122
	Dump truck	113	2	75	
	Tipper lorry	107	4	50	
	Dozer	109	1	100	
	Vibratory roller	102	1	75	
	Excavator mounted rock breaker	121	1	50	
Upgraded Site Track	Tracked excavator	113	3	100	120
	Dump Truck	113	2	75	
	Tipper lorry	107	4	50	
	Dozer	109	1	100	
	Vibratory roller	102	1	75	
Construct Substations	Tracked excavator	113	1	100	115
	Concrete mixer truck	108	2	50	
	Lorry	108	1	50	
	Telescopic Handler	99	1	100	
Construct crane hardstandings	Tracked excavator	113	3	100	121
	Dump truck	113	3	100	
	Tipper lorry	107	4	50	
	Vibratory roller	102	1	50	
Construct Turbine Foundations	Tracked excavator	113	2	75	123
	Dump truck	113	2	75	
	Concrete mixer truck	108	5	50	
	Mobile telescopic	110	1	50	

Activities	Plant	Sound Power (L_{WA})	No. Items	Activity Duration (%)	Effective Sound Power (L_{WA})
	Concrete pump	106	2	50	
	Water pump	93	1	100	
	Hand-held pneumatic	111	1	75	
	Compressor	103	3	50	
	Piling Rig	117	1	100	
	Poker vibrator	106	4	50	
	Excavator mounted rock breaker	121	1	50	
Excavate and Lay Site Cables	Tracked excavator	113	2	100	122
	Dump truck	113	2	75	
	Tractor (Towing Equipment)	108	1	75	
	Tractor (Towing Trailer)	107	1	75	
	Vibratory plate	108	1	50	
	Excavator mounted rock breaker	121	1	50	
Erect Turbine	Mobile telescopic	110	3	75	119
	Lorry	108	1	75	
	Diesel generator	102	1	100	
	Torque guns	111	4	100	
Reinstate Crane Bases	Tracked excavator	113	1	75	116
	Dump truck	113	2	75	
Reinstate Road Verges	Tracked excavator	113	1	75	115
	Dump truck	113	1	75	
Lay Cable to Substations	Wheeled loader	108	1	100	117
	Saw	114	1	50	
	Hand-held pneumatic	111	1	50	
	Dump truck	113	1	75	
	Tipper lorry	107	1	50	
	Vibratory plate	108	1	75	
	Tandem roller	102	1	75	
	Tractor (Towing Trailer)	107	1	50	
	Lorry	108	1	75	
Forestry Felling	Saw	114	1	100	116
	Harvester	108	2	100	
Borrow Pits	Excavator mounted rock breaker	121	1	100	126
Construct New Water Crossing	Dump truck	113	2	75	120
	Dozer	109	1	100	
	Tracked semi-mobile	124	1	100	
	Tracked excavator	113	1	100	
	Tracked Excavator	113	1	100	
	Dump Truck	113	1	100	
	Tipper lorry	107	4	50	
	Dozer	109	1	75	
	Vibratory Roller	102	1	75	
	Telescopic Handler	99	1	100	
	Piling Rig	117	1	50	
	Concrete Pump	106	1	50	
	Concrete mixer truck	108	3	50	
	Poker vibrator	106	2	50	
	Water pump	93	2	100	

9.81 Predictions of construction noise levels have been carried out using the methods prescribed in Annex F of BS 5228-1:2009[15]. The worst case scenario, where each construction activity takes place at the nearest proposed location to the residential property being assessed, is considered. The locations of the construction activities are taken from the infrastructure drawing. The results of these predictions, made at 10 representative critical residential properties to the proposed wind farm, are shown in Table 9.19.

9.82 In all cases average noise levels over the construction period will be lower as the worst case is presented for when the activities are closest to the residential property.

Table 9.19: Predicted Sound Pressure Level due to Construction Noise (dB L_{Aeq})

Activity	H4	H19	H22	H24	H29	H33	H35	H37	H46	H63
Construction Site Compound	36.9	36.0	40.4	37.6	38.6	38.6	39.3	38.7	37.1	35.1
Construct Temporary site compound	32.3	39.6	51.5	44.9	54.7	60.4	57.4	66.1	51.3	37.9
Upgrade Site Tracks	39.6	41.7	55.9	45.2	56.3	55.1	59.1	67.2	56.1	40.1
Construct site tracks	42.5	42.0	45.8	42.1	43.7	60.9	61.3	65.9	66.0	42.1
Construct Substations	32.0	31.4	35.9	33.0	34.0	34.0	34.7	34.1	32.4	30.3
Construct crane hard-standings	41.2	41.2	44.4	42.3	42.0	41.7	43.1	41.9	40.3	38.2
Construct Turbine Foundations	43.6	43.6	46.8	44.7	44.4	44.1	45.5	44.3	42.7	40.6
Excavate and Lay Site Cables	41.7	41.7	44.9	42.8	42.5	42.2	43.6	42.4	40.8	38.7
Erect Turbine	39.2	39.2	42.4	40.3	40.0	39.7	41.1	39.9	38.3	36.2

[15] A 50% mixed ground attenuation has been used throughout to conservatively account for the arable nature of ground conditions at Highlee Hill

Activity	H4	H19	H22	H24	H29	H33	H35	H37	H46	H63
Reinstate Crane Bases	36.5	36.5	39.7	37.6	37.3	37.0	38.4	37.2	35.6	33.5
Reinstate Road Verges	34.8	36.0	50.2	39.5	50.6	55.0	53.7	61.5	50.4	34.4
Lay Cable to Substations	37.6	37.6	40.8	38.7	38.4	38.1	39.5	38.3	36.7	34.6
Forestry Felling	36.3	35.9	40.1	37.0	38.0	38.2	39.8	38.5	36.5	33.4
Borrow Pits	51.8	42.2	46.5	43.8	44.9	44.9	45.8	45.0	43.6	44.7
Construct Water Crossing	39.3	41.2	43.4	41.9	41.0	40.3	39.5	40.0	37.6	35.4

Construction Traffic

9.83 Due to the provision of construction material and wind farm components, vehicle movements either into or away from the site shall increase levels of traffic flow on public roads in the area. Traffic regularly accessing the site is shown in **Chapter 11: Access Traffic and Transport** and is assumed to be characterised by the sound power levels of Dump Trucks, Lorries and Concrete Mixers as a worst case. It is estimated that a total of 376 vehicle movements per day would be required during the most intense period of construction activity although this would only be the case for a maximum of 13 days during foundation pouring.

9.84 Construction traffic noise has been quantified using the method described in BS 5228:2009 Part 1. Using the distances from residential properties to the centre of the relevant carriageway where site traffic will be, the noise levels predicted are presented in Table 9.20. According to the assumptions made the maximum sound pressure level due to traffic flows during the most intensive period of activity will be 64.7 dB L_{Aeq}. The property where this occurs is adjacent to the proposed delivery route and, as such, corresponds to the worst case.

Table 9.20: Traffic Noise Predictions by Activity (dB L_{Aeq})

House ID	Dump Truck	Lorries	Concrete Mixer
H4	33.7	31.1	31.6
H19	60.2	57.6	58.1
H22	43.5	40.9	41.4
H24	61.3	58.7	59.2
H29	57.0	54.4	54.9
H33	57.4	54.8	55.3
H35	44.1	41.5	42.0
H37	54.5	51.9	52.4
H46	47.4	44.8	45.3
H63	36.8	34.2	34.7

General Construction Noise in Conjunction with Traffic Noise

9.85 Worst case construction noise levels may arise when the following simultaneous activities occur: construction of nearest access tracks; construction of substation; excavation and laying of site cables; construction of nearest crane hard-standings and construction of nearest turbine foundations. Therefore cumulative predictions of these construction activities and the additional noise contribution from construction traffic have been calculated and are shown in Table 9.21.

9.86 Whilst the cumulative construction noise levels calculated for the simultaneous activities detailed above are greater than the noise levels due to any other activity at nine of the ten assessed properties, this is not the case at H4 where noise levels of 51.8 dB(A) are predicted during work to the borrow pits. This activity is not considered in the combined predictions as the work is unlikely to take place at the same time as the concurrent activities stated in the previous paragraph and the amount of construction traffic is no longer at its maximum. It should be noted that this is only temporary and will only occur in the short time period when the activity is at the closest point to the property.

9.87 It should be noted that the predictions exclude the screening effects of local topography therefore actual levels of noise experienced at nearby residential properties could be lower.

Table 9.21: Predicted Noise Due to Combined Traffic Noise and Turbine Construction (dB L_{Aeq})

House ID	Construction Plant Noise	Traffic Noise	Combined Noise
H4	48.5	37.1	48.5
H19	48.3	63.6	63.6
H22	57.0	46.9	57.0
H24	50.0	64.7	64.7
H29	56.9	60.4	62.0
H33	61.1	60.8	64.0
H35	61.6	47.5	61.6
H37	67.3	57.9	67.8
H46	66.0	50.8	66.0
H63	46.3	40.2	47.3

Assessment of Construction Noise

9.88 In accordance with the ABC method of Annex E of BS 5228-1:2009, due to the relatively low levels of ambient noise at the proposed Highlee Hill Wind Farm site, a Category A assessment is appropriate. This category sets minimum L_{Aeq} criteria of: 65 dB(A) during weekdays (0700-1900) and Saturdays (0700-1300); below 55 dB(A) at evenings and weekends; and below 45 dB(A) for night-time (2300-0700) periods. Table 9.21 shows that predicted noise levels from the combined effect of increased traffic flows and activities associated with peak construction of the wind farm are below the 65 dB(A) daytime target level specified by BS 5228-1:2009 at eight of the ten assessed residential properties. Peak construction noise levels are predicted to exceed the 55 dB(A) target level for evenings and weekends at eight of the assessed properties although, of the times when this criterion applies, construction is only scheduled to take place on Saturdays 1300-1900 with the exception of turbine erection and commissioning or periods of emergency work. An assessment against the night-time target level has not been undertaken as construction work is not scheduled to take place during the night. The predictions made represent the worst case combination of most intensive traffic activity with simultaneous construction activity at the nearest possible location to each residential property.

9.89 The temporary higher levels of construction noise for upgrading the access track, constructing the site access track and constructing the temporary site compound at the nearest point to H37 & H46, will only occur in the limited time period when these activities are at the closest point to the residential properties. Noise levels are predicted to drop below the 65 dB(A) criteria for the upgrading and construction of the site tracks after two days at H37 and one day at H46 based on typical rates of construction. For the construction of the temporary site compound it is conservatively predicted that it will require 12 days to complete the works, therefore it is predicted that the noise levels will drop below the 65 dB(A) criteria after 12 days.

Mitigation

Operational Noise

9.90 One of the key turbine layout design constraint considerations was the minimisation of potential noise impacts at the nearest residential receptors. As such the turbine layout was initially designed to ensure that there is an adequate separation distance between any of the proposed turbines and the nearest residential property.

9.91 Due to consideration in the design of the wind farm, no mitigation measures are required for the operation of the proposed turbines as the proposed development complies with noise criteria.

9.92 It is worth noting that the operation of many modern turbines may be altered by changing the pitch of the wind turbine blades resulting in a trade-off between power production and noise reduction. This provides a potential mechanism for reducing the level of noise experienced at nearby residential properties once a wind farm becomes operational should it be required.

9.93 If planning permission is granted for the proposed wind farm, the decision notice would likely contain planning conditions which would provide a degree of protection, in the form of limits relating to noise level and tonality, to nearby residents in the event that noise from the wind farm causes disturbance.

9.94 **Technical Appendix 9.6Error! Reference source not found.** contains a set of conditions that RES considers appropriate. Any final conditions attached to the proposal, if accepted, would be according to the discretion of the decision maker.

Construction Noise

9.95 For all activities, measures will be taken to reduce noise levels with due regard to practicality and cost as per the concept of 'best practicable means' as defined in Section 72 of the Control of Pollution Act 1974.

9.96 BS 5228-1:2009 states that the 'attitude of the contractor' is important in minimising the likelihood of complaints and therefore consultation with the local authority and Community Liaison Group should occur / should occur along with letter drops to inform residents of intended activity. Non-acoustic factors, which influence the overall level of complaints such as mud on roads and dust generation, will also be controlled.

9.97 Furthermore, the following noise mitigation options will be implemented where appropriate:

- Consideration will be given to noise emissions when selecting plant and equipment to be used on site;
- All equipment should be maintained in good working order and fitted with the appropriate silencers, mufflers or acoustic covers where applicable;
- Stationary noise sources will be sited as far away as reasonably possible from residential properties and where necessary and appropriate, acoustic barriers will be used to screen them; and
- The movement of vehicles to and from the site will be controlled and employees will be instructed to ensure compliance with the noise control measures adopted.

9.98 Site operations will be limited to 0700-1900 Monday to Saturday except during turbine erection and commissioning or during periods of emergency work. Should it be considered necessary to reduce noise levels from the conservative predicted levels to adhere to the 55 dB(A) target level for Saturdays 1300-1900, the following mitigation measures would be considered:

- Reduce the number of construction activities occurring simultaneously;
- Restrict the distance of construction activity from nearby properties during these times; &
- Reduce construction traffic as appropriate.

The temporary increase of construction noise above the 65 dB(A) daytime target level at H37 & H46 could be mitigated through the use of acoustic barriers if required.

9.99 There are many strategies to reduce construction noise by the limitation of activities that would result in predicted noise levels being lower than the specified target. Any such measures should be considered adequate and the mitigation adopted should not be limited to the measures proposed.

Residual Effects

Operational

9.100 The acoustic assessment concludes that predicted noise levels at the nearest residential properties do not exceed the limits under all considered conditions. This should not be interpreted to mean that wind farm operational noise will be inaudible (or masked by background noise) under all conditions, but that the levels of noise are acceptable in accordance with relevant legislation and guidance.

Construction

9.101 There may be a temporary increase above the 65 dB(A) criteria noise level due to constructing site tracks track near H37 & H46 and for upgrading site tracks and constructing a temporary site compound at H37, but this is only when this activity is at its closest. There may be an increase above the 55 dB(A) criteria level for Saturdays 1300-1900 at eight properties although this can be mitigated by restricting the activities that are allowed to take place as necessary. At all other times predicted noise from worst case combination of increased traffic and site construction noise will not exceed relevant criteria and therefore no significant impacts are expected.

Cumulative Effects

Cumulative Operational Noise Assessment

9.102 An assessment of the cumulative acoustic impact of the proposed Highlee Hill Wind Farm in conjunction with the proposed Birneyknowe Wind Farm, comprising 15 wind turbines, and the proposed Windy Edge Wind Farm, comprising 9 wind turbines, has been undertaken in accordance with the guidance on wind farm noise assessment; ETSU-R-97 and the IoA GPG. It should be noted that an additional wind farm development known as Wauchope and Newcastleton Wind Farm has been recently scoped. This development comprises three sections, Wauchope East, Wauchope West and Newcastleton. However, this development is at an early stage and is likely to undergo substantial redesign. Due to the lack of certainty on the layout for Wauchope and Newcastleton Wind Farm this development is not included in this assessment as the results of any modelling would be inherently inaccurate.

9.103 Cumulative predicted noise levels at 70 of the 72 nearest residential properties are below 35 dB(A), indicating that the noise immission levels would be regarded as acceptable and the residents amenity as receiving 'sufficient protection' without further assessment requiring to be undertaken. At the two properties with predicted noise levels greater than 35 dB(A), the cumulative predicted noise levels due to the proposed Windy Edge and Birneyknowe wind farms are 10 dB(A) below the predicted noise levels due to the proposed Highlee Hill Wind Farm. In acoustic practice it is generally accepted that where there is such a difference between the noise levels from two sources, there is no cumulative impact and the smaller source can be ignored. The impact on the amenity of all nearby residential properties due to cumulative operational noise levels would therefore be regarded as acceptable.

Cumulative Construction Noise Assessment

9.104 Any noise for the construction of the cumulative wind farms is not likely to be ongoing at the same time as the construction of the Highlee Hill Wind Farm. However if this is the case, and due to the location of the other wind farms, then the site activities for both will be far enough away from each other to not have a cumulative impact.

Summary

9.105 The acoustic impact for the operation of the proposed Highlee Hill Wind Farm on nearby residential properties has been assessed in accordance with the guidance on wind farm noise as issued in the DTI publication "The Assessment and Rating of Noise from Wind Farms", otherwise known as ETSU-R-97, and Institute of Acoustics Good Practice Guide (IoA GPG), as recommended for use by relevant planning policy.

9.106 To establish baseline conditions, background noise surveys were carried out at four nearby properties and the measured background noise levels used to determine appropriate noise limits, as specified by ETSU-R-97 and the IoA GPG.

9.107 Operational noise levels were predicted using a noise propagation model, the proposed wind farm layout, terrain data and assumed turbine emission data. The predicted noise levels are within derived appropriate noise limits at all considered wind speeds. The proposed wind farm therefore complies with the relevant guidance on wind farm noise and the impact on the amenity of all nearby residential properties would be regarded as acceptable.

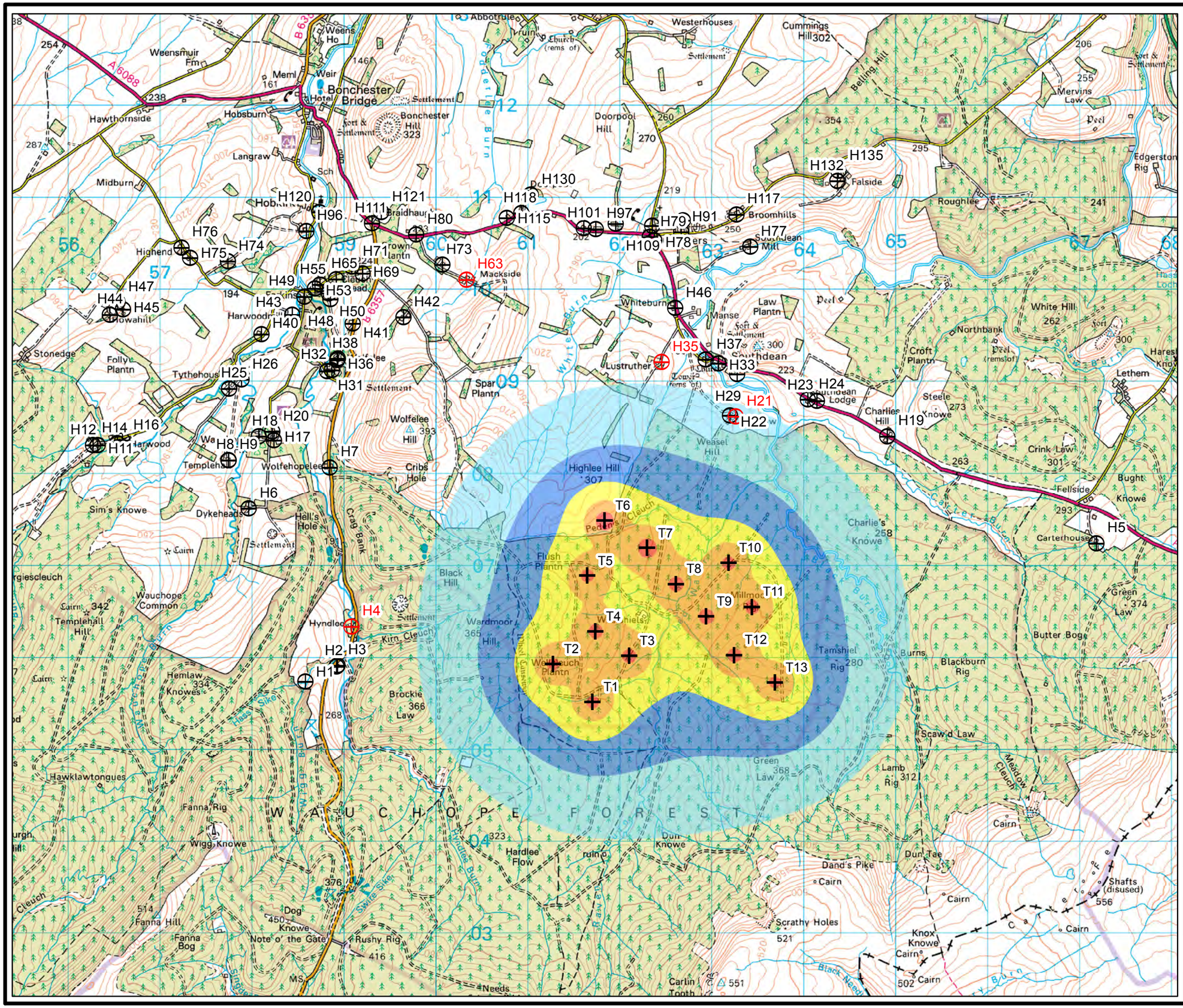
9.108 A construction noise assessment has been carried out in accordance with BS 5228-1:2009 "Noise control on construction and open sites Part 1 - Noise", and with due regard to mitigation outlined, indicates that predicted noise levels likely to be experienced at representative critical residential properties are below relevant construction noise criteria.

9.109 A cumulative operational noise assessment was completed to determine the potential impact of the proposed Highlee Hill Wind Farm alongside the proposed Birneyknowe and Windy Edge wind farms. The predicted noise levels are within derived appropriate noise limits at all considered wind speeds and properties, such that the impact on the amenity of nearby residential properties due to cumulative operational noise levels would be regarded as acceptable.

9.110 The potential impact of the proposed Highlee Hill Wind Farm, along with the mitigation proposed and any residual impact, is summarised in Table 9.22.

Table 9.22: Summary of Potential Impacts of the Proposed Wind Farm, Mitigation and Residual Impacts

Potential Impact	Mitigation Proposed	Means of Implementation	Outcome/ Residual Impact
Operational Noise			
Impact is deemed to be acceptable as wind farm designed to meet noise limits specified by relevant guidance	Not required due to absence of identified significant impact	Not applicable	No significant impacts identified
Construction Noise			
Potential for significant impact due to construction noise at nearby residential properties	Action may be required to reduce construction noise levels at nearby properties to meet the 65 dB(A) criteria noise level during construction of the temporary site compound and for the construction and upgrading of site tracks	Acoustic barriers can be deployed during the construction activities if necessary considering their temporary nature	No significant impacts expected should appropriate mitigation measures be implemented
	Action may be required to reduce construction noise levels at nearby properties for work scheduled to take place on Saturdays 1300-1900, to meet the 55 dB(A) criteria noise level	Reduce number of activities occurring simultaneously, restrict distance to nearby residential properties or reduce construction traffic as required	


H120
H121
H111
H96
H80
H118
H130
H115
H101
H97
H79
H91
H117
H109
H78
H77
H135
H132
H73
H63
Mackside
H71
H65
H55
H69
H53
H49
H47
H44
H45
H43
H50
H42
H40
H48
H41
H38
H32
H36
H31
H26
H25
H12
H14
H16
H11
H8
H9
H18
H20
H17
H7
H6
H46
H35
H37
H33
H23
H24
H29
H21
H22
H19
H5
T6
T7
T10
T5
T8
T11
T9
T4
T3
T12
T2
T13
T1
H4
H2
H3
H1
Highlee Hill
307
Weasel Hill
Wolfelee Hill
393
Cribs Hole
Wolfehopelee
Templehall Hill
Fanna Hill
Fanna Bog
Note o' the Gate
Rushy Rig
Dog Knowe
Hardlee Flow
Scrathy Holes
Dand's Pike
Knox Knowe
Shafts (disused)
Carterhouse
Crink Law
Bonchester Bridge
Bonchester Hill
Doorpool Hill
Broomhills
Falside
Roughlee
Edgerston Rig
Mervins Law
Cummings Hill
Westerhouses
Abbotrule
Hobsburn
Hawthornside
Weensmuir Fm
Midburn
Langraw
Highend
Harwood
Stonedge
Tythehouse
Wauchope Common
Hyndlee
Kirn Cleuch
Brockie Law
Hawklawtongues
Hemlaw Knowes
Wauchope Forest
Whiteburn
Lustruther
Manse
Law Plantn
Northbank
Croft Plantn
Lethem
Steele Knowe
Charlie's Knowe
Bught Knowe
Fellside
Butter Bogs
Blackburn Rig
Scaw'd Law
Lamb Rig
Green Law
Dun Knowe
Dun Tae
Cairn
Needs
Carlin Tooth
Doodle Burn
Whiteburn
Cleuch
Crag Bank
Hell's Hole
Swire Sike
Hass Sike
Hyndlee Burn
Caty Lee Burn
Meadow Cleuch
Black Needle
Flush Plantn
Wardmoor Hill
Spar Plantn
Folly Plantn
Harwood Plantn
Whiteburn Plantn
Tamshiel Rig
Millmoor
Peel
Settlement
Ruin
Church (rems of)
Sch
Weens Ho
Weir
Meml
Hotel
Bridge
Cairn
Dykeheads
Sim's Knowe
Larwood
Braidhaugh
Lantn
Clerkhaugh
Howahill
Southdean
Lodge
Mill
Law
Pedlam's Cleuch
Hobsburn
Hobkirk
Southdean
Charlie's Knowe
Green Law
Burns
Hyndlee Burn
Swire Sike
Hass Sike
Kirn Cleuch
Meadow Cleuch
Caty Lee Burn
Black Needle
Doodle Burn
Whiteburn
Crag Bank
Hell's Hole
Wauchope Forest
Settlement
Cairn
Ruin
Fort
Fort & Settlement
Peel (rems of)
Lower (rems of)
Sch
Hotel
Bridge
Weir
Meml
Ho
Fm
Plantn
Knowe
Law
Hill
Rig
Burn
Sike
Cleuch
Hole
Bog
Common
Forest
Needs
Tooth
Pike
Tae
Lodge
Mill

10 Forestry

Introduction

10.1 This chapter of the Environmental Statement (ES) describes the forestry aspects of the proposed Highlee Hill Wind Farm (hereafter referred to as 'the Development'). The chapter was prepared by DGA Forestry (DGA). Forestry is not being regarded as a receptor for Environmental Impact Assessment (EIA) purposes in this report; forests are dynamic and continually undergoing change due to planned felling and restocking by the landowner and natural events. This ES chapter therefore describes the Development plans for felling, restocking and forest management practices, and the process by which these were derived.

10.2 This chapter identifies areas of forest to be removed for the construction and operation of the Development (as described in **Chapter 2: Proposed Development**), outlines the proposed management practices, harvesting operations and transportation of timber products from forest to market. The responsibility for the implementation of the long term Forest Plan sits with the landowner and therefore the wider felling operations, restocking, and aftercare operations do not form part of the Development for which consent is sought by RES.

10.3 The majority of the Development (as shown in Figure 4.2) lies within an existing commercial forestry plantation known as Dykeraw Forest. The forestry affected is privately owned and managed. The forestry proposals have been developed to:

- identify areas of forest to be removed for the construction and operation of the Development;
- identify those areas which may or may not be replanted as part of the Development; and
- propose management practices for the forestry works.

10.4 In general throughout this chapter, data labelled 'baseline' refers to the current crop composition and the existing felling and restocking plans without any modification as a result of the Development. Data labelled 'wind farm' refers to the forestry plans incorporating the Development.

10.5 Forestry proposals are interrelated to other environmental effects which are assessed separately. This chapter should be read in conjunction with **Chapter 3: Design Evolution and Alternatives, Chapter 4: Landscape and Visual, Chapter 5: Ecology, Chapter 5: Ornithology, Chapter 7 Cultural Heritage and Chapter 8 Hydrology, Hydrogeology and Geology** as they are interrelated to this assessment.

Legislation and Planning Policy Guidance

Summary of Relevant Planning Policy

10.6 A desktop study was undertaken drawing upon published national, regional and local level publications, assessments and guidance to establish the broad planning and forestry context within which the Development is located. The following section provides an outline of those planning policies which are relevant to the Development and in particular to forestry. These forestry related policies and documents have been considered within the forestry assessment.

National Legislation and Policy

Scottish Forestry Strategy (SFS)

10.7 The Scottish Forestry Strategy (SFS)[1] provides the wider context and Scottish Ministers' vision for multi-benefit woodland management and expansion focussing on the key themes of climate change, timber, business development, community development, access and health, environmental quality and biodiversity. It sets out a vision that acknowledges the central role that the forestry resource will play in the culture, environment and economy of Scotland. The SFS informs other policies and guidance about woodland expansion and removal in Scotland.

10.8 The SFS set the following targets:

- 25% woodland cover in Scotland by the second half of this century;
- a woodland creation target of 10,000 hectares (ha) per year over the period 2012 - 2022; and
- the forestry sector delivering annual carbon savings of 0.6 million tonnes of carbon (MtC) by 2010, 0.8 MtC by 2015 and 1.0 MtC by 2020.

Scottish Land Use Strategy

10.9 The Scottish Land Use Strategy[2] sets out a strategic framework for getting the best out of Scotland's land resources. It looks at the potential of the land and the ways in which it is used, both now and its potential in the future. Principles of sustainable land use are central to its vision for the future. With specific reference to forestry, the strategy seeks to identify more closely which types of land are best for tree planting in the context of other land-based objectives, and promote good practice and local processes in relation to tree planting so as to secure multiple benefits. This will be achieved by a partnership approach through Forestry and Woodland strategies to be developed by local authorities within Scotland.

Scottish Planning Policy (SPP)

10.10 The Scottish Planning Policy (SPP)[3], issued in June 2014, includes a section on woodlands (paragraphs 216 - 218). This refers to the Scottish Government's Control of Woodland Removal Policy (Forestry Commission Scotland, 2009) which is discussed in more detail in paragraphs 10.14 to 10.19. The SPP states that woodland removal should only be permitted where it would achieve significant and clearly defined additional public benefits. It further states that where woodland is removed in association with development, developers will generally be expected to provide compensatory planting and that the acceptability of woodland removal, in the context of the Control of Woodland Removal Policy, should be taken into account in determining planning applications.

[1] Forestry Commission Scotland (2006): The Scottish Forestry Strategy. Forestry Commission, Edinburgh.
2 The Scottish Government (2011): Scottish Land Use Strategy. Edinburgh
3 The Scottish Government (2014): The Scottish Planning Policy. Edinburgh

Third National Planning Framework (NPF3)

10.11 Scotland's Third National Planning Framework (NPF3)[4], issued in June 2014, recognises woodlands and forestry are an economic resource, as well as an environmental asset (paragraph 4.2). It further supports the continued expansion of Scotland's woodland and forestry resource (paragraph 4.23). A key action of NPF3 (paragraph 6.10) is a commitment to create on average 10,000 ha per annum of new woodland from 2015.

Right Tree in the Right Place

10.12 Right Tree in the Right Place - Planning for Forestry & Woodlands (2010)[5] sets out detailed guidance to planning authorities when considering development proposals involving forestry and woodland: it advises that planning authorities should:

- Assess the current and likely future public benefits (social, economic and environmental) deriving from the existing woodland;
- Determine whether the Development should be modified or the woodland redesigned to avoid or reduce woodland loss (e.g. by accommodating new development within 'open space' within woodlands);
- Where woodland loss cannot be avoided, assess the public benefit of the proposed development to see if it would justify the loss of the woodland;
- Consider whether any loss of woodland should be mitigated by compensatory planting; and
- Consider whether any felling consent needs to specify the timing of forestry operations to avoid disturbance to wildlife present on the Site.

10.13 If an authority decides that a development proposal involving woodland loss should receive planning permission, it should specify the precise area of felling permitted and ensure that planning conditions and/or agreements would ensure the provision of any compensatory planting which is required.

Control of Woodland Removal Policy

10.14 In parallel with the SFS and other national policies on woodland expansion there is a strong presumption against permanent deforestation unless it addresses other environmental concerns. In Scotland such deforestation is dealt with under the Scottish Government's Control of Woodland Removal Policy[6].

10.15 The purpose of the policy is to provide direction for decisions on woodland removal in Scotland. The policy document lays out the background to the policy, places it into the current policy and regulatory context and discusses the principles, criteria and process for managing the policy implementation. The following paragraphs summarise the policy relative to the Development.

10.16 The principal aims of the policy include:

- to provide a strategic framework for appropriate woodland removal; and
- to support climate change mitigation and adaptation in Scotland.
- The guiding principles behind the policy include:
- a strong presumption in favour of protecting Scotland's woodland resources; and
- woodland removal should be allowed only where it would achieve significant and clearly defined additional public benefits. In appropriate cases a proposal for compensatory planting may form part of this balance.

10.17 Woodland removal, without a requirement for compensatory planting, is most likely to be appropriate where it would contribute significantly to:

- enhancing priority habitats and their connectivity;
- enhancing populations of priority species;
- enhancing nationally important landscapes, designated historic environments, and geological Sites of Special Scientific Interest (SSSI);
- improving conservation of water or soil resources; or
- public safety.

10.18 The consequences of the policy are stated as:

- minimising the inappropriate loss of woodland cover in Scotland;
- enabling appropriate woodland removal to proceed with no net loss of woodland-related public benefits other than in those circumstances detailed in the policy; and
- facilitating achievement of the Scottish Government's woodland expansion ambition in a way that integrates with other policy drivers (such as increasing sustainable economic growth, tackling climate change, rural / community development, renewable energy and biodiversity objectives).

10.19 The requirements can be met through changes to forest design; increasing designed open space; changing the woodland type; changing the management intensity; or completing off site compensation planting.

Forestry Study Area

10.20 The Forestry Study Area, as shown on Figure 10.1, extends to 965.98 ha.

10.21 Dykeraw Forest contains a range of woodland types and age classes. There is a small area of established woodland dating back to the late 1900's, which is comprised mainly of native broadleaf woodland and is classed as a SSSI (Site of Special Scientific Interest). The forest was originally planted from 1973 – 1976 and was comprised largely of commercial conifers. The forest is now well into the production phase with planned felling and restocking programmes underway. The main bulk of the forest now consists of young second rotation crop planted within the last 10 years. Detailed information on the composition of the woodlands in the Forestry Study Area is provided in the baseline description in paragraphs 10.36 to 10.46.

10.22 One of the original key objectives of the Forestry Commission (FC) was forest expansion, in both state and private forests, to produce a strategic reserve of timber and consequently a limited range of species was planted. More recently, greater emphasis has been placed on developing multi-purpose forests, which require a restructuring of age and species in existing woodlands. Restructuring is achieved through the forest planning process. This can be seen in the changes to the age class and species structure within Dykeraw irrespective of whether or not the Development proceeds.

10.23 Restructuring presents forest managers with many challenges and opportunities, particularly in relation to the management of potential catastrophic windblow. The Forest Plan process allows forest managers to review and revise proposals in a structured way to take account of such external factors. The inclusion of a wind farm within the forest is an example of one such external factor. The current guidelines require diversification of species and woodland types as part of the forest

4 Scottish Government (2014): National Planning Framework 3 (NPF3). Edinburgh.

[5] Forestry Commission Scotland (2010): Right Tree in the Right Place - Planning for Forestry & Woodlands. Forestry Commission, Edinburgh.

[6] Forestry Commission Scotland (2009): The Scottish Government's Policy on Control of Woodland Removal. Forestry Commission Scotland, Edinburgh.

planning process, specifically an increase in the proportion of broadleaf woodland, other conifers and open ground.

Forest Plans

10.24 A Forest Plan relates to individual forests or groups of woodlands. It describes the woodlands, places them in context with the surrounding area and identifies issues that are relevant to the woodland or forest. They describe how the long-term strategy would meet the management objectives of the owner, the criteria of the UK Forestry Standard (UKFS)[7] and the UK Woodland Assurance Standard (UKWAS)[8] under which the woodlands would be managed, if certificated.

10.25 The plans involve a scoping exercise whereby the views of Statutory Consultees, neighbours and stakeholders are sought, resulting in an agreed Scoping Report. The results of the scoping exercise are incorporated into the plan. The plan covers all aspects, such as conservation, archaeology, landscape and the local community in addition to forestry and silvicultural considerations. Restructuring of age class and species are important factors in this process to ensure proposals meet the current standards. The Wind Farm Forest Plan is prepared along the same principles with the relevant site information being provided by other members of the Project Team.

10.26 Dykeraw Forest is managed under a Forest Plan approved by Forestry Commission Scotland (FCS). This plan describes the landowner's felling and restocking proposals for the woodland which are detailed in the Baseline Conditions section of this chapter.

Development of the Wind Farm Forest Plan

Introduction

10.27 Existing crop information was provided by the landowner. Information comprised existing species, planting year, yield class, felling and restocking plans. Site inspections were undertaken in early 2014 to verify the data and in particular to update information provided by the landowners. Information from aerial photographs was incorporated including more accurate mapping of species, open ground and management boundaries. Consultations with the landowner confirmed the baseline conditions had not changed since the site inspection in 2014.

10.28 Details of turbine locations, new tracks, existing tracks, storage compounds and substations were all provided by other disciplines within the project team. This data was amalgamated with the existing forestry data to construct the forestry proposals. All of the proposed turbines and principle access tracks are located within forestry except for one (Turbine 6). The location of turbines and infrastructure is heavily influenced by site constraints and technical considerations e.g. wind capture, gradients, etc. Environmental constraints, together with any land management requirements, associated with the proposed construction of the Development have also been incorporated into the forestry proposals where appropriate. In particular the wind farm access tracks have utilised existing forestry tracks where possible thus minimising the need for further land take.

10.29 The wind farm felling plan was largely driven by the location of the wind farm infrastructure. Areas of forestry would be felled to accommodate the construction and operation of the Development. Typically, a minimum area of about 0.8 ha would be required to be felled for each turbine; a 10 m buffer around each item of infrastructure, in addition to the area required for the infrastructure; and a 30 m corridor for access roads. In certain cases, applicable in this instance, further felling may be required above the minimum stated above for wind yield and turbine performance purposes or forest management purposes.

Felling Plan

10.30 Felling required for a development can be divided into two categories. Firstly, felling that is required during the construction phase of the Development, which for the purposes of this assessment, has been anticipated as 2019 and secondly, felling required during the operational period of the Development. In this case Development felling would take place at the start of the construction phase prior to the start of the main civils works and felling may also overlap with the early stage civils work. No Development felling is predicted to be required during the operational period.

10.31 The existing woodlands were assessed to identify the crops which would require to be felled for a number of reasons including:

- the presence of turbines, access roads or other infrastructure;
- environmental considerations such as forest landscape design and bat buffers;
- forest management purposes, for example to reduce the risk of subsequent windblow; and
- to reduce coupe fragmentation; to ensure access for future forest operations or to integrate with the existing plans.

10.32 The wind farm felling plan shows which woodlands within the Forestry Study Area (Figure 10.6) would be felled as a result of the Development and when this felling would take place.

Restocking Plan

10.33 The wind farm restocking plan (Figure 10.7) shows which woodlands would be restocked and when this restocking would be carried out as a result of the Development. The majority of the areas to be felled for the Development would be restocked apart from the areas detailed below:

- land required for the Development infrastructure subject to the buffer zones described in paragraph 10.29; and
- land to be left unplanted for forest management, forest design or environmental purposes.

10.34 In modifying the restocking plan, a number of points would be taken into account as detailed below:

- fragmentation of coupes to be minimised as much as possible;
- coupe shapes would be modified to ensure that access for future forestry operations, principally harvesting, is maintained; and
- coupe shapes and edges would be modified to follow good practice.

10.35 In addition, the opportunity to increase restocking would be identified where possible to offset any loss of woodland area resulting from the Development by, for example, planting redundant management boundaries as part of the plan. Species composition was also considered taking into account existing restocking plans, the Development operational objectives, landowner objectives and forestry policies.

10.36 The forestry proposals have been assessed by each of the separate environmental disciplines / consultants as part of the EIA process and the effects are reported in individual chapters of this ES and supporting Technical Appendices.

[7] Forestry Commission (2004) The UK Forestry Standard: The Government's Approach to Sustainable Forestry, Forestry Commission, Edinburgh.
[8] UKWAS (2008) The UK Woodland Assurance Standard Second Edition (Amended November 2008), UKWAS, Edinburgh.

Baseline Conditions

Baseline Planting Year/Age Class Structure

10.37 The current age class structure of the woodlands within the Forestry Study Area is shown in Figure 10.2. The data are summarised in Table 10.1. The majority of the woodlands were planted in the 1970's with a small area established in 1959. The age class structure is therefore relatively even aged with the majority of the crops in the mid rotation phase.

Table 10. 1: Baseline Age Class Structure

Age (Yrs)	Area (ha)	Area (%)
0	219.69	22.74%
1-5	211.18	21.86%
6-10	153.37	15.88%
11-15	33.60	3.48%
20-25	1.82	0.19%
40-45	330.69	34.23%
50+	12.93	1.34%
100+	2.69	0.28%
Totals	**965.98**	**100.00%**

10.38 Many woodlands established in the mid to late 1900's were planted in large contiguous blocks, often over a limited number of years and with a limited range of species. Such woodlands develop poor structural diversity, especially on upland sites. Restructuring the age class and species of such forests would yield both forest management and environmental benefits.

10.39 The current recommendations contained within the UK Forestry Standard are for a minimum interval between felling adjacent coupes of 8 - 15 years in the uplands and 7 - 15 years in the lowlands. There can be implications from such a strategy, which involves both advancing and delaying felling, on crop stability and financial returns. For forest planning purposes the target interval between felling adjacent coupes is taken as 7 years or at least 2 m in crop height. It is recognised that in large even-aged plantations, especially in the uplands, restructuring age class structure to meet this target may take more than one rotation.

Species Composition

10.40 The current species composition of the woodlands within the Forestry Study Area is shown in Figure 10.3 and illustrated in Table 10.2. The main species are commercial conifers, principally Sitka spruce, which accounts for approximately 74.25% of the total area, with a further 11.23% felled awaiting restock. Other conifer woodland and broadleaves form very small components of the woodlands. Open ground accounts for the second largest component at 11.52%. For the purposes of this report 'other conifers' covers a wide range of species from Noble fir to Japanese larch. These species are planted in such small areas and form such a small proportion of the overall forest area that for simplification they have been grouped together.

Table 10.2: Baseline Species Composition

Species	Abbreviation	Area (ha)	Area (%)
Sitka spruce	SS	717.26	74.25%
Other conifers	OC	17.73	1.84%
Broadleaves	MB	11.30	1.17%
Open ground	OG	111.24	11.52%
Felled awaiting restock	FELL	108.45	11.23%
Totals		**965.98**	**100.00%**

10.41 The species composition, in particular the low broadleaf woodland presence and the high proportion of Sitka spruce reflect the period when the woodlands were planted. Such woodlands tended to lack species diversity.

Baseline Felling Plan

10.42 The baseline felling plan (Figure 10.4) has been taken from the approved Forest Plan and would be the plan if there was no wind farm development on the site. The felling programme is illustrated in Figure 10.4 and presented in Table 10.3.

Table 10.3: Baseline Felling Plan

Felling Phase	Area (ha)	Area (%)
No Felling	121.74	12.60%
Phase 3: 2013-2017	196.81	20.37%
Phase 4: 2018-2022	191.06	19.78%
Phase 5: 2023-2027	23.92	2.48%
Outside Plan Period	388.52	40.22%
Long Term Retentions	14.11	1.46%
Natural Reserves	29.83	3.09%
Totals	**965.98**	**100.00%**

10.43 Small areas are provisionally designated as Natural Reserves (NR). Natural reserves are predominantly wooded, are permanently identified and are in locations which are considered of particularly high conservation interest or potential. They are managed by minimum intervention unless alternative management has higher conservation or biodiversity value. It should be noted that the Natural Reserves contain the area designated as a SSSI. Other areas are identified as Long Term Retentions (LTR). These are coupes or trees retained for environmental benefit significantly beyond the age or size generally adopted for the woodlands. The identification of Natural Reserves and Long Term Retentions is part of the requirements of both UKWAS and the UK Forestry Standard.

Baseline Restocking Plan

10.44 The baseline restocking plan has been taken from the approved Forest Plan and is shown in Figure 10.5 and presented in Table 10.4. This would be the restocking plan if there was no wind farm development on the site.

Table 10.4: Baseline Restocking Plan

Species	Abbreviation	Area (ha)	Area (%)
Sitka spruce	**SS**	**628.46**	**65.06%**
Sitka spruce mix	SS/OC	20.01	2.07%
Other conifers	OC	86.10	8.91%
Broadleaves	MB	62.96	6.52%
Open ground	OG	168.45	17.44%
Totals		**965.98**	**100.00%**

10.45 The restocking proposals illustrate how the forests in the study area would be structured at the end of the plan period if the entire existing plan was implemented. Table 10.5 compares the baseline current species composition and the baseline restocking species composition at the end of the plan period without the effect of the Development.

Table 10.5: Baseline Species Comparison

Species	Abbreviation	Baseline	Restock	Difference
		Area (%)	Area (%)	Area (%)
Sitka spruce	SS	74.25%	65.06%	-9.19%
Sitka spruce mix	SS/OC	0.00%	2.07%	2.07%
Other conifers	OC	1.84%	8.91%	7.08%
Broadleaves	MB	1.17%	6.52%	5.35%
Open ground	OG	11.52%	17.44%	5.92%
Felled awaiting restock	FELL	11.23%	0.00%	-11.23%
Totals		**100%**	**100%**	

10.46 The changes between the current species composition and that contained within the baseline plan are discussed below (all figures relate to the % of the Forestry Study Area):

- the proportion of Sitka spruce / other conifer mixtures increases from 0% of the total area to 2.07%;
- the proportion of pure Sitka spruce crop decreases from 74.25% to 65.06%;
- the area of other conifers increases from 1.84% to 8.91%;
- the proportion of open ground increases due to the re-design of felled areas to 17.44% compared with 11.52%;
- the proportion of broadleaf / native woodland increases from 1.17% to 6.52%.

10.47 The net effect of the baseline plan sees a decrease in the stocked woodland area and a change in the species diversity with an increase in mixed conifers and broadleaf woodland balanced by a decrease in the proportion of Sitka spruce crops. These changes reflect the need to comply with the UK Forestry Standard and its associated guidelines.

Wind Farm Forest Plan

Introduction

10.48 The impact of the Development on the structure of the woodlands within the Forestry Study Area has been compared against the baseline plan. This has concentrated on amendments to the felling plan, species composition, and the restocking design required to accommodate the Development.

Felling Plan

10.49 The Development felling plan is shown in Figure 10.4 and summarised in Table 10.6.

Table 10.6: Windfarm Felling Plan

Felling Phase	Area (ha)	Area (%)
No Felling	121.74	12.60%
Phase 3: 2013-2017	196.81	20.37%
Phase 4: 2018-2022	221.04	22.88%
Phase 5: 2023-2027	23.92	2.48%
Outside Plan Period	359.13	37.18%
Long Term Retentions	13.93	1.44%
Natural Reserves	29.41	3.04%
Totals	**965.98**	**100.00%**

10.50 The baseline and Development felling data are compared in Table 10.7. The impacts on timber volumes are discussed later in this chapter.

Table 10.7: Comparison of Baseline and Wind Farm Felling Plans

Felling Phase	Baseline	Wind Farm	Difference	
	Area (ha)	Area (ha)	Area (ha)	Area (%)
No Felling	121.74	121.74	0.00	0.00%
Phase 3: 2013-2017	196.81	196.81	0.00	0.00%
Phase 4: 2018-2022	191.06	221.04	29.98	3.10%
Phase 5: 2023-2027	23.92	23.92	0.00	0.00%
Outside Plan Period	388.52	359.13	-29.39	-3.04%
Long Term Retentions	14.11	13.93	-0.18	-0.02%
Natural Reserves	29.83	29.41	-0.42	-0.04%
Totals	**965.98**	**965.98**		

10.51 There would be an increase of 3.10% or 29.98 ha in the felling programme during Phase 4 (2018 – 2022) due to the wind farm felling plan during the construction period. This is balanced out by reductions in the felling programme in subsequent periods. The increase is due to the advanced

felling of plantations before they reach the current approved felling date for construction and operation of the wind farm.

Restocking Plan

10.52 The wind farm restocking plan is created by taking the baseline restocking plan and amending it to integrate the Development infrastructure into the forest design and to take account of the site conditions (such as risk of windblow, coupe fragmentation etc). The wind farm restocking plan is shown in Figure 10.7 and summarised in Table 10.8.

Table 10.8: Wind Farm Restocking Plan

Species	Abbreviation	Area (ha)	Area (%)
Sitka spruce	SS	604.40	62.57%
Sitka spruce mix	SS/OC	20.01	2.07%
Other conifers	OC	84.16	8.71%
Broadleaves	MB	62.83	6.50%
Open ground	OG	168.45	17.44%
Wind farm open ground	W/F OG	26.13	2.71%
Totals		**965.98**	**100.00%**

10.53 The baseline and wind farm restocking data have been analysed to assess the impact construction of the Development would have on the species composition of the forest. These data are presented in Table 10.9. The data is shown as a percentage of the Forestry Study Area.

Table 10.9: Comparison of Baseline and Wind Farm Restock Plans

Species	Abbreviation	Baseline		Wind Farm		Difference	
		Area (ha)	Area (%)	Area (ha)	Area (%)	Area (ha)	Area (%)
Sitka spruce	SS	628.46	65.06%	604.40	62.57%	-24.06	-2.49%
Sitka spruce mix	SS/OC	20.01	2.07%	20.01	2.07%	0	0.00%
Other conifers	OC	86.10	8.91%	84.16	8.71%	-1.94	-0.20%
Broadleaves	MB	62.96	6.52%	62.83	6.50%	-0.13	-0.01%
Open ground	OG	168.45	17.44%	168.45	17.44%	0	0.00%
Wind farm open ground	W/F OG	-	0.00%	26.13	2.71%	23.13	2.71%
Totals	**965.98**		**100%**		100%		

10.54 The changes in the structure of the woodlands are discussed below. The changes refer to a comparison of the wind farm restocking plan against the baseline restocking plan:

- There would be a small decrease in the area under broadleaves. This would decrease from 6.52% in the baseline restocking plan to 6.50% in the wind farm restocking plan;
- The proportion of Sitka spruce decreases from 65.06% to 62.57%;
- The proportion of other conifers decreases from 8.91% to 8.71%;
- The total proportion of open ground would increase from 17.44% in the baseline to 20%. This comprises 17.44% designed open ground as part of the forest plan and 2.71% open ground due to wind farm infrastructure; and

10.55 As a result of the woodland re-design, the stocked area of woodland would decrease under the wind farm restocking proposals from 82.56% of the total Forestry Study Area to 79.86%; a decrease of 2.71%, which is equivalent to 26.13 ha.

Timber Harvesting Volumes

10.56 The volume of timber to be harvested during the period of the operational period of the Development is shown in Table 10.10. This is compared with the volume which would have been harvested as a result of the felling proposals contained within the existing approved plans. It should be noted that these volumes refer only to timber to be harvested from the Forestry Study Area.

Table 10.10: Timber Harvesting Volumes

Felling Phase		Without Wind Farm		With Wind Farm		Variation	
		M^3	%	M^3	%	M^3	%
2013	2017	68,650	17.2%	68,650	17.4%	0	0.0%
2018	2022	78,007	19.5%	82,749	21.0%	4,742	6.1%
2023	2027	16,498	4.1%	16,718	4.2%	220	1.3%
Outside Plan Period		208,588	52.2%	198,309	50.3%	-10,279	-4.9%
Long Term Retentions		13,717	3.4%	13,413	3.4%	-304	-2.2%
Natural Reserves		14,067	3.5%	14,067	3.6%	0	0.0%
Totals		**399,526**	**100%**	**393,906**	**100%**	**-5,620**	**-1.4%**

10.57 These data have been derived from the information provided by the forest managers, updated as necessary, and Forestry Commission Yield Models[9]. It is based on a number of assumptions including: accuracy of the yield class data provided by the landowner; assumptions about yield class where no data was provided; and assumptions about the proportions of each species in mixture. No measurements have been made to check yield class accuracy.

10.58 The default yield table used has been the Sitka spruce, non-thin, 2 m initial planting spacing model. This species was used as it forms the largest proportion of the conifer crops and due to the growth rates of Sitka spruce represents a worst case scenario. In mixtures, the proportion of the individual species is uncertain and therefore yield class has been adjusted based on an assumption regarding the species proportions.

10.59 Due to the Development proposals some timber harvesting within the Forestry Study Area is brought forward compared with when the felling would have taken place under the baseline scenario. As a result, there is an increase in the volume of timber harvested during the construction phase of the wind farm of 4,742 m^3 (or 6.1%) and there is a projected decrease of 5,620 m^3 (1.4%) over the life of the wind farm compared with the baseline. This is due to advanced felling of plantations before they reach maturity yielding a lower volume of timber per hectare.

[9] Forestry Commission (1981) Yield Models for Forest Management: Forestry Commission Booklet 48, Forestry Commission, Edinburgh.

10.60 The timber from the baseline felling plan would, as it stands at present, all be despatched via internal forest roads to the B6357 to the west of the site. Timber would then be transported via the agreed routes for timber traffic. The timber from the wind farm felling plan that is felled during construction of the Development would also be despatched via the existing western site entrance via agreed timber routes.

Requirement for Compensatory Planting

10.61 As a result of the construction of the Development, there would be a net loss of woodland area. The area of stocked woodland would decrease by 2.71%, which is equivalent to 26.13 ha.

10.62 In order to comply with the criteria of the Scottish Government's Control of Woodland Removal Policy, off-site compensation planting would be required. The developer is committed to providing appropriate compensation planting. The extent, location and composition of such planting will be agreed with FCS, taking into account any revision to the felling and restocking plans prior to the commencement of construction.

Forestry Management Practices

10.63 Forestry management practices and responsibility for their implementation will be agreed with the landowner prior to commencement of construction of the Development. It is, however, anticipated that forestry management practices would consist of the following:

Conventional Harvesting

10.64 It is anticipated that the majority of the crops would be of sufficient tree size and standing volume that they would be harvested conventionally. Timber operations would be undertaken with standard harvesting and forwarding equipment utilising flotation tracks. The flotation devices are fitted to each machine wheel which gives the machines low ground pressure and minimises the ground disturbance during the forestry operations.

10.65 Stemwood down to 7 cm or below would be removed from site and sold into the timber markets. The harvester would maximise timber recovery wherever possible by cutting a fuelwood product; this would result in the maximum timber volume being recovered to ensure the volume used in the brash mats is kept to a minimum. The harvester would follow the ploughing direction on the site where possible and would harvest all the trees in approximately an 18 m zone around the machine. The branches and tops of the trees (brash) would be placed in front of the harvester in the direction of the machine travel. The harvester would lay the brash forming a mat at 90 degrees to the plough furrows and the direction of travel of the machine. This would form the running surface for the forestry machines and would minimise ground damage. On wetter ground the harvester would build stronger brash mats to ensure there would be minimal damage to the peat and soil structure by the forwarder during extraction.

10.66 Lop and top resulting from such felling would be left in 'brash mats' created by the harvesting machines and would be used to aid extraction of the timber to roadside. Such brash mats would be left on site as per current industry practice. The material within the brash mats decomposes over a number of years and where replanting is carried out, provides nutrition for the next rotation.

Removal of Unmerchantable Crops

10.67 Some areas of younger crops would require to be cleared to create the turbine keyholes and access tracks. It is proposed that such unmerchantable crops would be removed by various methods depending on the age of the crops.

10.68 Crop less than 10 years old could be removed mechanically by construction machinery or it may be more viable to remove the crop by felling manually with chainsaws or scrub cutters. Such felling would not produce any recoverable timber volume for sale into timber markets. It is proposed that such material arising from these activities is left in situ at low volumes.

10.69 Unmerchantable crops older than 10 years would, where possible, be harvested conventionally with round timber being produced for the timber markets, but such an assessment could only be made at the date of construction and would depend on crop age and yield class.

10.70 The exact methodology would be finalised nearer the time of construction taking into account the growth of the trees and any developments in the timber markets for small diameter timber or chipped material in the intervening period to deliver the best overall environmental outcome.

Restocking Methodology

10.71 Restocking would be carried out to current standard practice, guidelines and in accordance with the UK Forestry Standard and UKWAS as a minimum, where applicable. The methodology would vary depending on the type of restocking being carried out.

10.72 On commercial conifer areas methodology would normally include:

- Site preparation by machine mounding and drainage;
- Manual planting;
- Subsequent follow-up establishment operations such as the replacement of failures, weeding and protection measures until the crops are satisfactorily established; and
- Replanting would be carried out with the conifer species identified in the restocking plan at the minimum density of 2,500 trees per hectare.

10.73 Restocking within the broadleaf woodland areas would be carried out to broadly the same specification with the following changes:

- Planting density would be a minimum of 1,100 trees per hectare; and
- The principal species would be downy and silver birch with small components of other species as appropriate such as oak, rowan, hazel, gean, grey willow, goat willow, alder and woody shrubs.

10.74 Restocking would be carried out within four years of the felling date. Delayed restocking is being used to reduce the use of chemicals to prevent damage from pine weevils as per the commitment within UKWAS.

Aftercare Works

10.75 Aftercare establishment works would include, but are not limited to, the following:

- The woodlands would be beaten up (replacement of failures) to ensure satisfactory stocking levels by year 5;
- The woodlands would be weeded as necessary to ensure satisfactory establishment by year 5;
- The woodlands would be protected against pine weevils by management inspections and remedial treatment as necessary;
- The woodlands would be protected against browsing damage from wild and domestic animals;
- The woodlands would be protected against fire;

- Fertiliser would be applied as necessary to ensure satisfactory establishment and growth; and
- Other works to be agreed as reasonably required ensuring satisfactory establishment of the woodlands.

Standards and Guidelines

10.76 All forestry operations would be carried out in strict accordance with current good practice and guidelines. This would include, but not be limited to:

- UK Forestry Standard Guidelines (UKFSG)[10]; and
- Forest Industry Safety Accord (FISA) Safety Guides[11] (or equivalent).

10.77 All operations would be carried out in accordance with current relevant legislation including, but not limited to, Health and Safety at Work Act.

Summary

10.78 The total Forestry Study Area extends to 965.98 ha and is comprised of privately owned and managed woodlands.

10.79 The species composition of the forest would change as a result of the Development forestry proposals. In particular, the area of Sitka spruce and Sitka spruce other conifer mixtures would decrease from 65.06% in the baseline restocking plan to 62.57% under the wind farm restocking plan.

10.80 The total proportion of open ground would increase from 17.44% in the baseline to 20.15% in the wind farm restocking plan due to the re-design of the forest.

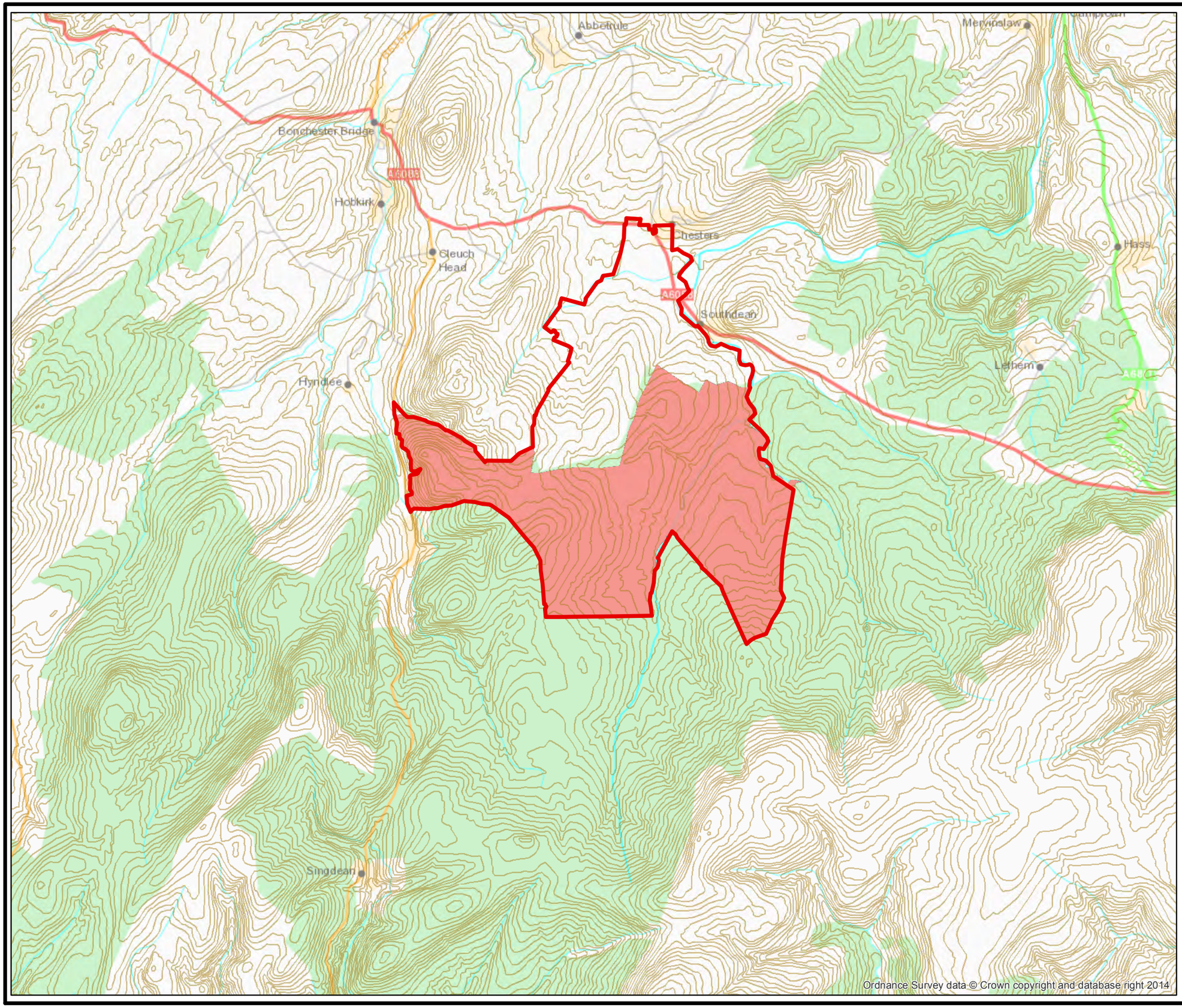
10.81 There would be a net loss of woodland area. The area of stocked woodland would decrease by 2.71%, which is the equivalent to 26.13 ha.

10.82 There would be a change in the pattern of timber harvesting with part of the felling programme being advanced compared with the baseline. As a result the total volume of timber to be harvested over the Forest Plan period would decrease by 5,620 m^3 (1.4%).

10.83 In order to comply with the criteria of the Scottish Government's Control of Woodland Removal Policy, off-site compensation planting would be required. The developer is committed to providing appropriate compensation planting. The extent, location and composition of such will be agreed with FCS, taking into account any revision to the felling and restocking plans prior to the commencement of construction.

[10] Forestry Commission (2011): The UK Forestry Standard Guidelines. Edinburgh

[11] Forest Industry Safety Accord (2014). FISA Safety Guides (various). Edinburgh.



HIGHLEE HILL
WIND FARM

FIGURE 10.1

FORESTRY STUDY AREA

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

Legend

- Boundary
- Contours
- Forestry Study Area

LAYOUT DWG	T-LAYOUT NO.
02836D0002-13	PSCOhhi041

DRAWING NUMBER
FIGURE 10.1: FORESTRY STUDY AREA

SCALE - 1:50,000 @ A3

ENVIRONMENTAL STATEMENT &
PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL
WIND FARM

FIGURE 10.2

BASELINE
AGE CLASS STRUCTURE

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

Legend

- Watercourses
- Contours

Age Group (yrs)

- n/a
- 1-5
- 6-10
- 11-15
- 20-25
- 40-45
- 50+
- 100+

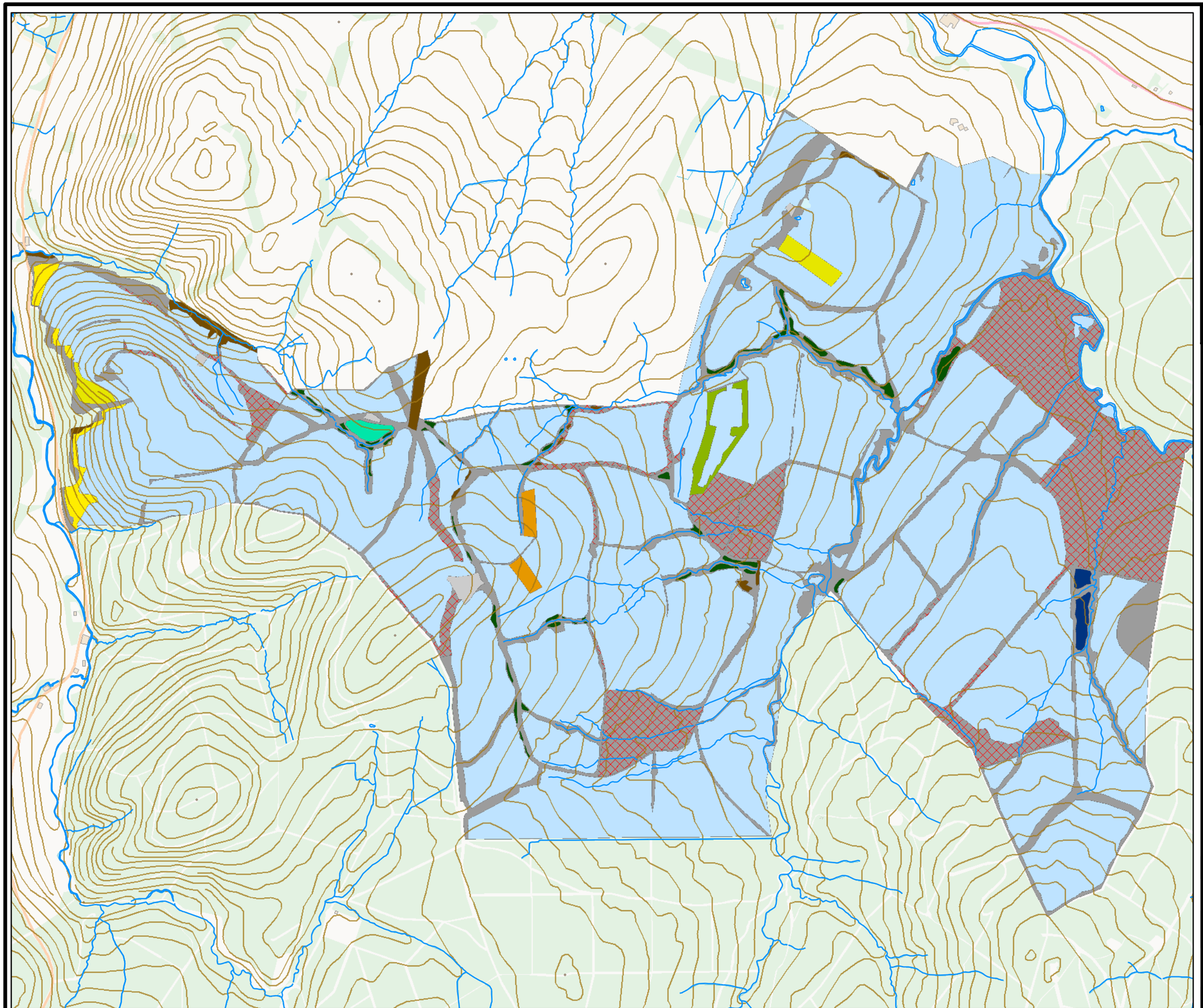
LAYOUT DWG	T-LAYOUT NO.
02836D0002-13	PSCOhhi041

DRAWING NUMBER
FIGURE 10.2: BASELINE AGE CLASS STRUCTURE

SCALE - 1:17,500 @ A3

ENVIRONMENTAL STATEMENT &
PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL
WIND FARM

FIGURE 10.3

BASELINE
SPECIES COMPOSITION

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

Legend

- Watercourses
- Contours

SPECIES

- Native broadleaves
- Felled awaiting restock
- Japanese larch
- Lodgepole pine
- Mixed broadleaves
- Mixed conifers
- Norway spruce
- Norway spruce/Scots pine
- Quarry
- Scots pine
- Sitka spruce
- Open ground
- Water

LAYOUT DWG	T-LAYOUT NO.
02836D0002-13	PSCOhhi041

DRAWING NUMBER

FIGURE 10.3: BASELINE SPECIES COMPOSITION

SCALE - 1:17,500 @ A3

ENVIRONMENTAL STATEMENT &
PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIGURE 10.4

BASELINE FELLING PLAN

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

Legend

- Watercourses
- Contours

Felling Phase

- Fell Phase 3: 2013-2017
- Fell Phase 4: 2018-2022
- Fell Phase 5: 2023-2027
- Long Term Retentions
- Natural Reserves
- No Felling
- Outside Plan Period

LAYOUT DWG	T-LAYOUT NO.
02836D0002-13	PSCOhhi041

DRAWING NUMBER
FIGURE 10.4: BASELINE FELLING PLAN

SCALE - 1:17,500 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIGURE 10.5

BASELINE RESTOCK PLAN

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

Legend

- Watercourses
- Contours

Species

- Mixed broadleaves
- Mixed broadleaves/Open ground
- Mixed conifers
- Norway spruce
- Open ground
- Natural reserves
- Long term retentions
- SSSI
- Sitka spruce
- Sitka spruce/Norway spruce
- Western hemlock

LAYOUT DWG: 02836D0002-13

T-LAYOUT NO.: PSCOhhi041

DRAWING NUMBER

FIGURE 10.5: BASELINE RESTOCK PLAN

SCALE - 1:17,500 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

HIGHLEE HILL WIND FARM

FIGURE 10.6

WIND FARM FELLING PLAN

© CROWN COPYRIGHT, ALL RIGHTS RESERVED. 2016 LICENCE NUMBER 0100031673.

T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13

Legend

- Watercourses
- Contours
- Wind Farm Infrastructure

Felling Phase

- Fell Phase 3: 2013-2017
- Fell Phase 4: 2018-2022
- Fell Phase 5: 2023-2027
- Long Term Retentions
- Natural Reserves
- No Felling
- Outside Plan Period

LAYOUT DWG
02836D0002-13

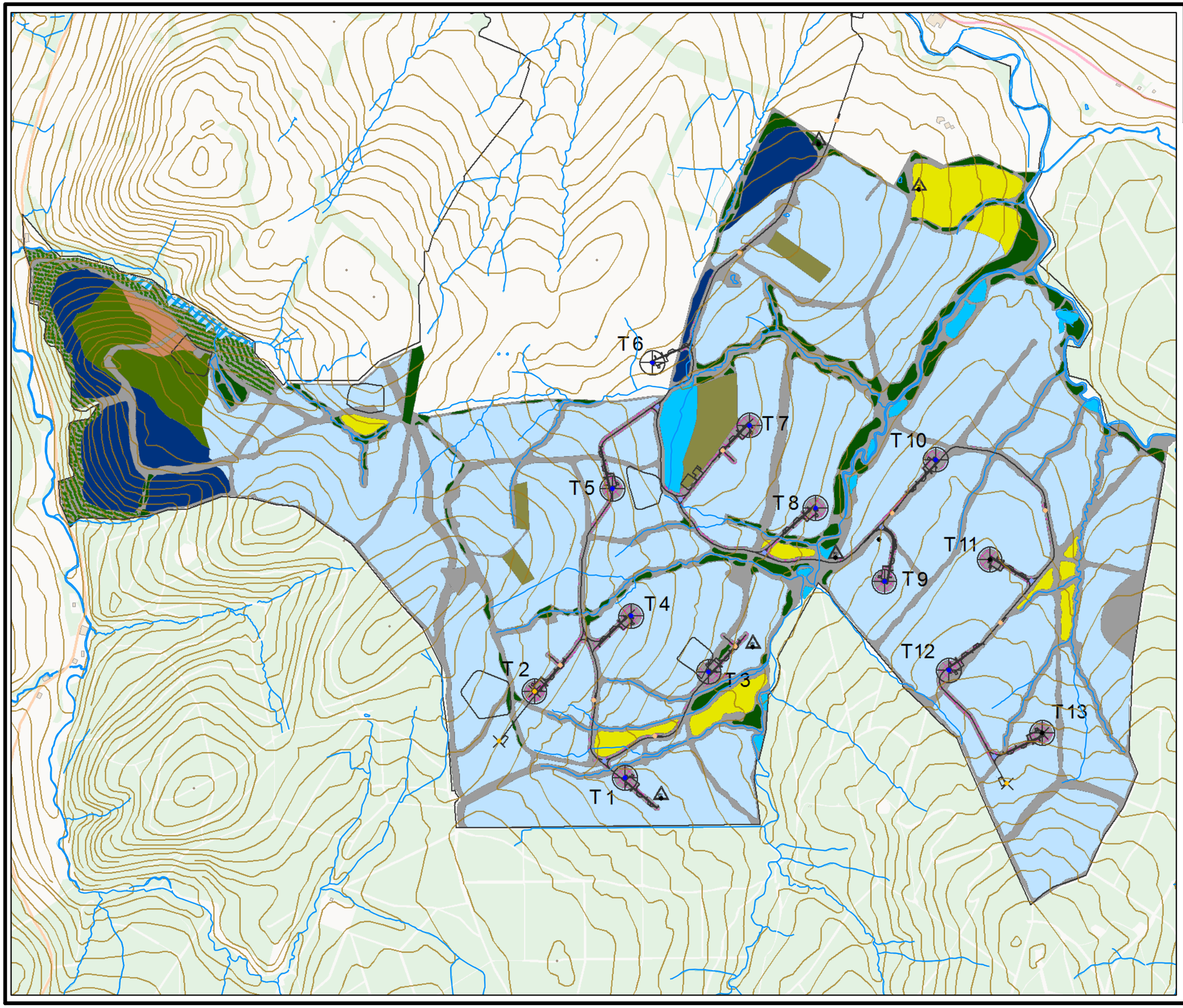
T-LAYOUT NO.
PSCOhhi041

DRAWING NUMBER
FIGURE 10.6: WIND FARM FELLING PLAN

SCALE - 1:17,500 @ A3

ENVIRONMENTAL STATEMENT & PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION



HIGHLEE HILL
WIND FARM

FIGURE 10.7

WIND FARM
RESTOCKING PLAN

© CROWN COPYRIGHT, ALL RIGHTS RESERVED.
2016 LICENCE NUMBER 0100031673.

Legend

- Watercourses
- Contours
- Wind Farm Infrastructure

Species

- Mixed broadleaves
- MB/OG
- Mixed conifers
- Norway spruce
- Open ground
- RES
- RET
- SSSI
- Sitka spruce
- Sitka spruce/Norway spruce
- Western hemlock
- Wind farm open ground

LAYOUT DWG
02836D0002-13

T-LAYOUT NO.
PSCOhhi041

DRAWING NUMBER
FIGURE 10.7: WIND FARM RESTOCKING PLAN

SCALE - 1:17,500 @ A3

ENVIRONMENTAL STATEMENT &
PLANNING APPLICATION 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

11 Traffic and Transport

Introduction

11.1 This Chapter of the Environmental Statement (ES) evaluates the effects of the proposed Highlee Hill Wind Farm ('the Development') on the traffic and transportation resource.

11.2 This chapter identifies the potential effects of increased road traffic expected as a result of the Development, assesses the significance of these effects against identified criteria and, where required, identifies appropriate mitigation measures.

11.3 This chapter assesses the following access, traffic and transportation effects of the Development:

- Traffic generation;
- Hazardous loads;
- Accidents and safety;
- Driver delay;
- Pedestrian amenity;
- Pedestrian delay;
- Severance;
- Noise and vibration; and
- Visual effects.

11.4 The Development is located south of Chesters, in the Scottish Borders, and will be accessed via the A6088 which lies to the north of the development.

11.5 This chapter is supported by the following technical appendix contained in Volume 3:

- Appendix 11.1: Phase 1 Access Study (Halcrow 2011); and
- Appendix 11.2: Additional Swept Path Analysis (57.3 m blade).

Methodology

Guidance

11.6 In undertaking the assessment of potential access and traffic effects on the local road network, planning policy has been considered. A brief review of key policy has been provided below to set the context to the sensitivity aspect of significance criteria.

11.7 In addition to the planning policy, the following guidance documents have been taken into account:

- The Institute of Environmental Management and Assessment ('IEMA', 1993) Guidelines for the Environmental Assessment of Road Traffic[1]; and
- The Transport Assessment Guidance (Transport Scotland, 2012)[2].

National and Local Legislation and Policy

11.8 The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011[3] ('the EIA Regulations') establish in broad terms what is to be considered when determining the effects of development proposals on the transport network. The EIA Regulations, in combination with expert professional judgement and specific guidance from government agencies such as Transport Scotland, and professional bodies, such as the Institute of Environmental Management and Assessment (IEMA), provide a framework for the methodology adopted to assess potential effects on the traffic resource and sensitive receptors of the Study Area and their likely level of significance.

11.9 The Scottish Planning Policy[4] ("SPP") provides a statement of the Scottish Government's policy on nationally important land use planning matters including renewable energy. SPP indicates that proposals for onshore wind should consider the effect on road traffic and on adjacent trunk roads.

11.10 At a national level, traffic and access policy largely focuses upon freight by rail and sea and therefore does not apply to the Development.

11.11 Planning Advice Note 75 (PAN 75) Planning for Transport[5] provides guidance on sustainable transport planning in the context of new and existing development. The document also indicates that all planning applications that involve the generation of person trips should provide information which covers the transport implications of the development. The level of detail is to be proportionate to the complexity and scale of the effect of the development.

11.12 Regarding traffic and access, the Scottish Borders Council Local Development Plan[6] promotes proposals for the generation and utilisation of renewable energy and states that the Council will support proposals where these are consistent with the principals of sustainable development and the SPP. The development should be sited and designed such that they will not be significantly adverse effects overall, either individually or cumulatively with other developments, having regard in particular to (among other issues) any significant effects on the land and water based traffic and transport interests.

Scoping and Consultation

11.13 The Scoping Opinion, as described in **Chapter 3: Design Evolution and Alternatives**, included responses detailing the scope to be undertaken for the assessment of effects on access, traffic and transport resources. Specific issues highlighted during scoping and subsequent consultation relating to traffic and transportation during consultation are summarised in Table 11.1.

Table 11.1 : Summary of Consultation Responses

Consultee	Type and Date	Summary of Consultation Response
Scottish Borders Council – Roads Planning Service	Letter- 02/12/2015	No objection to the proposal in terms of long-term road considerations.

[1] Institute of Environment Management and Assessment (1993) 'Guidelines for the Environmental Assessment of Road Traffic', IEMA: London.

[2] Transport Scotland (2012) Transport Assessment Guidance [Online]. Available At: http://www.thenbs.com/PublicationIndex/DocumentSummary.aspx?PubID=957&DocID=301489 [Accessed 22/07/15]

[3] The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 [Online]. Available at: http://www.legislation.gov.uk/ssi/2011/139/contents/made [Accessed 05/10/2015]

[4] The Scottish Government (2014), Scottish Planning Policy (SPP). Available Online At: http://www.scotland.gov.uk/Publications/2014/06/5823/0 [Accessed 22/07/2015]

[5] The Scottish Executive (2005), Planning Advice Note: PAN 75 – Planning for Transport, Available Online At: http://www.scotland.gov.uk/Resource/Doc/57346/0016795.pdf [Accessed 22/07/2015]

[6] Scottish Borders Council (2015), Local Development Plan, Available online at: http://www.scotborders.gov.uk/info/178/development_plans/659/local_development_plan [Accessed 02/03/2016]

Consultee	Type and Date	Summary of Consultation Response
Transport Scotland	Letter – 19/11/2015	States that Transport Scotland no longer respond to EIA consultations.
Port of Blyth	Email – 14/10/16	Confirmed that the port would be capable of handling 57.3 m blades.
Northumberland County Council	Scoping	No consultation response was received to either the Jan 2014 or Nov 2015 Scoping Reports.
	Phonecall – 27/10/15	Discussion with C Woodhouse from NCC. She highlighted a previous incident on the A68 with a turbine delivery. Stated that NCC would like to see a dry run undertaken before deliveries take place.

Issues Scoped Out of the Assessment

11.14 No visitor traffic is expected for the Development, and therefore this will not be assessed within this Chapter.

Study Area

11.15 The traffic Study Area has been defined by identifying road sections likely to be affected by the Development.

11.16 The study area has been defined by the public road network in the vicinity of the Development and potential delivery corridors to be used during construction. These take into account the local strategic / trunk road network, sources of labour and the potential sources of construction materials, specifically stone and concrete from local quarries.

11.17 The main approach corridor considered in this assessment assumes that wind turbine components will be transported as abnormal loads and approach the Development Site from:

- The Port of Blyth;
- B1329;
- A1061 (South Newsham Road);
- A189;
- A19;
- A1;
- A696;
- A68;
- A6088; and
- Site Access.

11.18 Throughout all phases of the Development, all other traffic including Heavy Goods Vehicles (HGVs) and construction traffic could approach the Development from other directions. For the purposes of this assessment two other approach routes are to be considered in addition to the main approach corridor:

- Via the A6088 approaching from the north.
- Via the B6357 from the south.

11.19 This assessment will consider a worst case scenario in which all traffic uses each approach corridor, except for Abnormal Indivisible Load Vehicles (AILV) traffic which must use the main approach corridor.

Assessment Methodology and Significance Criteria

Description of Methodology

11.20 The methodology adopted within this assessment has been developed from guidance given in the Institute of Highways and Transportation (IHT) 'Guidelines for Traffic Impact Assessment'[7] and also the IEMA 'Guidelines for the Environmental Assessment of Road Traffic'[8]. Methodologies detailed in the IHT guidelines recommend that ESs for large developments should be assessed in accordance with the IEMA guidelines noted above.

11.21 The potential traffic effects of the Development were assessed utilising the following approach:

- Relevant transport policies were reviewed to establish any local or regional HGV or freight access strategies;
- A Phase 1 Access Study has been carried out (see **Technical Appendix 11.1**) to consider the ability to deliver abnormal loads (turbine components, cranes, transformers etc.) to the site;
- Additional Swept Path Analysis was carried out to allow for increased blade size of 57.3 m (see **Technical Appendix 11.2**.
- Consultation with relevant local authorities and roads authorities was carried out;
- The road sections likely to be affected by the Development have been identified;
- The existing character of the road network has been determined;
- Existing traffic levels on the road network have been determined;
- The additional traffic generated by the Development has been estimated;
- The effect of the additional traffic has been assessed;
- The delivery routes for construction and AILVs were identified and appraised; and
- An appropriate mitigation strategy has been prepared to ensure that any potential traffic effects are kept to a minimum.

11.22 The IEMA guidelines suggest two broad principles to be used as a screening process to delimit the scale and extent of the assessment. These are:

- *"Rule 1 - include road links where traffic flows are predicted to increase by more than 30% (or where the number of heavy goods vehicles is predicted to increase by more than 30%); and*
- *Rule 2 - include any other specifically sensitive areas where traffic flows are predicted to increase by 10% or more*".

11.23 Where the predicted increase in traffic flow is lower than these thresholds then the significance of the effects can be considered to be low or not significant and further detailed assessments are not considered necessary. Consequently, where the predicted increase in traffic flow is greater than these thresholds then the effects are considered to be potentially significant, and will be assessed in greater detail.

11.24 These guidelines are intended for the assessment of environmental effects of road traffic associated with major new developments giving rise to traffic generation as opposed to short-term construction.

[7] The Institution of Highways and Transportation (1994). Guidelines for Traffic Impact Assessment.

[8] Institute of Environmental Management and Assessment (1993). Guidelines for the Environmental Assessment of Road Traffic.

In the absence of alternative guidance and, as the traffic generation during the operational phase is very low, these guidelines have been used to assess the short-term construction phase.

11.25 It is worth noting that on roads where existing traffic levels are generally low (e.g. rural roads and some unclassified roads), any increase in traffic flow may result in a predicted increase that would be higher than the IEMA guideline thresholds. In situations such as these, it is important to consider any increase in terms of overall traffic flow in relation to the capacity of the road.

11.26 Any change in traffic flow which is greater than the thresholds set out in the IEMA guidelines would be subject to further analysis using this method to establish if the increased traffic flow is within the capacity of the road. In instances where traffic flow is higher than the IEMA guideline thresholds but within the capacity limits of the road, and the potential magnitude of change on receptors is minor or negligible, this increase would generally be considered to be not significant. It is acknowledged that capacities can be reduced by local conditions.

11.27 An assessment has also been undertaken of the effects on other users of the road improvements required for the safe transport along the AILV route, using the significance criteria set out below.

Other Effects

11.28 IEMA guidelines identify that the following environmental effects should be considered when assessing the effects of traffic related to the Development:

- Hazardous loads;
- Accidents and safety;
- Driver delay;
- Pedestrian amenity;
- Pedestrian delay;
- Severance;
- Noise and vibration; and
- Visual effects of traffic.

11.29 A qualitative assessment of these effects has been undertaken, using the criteria detailed below.

Policy Guidance

11.30 Most roads considered within this study are strategically important regional or local roads, and have a greater traffic capacity and better general safety record when compared with roads of a lower classification. On this basis it is preferable to use these strategic routes where possible. Transport Scotland also promotes the use of sea ports to reduce the effects of abnormal load movements on the road network.

11.31 In addition to the guidance listed above, reference has also been made to the 'Transport Assessment and Implementation: A Guide' published by the Scottish Government[9] in order to determine whether a Transport Assessment is necessary in support of the Development. This document outlines the necessary considerations in the production of a Transport Assessment. The long-term traffic generation of the Development during operation will be minimal and on this basis a Transport Assessment is not required.

[9] Scottish Government (2005). Transport Assessment and Implementation: A Guide Available at: http://www.scotland.gov.uk/Resource/Doc/57346/0016796.pdf [Accessed: 27/11/2015]

Significance of Effects

Significance Criteria

11.32 Two broad principles outlined within the IEMA guidelines are advised for use as a screening process to limit the scale and extent of the assessment as detailed in section 12.4.1.

11.33 For the purposes of this assessment and in accordance with the criteria set out within the IEMA guidelines, the scale (magnitude) of any increase in traffic flows on a particular section of the road network as a result of the Development construction activities will determine the significance of any effects associated with such increases. For example an increase in traffic flows of more than 90% on a particular section of the road network, will likely have a major effect on the road section being assessed. The range of potential effects is outlined in paragraphs 11.55 to 11.67.

11.34 An assessment has been made of the significance of further effects taking into account the importance / sensitivity of the receptor, the magnitude of effect, the duration/ persistence of the effect and the likelihood of the effect occurring. The criteria used to make judgements on the importance/sensitivity of the receptor(s) and the magnitude of the effect are presented in Table 11.2 and Table 11.3.

Table 11.2 : Receptor Sensitivity

Receptor Sensitivity	Description
High	People whose livelihood depends upon unrestricted movement within their environment; this includes commercial drivers and the companies who employ them. Local residents whose daily activities depend upon unrestricted movement within their environment. Receptors such as schools, colleges, accident hotspots.
Medium	People who pass through or habitually use the area but whose livelihood is not wholly dependent on free access. Receptors such as congested junctions, hospitals and conservation areas.
Low	Occasional users of the road network. Receptors such as public open space and residential areas.
Negligible	Users not sensitive to transport effects.

Table 11.3 : Magnitude of Change

Magnitude	Definition
Major	The proposals could result in an appreciable change in terms of length and/or duration to the present traffic routes or schedules or activities, which may result in hardship.
Moderate	The proposals could result in changes to the existing traffic routes or activities such that some delays or rescheduling could be required, which cause inconvenience.
Minor	The proposals could occasionally cause a minor modification to routes, or a very slight delay in present schedules, or on activities in the short-term.
Negligible	No effect on movement of road traffic above normal level.

11.35 A combination of the sensitivity of the receptor and the magnitude of the effect are then used to inform the significance of the effect as outlined in Table 11.4.

Table 11.4 : Significance of Effects

Magnitude / Sensitivity	Major	Moderate	Minor	Negligible
High	Major	Moderate	Minor	Negligible
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

11.36 Effects assessed as major or moderate are considered to be significant for the purposes of the EIA Regulations. Effects assessed as minor or less are considered to be not significant.

Embedded Mitigation

11.37 A detailed Traffic Management Plan (TMP) will be submitted and agreed with The Borders Council ('The Council') prior to the construction phase of the Development. The TMP would contain further information regarding transport routes, road upgrades and working hours.

11.38 The TMP prepared prior to construction will include discussion on any mitigation required to ensure there are no effects to receptors on this route.

Development Design Mitigation

11.39 The Development has sought to minimise effects on the local road network by using the A68 which is an established strategic transport route in the area. The Access Study, and Additional Swept Path Analysis included in **Technical Appendices 11.1** and **11.2** indicate that minor widening works will be required at one location to negotiate the route to the site entrance, but that no further significant temporary works will be required.

11.40 By maintaining appropriate visibility splays, the junction between the A6088 and the site entrance would be designed to ensure that vehicles can enter and exit the Development Site without affecting safety on the existing public road.

Baseline Conditions

Abnormal Loads and Construction Access

11.41 The wind turbine components would be classified as abnormal loads when being delivered to the Development. The abnormal loads would consist of components summarised below which due to their sizes and weights, would need to be transported on specialist vehicles AILV.

- Turbine Blades – 57.3 m in length
- Tower Sections - 5 sections each 30 m in length
- Nacelle – weighing 115 tonnes

11.42 In order to avoid undue disruption to the road network, the Transport Scotland advises that, where possible, abnormal loads should be directed to the nearest suitable water port. In this case, the Port of Blyth would receive such loads.

11.43 RES has undertaken a Route Access Survey which identified a suitable route for the transportation of abnormal loads from the Port of Blyth to the Development. The route is as defined in paragraph 11.17 and can be seen in Sheet 1 of **Technical Appendix 11.2**.

11.44 Construction vehicles other than AILVs may access the site using any potential route, and it should be assumed that these vehicles will approach the site from a dispersed range of origins. Therefore this assessment will focus on assessing the potential impacts of traffic on all reasonable routes leading to the site from the trunk road network.

Existing Road and Access Arrangements

A68

11.45 The A68 is a trunk road of regional and national significance which travels between Edinburgh in the north and Newcastle in the south. The road is subject to national speed limit except where it passes through settlements.

A6088

11.46 The A6088 is a high standard single carriageway road which connects the site entrance to the A68 to the east. It is subject to national speed limit.

B6357

11.47 The B6357 is a low standard single carriageway road. It connects the A6088 to the A7 south-west of the site, and could potentially be used by site personnel or delivery vehicles approaching the site from this direction. It is subject to national speed limit.

11.48 Both the A68 and the A6088 will be used by construction personnel, general delivery vehicles and by abnormal load vehicles. The B6357 may only be used by construction personnel and general delivery vehicles.

Baseline Traffic Data

11.49 Traffic surveys were conducted for 14 days in June 2015 at a number of locations on the road network surrounding the site entrance. The data collected is presented in Table 11.5 and Table 11.6. Figure 11.1 indicates the approximate survey locations.

11.50 Background traffic growth will occur on the local road network irrespective of whether or not the Development is constructed. Projected baseline traffic flows for the expected year of construction (anticipated to be 2019) have been calculated by applying the National Trip End Model (NTEM) central growth (all vehicles) factor. NTEM[10] is designed by the Department for Transport (DfT) and provides projections of growth over time for use in local and regional transport models. NTEM is the industry standard tool for estimating traffic growth.

Table 11.5 : Existing Annual Average Daily Traffic (AADT)

Location	Year Data Collected	Average Number of Vehicles	% HGVs
1 – A6088 South	2015	420	22

[10] https://www.gov.uk/government/collections/tempro [Accessed 30/11/2015]

Location	Year Data Collected	Average Number of Vehicles	% HGVs
2 – A6088 North	2015	496	22
3 – B6357	2015	317	23

Table 11.6 : Projected AADT (2019)

Location	Average Number of Vehicles	% HGVs	Number of HGVs
1 – A6088 South	437	22	97
2 – A6088 North	516	22	114
3 – B6357	330	23	76

11.51 Typical capacity values for a variety of road types are provided within the Design Manual for Roads and Bridges (DMRB), in which capacity is defined as the maximum sustainable flow of traffic passing in one hour under favourable road and traffic conditions. Table 1 and 2 in Advice Note TA 79/99 of DMRB Volume 5[11], and Tables 5/3/1 and 5/3/2 of the DMRB Volume 15 (SIAS, 2013)[12] give the flow capacity for various urban and rural road types. Table 11.7 summarises the theoretical capacity of each of the roads within the study area.

Table 11.7 : Theoretical Link Speed and Capacity

Road	Description	Speed Limit (kph)	Default Link Speed – HGVs (kph)	Capacity (Veh/hr/direct-ion)	Total Hourly Capacity	Total Daily Capacity
A6088	Rural – typical single 6.0 m.	96 (60mph)	55 (34mph)	900	1,800	43,200
B6357	Rural – typical single 5.5 m.	96 (60mph)	55 (mph)	800	1,600	38,400

11.52 It can be seen from Table 11.7 that compared with observed AADT and ADT flows listed in Table 11.5 and Table 11.6, roads within the Study Area are operating considerably below capacity.

Sensitive Receptors

11.53 There are a number of residential areas within the Study Area; those located closest to the Development being Chesters, Bonchester Bridge and Hawick. Each of these areas will be considered as a sensitive receptor as a result of the residential / commercial frontage on one or both sides of the carriageway.

11.54 It is likely that all AILVs will travel from the Port of Blyth in the south and therefore will not pass through any of these settlements. Other construction traffic may approach the site from any direction and therefore may pass through Chesters only if approaching via the B6357 or through all of these settlements if approaching via the A6088. This traffic will consist of HGVs and other smaller vehicles such as vans and cars.

[11] Design Manual for Roads and Bridges Volume 5 Section 1 TA 79/99 Traffic Capacity of Urban Roads. Available at: http://www.standardsforhighways.co.uk/dmrb/vol5/index.htmpdf [Accessed 30/11/2015]

[12] SIAS (2013). DMRB Volume 15 Economic Assessment of Road Schemes in Scotland; Section 1 The NESA Manual, March 2013. (Acknowledged that this document has been withdrawn. However until an adequate replacement is provided it will remain the most appropriate method of determining capacities)

Information Gaps

11.55 In relation to existing traffic flow information for the road network surrounding the Development Site, sufficient information has been obtained to allow an assessment to be made of the potential traffic effects as a result of the Development.

Assessment of Potential Construction Phase Traffic Effects

11.56 The principal potential traffic effects associated with the Development result from the need to import materials and from AILVs associated with the construction phase.

11.57 Standard HGVs would be used to transport general construction materials (concrete, aggregates, cement, cabling, etc.) to the various elements of the Development. The characteristic effect of this form of traffic is a general increase in HGV movements on the road network during the construction phase of the wind farm.

11.58 A proportion of the turbine components would be transported on AILVs. Such loads may require police or other forms of escort and can restrict traffic on the road network for a short period of time. Measures such as this would be set out in detail in the TMP produced for the Development. AILVs would be limited to using the defined approach corridor via the A6088 and the construction site entrance.

11.59 AILVs would constitute abnormal loads during delivery to the Development site. Once the component is unloaded, the AILV would be retracted to the size of a standard articulated lorry and would not require an escort vehicle.

11.60 The main erection crane would have approximately 750 tonnes lifting capacity. Whilst travelling to the Development Site on public roads, the crane would be de-rigged and its axle weights would be within that permissible by current legislation. The width of the crane while travelling would be approximately 3 m and the length of the crane would be approximately 22 m.

11.61 One smaller assisting crane (of lifting capacity between 150 and 300 tonnes) would also be required for the blade erection, and assembling of the main lifting crane.

11.62 The longest vehicle that would access the Development Site would be the blade AILV. This vehicle would be approximately 62.3 m in length to carry 57.3 m long blades.

11.63 Traffic is currently generated from ongoing forestry operations in areas of the Development. Forestry traffic takes accesses to existing operations areas via a timber extraction route located at the west of the Development site which is taken directly from the B6357, as indicated on the Site Location Plan Figure 1.1. During construction of the wind farm there will be an increase in the amount of forestry traffic due to tree felling operations around the turbines and access tracks. This assessment will consider the effects of the increase in forestry traffic associated with the development only (excluding the traffic generation from forestry operations were the Development not progressed). As forestry operations have been ongoing since 2013, existing traffic generated from forestry operations will have been captured in the traffic survey conducted in 2015, and therefore the figures in Table 11.6 include this.

11.64 The indicative construction programme and associated construction traffic movements information are provided in Table 11.8 and Table 11.9 respectively.

Table 11.8 : Indicative Construction Programme

	Month																				
Activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Forestry Works																						
Site Set-Up																						
Tracks & Hardstandings																						
Foundation Construction																						
Met Mast																						
Turbine Erection																						
Cable Installation																						
Substation																						
Reinstatement																						
Site Demobilisation																						
Site Staff																						
Miscellaneous Deliveries																						

11.65 In addition to the activities indicated in Table 11.8, vehicle movements will be generated by staff travelling to and from the site, and from miscellaneous deliveries. Vehicle movements associated with staff and miscellaneous deliveries will occur throughout the entire construction program.

11.66 Vehicle movements associated with staff will be via car or minivan. For the purposes of this assessment it has been assumed that all other deliveries will be made via HGV, although it is possible that a small number may arrive via van.

Table 11.9 : Indicative Construction Movements

Activity	Total Number of Vehicle Movements During Construction	Average No. of Daily Vehicle Movements	Approx. Max No. of Vehicle Movements in Any Day
Forestry	238	3	6
Site Set-Up	62	2	10
Tracks & Crane Hardstandings	22,448	128	140
Foundations	2,478	28	168
Met Mast	16	<1	2
Turbine Erection	308	4	20
Cable Installation	266	4	40
Substation	94	<1	6
Site Demobilisation	62	4	22
Site Staff	39,456	82	130
Miscellaneous Deliveries	5,339	12	30
TOTAL	70,767		

11.67 The construction movements indicated in Table 11.9 have been derived using the estimated volumes and quantities of construction material required for the Development. The average number of movements per day has been calculated by dividing the total number of movements for that activity by the number of programmed days for that activity, assuming an average of 22 working days per month. The estimated maximum number of vehicle movements in any day is an estimate of the absolute maximum number of vehicle movements that could occur for any activity in one day.

Predicted Traffic Generation

11.68 The total number of vehicle movements generated during the construction of the Development is estimated to be 70,767 over the 22 months of the construction period. This figure includes 130 turbine component abnormal load deliveries (although it may be possible to transport the nacelle, rotor hub and drive chain components together, reducing the number of abnormal loads) and takes account of all construction vehicles generated by the above works during the construction period. These figures include an estimate of light vehicle (cars and vans) movements predominantly for construction personnel transport that considers the amount of activity in each month. These figures are based on all of the Development's site construction materials being imported.

11.69 The total daily vehicle movement numbers peak during months 11 and 12 of the construction period when the concurrent activities comprise the construction of tracks and hardstandings; foundations; cable installation; the substation; site staff; and miscellaneous deliveries. During these months, the *average* number of movements is estimated at 255 per day with the number of HGV movements estimated at 174. The approximate *maximum* number of vehicle movements during months 11 and 12 is estimated at 514, of which 384 will be HGVs.

11.70 Over the whole of the 22 month construction period, the average number of vehicle movements per day is expected to be 73. The average number of HGV movements per day is expected to be 33.

11.71 For the purposes of this assessment, a worst case scenario shall be assumed whereby the all of the traffic approaches the site using only one route. In reality, construction traffic will likely be distributed over each of the approach routes, therefore the actual effect at the assessed locations is likely to be less than defined in this chapter. AILVs must approach the site using the agreed abnormal load route as defined in paragraph 11.17. However the traffic generated during months 11 and 12 do not include and AILVs (as there are no AILV deliveries during those months), therefore it is appropriate to assess each route using the traffic generation figures summarised in this section.

11.72 An assessment of construction traffic effects has been undertaken for each of the possible delivery routes. The worst case scenario increases in daily traffic for months 11 and 12 are summarised in Table 11.10 and Table 11.11.

Table 11.10 : Average Increase in Vehicle Movements during Months 11 and 12

	Projected AADT Without Development		Average AADT With Development		% Increase	
Location	**All Vehs**	**HGVs**	**All Vehs**	**HGVs**	**All Vehs**	**HGVs**
1 – A6088 South	437	97	692	271	58	179
2 – A6088 North	516	114	771	288	49	153
3 – B6357	330	76	585	250	77	229

Table 11.11 : Maximum Increase in Vehicle Movements

	Projected AADT Without Development		Max AADT With Development		% Increase	
Location	**All Vehs**	**HGVs**	**All Vehs**	**HGVs**	**All Vehs**	**HGVs**
1 – A6088 South	433	95	951	481	118	396
2 – A6088 North	512	113	1030	498	100	337
3 – B6357	327	75	844	460	156	505

A6088 South

11.73 As indicated in Table 11.10 and Table 11.11 traffic volumes are expected to increase on this section of road by an average of 58% and a maximum of 118% during months 11 and 12 of construction. HGV traffic is expected to increase by an average of 179% up to a maximum of 396% during this period. These increases in overall vehicle movements and HGV movements are above IEMA thresholds for significance. However the overall volume of traffic is still significantly below the theoretical road capacity of 43,200 daily movements as given in Table 11.7. The cause of the large percentage increase in flow can be attributed to the very low existing traffic numbers.

11.74 As a result of the very low baseline flow in relation to the overall capacity of the road, the magnitude of change resulting from the increased traffic and HGV movements on this road is considered to be minor. As there are no receptors over high sensitivity on the route, applying the test of significance as defined in Table 11.4, the significance of the effects are consider **minor** and short term.

A6088 North

11.75 As indicated in Table 11.10 and Table 11.11 traffic volumes are expected to increase on this section of road by an average of 49% and a maximum of 100% during months 11 and 12 of construction. HGV traffic is expected to increase by an average of 153% up to a maximum of 337% during this period. These increases in overall vehicle movements and HGV movements are above IEMA thresholds for significance. However, the overall volume of traffic is still significantly below the theoretical road capacity of 43,200 daily movements as given in Table 11.7. The cause of the large percentage increase in flow can be attributed to the very low existing traffic numbers.

11.76 As a result of the very low baseline flow in relation to the overall capacity of the road the magnitude of change resulting from the increased traffic and HGV movements on this road is considered minor, however the route passes through Chesters and Bonchester Bridge which may be perceived to be receptors of high sensitivity. Applying the test of significance as defined in Table 11.4, the effects are **minor** and short term.

B6357

11.77 As indicated in Table 11.10 and Table 11.11 traffic volumes are expected to increase on this section of road by an average of 77% and a maximum of 156% during months 11 and 12 of construction. HGV traffic is expected to increase by an average of 229% up to a maximum of 505% during this period. These increases in overall vehicle movements and HGV movements are above IEMA thresholds for significance. However the overall volume of traffic is still significantly below the theoretical road capacity of 38,400 daily movements as given in Table 11.7. The cause of the large percentage increase in flow can be attributed to the very low existing traffic numbers.

11.78 As a result of the very low baseline flow in relation to the overall capacity of the road the magnitude of change resulting from the increased traffic and HGV movements on this road is considered minor. However the route passes also through Chesters via the A6088 which may be perceived to be a receptor of high sensitivity. Applying the test of significance as defined in Table 11.4, the effects are **minor** and short term.

Other Effects

Road Widening Works

11.79 The proposed road widening works are shown in Detail 1, 10 and 17 of Technical Appendix 11.2. Descriptions of the proposed works are as follows:

- Detail 1 – Depending on whether the Port Authority deems a wider entrance would benefit the Port in the longer term the existing port entrace would be widened either permanently (tarmac finish) or would be temporarily widened with hard standing. The widening works would necessitate the remove of a number of small bush/shrubs at the gate and the relocation of 2 lamposts and a security fence.
- Detail 10 – A very small area of hardstanding would be required on the edge of an existing roundabout. This land will already be under the control of the Highways Authority.
- Detail 17 – removal of existing stone wall, lay down of hardstanding to allow delivery vehicles to drive on the identified over run area. The over run area will be retained for possible use during the wind farm operational life however following the constuction phase the hardstanding would be covered in top soil and grass seeded until required again. During the wind farm operational phase the stone wall will be rebuilt further back to allow continued access to the widened area.

11.80 All these areas are all located outwith Scottish Borders Council boundary and as such are not covered by this application. Where required the appropriate consents will be sought from Northumberland County Council.

11.81 A desk review of the proposed widening works has been carried out in order to identify any key issues to be addressed when consents are applied for. The areas to be widened are not within any land designations although Monkridge Hall next to the widening works in Detail 17 is a listed bulding.

11.82 No concerns regarding the widening shown in Detail 1 and 10 were raised by any of the spcialists. The larger area of over run had comments from two specialists are detailed in paragraphs 11.83 to 11.86.

Landscape and Visual

11.83 As the adjustments to the road alignment will be temporary there are no significant concerns. It is advisable to reinstate the original landscape features to their original form to retain carriageway character

Cultural Heritage

11.84 There are no archaological designations covering this area however earthmoving activity has the potential to affect unknown buried archaeological remains.

11.85 A Watching brief likely to be required and should be agreed with the local planning authority. The Watching brief will allow any remains to be identified and be preserved by record.

11.86 There will be indirect effects (possibly major) on the setting of Monkridge Hall (a listed building) during construction (and periodically during the delivery schedule), but these are mitigated by short term/incidental nature. Otherwise, after reinstatement, no significant effect.

Hazardous Loads

11.87 During the construction phase, fuel would need to be delivered to the site. This is categorised as a hazardous load. It is anticipated that there would be approximately 8 deliveries per month during the construction phase. This would not represent a high traffic volume, and the transport of fuel is commonplace and controlled by legislation. Consequently, the magnitude of effect associated with the very low risk of an accidental spill occurring is negligible. Although receptors would be of high sensitivity, with the negligible magnitude of effect, the overall effect of hazardous loads is assessed as being negligible, and **not significant** in terms of the EIA Regulations.

Accidents and Safety

11.88 There are no general thresholds for determining the significance of increased traffic on road safety. Effects on road safety during construction could occur as a result of increased traffic on the road network, or through large and slow moving vehicles on the road or turning into or out of the site. These risks can be mitigated with appropriate control measures as detailed in the outline Traffic Management Plan, in order to protect road safety.

11.89 The increase in the number of HGV movements on the B6357, which represents the worst case, would average 15 per hour during construction working hours (assuming 12 hours per working day), up to a maximum of 32 per hour, during months 11 and 12, when they would be at their highest. Across the remaining months, the number of HGV movements is less than this. These increases are considered to have a negligible, short-term effect on road safety conditions along the delivery routes assuming the implementation of appropriate traffic control measures.

11.90 An escort for AILV movements, coupled with careful timing of movements, would not result in the movement of AILVs having an effect of greater than negligible magnitude in relation to the safety of other road users.

11.91 Although receptors relating to accidents would typically be considered to be of high sensitivity, with the implementation of the mitigation measures identified the magnitude of the effect is considered to be minor. Therefore, the overall effect on road safety due to the Development is considered to be of minor and **not significant** under the EIA Regulations.

Driver Delay

11.92 Minor, short-term traffic delays may occur during limited periods over the duration of the Development construction period due to increases in road traffic associated with construction traffic. The IEMA (1993) guidelines note "*these delays are only likely to be significant when the traffic on the network surrounding the development is already at, or close to, the capacity of the system*". The assessed route is not considered to be at or close to capacity, given the baseline traffic flows set out in Table 11.5 and Table 11.6.

11.93 Minor delays may occur at junctions where HGVs are manoeuvring. However, the worst-case additional 32 HGV movements per hour, as an average over the busiest part of the construction period, are expected to have a minor effect on the operation of the links or junctions along the delivery route.

11.94 Slow moving AILVs could also create minor delays along the main corridor route in general. Once the component is unloaded from an AILV, the vehicle would be retracted to the size of a standard articulated lorry and not require an escort vehicle for further travel. The effect of AILVs would therefore be limited to the inbound direction other than for the crane movements which may require to exit the site as AILVs. The cranes will stay on site for the duration of the turbine installation and will have no traffic impact in the interim.

11.95 Appropriate times for vehicle movements would be agreed with Transport Scotland Abnormal Loads department, the Council and the Police to ensure that turbine deliveries occur outside of peak traffic hours and would be controlled by Abnormal Loads Orders. It is unlikely that delays would occur on the local roads at the site entrance due to turning heavy vehicles as the proposed new junction at the site access point has been designed in line with the requirements of the DMRB and traffic flows around on the A6088 are well below capacity. The overall effect on driver delay is considered to be minor and **not significant**.

Pedestrian Amenity

11.96 Traffic volume, composition and speeds, pedestrian footways and crossings all contribute to the experiences of pedestrians, cyclists and other vulnerable road users.

11.97 The routing of vehicles to the site uses the Trunk and strategic road network as far as practicable. Through residential areas where footpaths are present, HGVs would maintain a safe distance from these footpaths whilst manoeuvring and at reduced speed within 30 mph restricted areas (and under escort in the case of AILVs). In addition, appropriate traffic management would be implemented to warn other road users of the presence of HGVs associated with the construction of the Development.

11.98 Although pedestrian amenity is considered to be a receptor of high sensitivity, the predicted short-term increase in traffic movements on an established transport route in the area would be of a negligible magnitude, with the overall effect on pedestrian amenity considered to be negligible and **not significant**.

Pedestrian Delay

11.99 Changes in traffic volume, composition and speeds contribute to the ability of pedestrians to cross roads. Therefore, the effect on pedestrian movements needs to be considered as a result of the Development. The changes in traffic volume, composition and speeds arising due to the construction of the Development are of minor magnitude and are short-term and reversible, with the receptor being of high sensitivity.

11.100 The overall effect on pedestrian delay is considered to be minor and **not significant**.

Severance

11.101 The IEMA (1993) guidelines note that: "Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery".

11.102 All AILVs will be required to use the main corridor route from the Port of Blyth. An Access Study, and additional Swept Path Analysis are found in **Technical Appendix 11.1** and **11.2** respectively and identify locations along the proposed route that may require measures necessary to mitigate the effects of AILV movements. The short term and temporary delivery of abnormal load components is

considered to have an effect of negligible magnitude on a receptor of high sensitivity and is therefore assessed as being negligible and **not significant**.

11.103 On the route the increase of around 16 HGVs per hour during the peak month is considered likely to have an effect of negligible magnitude on a receptor of high sensitivity. Consequently, the effect of construction of the Development is considered to be negligible and **not significant**.

Visual Effects

11.104 The movements of AILVs could be considered visually intrusive. This effect would be short-term and would only occur during the movement of abnormal loads. It is therefore considered the visual effect as a result of the AILVs upon receptors along the routes would be minor and **not significant**.

Operational Phase

11.105 Traffic associated with the operation of the Development is limited to maintenance and is expected to be nominal in comparison to the traffic generated during construction.

11.106 Maintenance visits including those requiring large vehicles will access the Development via the access track from the site entrance off the A6088

11.107 Table 11.12 summarises the predicted levels of traffic associated with the operation and maintenance of the Development.

Table 11.12: Summary of Vehicle Movements during Operation

Activity	Type of Vehicle	Annual Vehicle Movements	Duration
Standard Turbine Servicing	Light Goods Vehicle (LGV)	Year 1: 39 visits (78 vehicle movements) Year 2-30: 26 visits (52vehicle movements)	Year 1: 1 visit per turbine, lasting 3 days, 3 times over the year. Year 2-30: 1 visit per turbine, lasting 3 days, 2 times over the year.
Track Maintenance	LGV	10 visits (20 vehicle movements) (every other year)	2 vehicles per day, lasting approximately 5 days every other year.
Snow Clearance	HGV	5 visits (10 vehicle movements)	1 vehicle per day, estimated at 5 visits per year.
Grid Maintenance	LGV	5 visits (10 vehicle movements)	1 vehicle per day, estimated at 5 visits per year.
Blade Inspection	LGV	13 visits (26 vehicle movements)	1 visit per turbine, lasting approximately 1 day once every three years.
Unexpected Events	LGV and cranes	20 visits (40 vehicle movements)	Experience from similar developments indicate that these events are likely to generate up to 40 additional vehicle movements per year.
Total visits per year*		**Year 1: 92** **Year 2 - 30: 79**	

*Total based on a worst case scenario where all events occur in the same year.

Decommissioning Phase

11.108 Decommissioning of the Development would comprise removal of the turbines and all associated above ground equipment. Turbine towers and blades are likely to be dismantled into smaller sections prior to their removal to ease transport requirements.

11.109 At this stage, it is not possible to forecast quantitatively or accurately the traffic effect during decommissioning of the Development as the baseline data would no longer be valid in 30 years. It is reasonable to assume that baseline traffic would continue to increase. The implication of applying further background traffic growth would be that the proportional effect of the decommissioning traffic would reduce in comparison to the construction traffic effect that has been assessed. It is expected that traffic flow along the main route corridor would continue to remain well below capacity.

11.110 The decommissioning effects would also be greatly reduced as the majority of the construction traffic is created by the import of concrete for turbine foundations and granular fill for infrastructure, the majority of which (e.g. access tracks) is likely be left in situ or in the case of above ground structures, will be taken below ground level and then reinstated. It is therefore likely that the effects of decommissioning would be of the same, or of a lesser magnitude as effects during construction, which have been assessed as negligible and **not significant** in all cases.

Mitigation

Construction Phase

11.111 Based on the analysis set out above, the following mitigation measures are proposed:

- The contractor will be required to prepare a TMP which will identify to all staff the appropriate and safe routes to and from the development.

11.112 With regard to abnormal loads, the following mitigation measures are proposed:

- All movements should take place outside of peak flow hours, in order to minimise disruption to general traffic flows on the network;
- An escort will accompany all abnormal vehicle deliveries;
- It will be necessary to stop traffic travelling in the opposite direction in order to allow abnormal load vehicles to negotiate specific pinch points on the route;
- Appropriate warning signs will be used to warn other motorists of the presence of abnormal load vehicles; and
- Discussions with the local authority will be necessary to determine traffic management measures for the abnormal load vehicle movements.

11.113 Continuous monitoring during construction is not necessary, however the TMP will ensure that frequent inspections are carried out to ensure that agreed mitigation measures, as outlined above, are being undertaken.

Residual Effects

Construction Effects

11.114 The assessment predicted no significant environmental effects and short-term negligible increases in traffic flow at all assessed counter locations during the construction phase of the Development. The

proposed mitigation measures will reduce effects in accordance with good practice and through consultation with the relevant authorities.

Operational Effects

11.115 There will be negligible residual effects on the existing road network from the operation of the Development.

Decommissioning Effects

11.116 Effects associated with traffic generated during the decommissioning phase are not expected to be significant.

Assessment of Cumulative Effects

11.117 Given that significant effects are only likely to occur during the construction stage of the Development, it is considered likely that significant cumulative effects are only likely to occur where the timing of the construction of the Development overlaps with that of another development within the study area i.e. where construction traffic for both developments uses the same roads. No proposed developments are known in close enough proximity to the Development that there would be likely to be significant effects as a result of construction traffic movements occurring at the same time within the study area.

Statement of significance

11.118 The additional traffic as a result of the Development construction and operational activities will result in an increase in traffic flows on the local roads leading to the Development, however, the effects on potentially sensitive receptors has been assessed as not significant in terms of the IEMA Regulations. Furthermore, through the TMP, abnormal load deliveries will be programmed to coincide with the quietest periods on the road network which will ensure that any impacts on local road network are kept to a minimum.

APPLICATION BOUNDARY

LOCATION OF TRAFFIC SURVEY COUNTER

SURVEY LOCATION 1

SURVEY LOCATION 2

SURVEY LOCATION 3

MAIN SITE ENTRANCE / EXIT

LOCATION OF TIMBER EXTRACTION ENTRANCE / EXIT

HIGHLEE HILL WIND FARM

FIGURE 11.1

LOCATION OF TRAFFIC SURVEY COUNTERS

LAYOUT DWG	N/A
T-LAYOUT NO.	N/A
DRAWING NUMBER	2053-DR-PRE-0002
SCALE -	1 : 25,000
	ENVIRONMENTAL STATEMENT 2016

THIS DRAWING IS THE PROPERTY OF RENEWABLE ENERGY SYSTEMS LTD. AND NO REPRODUCTION MAY BE MADE IN WHOLE OR IN PART WITHOUT PERMISSION

Reproduced from Ordnance Survey digital map data © Crown copyright 2016. All rights reserved. License number 100048606