Carno III Wind Farm
Tip Height Extension

Further Environmental Information
July 2020

VOLUME 1 of 3
WRITTEN STATEMENT AND APPENDIX

Prepared by

Preface

This Further Environmental Information (FEI) has been prepared by Natural Power Consultants Ltd., on behalf of Amegni Renewables Ltd. in accordance with the statutory procedures set out in the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. The FEI supports the formal Section 73 application for the Carno III Wind Farm Tip Height Extension (THE) and associated infrastructure, near Carno, Powys, Mid-Wales, which has been prepared for Powys County Council (PCC) under the Town and Country Planning Act 1990 (as amended).

A separate application will also be submitted to Powys County Council under the Town and Country Planning Act 1990 (as amended) for a new section of access track that leaves the main public highway and enters agricultural land opposite Wig Lane.

Due to Covid-19 restrictions a hard copy will not be available for viewing, as agreed with Powys County Council.

The Section 73 application and supporting documents will be available for viewing on the Powys County Council website using their online ‘Search for Planning Applications’ facility.

This is Volume 1 of 3 of the Further Environmental Information. This volume presents all the relevant environmental assessments that have been undertaken along with their appendices.

Volume 2 contains all the relevant maps, plans, figures, diagrams and visualisations.

Volume 3 presents the key information in the Non-Technical Summary as a bilingual English/Welsh document.

Electronic copies on DVD/memory stick can also be obtained from Natural Power Consultants Ltd., Harbour House, Y Lanfa, Aberystwyth, Ceredigion, SY23 1AS

Tel: +44 (0) 1970 636869

Further Environmental Information, Environmental Statement and Supplementary Environmental Information in PDF file format on DVD/memory stick. £25

VOLUME 1 WRITTEN STATEMENT

CONTENTS PAGE

SECTION 8: HYDROLOGY, GEOLOGY AND HYDROGEOLOGY

SECTION 9: ECOLOGY

SECTION 10: NOISE

SECTION 11: FORESTRY

SECTION 12: CULTURAL HERITAGE

SECTION 13: TRAFFIC AND TRANSPORT

SECTION 14: EXISTING INFRASTRUCTURE

SECTION 15: SUMMARY

VOLUME 1 APPENDICES

CONTENTS PAGE

APPENDIX 4: DESCRIPTION OF THE DEVELOPMENT

APPENDIX 6: LANDSCAPE AND VISUAL

Section 1

Project Overview and Update

CONTENTS

1.11 INTRODUCTION

1.11.1 The Carno Wind Farm Extension - Phase III (known hereafter as Carno III) currently has planning permission for the construction and operation of 13 turbines at up to 126.5 metres (m) in maximum height to blade tip, and associated wind farm infrastructure, with an indicative development capacity of 41.6 Megawatt (MW). The consent was granted in May 2017 under the Town and Country Planning Act 1990 (planning reference: P/2010/0762).

1.11.2 The original application was submitted in July 2010 for a wind farm comprising up to 18 wind turbines of an overall height from base to tip not exceeding 126.5 m, site tracks, foundations, underground electricity cables, borrow pits, a permanent anemometer mast, an on-site 33/132 kiloVolt (kV) substation and operations building housing switchgear and metering equipment, two temporary construction and storage compounds, and associated works/infrastructure. A Supplementary Environmental Information (SEI) was submitted in July 2015 with a reduction in turbine numbers down from 18 to 13, with no change to turbine dimensions proposed. The reasons for the reduction in turbine numbers are explained in Section 3 of the SEI.

1.11.3 The Further Environmental Information (FEI) document has been produced by Natural Power Consultants Ltd (Natural Power), on behalf of the applicant, Amegni Renewables Ltd (Amegni Renewables), in support of the Section 73 application to amend the existing consent. The proposed changes are to seek an increase in tip height for all 13 turbines from 126.5 m to tip to a maximum of 149.9 m to tip ('the proposed development'); this represents a 23.4 m increase in tip height.

1.11.4 This document has been produced to provide Powys County Council (PCC) and other key consultees with additional information relevant to the ongoing Environmental Impact Assessment (EIA) process. All further information presented within this FEI has been provided in response to specific consultation responses to date.

1.11.5 Amegni Renewables are seeking to increase the tip height of the turbines to maximise the wind farm's efficiency. Since submission of the original application in 2010 there has been considerable change in the onshore wind market. Due to the removal of subsidies (Renewable Obligation Certificates and Contracts for Difference), it is now vital that onshore wind farms maximise their efficiency. Therefore larger, more productive turbines that can maximise energy yields must be considered. Turbine availability has also changed considerably with fewer turbine manufacturers providing turbines in the lower height ranges. Turbines in the height range over 150 m to tip are now considered typical in today's market.

1.11.6 As set out by the Cabinet Secretary for Environment (at the time), Lesley Griffiths, has set targets for Wales to generate 70% of its electricity consumption from renewable energy by 2030, for one gigawatt of renewable electricity capacity in Wales to be locally owned by 2030, and by 2020 renewable energy projects have at least an element of local ownership. Carno III would contribute to these targets set for Wales. Amegni Renewables is a locally based renewable energy company and a local enterprise formed by farmers from Carno, Mid Wales, who teamed up with their neighbouring landowners to pursue the development, therefore supporting Welsh Government's aspirations for local ownership of renewable energy projects in Wales.

1.12 SITE LOCATION

1.12.1 The consented Carno III Wind Farm is located on land south-west of Carno village, Powys, Mid Wales. The site is characterised by upland commercial coniferous forestry, improved upland farmland and areas of acid grassland and peatland. The proposed development lies largely within Technical Advice Note 8 (TAN 8) Refined Carno North Strategic Search Area (SSA B), as identified by Powys County Council. Figure 1.2 within Volume 2 of this FEI shows the location of the consented Carno III Wind Farm.

1.12.2 Figure 1.2 within Volume 2 of this FEI shows the location of the consented Carno III Wind Farm.

1.12.3 The proposed development is considered an extension to the adjacent operational wind farms; Carno I and Carno II as seen in Figure 1.3 within Volume 2 of this FEI.

1.13 PROPOSED CHANGES

1.13.1 Based upon the assessment work undertaken, and due to the nature of the site, the lead Environmental Impact Assessment (EIA) consultants, Natural Power, has identified that the changes proposed to the consented scheme will not result in fundamentally different impacts. We are therefore applying under a Section 73 application of the Town and Country Planning (Wales) Act 1990 (as amended), to Powys County Council.

1.13.2 Table 1.5 includes the easting and northing grid reference for the thirteen turbine project (which remains unchanged from that consented) along with the proposed heights.

Table 1.5: Consented Tip and Proposed Tip Heights

Turbine number (as per consented layout)	Easting	Northing	Consented turbine tip height (m)	Maximum proposed turbine tip height (m)
1	291701	294597	126.5	149.9
2	291383	294392	126.5	149.9
3	291311	294120	126.5	149.9

Turbine number (as per consented layout)	Easting	Northing	Consented turbine tip height (m)	Maximum proposed turbine tip height (m)
4	290575	294469	126.5	149.9
5	290121	294493	126.5	149.9
6	289979	294758	126.5	149.9
8	289944	294221	126.5	149.9
10	292091	294276	126.5	149.9
11	291892	293961	126.5	149.9
12	291521	293781	126.5	149.9
13	292337	293870	126.5	149.9
14	292562	293616	126.5	149.9
15	292989	293728	126.5	149.9

1.13.3 Indicatively, candidate turbines are being considered at this time with component parts which include hub heights ranging from approximately 83.9 m to 92 m, blade length of approximately 56.5 m to 64.5 m and rotor diameter of approximately 115.7 m to 132 m. These are the heights of turbines that are currently available in the market. Such dimensions are likely to change as a balance is reached in procuring a turbine to fit the 149.9 m to tip criteria. The final turbine hub height and rotor diameter would be agreed as a part of pre-commencement condition 16 of the existing consent.

1.13.4 It is envisaged that the generating potential of the site will also increase, although this will be dependent on final turbine selection. Currently the turbines available range between 3-4.5 MW in capacity. A grid connection offer has been entered with Scottish Power Manweb for a connection up to 48 MW. The maximum generating capacity of Phase III will be confined to the grid connection.

1.13.5 Due to the proposed increase in turbine tip height for Carno III the permanent anemometer mast is also proposed to be increased in height to closer reflect the proposed hub height for better wind data collection and correlation. The consented height for the mast was indicatively 80 m and Amegni Renewables is seeking to increase this to 90 m. This has been taken into account in the visualisations and as part of the assessment.

1.13.6 Similarly, as a result of the increase in tip height there is expected to be an increase in civil infrastructure requirements with regards to crane pad area, turbine foundation size and minor increase in access track widths compared to the original proposal. Once again however, whilst larger, the increase will not alter the number or general location of the proposed infrastructure and the entire proposal is intended to operate within the parameters of the consented conditions.

1.13.7 To accommodate these proposed changes, it is suggested that planning condition (PC) 1, PC 2, PC 14 and PC 45 of the current consent are reworded as follows:

PC 1:

"development" *means the works that are permitted to take place as a result of this permission. This includes;*

a) up to 13 wind turbines each sited, subject to conditions, in locations shown on Figure 4.15 FEI Site Layout contained within 2020 Further Environmental Information, on concrete foundations incorporating hardstandings for cranes and fitted with rotating blades having a blade tip of up to 149.9 metres including transformers.

b) A series of cables buried beneath the surface of the ground and connecting the wind turbines to the substation.

c) Construction compounds.

d) A substation.

e) A series of access tracks between the wind turbines.

f) A construction maintenance and emergency site access road.

g) An anemometry mast.

h) Borrow pits for the extraction of stone to be used in the construction of the development.

PC 2:

Subject to the conditions attached to this permission, the development shall be carried out in accordance with the following approved plans and documents:

a) 2020 FEI (Section 73 application):

I. Volume 1: Written Statement and Appendix.

II. Volume 2: Supporting Figures and Visualisations.

b) 2015 SEI:

I. Appendix 8 in Volume 3A: Appendices

c) 2010 ES:

I. Figures 4.1, 4.5, 4.6, 4.7, 4.9, 4.11a, 4.11b and 4.12 in Volume 2.

PC 14:

No development shall commence, excluding tree felling, until a micro-siting protocol has been submitted to and approved in writing by the local planning authority. It shall set out a protocol for deciding on micrositing of all development to minimise the development's impact on, but not limited to, peat, blanket bog, habitat, curlew, protected species watercourses, public rights of way, heritage assets, bats, health and safety and any other identified environmental or engineering constraints. This protocol shall conform to the following criteria:

a) It shall be informed by detailed peat assessments carried out in accordance with Condition 45.

b) All aspects of the development shall be located within 50 m of the locations shown on Figure 4.15 contained within 2020 Further Environmental Information.

c) T1, T10, T11, T12, T13, T14 and T15 may be microsited no closer to a public right of way or permissive route as shown on Figure 14.5 contained within the 2020 Further Environmental Information.

The micrositing principle shall be implemented as approved.

PC 45:

No development shall commence until a Peat Management Plan (PMP) incorporating the objectives and measures outlined in the draft PMP contained within the Carno 3 Wind Farm Further Environmental Information 2020 has been submitted to, and approved in writing by the local planning authority. The PMP shall include:

a) measures to minimise impacts on peatland habitats during site clearance, tree harvesting and construction;

b) updated peat probing surveys and peat depth modelling;

c) the storage, handling and re-use of all excavated peat;

d) a revised peat budget based on a drain survey following tree felling and revised peat excavation volumes;

e) Measures for the blocking and/or infilling of drains.

The development shall be implemented in full accordance with the approved plan.

1.13.8 The description of the development, as shown on the front page of the consent in bold, for the application does not require amending.

'Wind energy development comprising 13 wind turbines, transformer housing, one anemometer mast, new access tracks, substation, control building, crane hardstandings, upgrading of existing access tracks, main access road alterations, underground cable route, borrow pits and construction compound areas at land adjacent to Carno Wind Farm, Carno.'

1.13.9 As we are seeking consent to increase the tip height, this has resulted in the need to bring larger components to site. Investigations on the proposed route to the wind farm site has identified pinch points for delivering the larger components and therefore some modifications are required to the consented access route.

1.13.10 The main pinch point identified is at Pontdolgoch, along the A470 between Carno and Caersws, where the public road goes under Pontdolgoch railway bridge which has a height and width restriction. Alternative options for this bridge restriction were investigated which has resulted in an alternative access route corridor being identified, shown on Figure 13.4 and 13.5.

1.13.11 This figure shows that the abnormal indivisible loads would (on route to site) pull off the A470 onto adjacent private land (utilising temporary track system), and once given the all clear, cross the A470 and enter Wig Lane unclassified road, over Wig railway crossing and river bridge, before entering private land and follows a new route (with some existing track to be utilised) until reaching an existing junction north of the Pontdolgoch railway bridge at the A470.

1.13.12 The construction of this route would be subject to a separate planning application to Powys County Council as it lies outside the existing red line planning application boundary (updated July 2015), however the potential environmental impact of this route will be considered as part of the Section 73 report.

1.13.13 There is also an alternative off-site grid connection. The proposed grid route from the on-site substation to the off-site substation, that was considered at high level within the EIA, is no longer being pursued. The original proposal considered was a connection via 132 kV overhead line to a proposed National Grid 132/400kV substation near Cefn Coch (as part of the Mid Wales connection project). However, as many projects funding the new substation are no longer being actively progressed or are still within the planning system, the Applicant has looked at alternative grid connections.

1.13.14 The latest proposed grid connection is a connection into the existing mid Wales 132 kV network, connecting at Carno substation. Additional capacity has been identified on the existing 132 kV network subject to reinforcement works in the Newtown/Welshpool area to allow the export of power from Carno III. The Applicant has received a formal connection offer and is working with Scottish Power Energy Networks (SPEN) on the proposed connection. Discussions with SPEN are currently ongoing with any proposed reinforcement works being considered to be via underground cable works and alterations to existing infrastructure. This means the consented wind farm is no longer reliant on the Mid Wales hub connection project.

1.14 CONSULTATION

1.14.1 A scoping report was issued in October 2019 to consultees and a scoping opinion was issued February 2020, which has resulted in the scope presented in this FEI. The full scoping report and scoping opinion can be found in Appendix 4 within Volume 1 of this FEI.

1.14.2 As a result of the scoping consultation, a number of topics have been scoped out of this FEI, resulting in a proportionate sized assessment, where only those with potentially significant effects have been included.

1.14.3 The following assessments have been scoped out:

- Section 2: Needs and Benefits
- Section 3: Site Selection, Site Design & Approach to EIA
- Section 5: Planning Policy
- Section 7: Socio-economic and Tourism

1.14.4 However, in their scoping opinion Powys County Council (PCC) indicated that all topics should be updated from the ES to reflect any changes. This was further discussed at a meeting with PCC on 5th March 2020 and agreed with Louise Evans, case officer at the time, that the scoping report would be included in the FEI (see Appendix 4) and that this would provide the justification why the sections listed above were not to be included in the FEI.

1.14.5 In summary, the need for the proposed development is outlined in the scoping report (subsection 2.1) explaining how the project would contribute to Welsh Government targets for Wales regarding renewable energy generation. Furthermore, the tip height extension will be able to maximise the grid capacity with the use of turbines with a greater generating potential than previously proposed, maximising its ability to contribute to renewable targets. With regards to Section 3, the design aspect of the tip height extension is covered in Section 4 of this FEI and any changes to approach to EIA (and therefore methodology) is covered in the individual FEI sections where relevant. Any updated planning policy relevant to the tip height extension is also discussed in the individual FEI sections and not repeated as a standalone section. In relation to socio-economic and tourism, given the overall conclusions of the ES and SEI, where significant economic benefits and minimal if not negligible effects on tourism as a result of the proposed wind farm were identified, the proposed tip height extension doesn't alter these conclusions. Furthermore, more recent literate evidence suggests that overall the research tends to support the premise that wind farm development has not resulted in a serious negative economic impact on tourism and could even have wider positive impacts.

1.15 STRUCTURE OF FURTHER ENVIRONMENTAL INFORMATION (FEI)

1.15.1 The sections included in this FEI are titled as follows:

- Section 1: Project Overview and Update
- Section 4: Project Description
- Section 6: Landscape and Visual
- Section 8: Hydrology, Geology and Hydrogeology
- Section 9: Ecology
- Section 10: Noise and Shadow Flicker
- Section 11: Forestry Assessment
- Section 12: Cultural Heritage
- Section 13: Traffic and Transport
- Section 14: Existing Infrastructure
- Section 15: Summary, residual effects and mitigation

1.15.2 The original ES and SEI were prepared in accordance with the Town and Country Planning (Wales) (Environmental Impact assessment) Regulations 1999 which were the relevant EIA regulations at the time. Natural Power, on behalf of the Applicant, has prepared this FEI in order to ensure that the information before PCC is up to date and affords them the opportunity to make a robust decision on the potential effects of the increase in wind turbine height. In addition and for completeness, the Applicant has undertaken additional work in order to voluntarily comply with the Town and Country Planning (Wales) (Environmental Impact Assessment) Regulations 2017. Any additional requirements now in place as a result of the 2017 EIA Regulations are considered within this FEI to ensure that the EIA is fully compliant with current legislative requirements. The original ES, SEI and FEI should be read together for the entirety of an Environmental Statement.

1.15.3 In considering the increased turbine heights, the Applicant gave due attention to the relevant design strategy principles (Section 4 of the SEI) incorporated in forming the consented layout and believes those same objectives aspired to in the original ES and SEI have been met in the proposed development.

1.15.4 To enable consideration of the proposed changes, several figures from the ES and SEI which supported the previous application and planning permission have been updated. Figure numbers have not been duplicated in this FEI, therefore the figure numbers presented in this FEI follow on from the last figure number presented in the ES or SEI. Same applies for table, section, and paragraph numbers to avoid any confusion when cross referencing.

1.16 PROJECT TEAM

1.16.1 The applicant has again employed Aberystwyth based consultants Natural Power to coordinate and submit the material required to support the Section 73 application. Natural Power has 25 years of experience producing and managing EIA, preparing and submitting planning applications and is a corporate member of the Institute of Environmental Management and Assessment (IEMA). Natural Power has managed the application and undertaken some of the assessments including Ecology and Ornithology, and hydrology, traffic and transport.

1.16.2 In line with the 2017 EIA regulations, to ensure the completeness and quality of the EIA, each consultant has included a statement of competence, outlining their experience and qualifications in Table 1.6 below.

Table 1.6 Statement of Competency

Discipline	Consultant	Company	Experience
Cultural Heritage	Timothy Malim	SLR Consulting	Timothy Malim has 40 years of experience in the archaeology and heritage sector, working in all parts of the UK and abroad. He is very familiar with the legislation and policy requirements in the different jurisdictions within the UK and has acted as expert witness at four public inquiries. He has undertaken many environmental impact assessments, examining the relationship between cultural heritage and the potential impact from wind turbines and other tall structures. He has a proven track record in analysing what is of significance for heritage assets, and what within their settings would contribute to understanding and appreciation of that significance. These are the criteria against which the magnitude of change and potential impacts are weighed as part of a methodical approach to EIA. Of particular relevance is the Cultural Heritage Assessment for EIA and assessment of settings of Listed Buildings, and impact Assessment on the setting of the World Heritage Site of Hadrian's Wall that he undertook for Hellrigg Wind Farm, Cumbria. He has also acted on schemes such as Carno III Wind Farm mid-Wales, Pantymaen Wind Farm (North Wales), Moel Fferm Wind Farm (South Wales), Allt Duine Wind Farm, Gilston Wind Farm (Scottish Borders), Stroupster Wind Farm (Highlands), Crida (Bridgnorth, Shropshire) Scout Moor (Greater Manchester), Harryburn (South Lanarkshire), various Fenland schemes, and others. He has also acted as expert witness on schemes which have gone to appeal such as Keirs Hill Wind Farm, Ayrshire in 2015. **Qualifications include**: BA (Hons) Archaeology FSA Fellow of the Society of Antiquaries of London MCIfA Member of the Chartered Institute for Archaeologists
Landscape and Visual	Mark Jones	SLR Consulting Limited	Mark undertook the majority of the existing landscape and visual assessments supporting the original ES and SEI for the Consented Carno III Wind Farm. Mark is an experienced landscape consultant whose role includes the management and provision of specialist landscape services, and consultation for a full range of energy, mineral, waste and general development projects. Mark has specialist knowledge of varied onshore legislation and planning across the UK as a whole relating to the landscape and visual assessment. This has been demonstrated through the delivery of consultancy to a number of large scale developments in Wales and across the UK over the last 13 years; including onshore wind farms. Qualifications include: BA Landscape Architecture Dip Landscape Architecture Member of the Landscape Institute

Discipline	Consultant	Company	Experience
Noise	Gavin Irvine	Ion Acoustics Ltd	The noise assessment of the AIL delivery route has been prepared completed by Gavin Irvine BSc MIOA, a Director of Ion Acoustics, who has over 25 years' experience of assessing noise associated with wind farms. He was a peer-reviewer of the Institute of Acoustics' Good Practice Guide for wind farm assessments and is chair of the Institute of Acoustics' Working Group on Amplitude Modulation in Wind Farm noise. In respect of construction noise, Gavin's expertise derives from various wind farm projects and from working on the construction of the Channel Tunnel Rail Link for various contractors along the length of the line from Folkestone to St Pancras Station. Qualifications include: BSc (Hons) Engineering Acoustics and Vibration Member of the Institute of Acoustics (MIOA)
Forestry	Stephen Knight	Pryor & Rickett Silviculture	Stephen has over 25 years of forestry and ecology management experience across the UK both in the public and private sectors. Stephen has previously worked on other windfarm development proposal such as Clocaenog Forest & Dyfnant Forest wind farms. During which time he worked with the wind farm developers to improve their design proposals around existing features found within the wooded landscape. Qualifications include: BSc (Hons) Forestry MSc Ecology & Conservation management Associate member of the Institute of Chartered Foresters
Ecology	Laura Shreeve	Natural Power	Laura is an experienced ecological consultant whose current role involves managing ecological aspects of onshore wind projects in the UK; including project management, management of ornithological and ecological surveys, tender preparation, production and review of ecological technical reports, overseeing ECoW work, client and consultee liaison, and post application support including discharge of planning conditions. Laura's specialist technical knowledge covers all aspects of terrestrial ecology. She has worked on small and large scale residential schemes, motorway and road infrastructure projects in addition to wind farm developments. Prior to her work in consultancy, Laura worked within the conservation sector for eight years gaining excellent field survey skills in ecology and ornithology in addition to extensive practical skills in habitat management. Qualifications include: BSc (Hons) Ecological Science (Ecology) Full Member of the Chartered Institute of Ecology and Environmental Management (MCIEEM)
Hydrology, Geology and Hydrogeology	Katherine Arthur	Natural Power	Katherine undertook much of the work for the FEI for Hydrology, Geology and Hydrogeology including overseeing the revision of the PMP. Katherine is an experienced Environmental Consultant and her role includes providing technical support to a wider team of consultants and document review and approval, for renewable energy projects. Katherine has worked for Natural Power since 2010 and has worked on numerous renewable energy projects involving hydrological and hydrogeological consultancy. Her work includes project management for pre-planning, construction and development phases of onshore wind farm projects of varying scale across the UK. Katherine has been responsible for the writing and review of Hydrology EIA Reports and is responsible for managing post-planning hydrology Qualifications include MA in Geography MSc in Energy and Environmental Management
Traffic and Transport Civil Infrastructure Design	Craig Galloway	Natural Power	Craig is an experienced renewable energy consultant whose role includes management of the Design and Advisory Services (DAS) team at Natural Power. Responsible for providing a range of services throughout all stages of a project lifecycle, Craig has provided consultancy services on a variety of large-scale renewable energy projects over the past 12 years, both across the UK and Internationally. These services include

Discipline	Consultant	Company	Experience
			feasibility studies, EIAR's, Pre-construction and Construction Services and Due Diligence reviews, with particular expertise in transport assessments and civil infrastructure design. Craig has specialist knowledge of Traffic and Transport related assessments, including Abnormal Load Route Assessments (incl. Swept Path Analysis), working closely with experienced haulage contractors, and Traffic Impact Assessments for inclusion within EIAR's, in line with the latest UK and local transport guidance. In addition, Craig is responsible for provision of civil infrastructure design, specialising in large scale wind farm projects, and acting as Principal Designer (Construction, Design and Management Regulations 2015) across the renewable energy sector. **Qualifications include:** BEng Energy and Environmental Engineering Member of Institution of Engineering and Technology

Section 4

Project Description

CONTENTS

4.22 INTRODUCTION

4.22.1 This section outlines the details of the proposed Carno III Tip Height Extension (the 'proposed development') as specified in Section 1, including specifications of changes to infrastructure from the original Environmental Statement (ES) and Supplementary Environmental Information (SEI). The proposed changes were also discussed in the scoping report and agreement on the scope of the Further Environmental Information (FEI) (scoping opinion) can be found in Appendix 4 of this FEI.

4.23 SITE LOCATION

4.23.1 Figure 4.15 in Volume 2 of this FEI shows the location and extent of the proposed development and sub-sections 4.2 of the ES and 4.18 of the SEI describes the location of the consented development, sites characteristics and site layout. The key change to baseline and the site's characteristics since the original ES and SEI was prepared is the forestry due to on-going forestry management. Section 11 of this FEI describes the baseline when the assessment was undertaken for the SEI (2015) and the current baseline, and has not been repeated here.

4.24 CHANGES TO PROJECT DESCRIPTION

4.24.1 As outlined in Section 1 of the FEI, the consented wind farm was for 13 turbines up to 126.5 m to tip height. This application is for a tip height extension to the consented 13 wind turbines. The turbines will be of a modern design and will all be similar size and type with three blades mounted on a horizontal axis passing through a nacelle housing the generator, gearbox and other operating equipment.

4.24.2 The nacelles will be mounted on a tubular tower which allows access to the nacelle. The maximum tip height of the proposed scheme is 149.9 m. The indicative hub height is in the range of approximately 83.9 m to 92.0 m, blade length approximately 56.5 m to 64.5 m, and rotor diameter of approximately 115.7 m to 132 m. Figure 4.16 and 4.17 demonstrate typical wind turbine dimensions for the range considered.

4.24.3 This FEI assess the range of rotor diameters and associated hub heights. This will mean that a candidate turbine with different dimensions will be used for different assessments to ensure that the 'worst case' scenario has been assessed for each topic area. For some assessments (e.g. landscape and visual impact) the highest hub, and therefore the smallest rotor diameter will represent the 'worst case' scenario, while for others (e.g. ecology) the largest rotor, and shortest hub height will represent the 'worst case' scenario.

4.24.4 Table 4.6 sets out whether the highest hub or the largest rotor diameter is assessed for each topic. Despite the variations in rotor diameter and hub height, the overall maximum tip height of the turbines will not exceed the proposed 149.9 m.

Table 4.6: Turbine Dimensions to be Assessed

Topic	Highest hub or largest rotor to be assessed
Landscape and Visual	Highest hub
Hydrology, Geology and Hydrogeology	Largest rotor
Ecology	Largest rotor
Forestry	NA
Cultural Heritage	Highest hub
Traffic and Transport	Largest rotor
Existing Infrastructure	NA

4.24.5 As per the original consented development, the final turbine colour would be decided in consultation with the local planning authority (as part of planning condition 17), although it is expected that the turbines will be a light grey or off-white colour and will match the existing turbines at Carno I and Carno II.

4.24.6 Planning condition 16 of the original consent also requires agreement with the local planning authority on the details of the turbines, including make, model, design, size, transformer location, power rating, the anemometer mast and associated apparatus.

4.24.7 Due to the proposed increase in turbine tip height, it is also proposed to increase the height of the anemometer mast from 80 m to 90 m to be more in line with the proposed hub height (ranging from 83.9 m to 92 m) to improve data correlation. See Figure 4.20 which shows the proposed height of the anemometer mast.

4.24.8 Due to the use of larger blades, a section of new access track will also be constructed off site within agricultural fields (see Figure 13.4) to avoid a railway bridge at Pontdolgoch, along the A470 between Carno and Caersws. The blades considered would be unable to pass due to height and width restrictions of the bridge. The construction of the new access track is subject to a separate Town and Country planning application but is considered in the FEI as its associated with the proposed development. A temporary track system is also proposed (see Figure 13.5) on private agricultural land to enable Abnormal Indivisible Loads (AILs) to safely leave the A470 and be given the all clear to cross the A470 and enter Wig Lane unclassified road, and over Wig railway crossing and river bridge, before entering private land and follow the new route (with some existing track to be utilised) until reaching an existing junction at Petheirin Farm north of the Pontdolgoch railway bridge on the A470.

4.24.9 The temporary track system and the permanent new access track will only be used by AILs for the delivery of turbine components only. See Section and Appendix 13 of the FEI for further information regarding the proposed new access route.

4.25 SITE LAYOUT

4.25.1 The turbine layout and associated infrastructure is presented in Figure 4.15 in Volume 2 of the FEI. This figure illustrates the relevant elements, including locations for the 13 turbines, crane pads, site tracks, on-site substation and control building, temporary construction and storage compound areas, borrow pits and anemometer mast.

4.25.2 The turbine locations remain identical to the consented layout, as does the substation, control building, borrow pits and anemometer mast. The proposed larger turbine size would result in an increase in civil infrastructure requirements with regards to crane pad area and turbine foundations, compared to the original proposal. The requirements provided for the tip height extension are an estimate of what is typically required for the turbine models being proposed. Crane pad area for the tip height extension may be approximately 70 m x 50 m (previously 40 m x 20 m) (see Figure 4.18 for indicative crane pad, although final configuration to be determined and this figure represents the permanent and temporary area for the crane hardstanding. Turbine foundations may be approximately 28 m wide (previously considered to be 18 m wide) (see Figure 4.19). Access tracks remain in the same locations, however some minor modifications to track widths is expected due to the larger turbines (e.g. slight further widening on corners etc.).

4.25.3 Micrositing allows the exact turbine location and infrastructure positioning to be modified post-consent, following detailed ground investigation and ground clearance. Planning condition 14 for the existing consent has specified that a micrositing protocol shall be agreed and that:

14.b. All aspects of the development shall be located within 50 m of the locations shown on Figure 4.13 contained within 2015 Supplementary Information.

4.25.4 Table 1.5 in Section 1 of the FEI gives the centre point location and proposed maximum tip height for each of the proposed turbines.

4.25.5 The total land take of the proposed development (25-year operation period), after completion of reinstatement measures, including foundations, crane pads, existing and new sections of on-site access tracks, substation and control building has been assessed to be approximately 159,012 m^2 or 15.9 hectares.

4.26 PUBLIC ROAD ACCESS

4.26.1 Section 13 of the original ES details the public road network suitable for the transportation of the turbine components. Some sections of the proposed route from port to site have changed slightly due to the Newtown Bypass becoming operational and the need to avoid the Pontdolgoch railway bridge. See Appendix 13 of the FEI for further detail on use of public road for turbine transportation.

4.27 NEW ACCESS ROUTE AT PONTDOLGOCH

4.27.1 As discussed in Section 4.24, a temporary track system will be installed, approximately 522 m in length on agricultural land opposite Wig Lane off the A470 North of Caersws to enable safe crossing of the A470 by AILs onto Wig Lane road. The route will travel along Wig Lane, over the railway crossing and river bridge before exiting onto a new access track to be constructed within agricultural fields to the north of Wig Lane. The new access track will be similar dimensions and material to the access tracks proposed at the wind farm (see Figure 4.5 of the ES) and will be approximately 1,546 m in length linking Wig Lane to the A470 north of Pontdolgoch railway bridge at the entrance to Pertheirin Farm (which also consists of upgrading of approximately 386 m of existing farm access track).

4.27.2 This new access route will only be utilised for delivery of AIL (turbine components with delivery assumed to be approximately 3 months) and rare occurrence of any future need for blade replacement etc. The construction of this new access track is expected to take approximately 1 month.

4.27.3 Following site investigation studies undertaken prior to construction the detail of the construction methods, including type and design of track, and reinstatement measures for the new access route will be agreed as part of a planning condition (e.g. within a Construction Method Statement) for the separate Town and Country planning application.

4.28 TURBINES

4.28.1 The selected turbines would be of a modern design with three blades mounted on a horizontal axis, attached to a nacelle, housing the generator, gearbox and other operating equipment. The nacelles would be mounted on a tubular tower which allows access to the nacelle. The maximum height (to blade tip) of turbines will be 149.9 m above ground. Planning condition 1 is varied to increase the maximum height to blade tip to 149.9 m from the original ground level.

4.28.2 The operation of the turbines remains the same as discussed in the ES, therefore have not been repeated in the FEI.

Turbine Foundations

4.28.3 As per the consented development, reinforced concrete gravity foundations are envisaged for use on the proposed turbines. This foundation type is typically an inverted T shape consisting of a large pad with protruding upstand left approximately 200 mm proud of the finished ground level. The pad is back filled with selected as-excavated material or stone material placed and compacted over the foundation. The base tower section of the turbine is subsequently connected to the foundation either via an embedded end can (short tower section) which is cast into the foundation or alternatively by using holding down bolts that are

cast into the upstand section of the foundation. Stability of the turbine is provided through the weight of the foundation and the material replaced and compacted over it.

4.28.4 Detailed design specifications for each foundation would depend on the site-specific factors such as ground conditions, the specific turbine used and various other engineering considerations. Typically, a square concrete base plate of approximately 28m x 28 m or 28 m diameter circular base usually suffices for turbines with the proposed turbine dimensions (Figure 4.19 of the FEI). The consented development assumed 18 m x 18 m or 18 m circular diameter base plates, therefore due to the taller turbine components a larger foundation will be required.

4.29 CRANE PADS

4.29.1 Cranes would be required during the erection of each turbine at the turbine site. Due to an increase in turbine dimensions the crane hardstanding areas will also increase in size. To provide stable, firm ground for safe operation of the cranes during the installation of the turbines, areas of hardstanding would be laid down on one side of each turbine foundation. These would need to be suitable for the outriggers of the respective cranes, leading to an area of approximately 70 m x 50 m (which includes the permanent and temporary crane hard standing area) for simultaneous use of both cranes (previously assessed as 40 m x 20 m for the consented layout). Their locations will be finalised following further site investigation, but will maximise use of the access tracks, where possible, to minimise the footprint of the proposed wind farm.

4.29.2 A diagram showing typical crane hardstanding area can be found in Figure 4.18, although the final configuration will vary depending on the exact make and model of turbine chosen. The location of the access track in relation to crane pad may differ from the figure as crane pad area may be split into several sections rather than one larger area.

4.30 BORROW PITS

4.30.1 There have been no changes to the proposed borrow pits on site, therefore no further detail has been provided in the FEI and the content in subsection 4.8 of the original ES remains valid. Planning condition 15 and 39.r. of the existing consent requires details of the location, maximum extent and depth, profiles, means of working including rock crushing and restoration of the borrow pits to be submitted and approved by the local planning authority before development commences.

4.31 SITE TRACKS

4.31.1 Figure 4.15 and the text in Sub-section 4.18 of the SEI, which describes site tracks, remain valid with the addition of some widening to some on-site tracks. The proposed length of new on-site access tracks is 3.9 km and proposed length of access track to be upgraded is 4.6 km (which is the same track length as the consented site layout).

4.31.2 The layout of the access tracks on site hasn't change from the consented scheme, however some further widening of on-site tracks is needed to facilitate manoeuvring larger turbine components through the site.

4.31.3 As per the consented layout, all tracks would be constructed and/or improved to allow a minimum running width of 5 m with local widening required at junctions, passing places and sharp bends. A more detailed pre-construction site survey will be carried out across the route, so there may be some realignment of track sections within the micrositing area when a full, intrusive site investigation has provided further details of underlying geology. Further detail in relation to track construction methods will be detailed within the Construction Method Statement (CMS) as part of the Construction Environment Management Plan (CEMP) (existing planning condition 39) which will be submitted and agreed with Powys County Council prior to commencement of construction.

4.32 ON-SITE CABLING

4.32.1 There are no proposed changes to on-site cabling works from the consented layout to the proposed development, therefore Sub-section 4.11 and Figure 4.7 remains valid and is not discussed further in the FEI. Condition 20 of the existing consent commits that all electricity and control cables between the turbines and the substation shall be laid underground and alongside tracks which are constructed on the site unless otherwise agreed in writing with the LPA.

4.33 SUBSTATION AND CONTROL BUILDING

4.33.1 There are no proposed changes to the substation and control building as part of this Section 73 application, therefore Sub-section 4.11 and associated figure remains valid and is not discussed further in the FEI. Condition 21 of the existing consent allows no work on the substation building until written approval has been obtained to its precise location, materials, external treatment, orientation and screening.

4.34 CONSTRUCTION COMPOUND AND FACILITIES

4.34.1 There are no proposed changes to the construction compound therefore Subsection 4.12 and associated figure remains valid and is not discussed further in the FEI.

4.35 OFF-SITE GRID CONNECTION

4.35.1 The proposed grid route from the on-site substation to the off-site substation, that was considered at high level within the EIA, is no longer being pursued. The original proposal considered was a connection via 132 kV overhead line to a proposed National Grid 132/400kV substation near Cefn Coch (as part of the Mid Wales connection project). However, as many projects funding the new substation are no longer being actively progressed or are still within the planning system, the applicant has looked at alternative grid connections.

4.35.2 The latest proposed grid connection is a connection into the existing mid Wales 132 kV network, connecting at Carno substation. Additional capacity has been identified on the existing 132 kV mid Wales network subject to reinforcement works in the Newtown/Welshpool area to allow the export of power from Carno III. Amegni Renewables has accepted a formal grid connection offer which allows Carno III to connect into the existing mid Wales network and is working with Scottish Power Energy Networks (SPEN) on the proposed connection. Discussions with SPEN are currently ongoing with any proposed reinforcement works being made via underground cable works and alterations to existing electrical infrastructure. Due to the nature of the proposed works this is not discussed any further in the FEI.

4.36 CONSTRUCTION PROGRAMME

4.36.1 The preliminary construction programme has been updated, from the SEI, see Table 4.7. This has been increased to a 15 month construction period due to the larger turbines proposed, from 11 months reported in the SEI based on the 13 turbine consented development; this increase remains less than the 16 months reported in the original ES programme based on the original 18 turbine proposal.

Table 4.7: Preliminary Construction Programme

Activity	Month														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Heavy Goods Vehicles Movements (including abnormal loads)															
Mobilisation to site															
Crane hard standing															
Turbine Foundations (ready mixed concrete)															
Substation															
Cabling															
Turbine Transformers															
Turbine deliveries															
Demob / site clearance															

4.36.2 Paragraph 4.12.7 to 4.12.11 of the ES contain generic information on the construction phase and these paragraphs remain valid and are not repeated here.

4.36.3 A detailed construction programme, with key dates for construction works, will be produced by the Principal Contractor when appointed. Upon appointment of the turbine supplier the delivery schedule of the wind turbine components will be incorporated into the construction programme.

4.37 EMPLOYMENT, OPERATIONAL PHASE, DECOMMISSIONING, AND HEALTH AND SAFETY

4.37.1 Sub-sections 4.12 and 4.16 of the ES remain valid which discussed the employment opportunity during the construction and operational phase, maintenance, storage, decommissioning and health and safety and therefore has not been repeated in the FEI.

4.38 SUMMARY

4.38.1 This section of the FEI has provided description of the proposed development having regard to any material differences between this and the consented development. This includes:

- Increase in tip height of the turbines from 126.5 m to 149.9 m;
- Increase in height of anemometer mast from 80 m to 90 m;
- Increase in area for crane hardstandings from 40 m x 20 m to 70 m x 50 m;
- Increase in turbine foundation from 18 m x 18 m or 18 m diameter circular base, to 28 m x 8 m or 28 m rotor diameter base plates;;
- Some additional widening works to the on-site access tracks;
- Creation of new access track at Pontdolgoch approximately 1,546 m in length (considered as part of a separate planning application);
- Further modifications to route from Carno village to site to accommodate larger turbines (considered as part of a separate planning application); and
- Alternative off-site grid connection (including underground cable works and alteration to existing infrastructure).

4.38.2 New figures have been included in this FEI to reflect the changes to the infrastructure and include:

- 4.15: Site Layout
- 4.16: Typical Wind Turbine Potential Largest Rotor 132 m
- 4.17: Typical Wind Turbine Maximum Hub Height 92 m
- 4.18: Typical Crane Hardstanding
- 4.19: Typical Turbine Foundation Specification
- 4.20: Indicative 90 m Anemometry Mast

4.38.3 These changes noted above have formed the basis for the updated assessment for the proposed development.

Section 6

Landscape and Visual Assessment

CONTENTS

6.16 INTRODUCTION

6.16.1 This section of the Further Environmental Information (FEI) has been prepared by SLR Consulting and should be read in conjunction with Section 6 of the original Environmental Statement (ES) submitted July 2010 and Section 6 of the Supplementary Environmental Information (SEI) submitted in July 2015. The original ES was prepared as part of a submitted scheme for 18 wind turbines with a blade tip height of 126.5 m and indicative hub height of 80 m. The SEI was prepared to provide additional information on revised cumulative scenarios, landscape and visual effects on specific areas to the south and west of Carno III, and an assessment of the proposed overhead grid connection to the mid Wales Hub. As part of the consultation process with Powys County Council, the proposed SEI development was reduced to 13 wind turbines with a blade tip height remaining at 126.5 m and indicative hub height of 80 m. This reduced scheme was consented by Powys in May 2017.

6.16.2 This section of the FEI describes and assesses the landscape and visual effects of the proposed turbines, with a maximum blade tip height of 149.9 m, against the consented development which forms the baseline for assessment purposes. The proposed turbines are referred to as the proposed development and/or Tip Height Extension (THE) turbines and represent the main element of change. More detailed information on the changes proposed are set out in Section 4 of this FEI and summarised at the start of Subsection 6.22.

6.16.3 For the purposes of this assessment, the 149.9 m turbines proposed are considered to comprise a hub height of 92 m and blade length of 57.9 m. This means that the assessment is based on the tallest potential hub height and not the widest blade swept path, with the options for turbines recorded in Table 6.34. The use of the tallest hub height was proposed as the worst-case scenario for landscape and visual effects, an approach which was agreed with Powys in the scoping response (found in Appendix 4 of this FEI).

6.16.4 To assess the potential levels of change a total of 10 of the original 24 ES viewpoints were proposed for inclusion. The reasons for the choice of the 10 proposed viewpoints were presented in the submitted scoping report (see Appendix 4), and their use agreed in the scoping response. In addition, the following viewpoints were also considered at a meeting with Powys County Council and Enplan to discuss scoping (as set out in Subsection 6.19 on consultation and scoping) and the decisions below agreed as part of the scoping process:

- VP2 and VP12 to be included in the FEI text and a screen shot of the Digital Terrain Model (DTM) view included to substantiate comments in the scoping report on the effects of distance or the perception of difference between the consented and proposed turbines. Although these viewpoints would not need full wireline/photograph visualisations;

- the effects at VP 13 were considered and it was agreed that no further assessment of this viewpoint would be required; and

- an additional viewpoint identified at the Pennant / B4518 road junction, to be included in the assessment with full viewpoint photography and wireline representation.

6.16.5 A turbine blade tip Zone of theoretical Visibility (ZTV) study illustrating the change in visibility between the consented scheme (126.5 m) and proposed development (149.9 m) has been produced as illustrated in Figure 6.29 a and b. A similar study has also been undertaken for the turbine hub levels of the permitted (80 m) and proposed (92 m) schemes and this is shown in Figure 6.30 a and b. The ZTVs indicate that areas of additional visibility would be limited for both the 149.9 m blade tips and 92 m worst-case hub height.

6.16.6 It was proposed in the scoping report and agreed during consultation with Powys County Council that the list of cumulative wind farms present within the study area would be updated for consideration in the assessment but that no new cumulative wirelines would need to be produced to illustrate these sites.

6.16.7 No additional significant effects have been identified as a result of the proposed development. Effects on landscape character have been assessed using the LANDMAP Visual and Sensory Aspect Areas, in all cases the level of change anticipated for the proposed development (compared to the consented development) would not be sufficient to alter the magnitude of landscape effect above the consented levels. The viewpoints within the FEI have also been assessed for additional change caused by the proposed development, and the visual changes identified would not be sufficient to increase the visual effects above the levels predicted for the consented development. Differences between the ZTVs for the consented and proposed developments have been considered in detail to consider the potential effects of the proposed development. A number of different receptors have been considered as identified in the ES/SEI and no new significant effects have been identified as a result of the proposed development. Some potential significant effects have been predicted for the proposed new access route, but these relate to a separate planning application for that proposed development. The significant element of these works would be linked to the construction and of the track and its use for the delivery of the wind turbine components.

6.17 LEGISLATION AND POLICY CONTEXT

6.17.1 A summary of the current main policy points relevant to landscape and visual issues is included below.

National Policy

6.17.2 Whilst the current consent was considered under the terms of previous versions of the PPW and the current TAN8 it is important to note the emergence of a new National Development Framework (NDF) 2020-2040 which is due to be published in September 2020. A Consultation Draft: 7 August – 1 November 2019 of the NDF has been published and has been reviewed for relevant national policy with regard to landscape and visual matters. Although not adopted the draft NDF indicates the current thinking of the Welsh Government on renewable energy as repeated below:

6.17.3 Renewable Energy (Page 36-37)

'Our spatial priority is for large scale wind and solar development to be directed towards Priority Areas for Wind and Solar Energy shown on page 42. There is a presumption in favour of large scale on-shore wind and solar energy development in these areas, an acceptance of landscape change and a focus on maximising benefits and minimising impacts.'

'However, the design and micrositing of proposals must minimise the landscape and visual impact, particularly those in close proximity to built-up areas.'

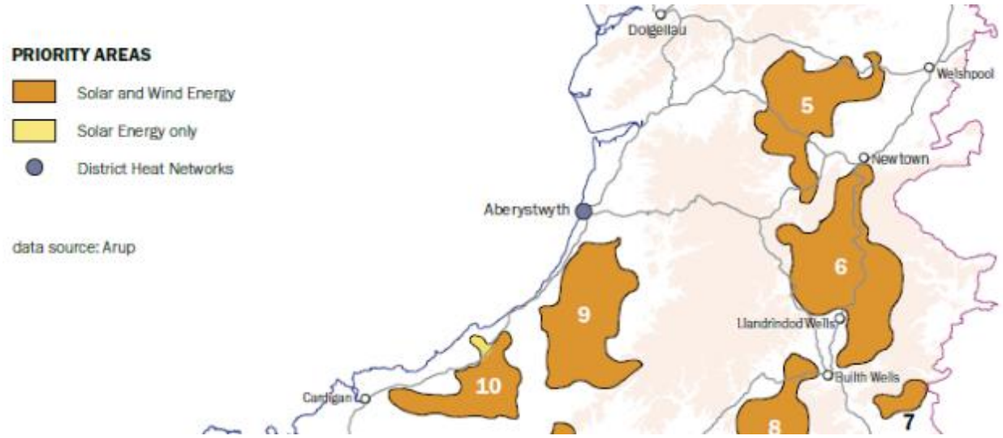
6.17.4 Policy 10 – Wind and Solar Energy in Priority Areas states;

'…presumption in favour of development for these schemes and an associated acceptance of landscape change…

6.17.5 The consented Carno III Wind Farm is located within Solar and Wind Energy Area 5 as shown in Image 6.2 of the FEI. The key elements for consideration in refinement of the area is stated as follows;

'Consideration of constraints in England. Proximity to LANDMAP visual sensory outstanding and high to the South. Grid and access constraints may make deliverability a challenge.'

Image 6.2: Wales Energy Priority Areas



6.17.6 Policy 10 – Wind and Solar Energy in Priority Areas states that:

'Planning applications must demonstrate how local social, economic and environmental benefits have been maximised and the following adverse impacts have been minimised:

• landscape and visual impacts;

• cumulative impacts;

• the setting of National Parks and Areas of Outstanding Natural Beauty;

• visual dominance, shadow flicker, reflected light or noise impacts;

• electromagnetic disturbance to existing communications systems; and

• the following identified protected assets:

- archaeological, architectural or historic assets;

- nature conservation sites and species;

- natural resources or reserves.

Suitable access to the site for construction and maintenance purposes must be provided. Plans must also be in place for the end of the development's lifetime, including the removal of all infrastructure as soon as their use ceases and the appropriate after-use of the site.'

Powys County Council

6.17.7 The Powys Local Development Plan (2011 – 2026) was adopted on 17th April 2018. Within the LDP Supplementary Planning Guidance provides detailed planning guidance for policies and proposals in the adopted Powys Local Development Plan.

Landscape Supplementary Planning Guidance

6.17.8 A Supplementary Planning Guidance (SPG): Landscape was adopted in April 2019 as part of the Powys Local Development Plan. The purpose of the SPG was defined as follows:

- Supplement the policies set out in the LDP by providing more detailed guidance.

- Assist and guide those proposing and designing new developments and submitting a planning application. To ensure development proposals are successfully integrated within the landscape; and to prevent development proposals from having an unacceptable adverse impact on the valued characteristics and qualities of the Powys landscape.

- Provide detail on what needs to be considered and submitted for varying types of development proposal, in order for the Council to establish landscape and visual impact in the determination of planning applications against LDP policy.

6.17.9 The SPG provides guidance on:

- *What landscape is and the Powys landscape.*
- *Relevant LDP policies relating to landscape.*
- *How policies in the LDP relating to landscape should be implemented.*
- *What is required to be submitted as part of a planning application for different scales / types of development.*
- *Monitoring and review processes associated with the LDP and SPG relating to landscape.*

6.17.10 Policy SP7 identifies the plan area's important strategic resources and assets which are set out and listed within the policy. Policy SP7 is as follows:

Strategic Policy SP7 - Safeguarding of Strategic Resources and Assets

'To safeguard strategic resources and assets in the County, development proposals must not have an unacceptable adverse impact on the resource or asset and its operation.

The following have been identified as strategic resources and assets in Powys:

1. Land designated at international, European and/or national level for environmental protection.

2. Historic environment designations, including:

i). Registered Historic Landscapes

ii). Registered Historic Parks and Gardens

iii). Scheduled Ancient Monuments and other archaeological remains

iv). Listed Buildings and their curtilages

v). Conservation Areas

vi). Historic Assets of Special Local Interest

AND the setting of designations i), ii,) iii), iv) and v).

3. Recreational Assets, including:

i) National Trails

ii) Public Rights of Way Network

iii) Recreational Trails

iv) National Cycle Network.

4. The valued characteristics and qualities of the landscape throughout Powys…….'

6.17.11 Policy DM4 – Landscape is a specific, topic-based policy in the plan in relation to landscape. It requires that development proposals do not to have an unacceptable adverse effect on the valued characteristics and qualities of the Powys landscape. The wording of the policy is as follows:

Policy DM4 – Landscape

'Proposals for new development outside the Towns, Large Villages, Small Villages and Rural Settlements defined in the Settlement Hierarchy must not, individually or cumulatively, have an unacceptable adverse effect, on the valued characteristics and qualities of the Powys landscape. All proposals will need to:

1. Be appropriate and sensitive in terms of integration, siting, scale and design to the characteristics and qualities of the landscape including its: topography; development pattern and features; historical and ecological qualities; open views; and tranquillity; and

2. Have regard to LANDMAP, Registered Historic Landscapes, adjacent protected landscapes (National Parks and Areas of Outstanding Natural Beauty) and the visual amenity enjoyed by users of both Powys landscapes and adjoining areas.

Proposals which are likely to have a significant impact on the landscape and/or visual amenity will require a Landscape and Visual Impact Assessment to be undertaken'.

6.17.12 A requirement to look at LANDMAP as part of Landscape and Visual Impact Assessment (LVIA) baseline assessment is identified in Figure 1 of the SPG (paragraph 6.8). This is expanded upon in undertaking a LVIA (paragraph 6.34) as follows:

> 'The LVIA should therefore make use of and include information from LANDMAP (collated in Step 2 above), particularly to inform the understanding of baseline conditions. Natural Resource Wales have produced "Guidance Note 3: Using LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines" which should be referred to for wind energy proposals. The guidance highlights the importance of using all five layers not just the Visual and Sensory Layer.'

6.17.13 As part of the SEI an appraisal of LANDMAP using the methodology identified in LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines was undertaken and used to inform the baseline and assess the sensitivity of the landscape. This exercise was recorded in Paragraph 6.12.9 of the SEI onwards, in Figures 19a-e of the SEI and Appendix 6A.17 of the SEI.

6.17.14 The Site Analysis Stage (Section 7) of the SPG specifies the process of site analysis and identifying landscape characteristics and qualities. This should be used to confirm what has been identified on maps and aerial photographs and should record:

- Skylines;
- View lines;
- Local materials and textures;
- Local vernacular;
- Colours;
- Hedgerows and trees;
- Existing buildings and uses;
- Noise levels, sense of place, remoteness, tranquillity and wildness; and
- Landmarks.

6.18 INFORMATION SOURCES

Landscape and Visual Impact Assessment

6.18.1 The original LVIA is contained in Section 6 of the 'Carno Wind Farm Extension Phase III Environmental Statement (July 2010) Volume 1'.

6.18.2 Figures and Appendices relating to the LVIA are included in ES Volume 2, specifically Figures 6.1 to 6.18.

6.18.3 Viewpoint illustrations accompanying the LVIA are contained within the ES Volume 3 Visualisations (Viewpoints 1-24). With details on the location, description and baseline photography included for each viewpoint. In addition, the original cumulative scenarios and magnitude of change, and residential landscape and visual effects for each viewpoint are included.

6.18.4 The more recent SEI document 'Carno Wind Farm Extension Phase III Supplementary Environmental Information (July 2015) Volume 1 Written Statement' contained updated information on the cumulative scenarios assessed, an assessment of the proposed grid connection and additional information and clarification of the assessment process.

6.18.5 A series of updated wirelines was produced in the SEI for the 17 cumulative viewpoints identified in the ES within 15 km (i.e. excluding viewpoints 1, 6, 9, 11, 16, 21 and 22). The SEI assessment levels for these viewpoints are set out in Table 6.24 (page 6-69) of the SEI for assessment of the proposed scheme in relation to the reduction in effects achieved by the removal of 5 wind turbines from the scheme proposed in the original ES, and Table 6.28 (page 6-88) of the SEI for cumulative viewpoint assessment, reflecting the changed cumulative scenarios in the SEI. Viewpoints that are not cumulative in nature or beyond 15 km for the SEI are therefore represented by viewpoint photography and wirelines in the ES. Table 6.31 identifies which viewpoints have been represented in each of the ES, SEI and FEI documents.

6.18.6 The scope of work carried out in the FEI is set out in Subsection 6.19 and summarised in this section.

LANDMAP and Landscape Character

6.18.7 LANDMAP information has been used to form the basis for a landscape character assessment of the 15 km study area used in the FEI.

6.18.8 Details of the approach used are set out in Subsection 6.21 of the FEI with the assessment of the effects on landscape character undertaken in Appendix 6A.21.

Viewpoint Assessment

6.18.9 Details of the viewpoints used and agreed in the scoping response, are recorded in Subsection 6.20 including Table 6.31 which lists all viewpoints included in the original ES, SEI and FEI. This subsection also includes a review of the original viewpoint photography used in the ES and SEI.

6.18.10 The chosen viewpoints have been assessed in Appendix 6A.22 of the FEI and used to inform the assessment of both landscape and visual effects throughout the FEI.

Proposed Additional Access Track Assessment

6.18.11 A high-level landscape and visual assessment of the additional off-site access track is contained within Appendix 6A.23. This will inform the separate planning application for that proposed development but is included here as part of the FEI and a summary of these effects is included in Subsection 6.23.

Residential Amenity Assessment

6.18.12 A Residential Visual Amenity Assessment (RVAA) was originally carried out in June 2011 and is included in Appendix 6A.10 of the SEI. The RVAA included an assessment of potential visuals effects at 28 properties with their positions illustrated on tip height and hub height ZTVs included in the document. The RVAA concluded that potentially significant views could occur from three properties (Blaencerniog, Pen-yr-Esgyn and Tyn y Sarn).

6.18.13 In addition, an update to the RVAA was included in the SEI (paragraph 6.12.51-58). This reviewed the 3 properties identified in the RVAA in respect of the removal of turbines (T7, T9, T16, T17 and T18) in the SEI proposals. The update also considered effects at an additional property named Cwm Mawr.

6.18.14 Appendix 6A.24 of this FEI contains an updated assessment of the above identified properties with regard to the additional effects of the proposed THE turbines. A summary of these effects is included in Subsection 6.23.

6.19 CONSULTATION AND SCOPING

6.19.1 A Section 73 Scoping Report for the variation in tip height was submitted 30th September 2019. A meeting was held to discuss the submitted Scoping Report with Powys County Council (PCC) and their representatives (Enplan) on 5th March 2020. The principal subject of the meeting was the content and form of the LVIA section of the FEI submission.

6.19.2 Table 6.30 summarises the received responses for the submitted Scoping Report and the Enplan Scoping Response issued by PCC on 17th March 2020 (included in full in Appendix 4).

Table 6.30: PCC / Enplan Scoping Response

Consultee/ subject	Response	Action Taken and Addressed in FEI
NRW		
General	Landscape - As per our planning consultation topic checklist, as we do not foresee potential significant effects to the Snowdonia National Park, any other national park or Area of Outstanding Natural Beauty, we do not have any further comment to make on this scoping consultation request.	None required
PCC / Enplan Scoping Response		
Worst-case turbine details	Enplan agrees that the highest hub scenario is appropriate for the landscape and visual assessment.	The highest hub level is illustrated in all wirelines and has been the basis for assessment work.
Assessment of additional access track section	Alternative access at Pontdolgoch - it was confirmed at the meeting on 5th March that the detail of the assessment within the LVIA would be at a "high-level". Enplan assumes that this will be to a level commensurate with the amount of detail of the alternative access design available at the time of the assessment.	A high-level landscape and visual assessment of the additional off-site access track is contained within Appendix 6A.23. A response to a query on the level of detail required was answered by Enplan requesting an appropriate number of viewpoints and apply the same methodology. With general comments about the key landscape characteristics that may be affected, to what degree

Consultee/ subject	Response	Action Taken and Addressed in FEI
		and the likely significance of the effect.[1]
Access track assessment methodology	Whilst it is accepted that the assessment of the alternative access route has to be high-level, Enplan requests that the visual impact assessment follows the same method as for the other elements of the scheme, albeit based on a number of appropriate assumptions.	The Scoping Report stated that the scope of the landscape character assessment will include the "additional effects on LANDMAP areas and landscape character effects caused by the revised access route". Paragraph 4.2.5 identifies that there would be "a consideration of public views towards the track area from the Public Rights of Way and adjacent houses" (i.e. private views). This is provided in Appendix 6A.23.
Grid connection	With regard the ungrounded grid connection, Enplan agrees that no LVIA work is required in this respect.	No LVIA work has been undertaken.
Assessment Methodology	The LVIA will summarise the effect of the consented scheme (as defined in the original ES and SEI), it will define the total overall effects of the amended scheme and will summarise the additional effects brought about by the proposed variations (i.e. the difference between the consented and the amended schemes).	Reference has been made to the relevant effects identified in the ES or SEI. The additional effect of the proposed development and potential to increase consented levels of effect has been assessed.
Turbine Bulk	Enplan requested that the FEI and LVIA chapter state any difference in the 'bulk' of the amended wind turbines, i.e. additional width to the towers and blades.	Details are included in Subsection 6.22.
LANDMAP	Enplan recommends that the LVIA follows the guidance set out in the Powys Landscape SPG and LANDMAP is used as the primary tool against which the effects on landscape	Use has been made of the LANDMAP study carried out as part of the SEI, supplemented by

Consultee/ subject	Response	Action Taken and Addressed in FEI
	and their significance can be judged. The applicant may also consider the effects in the context of the National Landscape Character Areas.	further work carried out for the FEI.
Landscape Character Areas	Since adoption of the Landscape SPG the Powys Landscape Character Assessment 2008 has been effectively superseded and should not be used as part of the landscape character assessment within the FEI.	No character areas used in the previous ES and SEI have been used for assessment purposes in the FEI.
Study Area	It is proposed to consider the extent of the assessment of effects out to 15 km. Enplan agrees.	A 15 km study area has been used.
Visualisations	Enplan confirms that the approach to the visualisations as set out is acceptable.	Noted
ZTVs	At the 5th March meeting Enplan requested that, in addition to these figures and relevant assessments in the narrative of the report, that the ZTVs especially focus on the 15 km limit and the intersection of the additional ZTV areas with publicly accessible locations is assessed in detail. Enplan would encourage the applicant to consider whether any new viewpoints are warranted in order to assess any likely significant visual effects on these new areas.	Comparative ZTVs for the 15 km study area have been produced and submitted. The LVIA text focuses on the areas of additional visibility these identify. It was considered that additional viewpoints were not required given the limited extent of visibility form the areas reviewed.
Additional Comparison Viewpoints	Enplan accepts the proposition that at distances of over 10 km it would not be likely that the difference in turbine height between the SEI and FEI layouts would be perceptible. However, Enplan recommends that the LVIA should seek to support the point by including Viewpoint 2: Mynydd yr Hendre, Cwm Llywd and Viewpoint 12: PRoW north of Llangurig, to the north and	The two identified viewpoints have been reviewed and included in the LVIA text along with DTM views from these positions, as presented in Appendix 6A.22

[1] Email to Ffion Edwards from Philip Russell-Vick: Re CIII Enplan response to LVIA scoping – clarification (27 March 2020)

Consultee/ subject	Response	Action Taken and Addressed in FEI
	south of the site respectively, as part of the assessment. From the evidence provided at the 5th March meeting (looking at the illustrations on the laptop screen), Enplan would be content for the LVIA to include DTM Model views for these two viewpoints, as opposed to verifiable wireframes.	
New Viewpoint	Enplan also recommends that a new viewpoint be included to illustrate the additional effect of the increase in tip height in the view from Pennant village and the valley area west of the Afon Twymyn. A location at the junction of the B4518 and the minor road to the village would be preferred. Enplan requests that a verifiable wireframe be provided from this location and additionally recommend, for the purpose of assisting parties reading the LVIA, that a photograph meeting the normal standards is also provided for this new viewpoint.	A new viewpoint at Pennant has been included. At the position agreed in the meeting views of the consented/proposed turbines would be screened by trees. An alternative position was therefore chosen where a clear view was present.
Age of Viewpoint Photography	In respect of all of the ten proposed viewpoints for the FEI assessment, Enplan recommends that either the original photographs are re-taken, as these are now relatively aged and some features in the views have changed, or that a short commentary should be provided in the LVIA to highlight any notable changes in the context of the view.	All the viewpoints were reviewed for changes in the landscape components of the view and little change identified. The text review of these changes is included in the LVIA.
Views from Pennant	Enplan raised concerns about the potential additional visual effects and requested that consideration be given to adjusting the locations of the most visible turbines (specifically T8), within the limitations of the 50 m micrositing condition.	Planning condition 14 of the consent includes provision for a micrositing protocol to minimise the developments impact on the environmental, therefore the micrositing of those turbines visible from Penant will be part of the consideration of the micrositing protocol.
Cumulative Assessment	Enplan agrees that any additional cumulative effects are likely to be “minor/negligible” and that a high-level, narrative based assessment will be adequate, noting that the consented and in-planning wind farms will be illustrated on the wireframes. As discussed at the 5th March meeting, the list of wind farms to be included in the cumulative assessment requires updating.	A high-level narrative based review of the cumulative effects is included in the LVIA, the text for each viewpoint and an updated cumulative table provided in Table 6.32.
Residential Visual Amenity Assessment	The approach to the Residential Visual Amenity Assessment (RVAA) is set out at Paragraph 4.2.25 of the Scoping Report and it highlights the three properties that were identified in the SEI as having the potential to be significantly visually affected: these being Blaencerniog, Pen-y-Esgyn and Tyn y Sarn. It is proposed to use the wirelines for Viewpoints 5 and 19 to inform the RVIA for these properties. Enplan accepts that this may be appropriate if it is evident that there would be no additional significant visual effects arising as a result of the proposals. If a significant effect is possible then Enplan would recommend a full RVIA be undertaken for the property or properties, including the use of computer-generated images from a location at each property (DTM view).	A review of the properties most affected by the consented development has been undertaken based on the previous RVAA to assess the additional and combined effects of the proposed development.
Level of additional effect	Enplan appreciates that for some, or potentially many of the individual effects, that the degree of magnitude of effect and its significance may not be so great as to lead to a conclusion that the degree of effect should be in a higher category than the effect assessed for the consented scheme.	The LVIA includes the additional effects of the proposed development in the context of the consented development and the overall effects of the proposed development.

Consultee/ subject	Response	Action Taken and Addressed in FEI
	Nevertheless, it is evident that as more of the turbines would be visible that there would inevitably be an increase in effect, no matter how small. Enplan requests that this additional effect is clearly expressed in the narrative of the assessment both for the individual receptors and overall conclusions.	

6.20 ASSESSMENT METHODOLOGY AND SIGNFICANCE CRITERIA

Assessment Methodology

6.20.1 The Assessment methodology used for the ES LVIA was set out in Subsection 6.3 with additional details included in the SEI Appendices 6A.3 to 6A.5. The FEI LVIA follows this methodology which is compliant with the Guidelines for Landscape and Visual Impact Assessment Edition 3 (GLIVIA3) published in 2013. GLIVA3 replaces GLVIA2 which was the basis for assessment in the original LVIA contained in the ES.

6.20.2 Other original guidance documents that have been updated include the following:

- Landscape Institute: Advice Note 01/11 - Advice on Photography and Photomontage, and Technical Guidance Note 02/17 - Visual Representation of Development Proposals, have both been superseded by the Landscape Institute: Visual Representation of Development Proposals – Technical Guidance Note 06/19 (17th September 2019);

- Scottish Natural Heritage: Visual Representation of Wind Farms Version 2 (2014) has been superseded by Visual Representation of Wind Farms Version 2.2 (2017); and

- Scottish Natural Heritage: Siting and Designing Windfarms in the Landscape Version 1 (2009) has been superseded by Siting and Designing Windfarms in the Landscape Version 3a (2017).

Viewpoints Used in Assessment

6.20.3 Table 6.31 identifies the viewpoints included in the ES, SEI and FEI for clarity.

6.20.4 The ES included photographs and wirelines for all viewpoints in Volume 3 of the ES. The SEI included wirelines for a selected number of viewpoints with updated graphics to reflect the latest cumulative wind farm scenarios (2015) in Volume 4 of the SEI. The FEI includes wirelines for 11 viewpoints where it is considered the differences in turbine heights proposed could have the greatest potential effects.

6.20.5 More detailed reasons for the choice of the FEI viewpoints are outlined in the Scoping Report dated 30th September 2019 and the Scoping Response from PCC in March 2020 as outlined in the Section 6.19 Consultation and Scoping (also found in Appendix 4)

6.20.6 Additional information on the viewpoints can be found in Table 6.1 of the ES, and text appended to the visualisations for each viewpoint in Volume 3 of the ES.

Table 6.31: Viewpoints and Visualisations Used in the Various Submissions

No	Name	ES	SEI	FEI	Comment
1	Pren Croes, Dyfnnt Forest	Y			
2	Mynydd yr Hendre, Cwm Llwyd	Y	Y	Y	Text review only in FEI
3	Carno Recreation Ground	Y	Y	Y	
4	A470 Caersws Basin	Y	Y	Y	
5	Unclassified Road. Bryn Crugog	Y	Y	Y	
6	Two Tumps, Kerry Hill	Y			
7	East of Trefeglwys	Y	Y	Y	
8	Unclassified Road, East of Llanidloes	Y	Y		
9	Llawr y Glyn	Y		Y	
10	Bryn y Fan, near B4518	Y	Y	Y	
11	Penrhiw-wen	Y			
12	Public Right of Way, North of Llangurig	Y	Y	Y	Text review only in FEI
13	Llyn Clywedog	Y	Y		
14	Glyndŵr's Way, Hafren Forest	Y	Y	Y	
15	Plynlimon	Y	Y		
16	B4518 Staylittle	Y			
17	Glyndŵr's Way, Penycrocbren	Y	Y	Y	
18	Unclassified Road, Lluest Dropyns	Y	Y	Y	
19	Allt Ddu, Trannon Moor	Y	Y	Y	
20	Foel Fadian	Y	Y		
21	Cadair Idris	Y			
22	Road nr Bont Dolgadfan	Y			

No	Name	ES	SEI	FEI	Comment
23	Foel Dinas, near Dinas Mawddwy	Y	Y		
24	Glyndŵr's Way, near Llanbrynmair	Y	Y		
25	B4518 Pennant			Y	New requested viewpoint for FEI

6.20.7 As part of the agreed scope of the FEI, a review of viewpoint photography was undertaken to identify any changes in the baseline landscape illustrated in the original viewpoint photography. This review is recorded in this section.

Viewpoint Photography and Reviewed Baseline

6.20.8 The original viewpoint photography undertaken for the ES was also used in the SEI but is now over 10 years old. As a result of scoping consultation all viewpoints proposed in the FEI Scoping Report were reviewed by direct observation on 20th March 2020. The purpose of this exercise was to identify if sufficient visual changes in the components of the views had occurred to require new viewpoint photography.

6.20.9 These differences are noted in the viewpoint descriptions in Appendix 6A.22 and a summary is provided here. One noted aspect was the growth of trees and woodland which was evident at Viewpoint (VP) 3 – Carno, VP 4 – Caersws and VP 9 - Llawr y Glyn. At these locations the growth of vegetation would have the benefit of reducing the visibility of the consented and proposed developments.

6.20.10 At Viewpoint 2 – Mynydd yr Hendre, Cwm Llwyd, the surrounding landscape is now greatly affected by the presence of the Tirgwynt Wind Farm directly east of the viewpoint position. Although views towards Carno III are not directly affected.

6.20.11 At Viewpoint 5 – Bryn Crugog, growth of forestry plantations to the south was noted, along with the removal of previous forestry to the west where the consented scheme is located.

6.20.12 Viewpoint 7– East of Trefeglwys, marginal change was recorded, with some growth of woodland on the skyline evident and expansion to farm buildings in the mid-distance.

6.20.13 At Viewpoint 9 – Llawr y Glyn, the red phone box has been removed and the adjacent garage repainted. Tree growth in the mid-ground would provide a slightly greater screen to the consented development.

6.20.14 Viewpoint 10 – Bryn y Fan, is an isolated hilltop covered by moorland vegetation and no changes were recorded in the immediate landscape. A number of individual wind turbines are visible in the valley to the south and east, and the Derwllwydion turbine to the north-west. The operational Tirgwynt and Bryn Blaen wind farms are also new features in the recorded landscape.

6.20.15 Viewpoint 12 – Public Right of Way, north of Llangurig, the surrounding landscape is now greatly affected by the presence of the Bryn Blaen Wind Farm directly south of the viewpoint position, although views towards Carno III are not directly affected.

6.20.16 Viewpoint 14 – Glyndwr's Way, Hafren Forest, change through the growth, management and additional planting of woodland was apparent, although without particular effects on likely visibility of the consented or proposed schemes. The Derwllwydion single turbine is prominent above the edge of a plantation to the right (east) on a hilltop to the north-east on the other side of Llyn Clywedog. Two additional single operational turbines (Maesmedrisiol and Hirnant) are visible to the north in the direction of Cemmaes II.

6.20.17 Views from Viewpoint 17 – Glyndwr's Way, Penycrocbren indicate some felling of forestry has occurred since 2010, but nothing significant enough to alter assessment levels. Two individual turbines are now operational (Maesmedrisiol and Hirnant) on the hillside west of the Carno I turbines and the Bryn Blaen Wind Farm is apparent in views to the south.

6.20.18 Viewpoint 18 – Unclassified road, Lluest Dropyns, some additional forestry planting and management has occurred, and two operational turbines of Maesmedrisiol and Hirnant are visible on the hillside beneath the Carno III consented location. The operational Bryn Blaen Wind Farm is now visible to the south-east.

6.20.19 The location of Viewpoint 19 – Allt Ddu, Trannon Moor, is visible from Viewpoint 18 and confirms the lack of change in views at that viewpoint location (other than cumulative wind turbine scenarios).

6.20.20 Overall it is concluded that only limited changes have occurred to the views present at each viewpoint, largely related to vegetation growth. Changes have occurred at the viewpoints related to the altered cumulative baseline of wind farms and turbines in the area. These principally relate to the Tirgwynt and Bryn Blaen wind farms at viewpoints 2 and 12 which are included in this FEI to help judge how the increased height is perceived at distances of approximately 10 km only. The changes at viewpoints 2 and 12 do not affect the composition of views or photography looking towards Carno III. Therefore, it is concluded that new photography is not necessary to allow accurate assessment of the changes identified. These changes have been noted for each of the main viewpoints in respect of the assessment as required.

Other Wind Farms within the Study Area

6.20.21 The cumulative study area for the SEI considered wind farms out to 35 km from Carno III (SEI Figure 6.22a to 22b) with ZTVs for Carno III (SEI Figures 6.20a to 20d) and cumulative ZTVs produced out to 35 km (SEI Figure 6.23a to 23l). Updated visualisations for a number of key viewpoints were included in the SEI (Volume 4) and were chosen through consultation, generally being within 15 km of Carno III and cumulative in nature.

6.20.22 The proposed and consented wind farms within the 15 km study area have changed status since the SEI was written in 2015. The reviewed cumulative wind farm sites included in this FEI are listed in Table 6.32 –

Cumulative Wind Energy Developments, and the list of wind farm and their status was agreed with PCC via email 9th April 2020. These are sites within the 15 km study area and are listed by status and starting with sites to the north of Carno III proceeding in a clockwise direction from north, for each status. Reference to Figure 6.22a of the SEI illustrates the positions of the majority of these wind farms. The wind farms are also illustrated on the original cumulative visualisations in Volume 3 of the ES or the key visualisations in Volume 4 of the SEI. No new cumulative visualisations have been prepared for the FEI.

6.20.23 It was agreed through scoping that any additional cumulative effects are likely to be "minor/negligible" and it has been agreed that a high-level, narrative based assessment would be adequate. The consented and 'in planning' wind farms are illustrated in the wirelines prepared for the SEI. The cumulative sites considered in the FEI are listed in Table 6.32 and are referred to in the viewpoint assessment text in Appendix 6A.22.

6.20.24 The only notable site not included in the SEI visualisations is the operational Bryn Blaen Wind Farm. However, this site is not seen within the context of the consented/proposed Carno III site from any of the chosen viewpoints. For example, Viewpoint 12 is located directly to the north of Bryn Blaen Wind Farm, but views toward Carno III are not affected directly as Carno III would be located to the north and Bryn Blaen is to the south. Bryn Blaen Wind Farm has been considered in the text-based review of cumulative sites and is referred to where visible.

Table 6.32: Cumulative Wind Energy Developments.

Wind Farm	Status	Comments
Carno I and II	Operational	Operational wind farms identified in the ES, directly to the north of Carno III
Tirgwynt	Operational	Submitted in the ES, operational in the SEI
Mynydd Clogau I	Operational	Existing operational wind farm identified in the ES
Garreg Lwyd	Operational	Submitted in the ES and now operational
Llandinam P&L	Operational	Operational in the ES
Llandinam Repower	Consented	Submitted in the ES/SEI and now consented but no approved grid connection
Bryn Titli	Operational	Existing operational wind farm in the ES, no with time extension approved
Bryn Blaen	Operational	Submitted in SEI, now operational
Cefn Croes	Operational	Existing operational wind farm identified in the ES
Derwllwydion	Operational	Operational in SEI
Hirnant	Operational	Operational in SEI
Maesmedrisiol	Operational	Submitted in SEI
Mynydd Glandulas / CAT I & II	Operational	Existing operational wind farm identified in the ES
Cemmaes II	Operational	Existing operational wind farm identified in the ES
Esgair Cwmowen	Submitted	Scoping in ES, submitted in SEI, to north east of Carno III adjacent to Tirgwynt.
Hirddywel	Submitted	Scoping in ES, submitted in SEI, south east of Carno III adjacent to Llandinam

6.21 BASELINE CONDITIONS

Background

6.21.1 The baseline information for Carno III is contained in the original ES and therefore reference to this document should be made where full baseline information is required. The original ES LVIA assessed the effects on the landscape character and visual amenity within a 35 km study area. The SEI supplemented the original ES and responded to requests for additional information on a number of subjects including:

- Additional information on the effects on a variety of specific receptors (Subsection 6.9 SEI);
- Review of LANDMAP baseline and sensitivity of LANDMAP Aspect areas (Subsection 6.12 SEI);
- The effects of the updated cumulative wind farm scenarios (Subsection 6.13 SEI);
- The landscape and visual effects of the proposed grid connection (Subsection 6.14 SEI);
- A Residential Amenity Survey (SEI Appendix 6A.10); and
- A detailed LANDMAP appraisal for the Carno III site using LANDMAP Guidance Note 3: Using LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines (SEI Appendix 6A.17).

6.21.2 The landscape and visual baseline conditions are therefore identified more completely in the ES, but with some additional information provided in the SEI. Levels of effect are identified for most receptors in the ES, but with revised assessment for some receptors in the SEI as a resultant of revisions to the proposed wind farm layout and the revised cumulative scenarios.

Study Area and Context

6.21.3 As part of the scoping process it was agreed that the assessment of effects out to 15 km would be considered and a 15 km study area has therefore been used.

6.21.4 Subsection 6.4 of the LVIA in the ES details the component landscape elements of the baseline. Those elements within the 15 km study area are considered within this section of the LVIA.

6.21.5 The proposed grid connection would comprise the reinforcement of several underground sections of the existing grid network. As agreed within the scoping process, no LVIA work is required for this component of the proposed development.

Landscape Character Areas

6.21.6 The original ES and SEI utilised the Landscape Character Map of Wales and Powys Landscape Character Assessment to describe and assess the general effects of the consented turbines and associated development on the landscape character of the study area.

National Landscape Character Areas (LCA)

6.21.7 A review and assessment of the National Landscape Character Areas (as illustrated in Figure 6.1 of the ES) was undertaken as part of the ES (starting from Paragraph 6.4.79 and 6.5.112 respectively).

6.21.8 The conclusion was that significant landscape effects would be restricted to the Cambrian Mountains LCA.

Powys Landscape Character Assessment

6.21.9 The Powys Landscape character Assessment has been withdrawn and cannot be used for assessment purposes for the FEI as defined in the scoping response received from PCC.

Use of LANDMAP to Assess Effects on Landscape Character

6.21.10 The LANDMAP Visual and Sensory Aspect Areas (informed by the other aspect areas) have therefore been used to provide a framework for assessing the effects of the proposed tip height extension on the character of the study area.

6.21.11 Additional information and analysis of LANDMAP was included in the SEI from Paragraph 6.12.9 onwards to establish the sensitivity of the visual and sensory aspect areas (SEI Table 6.22) and the methodology used in analysis was detailed in Appendix 6A.3 of the SEI.

6.21.12 A detailed LANDMAP Appraisal is recorded in Appendix 6A.17 of the SEI following the process recorded within LANDMAP Information Guidance Note 3[2] for a study area of between 5-20 km from the consented Carno III site.

6.21.13 The use of LANDMAP and assessment of landscape effects on the Visual and Sensory Aspect Areas is set out in Appendix 6A.21 of the FEI. This has drawn on work carried out in the SEI and informs the conclusions set out in this section in respect of effects on landscape character.

Landscape and Landscape Related Designations

6.21.14 There have been no changes to landscape designations or landscape related designations within the 15 km study area. Those designations present are identified below.

National Landscape Designations (ES paragraphs 6.4.76-78)

6.21.15 As illustrated on Figure 6.7 of the ES within the 15 km study area there are no national landscape designations such as National Parks or Areas of Outstanding Natural Beauty (AONB). The Snowdonia National Park is located to the north-west just outside the 15 km study area and the Shropshire Hills AONB is approximately 25 km to the east of the proposed development. The scoping response form NRW indicated that they did not foresee any potential significant effects on the National Park or any AONB, from the proposed development. The scoping response also agreed to the 15 km study area and these receptors have therefore not been considered any further.

Historic Landscape, Parks and Gardens (ES paragraphs 6.4.24-32)

6.21.16 Figure 6.6 of the ES identifies receptors within this category. Two Landscapes of Special Historic Interest are present within the FEI study area and two Historic Parks and Gardens. Further information on these receptors is outlined in the ES paragraphs 6.4.24 to 6.4.32 and 6.5.184 to 6.5.196.

Caersws Basin, Landscape of Special Historic Interest (LSHI)

6.21.17 A notable proportion of the Caersws Basin was identified as having theoretical visibility to blade tip for the consented turbines. The 15 km comparative ZTV prepared for the FEI as illustrated in Figure 6.29 b indicates

[2] LANDMAP Information Guidance Note 3: Using LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines (May 2013) Natural Resources Wales

a marginal increase in visibility to the north-east of Caersws village, centred on the valley of the River Severn and the edge of hills north of the B4568.

Clywedog Valley, Landscape of Special Historic Interest (LSHI)

6.21.18 The majority of the northern section of Clywedog Valley was identified as having widespread theoretical visibility to blade tip for the consented turbines. The 15 km comparative ZTV prepared for the FEI illustrated in Figure 6.29 b indicates very small increases in visibility around the very edges of the consented visibility.

Gregynog, Historic Park and Garden

6.21.19 This receptor is approximately 14 km from the proposed development with marginal visibility indicated by the comparative ZTV illustrated in Figure 6.29 b. The increases are all on the very edge of Gregynog and its 'Essential Setting'.

Plas Dinam, Historic Park and Garden

6.21.20 This receptor is approximately 10 km to the east-south-east of the proposed development with marginal visibility indicated by the comparative ZTV illustrated in Figure 6.29 b. A minimal increase is apparent on the very edge of its 'Essential Setting'.

Conservation Areas (ES paragraphs 6.4.57-60)

6.21.21 The only Conservation Area with theoretical visibility within the study area is the village of Llawr y Glyn to the south of the proposed development. The comparative ZTV illustrated in Figure 6.29 b illustrates theoretical visibility of the consented wind farm across the majority of the village and Conservation Area. Additional visibility from the proposed THE is almost identical suggesting little to no change from the proposed development.

Cultural Aspects of the Landscape

Settlements (ES paragraphs 6.4.47-56)

6.21.22 The LVIA in the ES identifies a number of settlements (Paragraph 6.4.47 onwards) in the ES study area. Those located within the 15 km FEI study area and with additional theoretical visibility, as identified in Figures 6.29 b and 6.30 b, are as follows (note Llawr-y-glyn is considered in the section assessing Conservation Areas):

- Carno;
- Caersws,
- Staylittle; and
- Trefeglwys.

6.21.23 Additional theoretical visibility is indicated on the edges of Carno and Staylittle, across the centre of Caersws and on the edges of Trefeglwys.

Individual Residential Properties

6.21.24 A number of individual properties were assessed as part of a Residential Visual Amenity Assessment undertaken post submission of the ES and reviewed as part of the SEI.

6.21.25 These properties have been reviewed again as part of the FEI as set out in Subsection 6.24.

Transport Routes (ES paragraphs 6.4.35-46)

6.21.26 The ES LVIA identifies a number of road and rail routes within the study area for the ES. Roads identified in the ES and within the 15 km study area are as follows:

- A470 Llanbrynmair to Llangurig;
- A489 Caersws to Newtown;
- B4518 Llanbrynmair to Llanidloes; and
- Unclassified road from the B4518 to Staylittle.

6.21.27 The A470 within the study area passes through two main sections of theoretical visibility as identified by the ZTV for the consented turbines (green fill) shown in Figure 6.29 b. These occur in the area of Carno (Viewpoint 3) and Caersws (Viewpoint 4), with a couple of restricted glimpses in the Severn Valley north and south of Llanidloes. Additional theoretical visibility (orange fill) as shown on Figure 6.29 b is minimal for all of these areas. Figure 6.30 b indicates a short section of additional hub visibility at Caersws.

6.21.28 Figure 6.29 b indicates no additional blade tip visibility from the A489 from Caersws to Newtown. Figure 6.30 b indicates some additional hub visibility within the Caersws basin close to Viewpoint 4.

6.21.29 Theoretical visibility for the B4518 Llanbrynmair to Llanidloes is limited to a few restricted areas close to Staylittle (New additional Pennant Viewpoint). The comparison ZTVs in Figures 6.29 b and 6.30 b indicates negligible additional visibility due to the proposed development for either blade tips or hubs.

6.21.30 The unclassified road from the B4518 to Staylittle via the southern shore of Llyn Clywedog has similar broken visibility to the B4518, with negligible change as illustrated in Figures 6.29 b and 6.30 b.

6.21.31 The only main railway line through the FEI study area is the Newtown to Machynlleth railway line. Figure 6.30 b indicates some limited additional hub visibility within Caersws village and near Carno village (Viewpoints 3 and 4).

National Trails/Long Distance Paths (ES paragraphs 6.4.61-65)

6.21.32 Glyndwr's Way is a national trail which passes through the 15 km study area from Llanidloes in the south-east to Machynlleth in the north-west, before passing across the northern section. Figures 6.29 b and 6.30 b indicate very little change in theoretical visibility between the consented turbines and the proposed turbines. Viewpoints 14 and 17 are located on the route, and wirelines for the FEI are therefore indicative of the potential changes, and these viewpoints have been reviewed as part of this LVIA.

6.21.33 The Severn Way enters the study area near Newtown, passing through the Caersws Basin and on to Llanidloes where it turns west, across elevated land to the source of the Severn. The Wye Valley Walk extends from the Severn Way (near the source of the Severn) southwards into the Wye Valley, which it then follows out of the study area. The Cambrian Way follows the spine of the Cambrian Mountains from Plynlimon northwards across the western side of the study area to Mynydd y Cemmaes.

Cycle Routes

National Cycle Route (NCR) 8

6.21.34 This route from Machynlleth, crosses the Cambrian Mountains on the western side of the study area, through the Hafren Forest, along the line of the River Severn and into the Wye Valley and south out of the study area. Additional visibility would be minimal as illustrated in Figures 6.29 b and 6.30 b.

National Cycle Route 81

6.21.35 This route runs from Newtown just east of the study area to Caersws and then south to Llanidloes to meet up with NCR8.

General Walking and Rambling (ES paragraphs 6.4.66-71)

6.21.36 A large number of Public Rights of Way provide extensive access to the countryside, extended by Open Access Countryside, Registered Common Land and Public Forests. This network of accessible land extends from the valley floors, across the hill sides and over the plateau and mountain landscapes of the study area. In general, the theoretical visibility of the proposed turbines largely matches that of the consented turbines. However, in a few areas the proposed turbines would lead to additional visibility with the extension of views of turbines for slightly longer, as hills are either climbed or descended.

6.21.37 In the area around Trefeglwys, a more extensive addition to theoretical visibility is apparent on Figures 6.29 b and 6.30 b. This includes areas of additional hub visibility within the edges of the Trannon Valley and the extension of blade tips visibility nearer the settlement of Trefglwys and across a hillside to the north.

Viewpoints

6.21.38 Table 6.33 identifies the viewpoints used in the ES, SEI and FEI and records the number of tips and hubs visible in each case.

6.21.39 The reviewed cumulative wind farm sites included in this FEI are listed in Table 6.32 – Cumulative Wind Energy Developments.

6.21.40 The original viewpoint descriptions are contained in the ES Volume 3 Visualisations (Viewpoints 1-24) with details on the location, description and baseline photography included for each viewpoint. In addition, the original cumulative scenarios and magnitude of change, and residential landscape and visual effects for each viewpoint are included at the same location.

Table 6.33: Viewpoint Comparison of theoretical visibility

Comparison of Visible Turbines								
Viewpoint	**Nearest Turbine**	**EIA Layout**		**SEI Layout**		**Proposed FEI Layout**		**Skylines and Backgrounds**
		Tips	Hubs	Tips	Hubs	Tips	Hubs	
3 – Carno	4.2 km	7	3	4	1	5	1	Some permitted/proposed turbines visible seen above skyline
4 – A470	10.9 km	11	6	8	2	10	4	Some permitted/proposed turbines visible seen above skyline
5 – Bryn Crugog	2.1 km	18	18	13	13	13	13	All permitted/proposed turbines visible seen above skyline
7 – East of Trefeglwys	8.5 km	11	4	8	1	9	4	Some permitted/proposed turbines visible seen above skyline
9 – Llawr y Glyn	2.5km	7	5	6	5	7	5	Some permitted/proposed turbines visible seen above skyline
10 – Bryn y Fan	5.1 km	18	18	13	13	13	13	All permitted seen on or below the skyline, more of proposed seen on or above the skyline
14 – Hafren Forest	6.0 km	18	18	13	13	13	13	All permitted/proposed turbines visible seen above skyline
17 – Peny-crocbren	4.1 km	18	18	13	13	13	13	All permitted/proposed hubs visible seen above skyline
18 – Lluest Dropyns	5.6 km	18	18	13	13	13	13	All permitted/proposed hubs visible seen above skyline
19 – Allt Ddu	1.0 km	18	18	13	13	13	13	All permitted/proposed turbines visible seen above skyline
25 - Pennant	3.7 km	n/a	n/a	2	0	3	0	Some permitted/proposed blade tips turbines visible seen above skyline
2 – Mynydd yr Hendre	9.1 km	18	18	13	13	13	13	All permitted/proposed hubs visible seen above skyline
12 - PROW north of Llangurig	10.3 km	18	18	13	13	13	13	All permitted/proposed hubs visible seen above skyline

6.21.41 The cumulative scenarios and resultant effects set out in the ES LVIA have been superseded for 17 of the 24 viewpoints by more recent work included in the SEI Section 6 Volume 1 Written Statement. The assessment levels for these superseded viewpoints are set out in Table 6.24 (page 6-69) of the SEI for assessment of the SEI scheme in relation to the reduction in effects achieved by the removal of 5 wind turbines from the scheme proposed in the original ES, and Table 6.28 (page 6-88) of the SEI for the cumulative viewpoint assessment, reflecting the changed cumulative scenarios in the SEI.

6.21.42 The revised cumulative scenario for the proposed development is summarised in Table 6.32 in this section. The majority of sites that were either in planning or scoping (in the ES or SEI) have either been withdrawn or moved into the operational/consented category and the cumulative situation is simplified.

6.22 ASSESSMENT OF EFFECTS AND MITIGATION

Introduction

6.22.1 This section of the FEI relates to Section 6.5 of the 2010 ES and reference to that section may be useful in providing additional information.

6.22.2 Some elements of the 2015 SEI supersede the ES or provide additional information as included in Subsection 6.12 of the SEI and summarised below:

- Updated (2015) cumulative ZTVs;
- Identified landscape sensitivity for LANDMAP areas and landscape character areas;

- Effects of the off-site access route (**not including the additional off-site access track included in the FEI**);

- Updated viewpoint assessment reflecting the revised cumulative wind farm scenarios and reduced turbine number in the SEI;

- In depth study of views from the local road network to the south and west of the development;

- A detailed assessment of the effects on Glyndwr's Way and National Cycle Route 8 to the west of the development; and

- The Residential Amenity Survey (RAS) submitted after the ES in 2011 has been reviewed and the identified properties updated, and this is referred to as the Residential Visual Amenity Assessment (RVAA).

6.22.3 This subsection of the FEI includes a description of the proposed development in relation to those aspects that have changed; largely restricted to the proposed increase in turbine height, but also including examination of the increased foundation requirements for the turbines and the additional access track components required that are located outside the application boundary and subject to a separate planning application.

6.22.4 In addition, this subsection examines the potential for additional effects from the proposed project changes on the various receptors (within 15 km) identified in Subsection 6.5 of the ES, and identifies the level of additional effect and whether this increases the level of the overall effect when the consented and additional effects are combined.

Sources of Landscape and Visual Effects

6.22.5 The baseline for assessment of the additional landscape and visual effects for the proposed development is the consented scheme of development for Carno III Wind Farm. Effects recorded in this LVIA would be the result of the additional changes to the landscape and visual amenity of the study area arising from the proposed THE which comprises an increase in tip height for all 13 turbines from 126.5 m to a maximum of 149.9 m to tip. This represents a 23.4 m (18.5%) increase in maximum tip height and this increase in height has been assessed in the LVIA in Subsection 6.22.

6.22.6 Details of the proposed construction and operation of the development are contained in Section 4 of the ES and Section 4 of the SEI. This section considers the changes arising from the currently proposed development likely to give rise to additional landscape and visual effects.

Wind Turbine Construction

6.22.7 The proposed turbines would be located at the same positions as the consented turbines (with the same consented micrositing options). The turbines would be constructed over a similar construction period and use similar equipment such as cranes and associated hardstandings. No further consideration of this element has been undertaken in the LVIA.

Turbine Foundations

6.22.8 The foundations for the proposed development turbines would need to be slightly larger to support the additional size of the proposed turbines, as detailed in Section 4 of the FEI. As illustrated in Figure 4.19of the FEI the foundations would be covered by compacted layers of backfilled material. This surface tends to revegetate naturally although at a slow rate but would have the same appearance within the landscape as the consented development. Although there would in theory be a marginally greater effect on the landscape this would be absorbed in the large-scale forest clearance works and change in habitats proposed by the development. No further consideration of this element has been undertaken in the FEI.

Borrow pits

6.22.9 No changes are proposed for the size or extent of the borrow pits identified for the consented development.

Grid Connection

6.22.10 The previously proposed grid connection which was included in the SEI linked to the then proposed Mid Wales national Grid 400 kilovolt (kV) substation. This connection extended from the on-site substation site down to the north of Carno, across the A470 and along the Cwm Llwyd Valley as shown on Figure 6.25a of the SEI. This grid connection is no longer required and thus avoids the associated landscape and visual effects, which were assessed as part of the SEI.

6.22.11 The proposed new grid connection would make use of the existing grid infrastructure and would be undergrounded, with some upgrading of various underground sections to provide additional capacity. It was agreed through scoping that LVIA of this component was not required for the FEI.

Turbine design

6.22.12 To ensure flexibility in turbine selection the application seeks consent for a range of rotor diameters and hub heights as defined in Table 6.34 with the worst-case scenario considered for each discipline. The rotor diameters currently available range between approximately 115 m and 132 m, with the tower height adjusted as required to remain below a maximum tip height of 149.9 m. The assessment included in the LVIA is based on the highest possible hub (92 m) currently available which is considered to be the worst-case scenario for landscape and visual effects. This approach was agreed in the scoping process for the proposed development with PCC.

Table 6.34: Potential Turbine Types Used in the Assessment

Manufacturer	Model	Rotor (m)	Hub (m)	Tip (m)	Blade length (m)
Enercon	E126	127	86	149.5	61.09
	E115	115.7	92	149.5	56.51
Siemens	SWT DD120	120	85	145	58.6
	SG132	132	83.9	149.9	64.5

6.22.13 As well as the increase in height, the proposed turbines would be marginally wider in terms of the tower diameter. The consented turbines were estimated to be 4.2 m at the base and 2.4 m at the top of the tower based on typical turbines that fit the 126.5 m tip height criteria. The proposed turbines are estimated to be a worst-case of 4.9 m at the base and 3.5 m at the top of the tower. This is an increase in overall width of 0.7 m at the base and 1.1 m at the top. Some of the turbine options would have smaller increases in width, but this is the wort-case potential based on turbines that fit the up to 149.9 m to tip criteria. This would result in a slight increase in the bulk of the towers and a marginal reduction in the tapering of the turbine towers. Within the scope of the consented tower size, spacing of the turbines and distance of views, it is considered this change would have a negligible effect on the appearance of the turbines and be unlikely to make them appear bulkier from any of the viewpoints used in this LVIA.

6.22.14 The proposed turbine designs follow the same basic structure with a cylindrical tower, nacelle containing gear box and generator and three rotor blades. In addition, a small transformer building is likely to be located at the base of each consented or proposed turbine. The current turbines available for the proposed development includes slightly different designs: either the Siemens SWT/SG, or Enercon E-126/115 as depicted for illustrative purposes in Images 6.3 and 6.4. All turbine options would be painted a pale grey off-white colour as per the consented turbines and would be agreed as part of planning condition 17 of the consent. No further consideration of this element has been undertaken in the LVIA. Figure 4.2 of the ES depicts a typical wind turbine design for the consented scheme in comparison, and illustrative views of a consented design is shown in Image 6.5.

Image 6.3: Potential Turbine Designs[3]

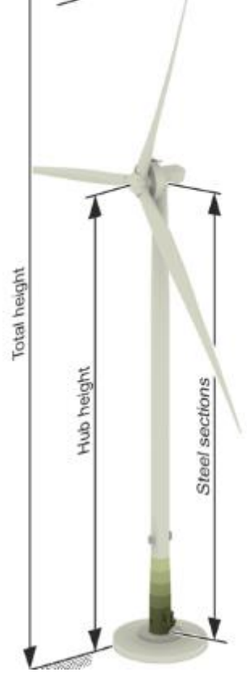
Siemens SWT-DD-120

Enercon E-115 EP3 E3

Image 6.4: Potential Turbine Designs[4]

Siemens SWT-DD-120

ENERCON E-115 EP3 E3

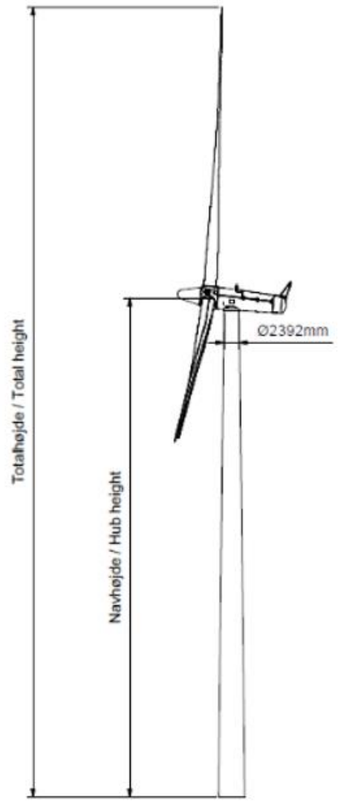


[3] Siemens Gamesa: Developer Package, SWT-DD-120 Weights and Dimensions E-126 EP3-ST-86-FB-C-01 and https://www.enercon.de/en/products/ep-3/e-115-ep3/ (accessed 31st March 2020)

[4] https://www.siemensgamesa.com/products-and-services/onshore/siemens-legacy-products (last accessed 31st March 2020) and Enercon Data Sheet: Weights and Dimensions E-126 EP3-ST-86-FB-C-01

Image 6.5: Example of Consented Turbine Designs[5]

Siemens SWT-2.3-93



Wind Farm Access Route

6.22.15 No changes are proposed for the majority of the off-site access route for turbine delivery, and thus effects would remain as recorded in the SEI. The landscape and visual effects of the consented changes were identified as not significant in the SEI Appendix 6A.18.

6.22.16 The main proposed variation is due to the larger turbines not being able to pass under the railway bridge at Pontdolgoch (2 km north of Caersws) on the A470. A proposed diversion crossing farmland and associated construction of a new section of off-site access route is therefore proposed. The proposed route is illustrated in Figure 13.4.

6.22.17 This proposed change is outside the consented application boundary and a separate planning application will be submitted to obtain permission for the construction of this access track. However, as this is associated with the wind farm a high-level assessment of the potential effects of the proposed access track is included within the FEI within Appendix 6A.23 and effects summarised in this section. Details of the proposed route are shown on Figure 13.4 and a full description of the works included in Section 13 of this FEI.

6.22.18 The route would involve turning north-east off the A470 into an agricultural field, just north of a farm lane which also turns north-east off the A470. The farm lane is shared with Footpath Caersws 18, and if heading north on the A470 is just prior to the turning on the opposite side of the road (south-west) into Wig Lane. The proposed route would bear gently off the A470 and follow a 270-degree clockwise loop made up of approximately 522 m of a temporary track system within the agricultural field, ending in a 90-degree approach and crossing of the A470 straight onto Wig Lane (see Figure 13.4). The route would then proceed south-west long Wig Lane and over Wig Bridge for approximately 411 m, after which it bears westwards onto adjacent agricultural land, forming a sweeping bend northward to run roughly parallel with the Afon Carno across farmland. This would be a permanent access track across agricultural land approximately 1,546 m in length (including 386 m of upgraded (existing) track), total area approximately 9,502 m^2. The route then emerges back on to the A470 to the west of the railway bridge at Pontdolgoch, at the end of the existing farm access drive for Dolerw/Perth-eiryn.

6.22.19 The type of construction for the main permanent section of track passing over agricultural land is illustrated on Figure 4.5 of the ES as 'Level Track Cut. This comprises 300-400 mm depth of compacted stone dependent on ground conditions with vegetation and topsoil reinstated to the edge of the track. The track in the field to the east of the A470 would include temporary track system which would be removed at the end of the turbine delivery period. The land that would be crossed by the track is low lying level ground with the need to culvert one small stream and cross a number of field boundaries. Part of the off-road route is already formed by exiting agricultural access tracks and the total construction time for the new and upgraded track is estimated at approximately 4-6 weeks. A 3-month delivery period is assumed for the delivery of the proposed 13 turbines, with no storage of turbines on the proposed track, and delivery periods restricted to 6 days per week.

Mitigation Measures

6.22.20 The original mitigation measures in the ES (paragraph 6.5.29 onward) remain valid in terms of the overall design objectives and would apply to the proposed development. The reduced number of turbines in the SEI can also be considered mitigation as it reduced the level of effects.

[5] Outstanding efficiency: Siemens Wind Turbine SWT-2.3-93 – Siemens (March 2010)

ZTV Analysis

6.22.21 An analysis of theoretical visibility has been undertaken, as shown on Figures 6.29 b and 6.30 b, comparing the consented Carno III turbines with the proposed THE turbines, for blade tips and hubs respectively.

6.22.22 Very little difference in the extent of theoretical visibility is shown by the comparative blade tip ZTV. This is attributed to much of the theoretical visibility consisting of views from similar elevations looking across valleys to the plateau where the consented and proposed turbines would be located. In such views, the proposed development would change the overall tip height, but the composition and number of turbines visible would be the same. In distant views, the proposed increase in height would become difficult to perceive due to the effects of distance. This factor is illustrated by Viewpoint 10 – Bryn y Fan and Viewpoint 17 – Glyndwr's Way, Penycrocbren and is considered in the analysis contained in Appendix 6A.22 of the FEI.

6.22.23 An increase in visibility extent, due to higher tip height, would occur on slopes facing the proposed development. This increase would relate to the proposed turbines being visible above intervening landforms at lower levels than the consented turbines. Within 15 km of the proposed development this increase in visibility would be most apparent near Trefeglwys and Caersws, as shown by the orange colour on the comparative blade ZTVs in Figure 6.29 b. Viewpoint 4 - A470 Caersws Basin and Viewpoint 7 - East of Trefeglwys would be representative of this type of visual change, and detailed examination of these areas is included in Appendix 6A.22. Similar effects may also occur at Viewpoint 3 – Carno Recreation Ground and Viewpoint 9 – Llawr y Glyn. Increases in potential hub visibility due to the proposed development are illustrated in Figure 6.30b and generally follow the same pattern as that for blade tip visibility with the main area of difference running across the Caersws Basin.

6.22.24 Additional visibility near the specific landscape and visual receptors and viewpoints considered in the LVIA is examined in this section of the FEI for individual receptors and/or viewpoints and covers all the main areas of additional visibility in depth.

6.22.25 It should also be noted that while visibility from open moorland areas to the consented site would be fairly accurately represented by the ZTV studies, lowland areas are much more likely to have an element of screening through buildings, hedgerow and woodland elements within the landscape which are not included in the ZTV.

Assessment of Effects on Landscape Fabric

6.22.26 The proposed turbines would be located in the same positions as the consented turbines with the same on-site development components. The direct effects of the proposed development on landscape fabric are therefore largely unchanged with the exception of mainly the turbine foundations and crane hard standings. It is not considered that these changes would have more than a negligible effect within the context of the consented works and they have not been considered further.

Summary of Effects on Landscape Character

6.22.27 The LANDMAP Landscape and Visual Aspect Areas have been used to identify landscape character areas as the baseline against which to assess the effects caused by the consented wind turbines on the landscape character of the study area. This process has had to be undertaken as the Powys Landscape Character Assessment has been withdrawn and cannot be used in the FEI, despite its use in the ES and SEI.

6.22.28 The LANDMAP Visual and Sensory Aspect Areas identified are those within the 15 km study area and which have visibility of the consented turbines as defined in Table 6A17.6 of Appendix 6A.17. The indicated landscape sensitivity is derived from Table 6.22 in the SEI and is a reflection of the values of all LANDMAP aspects as derived from the full LANDMAP study undertaken in Appendix 6A.17 of the SEI.

6.22.29 The full LANDMAP Appraisal in Appendix 6A.17 reviewed all 5 LANDMAP aspects and uses LANDMAP Information Guidance Note 3[6].

6.22.30 The magnitude of change has taken account of the distance of the application boundary from the Visual and Sensory area, and the geographical extent of theoretical visibility as defined in Table 6A21.1 of Appendix 6A.21 of the FEI and the comparative ZTVs Figures 6.29 b and 6.30 b. Reference has also been made to the viewpoint analysis in the ES, SEI and FEI. The levels of effect on each of the LANDMAP areas identified is summarised in Table 6.35.

6.22.31 The landscape effect is derived from considering the sensitivity and magnitude of change for each LANDMAP area, using the methodology identified in Appendix 6A.3 of the SEI.

6.22.32 The assessment summarised in Table 6.35 contains the sensitivity, magnitude of change and resultant level of effect for the consented SEI development. The table also contains the additional magnitude of change for the proposed THE turbines set against the baseline of the consented SEI scheme, and the overall predicted effects of the FEI.

[6] LANDMAP Information Guidance Note 3: Using LANDMAP for Landscape and Visual Impact Assessment of Onshore Wind Turbines (May 2013) Natural Resources Wales

Table 6.35: Landscape Effects on the Sensory Aspect Areas

UID	LANDMAP Name	Landscape Sensitivity	Consented Develop-ment Magnitude of Change	Consented Develop-ment Landscape Effect	FEI Additional Magnitude of Change	FEI Level of Additional Landscape Effect	FEI Overall Level of Landscape Effect
MNTGM VS147	Mynydd Lluest Fach	Medium/ low	Negligible	Moderate/ minor	Negligible	Negligible	Moderate/ minor
MNTGM VS179	Trannon Moors	Medium	Substantial	Major/ moderate	Slight	Minor	Major/ moderate
MNTGM VS200	Esgair Ychion	Low	Slight	Moderate/ minor	Negligible	Negligible	Moderate/ minor
MNTGM VS204	Llanidloes Farmland	Medium	Slight	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
MNTGM VS211	Llandinam	Medium/ low	Slight	Moderate/ minor	Negligible	Negligible	Moderate/ minor
MNTGM VS212	Llandinam Hill and Scarp Mosaic	High	Moderate/ slight	Moderate	Negligible	Moderate/ minor	Moderate
MNTGM VS227	Cefn Carnedd Wooded Hillside	Medium	Moderate	Moderate	Slight/ Negligible	Minor/ negligible	Moderate
MNTGM VS232	Wye Valley Uplands	Medium	Moderate	Moderate	Negligible	Minor/ negligible	Moderate
MNTGM VS235	Carno Mosaic	High/ Medium	Moderate	Moderate	Slight/ Negligible	Moderate/ minor	Moderate
MNTGM VS254	Kerry Ridgeway	High	Slight	Moderate	Negligible	Moderate/ minor	Moderate
MNTGM VS264	Banwy Upland	Medium	Slight	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
MNTGM VS276	Dyfi Valley Catchment	Medium	Negligible	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
MNTGM VS293	Esgair Geulan	Medium /low	Moderate	Moderate	Negligible	Negligible	Moderate
MNTGM VS312	Glaslyn Scarp	High/ medium	Negligible	Moderate /minor	Negligible	Minor	Moderate /minor
MNTGM VS320	Banwy Forest	Low	Slight	Minor	Negligible	Negligible	Minor
MNTGM VS337	Cwm Tafalog	Medium /low	Slight	Moderate/ minor	Negligible	Negligible	Moderate/ minor
MNTGM VS363	Newydd Fynyddog	Medium	Slight/ negligible	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
MNTGM VS413	Mynydd y Cemmaes	Medium	Slight/ negligible	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
MNTGM VS420	Upper Severn Valley	High	Slight	Moderate	Slight	Moderate/ minor	Moderate
MNTGM VS422	Llanerfyl Mosaic Farmlands	Medium	Slight/ negligible	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
MNTGM VS438	Old Chapel Hill Mosaic	Medium	Moderate/ slight	Moderate	Negligible	Minor/ negligible	Moderate
MNTGM VS441	Cemmaes Scarp	Medium	Slight	Moderate /minor	Negligible	Minor/ negligible	Moderate /minor
MNTGM VS443	Warn Ddubarthog Wind Farm	Medium	Slight	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor

UID	LANDMAP Name	Landscape Sensitivity	Consented Develop-ment Magnitude of Change	Consented Develop-ment Landscape Effect	FEI Additional Magnitude of Change	FEI Level of Additional Landscape Effect	FEI Overall Level of Landscape Effect
MNTGMVS457	Clywedog Upland Grazing	Medium	Substantial	Major/ moderate	Slight	Minor	Major/ moderate
MNTGMVS460	Clegyrnant Grazing	Medium	Slight/ negligible	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
MNTGMVS483	Dovey Forest	Medium	Slight	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
MNTGMVS493	Dyfi Valley Rolling Grazing	High/ medium	Slight	Moderate/ minor	Negligible	Minor	Moderate/ minor
MNTGMVS497	Llechwedd Melyn Scarp Moorland	Low	Slight/ negligible	Minor	Negligible	Negligible	Minor
MNTGMVS556	Carno	Medium/ low	Moderate	Moderate	Slight/ negligible	Negligible	Moderate
MNTGMVS571	Pen Coed Upland	Medium	Slight/ negligible	Minor	Negligible	Minor/ negligible	Minor
MNTGMVS575	Caersws	Medium	Slight	Moderate	Negligible	Minor/ negligible	Moderate
MNTGMVS579	Mynydd Bychan Woodlands	Low	Negligible	Negligible	Negligible	Negligible	Negligible
MNTGMVS672	Trannon Woodlands	Medium	Substantial	Major/ moderate	Slight	Minor	Major/ moderate
MNTGMVS694	Carno Uplands	Medium	Moderate	Moderate	Slight/ negligible	Minor	Moderate
MNTGMVS695	Trannon Uplands Bryn Crugog	High/ medium	Substantial	Major/ moderate	Slight	Moderate/ minor	Major/ moderate
MNTGMVS696	Carno Grazing	Medium	Moderate	Moderate	Slight/ negligible	Minor	Moderate
MNTGMVS733	Esgair Cwmowen Uplands	Medium	Moderate	Moderate	Negligible	Minor/ negligible	Moderate
MNTGMVS776	Cefn Coch Rolling Pasture	Low	Slight/ negligible	Minor	Negligible	Negligible	Minor
MNTGMVS796	Rhiw Goch	Medium	Substantial/ moderate	Major/ moderate	Slight	Minor	Major/ moderate
MNTGMVS833	Llyn Clywedog	High/ medium	Negligible	Minor	Negligible	Minor	Minor
MNTGMVS865	Caersws River Bowl	High	Slight	Moderate	Negligible	Moderate/ minor	Moderate
MNTGMVS899	Tregynon Rolling Hills	High/ Medium	Slight	Moderate/ minor	Negligible	Minor	Moderate/ minor
MNTGMVS907	Wye Valley	Medium	Slight	Moderate/ minor	Negligible	Minor	Moderate/ minor
MNTGMVS910	Plynlimon Moorlands	High	Moderate	Major/ moderate	Slight	Moderate	Major/ moderate
MNTGMVS916	Mynydd Pant Coch Hillsides	High/ medium	Slight	Moderate/ minor	Negligible	Minor	Moderate/ minor

UID	LANDMAP Name	Landscape Sensitivity	Consented Develop-ment Magnitude of Change	Consented Develop-ment Landscape Effect	FEI Additional Magnitude of Change	FEI Level of Additional Landscape Effect	FEI Overall Level of Landscape Effect
MNTGM VS917	Hafren Forest	Low	Slight	Moderate /minor	Negligible	Negligible	Moderate /minor
CRDGN VS151	Plynlimon	High	Slight/ negligible	Moderate /minor	Negligible	Moderate/ minor	Moderate /minor
RDNR VS115	Upland moor, north & west of Abbeycwm hir	Medium	Slight/ negligible	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
RDNR VS124	Improved upland, between Wye & Ithon	Medium	Slight	Moderate/ minor	Negligible	Minor/ negligible	Moderate/ minor
RDNR VS125	Bryn-y-Sarnau forest slopes and fields	Medium/ low	Slight/ negligible	Minor	Negligible	Negligible	Minor
RDNR VS135	Rolling hills, between Ithon & Wye	Medium/ low	Slight/ negligible	Minor	Negligible	Negligible	Minor

6.22.33 The landscape assessment in Appendix 6A.21, using the LANDMAP Visual and Sensory LCAs, concludes that, the level of effects identified for the THE (against the baseline of the consented SEI turbines) are not considered sufficient to increase the overall effect levels identified in the SEI. Therefore, there would be no increase in the combined levels of landscape effects.

6.22.34 These findings relate to the limited amount of change in geographical extent identified in the comparative ZTVs and the limited degree of change in terms of size and scale. The proposed 149.9 m tall turbines represent 118.5% the size of the consented turbines. In many cases, the consented turbines are viewed with all, or large numbers of turbines visible, at distances of 5 km or more and the difference in height would not be easily perceived or obvious. Where the difference may be most readily perceived, such as below within 3-4 km distant, it is limited to a slight increase in the prominence of the turbines.

6.22.35 Consequently, although change would occur in the landscape as a result of the proposed THE turbines, this change would not be sufficient to alter the levels of effect predicted by the SEI and therefore the levels of significance remains unchanged. Out of the 51 LANDMAP Visual and Sensory LCAs considered, significant effects would occur for the same six LCAs in the consented scheme and the proposed development.

Summary of Effects at Viewpoints

6.22.36 Table 6.36 summarises the findings of the viewpoint assessment contained within Appendix 6A.22 and separate wirelines as presented in Volume 2 of the FEI. The level of additional magnitude of change caused by the proposed THE turbines is predicted to vary between Negligible and Slight and is not regarded to be sufficient to increase the overall magnitude of change assessed for the viewpoints for the consented SEI scheme. If the magnitude of change is the same for both the SEI and overall FEI, then the various combinations of receptor sensitivity and magnitude of change will remain the same and no changes would occur to the resultant visual effects at the viewpoint and the level of significance would remain the same.

6.22.37 The general conclusion is that the magnitude of change caused by the proposed increase in height is minimal. This is due to the baseline landscape which includes the consented turbines, and this minimal degree of change can be seen in the various wirelines prepared to support the viewpoint assessment and presented in Volume 2.

Table 6.36: Viewpoint Assessment Comparison Summary

Viewpoint	Consented Magnitude of Change	Consented Level of Visual effect	Proposed Changes to permitted scheme as identified in the above text	FEI Additional Magnitude of Change	Overall Magnitude of Change	FEI Overall Level of Visual Effect
3 – Carno	Moderate	Major/ Moderate (residents)	1 additional blade tip visible and seen above	Negligible	Moderate	Major/ Moderate (residents)

Viewpoint	Consented Magnitude of Change	Consented Level of Visual effect	Proposed Changes to permitted scheme as identified in the above text	FEI Additional Magnitude of Change	Overall Magnitude of Change	FEI Overall Level of Visual Effect
		Moderate (road users)	the skyline at 4.2 km			Moderate (road users)
4 – A470	Slight	Moderate (residents) Moderate/ Minor (road users)	2 additional blade tips and 2 hubs visible and seen above the skyline at 10.9 km	Negligible	Slight	Moderate (residents) Moderate/ Minor (road users)
5 – Bryn Crugog	Substantial	Major/ Moderate (residents) Moderate (road users)	All SEI/FEI tips and hubs visible at 2.1 km	Slight/ negligible	Substantial	Major/ Moderate (residents) Moderate (road users)
7 – East of Trefeglwys	Slight	Moderate (recreational users) Moderate/ Minor (road users)	1 additional blade tips and 4 hubs visible and seen above the skyline at 8.5 km	Slight	Slight	Moderate (recreational users) Moderate/ Minor (road users)
9 – Llawr y Glyn	Substantial	Major/ Moderate (residents) Moderate	1 additional blade tip visible and seen above the skyline at 2.5 km	Slight	Substantial	Major/ Moderate (residents) Moderate (road users)
		(road users)				
10 – Bryn y Fan	Substantial	Major	All SEI/FEI tips and hubs visible at 5.1 km	Negligible	Substantial	Major
14 – Hafren Forest	Substantial	Major	All SEI/FEI tips and hubs visible at 6 km	Negligible	Substantial	Major
17 – Peny-crocbren	Substantial	Major	All SEI/FEI tips and hubs visible at 4.1 km	Negligible	Substantial	Major
18 – Lluest Dropyns	Moderate	Major/ Moderate (recreational users) Moderate (road users)	All SEI/FEI tips and hubs visible at 5.6 km	Negligible	Moderate	Major/ Moderate (recreational users) Moderate (road users)
19 – Allt Ddu	Substantial	Major (residents) Major/ Moderate (PRoW users)	All SEI/FEI tips and hubs visible at 1.0 km	Slight	Substantial	Major (residents) Major/ Moderate (PRoW users)

Viewpoint	Consented Magnitude of Change	Consented Level of Visual effect	Proposed Changes to permitted scheme as identified in the above text	FEI Additional Magnitude of Change	Overall Magnitude of Change	FEI Overall Level of Visual Effect
25 – B4519 near Pennant	Moderate/ slight*	Major/ Moderate (residents) Moderate (road users)	1 additional blade tip visible and seen above the skyline at 3.6 km	Slight	Moderate/ slight	Major/ Moderate (residents) Moderate (road users)
2 – Mynydd yr Hendre	Moderate/ slight	Moderate (residents) Moderate/ Minor (road users)	All SEI/FEI tips and hubs visible at 9.1 km	Negligible	Moderate/ slight	Moderate (residents) Moderate/ Minor (road users)
12 - PROW north of Llangurig	Moderate	Major/ Moderate (residents) Moderate (road users)	All SEI/FEI tips and hubs visible at 10.3 km	Negligible	Moderate	Major/ Moderate (residents) Moderate (road users)

*Defined magnitude of change identified for new viewpoint for consented Carno III development

6.22.38 At distances of approximately 10 km and beyond it is predicted that the differences in heights of the consented and proposed turbines would not be perceived. This is illustrated by the wirelines for Viewpoints 2 (9.0 km), 4 (10.9 km) and 12 (10.3 km) and described in Appendix 6A.22 and a Negligible additional magnitude of change is predicted as recorded in Table 6.36.

6.22.39 In addition, even at distances around 5 km the difference in height of the turbines becomes difficult to perceive at the location of the viewpoint given the comparison in height would never be viewed in reality. The wirelines for Viewpoints 3 (4.2 km), 10 (5.1 km), 14 (6.0 km), 17 (4.1 km) and 18 (5.6 km) illustrate the theoretical comparison. In both scenarios the components of the view would be the same and only the size of turbines different. A negligible additional magnitude of change has been assessed for these viewpoints as well.

6.22.40 At the closest distances Viewpoints 5 (2.1 km) and 19 (1.0 km) the difference in height is more likely to be apparent, particularly for the nearest turbines, less so for the more distant turbines. The increased scale of the nearer proposed THE turbines would result in additional prominence. Also, such views would have the potential for greater levels of effect on residential visual amenity and such effects have been examined in Appendix 6A.24 with reference to both Viewpoints 5 and 19. The additional magnitude of change at these viewpoints from the proposed THE turbines varies between Slight/negligible and Slight.

6.22.41 The wirelines themselves emphasise this difference, as in reality the consented and proposed turbines would never appear together to make such comparisons.

6.22.42 The main effects of note are therefore where the consented wind farm is partly screened from view as with Viewpoints 7 (8.5 km), 9 (2.5 km) and 25 (3.6 km). At these locations, additional blade tips and hubs may become visible as a result of the increased height of the proposed THE turbines. At these locations, Slight additional magnitudes of change would occur as detailed in Appendix 6A.22.

6.22.43 None of the levels of visual effect identified are great enough to cause a significant effect in themselves even for a high sensitivity receptor when using the methodology in Figure 6A3.6 and Appendix 6A.3 in the SEI.

6.22.44 In addition, it is not considered that the limited nature of the effects identified would raise any of the existing magnitudes of change, (i.e. as assessed and consented for the SEI layout) above their existing levels. The sensitivity of receptors would not alter, and the magnitude of change would not increase for any of the viewpoints. Therefore, the overall level or significance of visual effects would not alter from that identified in the consented scheme.

6.22.45 Therefore, it is concluded that while the additional height of the THE turbines might add to the combined effects with the consented turbines, the overall levels of visual effect assessed for each viewpoint would not be sufficiently increased to change the consented level of effect or create new significant effects.

Effects for Landscape Related Designations

Effects on Visitors to Cultural Heritage Receptors

6.22.46 These receptors include cultural heritage sites and are assessed in terms of the visual effects on visitors to these sites. Effects on heritage on not considered within section.

Caersws Basin, Landscape of Special Historic Interest (LSHI)

6.22.47 The introductory description for the LSHI states that;

'Topographically, the Caersws Basin presents a striking natural arena in the centre of Mid Wales. Visual prospects out of the basin are confined in almost every direction by the surrounding, seemingly unbroken, rim of low hills and ridges between about 300m and 400m above OD.'[7]

6.22.48 The area of additional visibility of blade tips arising from the proposed development is illustrated in Image 6.6, and hubs in Image 6.7, with the extent of the LSHI indicated by a purple line and Viewpoint positions marked.

6.22.49 The majority of the lowland area of the Caersws Basin, including the main area of additional theoretical visibility, is located in LANDMAP area MNTGMVS865 which has a summary description as follows;

'An extensive area of lowland agricultural land - and the upper level of the River Severn (Afon Hafren) valley, enclosed by a ring of higher ground giving a 360 view of upland encircling the viewer... The area is formed by the meeting of the three valleys carrying the Afon Carno, Trannon, Cerist and amalgamation into the Afon Hafren (River Severn) hence its broad flat bowl liked shape... Transport corridors are dominant in the area with the A489(T) and A470(T) meeting at Caersws... Wide angled views prevail with open skies and mid distance views to the surround higher ground...'

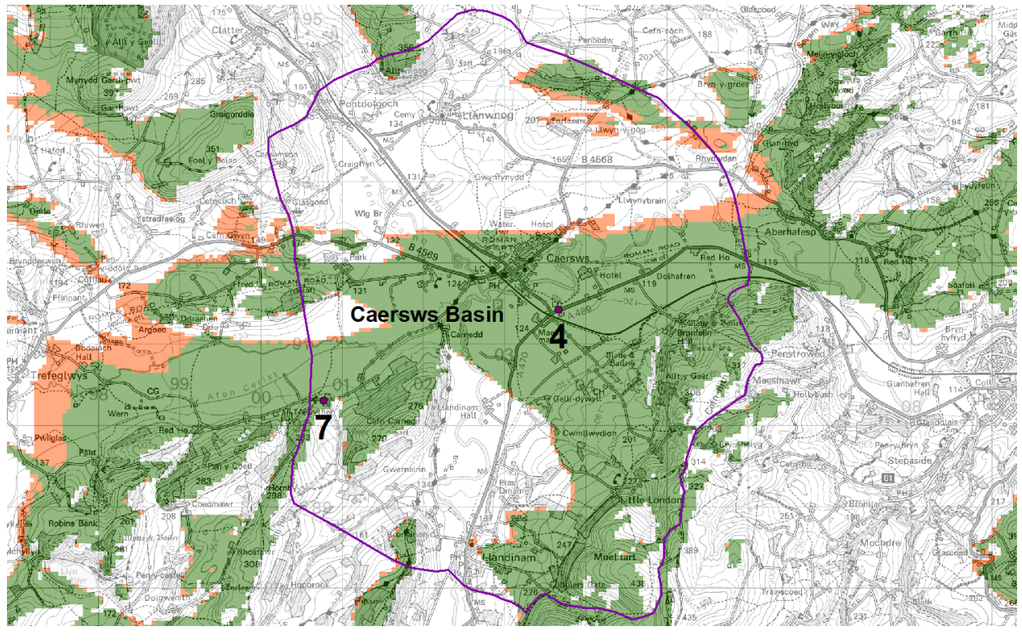
6.22.50 Scenic Quality for MNTGMVS865 is defined as moderate and described as;

'Open and expansive views to surrounding higher ground but of moderate interest within the aspect itself'

6.22.51 The Overall Evaluation for the aspect area is defined as moderate and the justification states:

'Although the area is unusual in its topography it does not possess a particularly significant aesthetic or scenic quality it is an area that is travelled through rather than a destination functional rather than aesthetic.'

Image 6.6: Caersws Basin Zone of Theoretical Blade Tip Visibility Comparison (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)



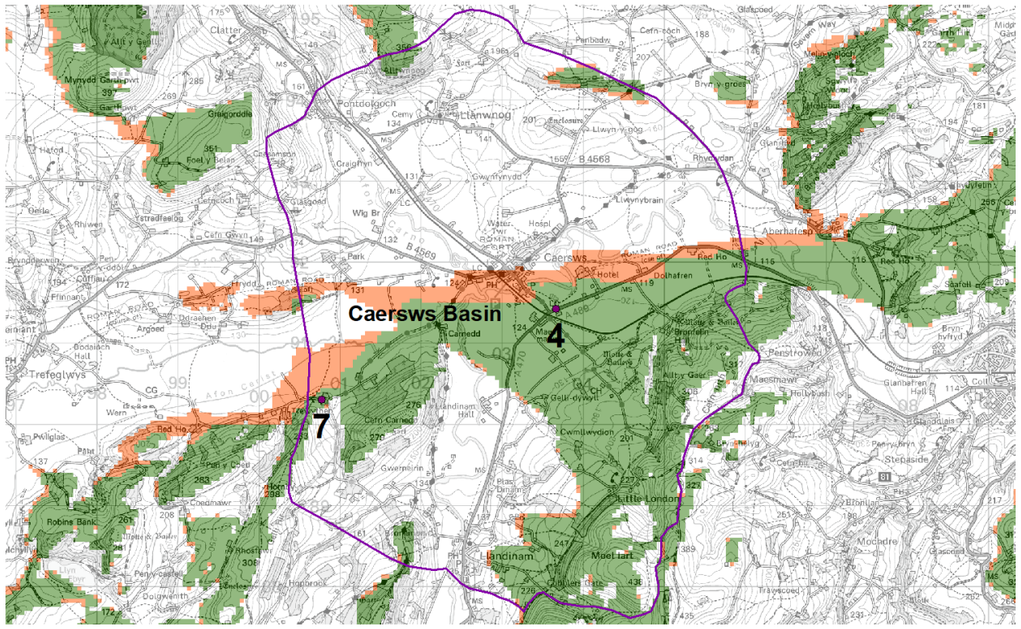
6.22.52 Thus, although the surrounding ring of hills is an important topographical feature, views within the LSHI are of limited scenic value as defined by LANDMAP.

6.22.53 Image 6.6 illustrates an extract from the comparative blade tip ZTV illustrated in Figure 6.30b of the FEI, with the extent of the Caersws Basin LSHI indicated by a purple line indicates a limited increase in tip visibility within the Caersws Basin LSHI, as indicated shown by the orange fill, with the green fill indicting the visibility of the consented Carno III blade tips. The area of additional theoretical visibility is limited to the north east of the LSHI. This includes additional theoretical visibility from a hilltop to the east of Llanwnog where a Roman Road crosses into the basin and then extending south-east around the edge of the consented turbine visibility near to Rhydlydan. The additional visibility then extends west and becomes in a thin zone of additional visibility directly north of Caersws. Other areas of additional visibility are considered marginal and negligible in extent and are not considered further.

6.22.54 The additional theoretical hub visibility is limited to a band across the north of the consented visibility and includes the settlement of Caersws and valley floor north of Viewpoint 7 (see Image 6.7).

[7] Historic Landscape Register: The Caersws Basin, Landscape of Special Historic Interest
https://www.cpat.org.uk/projects/longer/histland/caersws/swsint.htm

Image 6.7: Caersws Basin Zone of Theoretical Hub Visibility Comparison (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)



6.22.55 The assessment of additional visibility for the settlement of Caersws is considered under the section on settlements and recreational routes, and the area to the west considered under Viewpoint 7 and the settlement of Trefeglwys.

6.22.56 Additional tip visibility from the Roman Road to the east of Llanwnog is predicted to be screened by woodland and field boundary vegetation as shown by the view from Google Earth in Image 6.8. Additional hub visibility would be minimal in this area.

6.22.57 Hedgerow and tree vegetation would provide screening for the area to the east (north of Rhydlydan/ B4568) with a large number of mature trees within hedges and general landscape in this area, as illustrated in Image 6.9. Some additional blade tip views are likely, but these would be extremely limited in extent and negligible in nature. No hubs would be theoretically visible from this area.

Image 6.8: View looking South-West (north of Llwyn-y-gog) on the line of a Roman Road (Copyright 2020 Google Earth Imagery)

Image 6.9: Aerial View looking North towards area north of Rhydlydan (Copyright 2020 Google Earth Imagery)

6.22.58 Image 6.10 illustrates the riparian vegetation, present in the mid distance along the line of the River Severn, which would help screen additional blade tip views from much of the river valley in this area. Additional visibility would be most likely glimpsed from the B4568 to the south-east of Rhydlydan where hedgerows are close clipped and hedgerow trees widely spaced as shown in the foreground of Image 6.10.

6.22.59 The additional hub visibility is concentrated around the area immediately south of Caersws. Visibility from this area is greatly affected by riparian vegetation and vegetation around the Caersws football club grounds and the Maesmawr Hall Hotel. This is examined further in the subsection on settlements (Paragraph 6.22.74 onwards), but it is concluded that additional views of hubs would be screened in the majority of views.

6.22.60 Viewpoint 4 - A470 Caersws Basin is in the centre of the Caersws Basin, and a Slight magnitude of change was predicted for this viewpoint in the SEI for the consented turbines; this resulted in a Moderate and not significant visual effect.

6.22.61 The limited extent of additional visibility as shown in the wireline for this viewpoint and potential screening in many areas indicates an additional Negligible magnitude of change and it is not considered this would change the previous assessment level.

6.22.62 In conclusion it is predicted that there would be a negligible increase in the magnitude of change, but this would not be great enough to increase the level of effect on visitors from that assessed for the consented development for the Caersws Basin LSHI.

Image 6.10: View from area of additional Blade Tip visibility ZTV looking East (Copyright 2020 Google Earth Imagery)

Clywedog Valley, Landscape of Special Historic Interest (LSHI)

6.22.63 The introductory description for the LSHI states that;

'The River Clywedog in Mid Wales drains the north eastern flanks of the Cambrian Mountains, into which its narrow, winding valley has been deeply incised. The Clywedog is a tributary of the much larger River Severn which it joins at Llanidloes. From the site of this distinctive and picturesque historic market town, the hills and ridges on either side of the Clywedog Valley rise gradually from 300m above OD to reach 500m above OD near Dylife, just beyond the watershed in the north west. The fortunes of the Clywedog Valley and the area of its catchment identified here are generally linked with the contrasting industries of lead mining and wool, which have had a considerable impact on the landscape.' [8]'

[8] Historic Landscape Register: The Clywedog Valley, Landscape of Special Historic Interest https://www.cpat.org.uk/projects/longer/histland/clywed/clyint.htm

Image 6.11: Clywedog Zone of Theoretical Blade Tip Visibility Comparison (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)

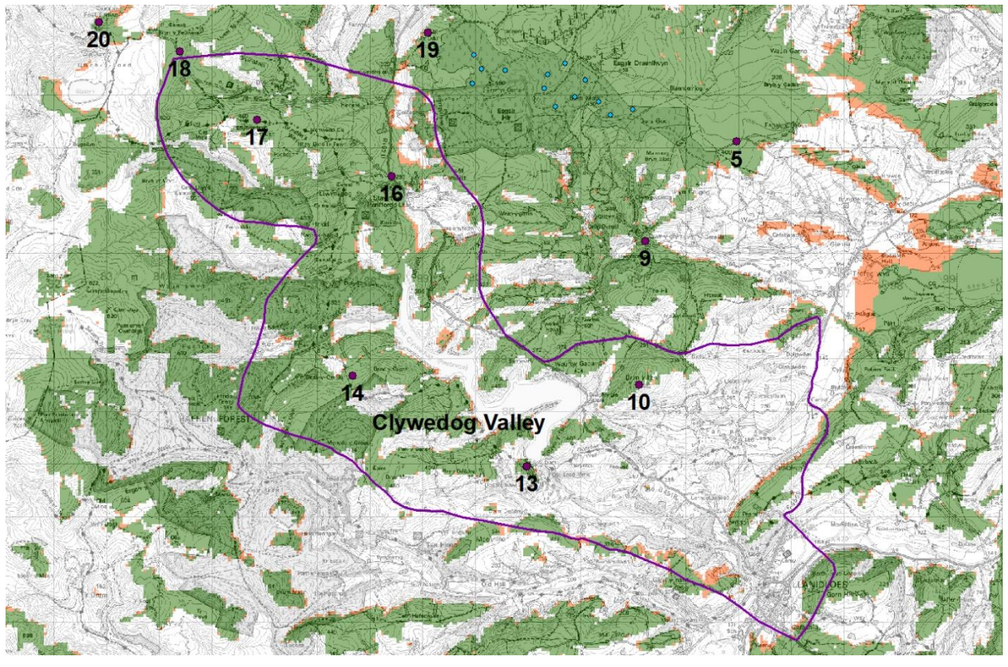
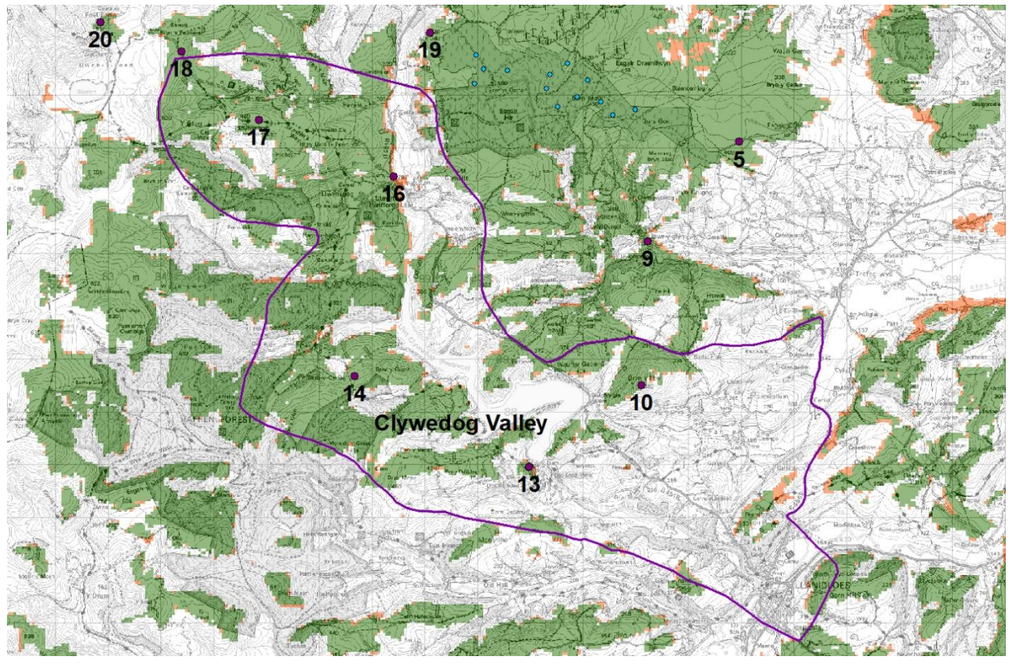


Image 6.12: Clywedog Valley Zone of Theoretical Hub Visibility Comparison (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)



6.22.64 Image 6.11 illustrates an extract from the comparative blade tip ZTV illustrated in Figure 6.30 b of the FEI, with the extent of the Clywedog Valley LSHI indicated by a purple line. The ZTV indicates a very marginal increase in visibility within the LSHI as indicated by the orange fill for the proposed blade tips, the green fill indicting the visibility of the consented Carno III blade tips.

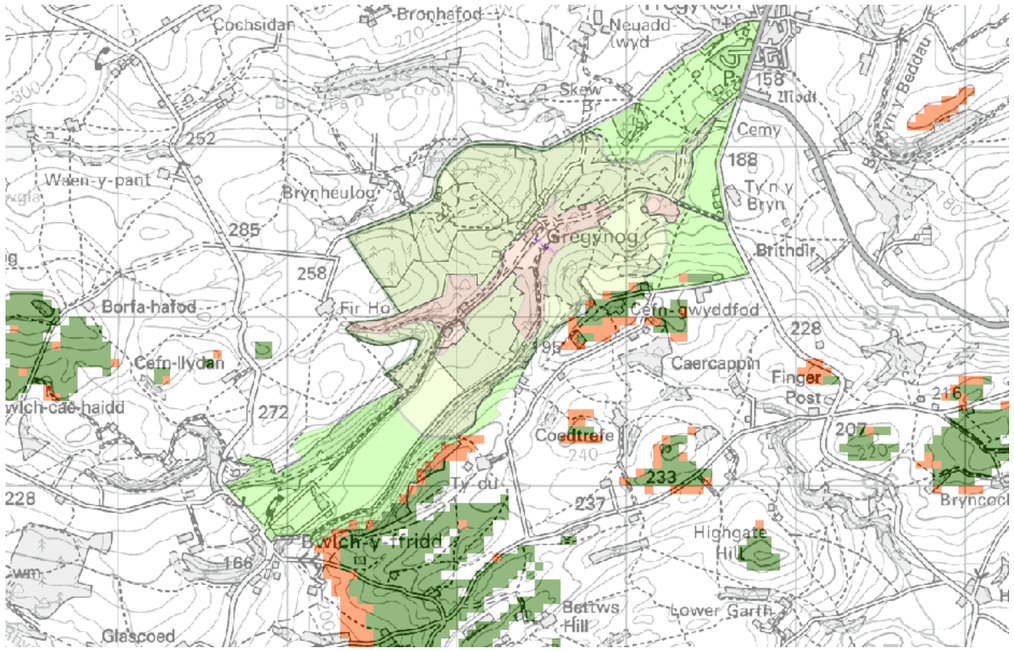
6.22.65 Very little additional visibility is identified for additional hub visibility as shown in Image 6.12.

6.22.66 A Substantial magnitude of change was identified in the SEI (Table 6.24 of the SEI) for visual effects at Viewpoints 13 and 14 for the consented development leading to a Major/moderate and significant visual landscape effect. It is not considered that the Negligible additional magnitudes of change predicted by the proposed development would alter the levels of effect identified in the SEI.

Gregynog, Historic Park and Garden

6.22.67 This receptor is approximately 14 km from the proposed development with marginal visibility indicated by the 15 km comparative ZTV illustrated in Figure 6.29 b.

Image 6.13: Gregynog Comparative ZTV Detail (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)



6.22.68 An enlarged extract of this ZTV is shown in Image 6.13. The magnitude of potential change was assessed as Negligible in the ES resulting in a Moderate/minor visual effect and not significant This was not assessed in the SEI and the reduction in turbine numbers may have reduced this level of effect but a Negligible magnitude of change would remain due to the potential for views from the very edge of the Historic Park and Garden. The central pink area in Image 6.13 represents the 'Gardens and Kitchen Gardens', the olive green/yellow the 'Park Boundary' and bright green the 'Extended Setting'.

6.22.69 Visibility of hubs from the receptor is not predicted based on Figure 6.30 b.

6.22.70 The minimal addition to blade tip visibility is not considered sufficient to increase the magnitude of visual change for visitors to this receptor and therefore the visual effect would remain the same, as Moderate/minor and not significant.

Plas Dinam, Historic Park and Garden

6.22.71 This receptor is approximately 10 km to the east south-east of the proposed development with marginal additional visibility indicated by the 15 km comparative ZTV illustrated in Figure 6.29 b. The ZTV indicates a theoretical view of blade tips from the extended setting of the receptor as shown in Image 6.14. In reality, intervening woodland, on Cefn Carnedd, would screen all development from view.

6.22.72 The LVIA in the ES concluded that no visual effects would occur for visitor to this site and the proposed THE turbines would not alter this prediction.

Image 6.14: Plas Dinam Blade Tip Comparative ZTV Detail (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)

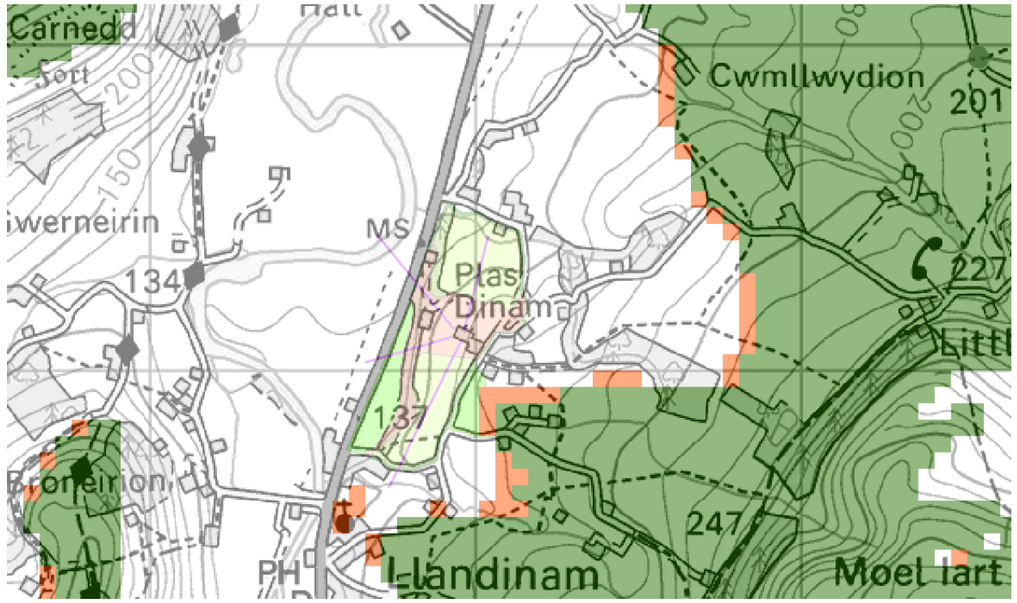
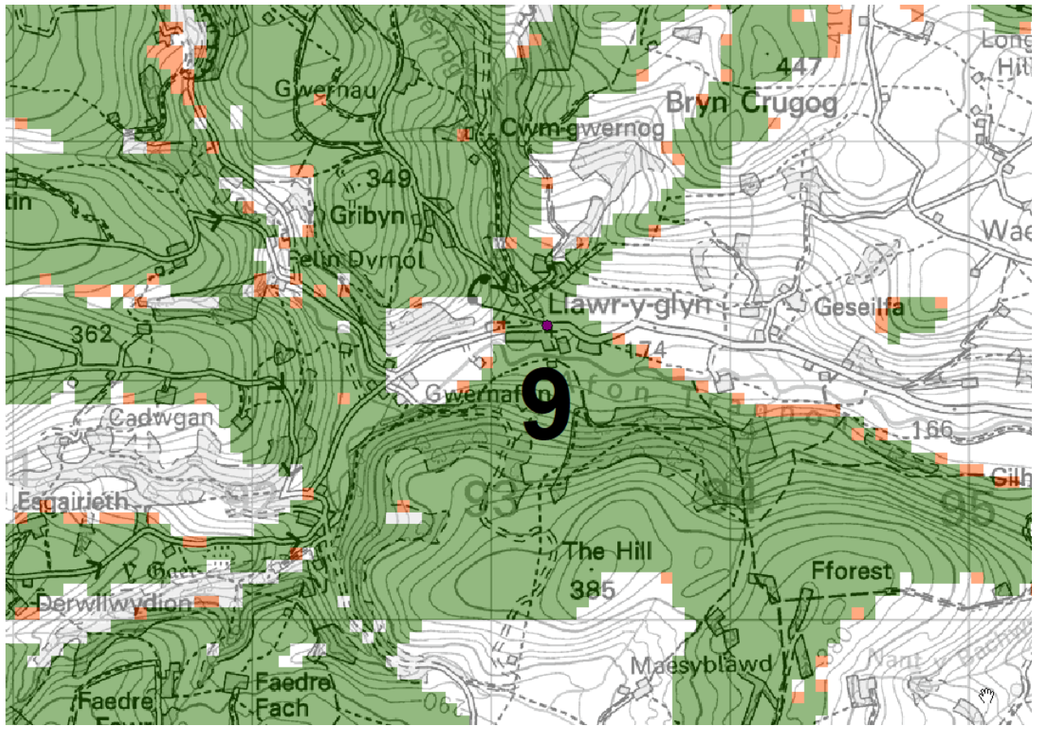


Image 6.15: Llawr-y-glyn Blade Tip Comparative ZTV Detail (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)



Llawr-y-glyn Conservation Area

6.22.73 Image 6.15 illustrates the limited change in additional visibility at the settlement and conservation area of Llawr-y-glyn and therefore no additional effects are predicted based on the ZTV studies. A more detailed study is recorded in the assessment of effects at Viewpoint 9 which is at the heart of the conservation area. This identifies a Major/Moderate and significant visual effect for residents with views of the consented development. The proposed THE development would have a Slight magnitude of change over the consented level of visual effect, but this would not be sufficient to increase the level of the already consented Major/Moderate and significant effect.

Visual Effects on Settlements

Carno

6.22.74 The SEI identified a Moderate magnitude of change and resultant Major/Moderate and significant visual effect for residents and moderate visual effect for road users, with views of the consented turbines. Some marginal increase in blade tip views would occur for the proposed development, to the north of the village in the area affected by large scale industrial buildings as shown in Image 6.16. This is considered to be Negligible in terms of the additional magnitude of change and it is predicted this would not increase the level of visual effect at the village.

Image 6.16: Carno Blade Tip Comparative ZTV Detail (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)

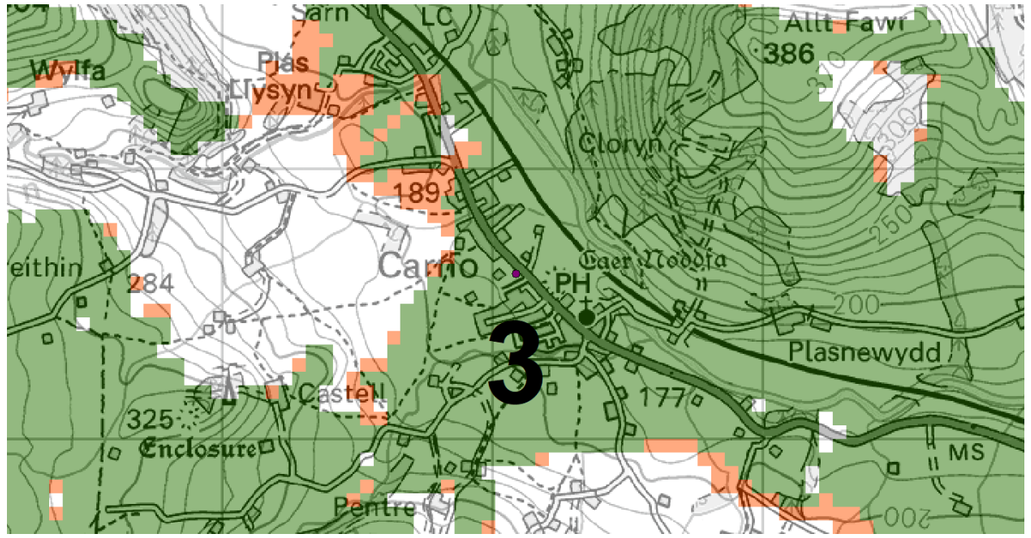
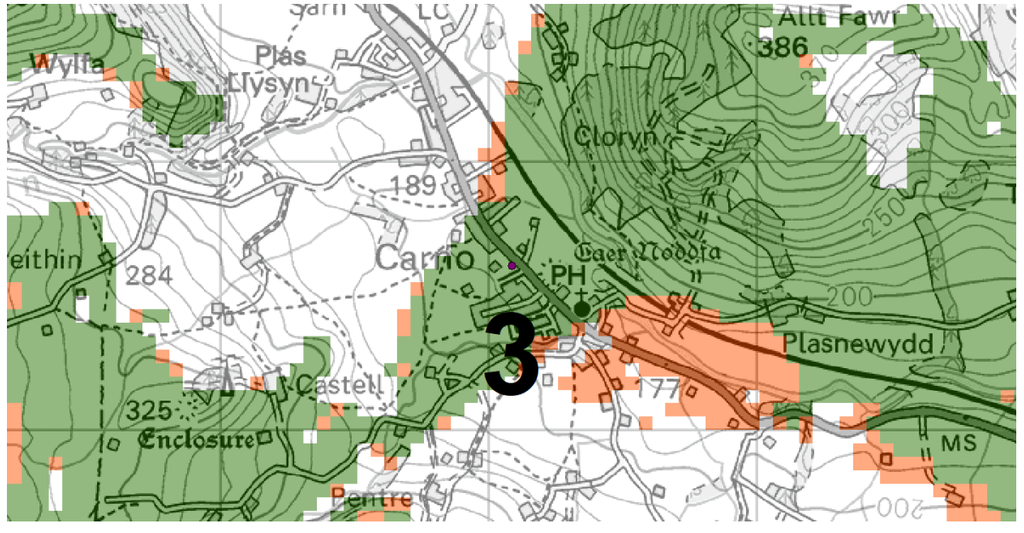


Image 6.17: Carno Hub Comparative ZTV Detail (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)



6.22.75 The effect of additional hubs would be marginally more pronounced, as shown on Image 6.17, where theoretical visibility is shown along the A470 to the south of the village. However, mature trees adjacent to

the village and on the rural land leading up to the moorland would screen the turbines from the A470 as illustrated in Image 6.18.

6.22.76 The additional visibility due to the proposed development is therefore considered to be a Negligible magnitude of change due to the limited nature and extent of views. This increase would not sufficient to change the Major/Moderate and significant (residents) or moderate and not significant (road users) consented level of visual effect identified in the SEI.

6.22.77 Viewpoint 3 – Carno Recreation Ground considers the potential for effects further at the position of the viewpoint.

Image 6.18: View from A470 South East of Carno (Copyright 2020 Google Earth Imagery)

Caersws

6.22.78 Images 6.6 and 6.7 illustrate the comparative ZTVs for the blade tips and hubs for the Caersws Basin, Landscape of Special Historic Interest (LSHI) which includes the settlement of Caersws. Reference should be made to those figures while reading the text of this receptor.

6.22.79 Viewpoint 4 helps to illustrate the level of tree cover and screening around Caersws. Image 6.19 is an enlargement of recent photography taken from the position of Viewpoint 4. The consented and proposed turbines would be partially screened in this view behind the poplar trees which are growing along the northern edge of the Caersws football club grounds. It is accepted that this alignment is a chance occurrence and other views to one side or the other would potentially be able to view the turbines directly, but it is indicative of the level of tree cover present and growth that has occurred since the original viewpoint photography was undertaken prior to 2010 and the modifying influence this would have on the effects of turbines on the distant hills.

Image 6.19: Enlarged View from Viewpoint 4 Illustrating Tree Cover (Copyright 2020 Google Earth Imagery)

6.22.80 From turning onto the A470 (just west of Viewpoint 4) towards Caersws no clear views of the hill side, on which the turbines would be located, occur until exiting the western side of Caersws on the B4569, as illustrated in Image 6.20. A combination of vegetation and built structures combine to screen all views from the A470 and B4569. In addition, riparian vegetation along the River Carno screens properties on the western edge of Caersws.

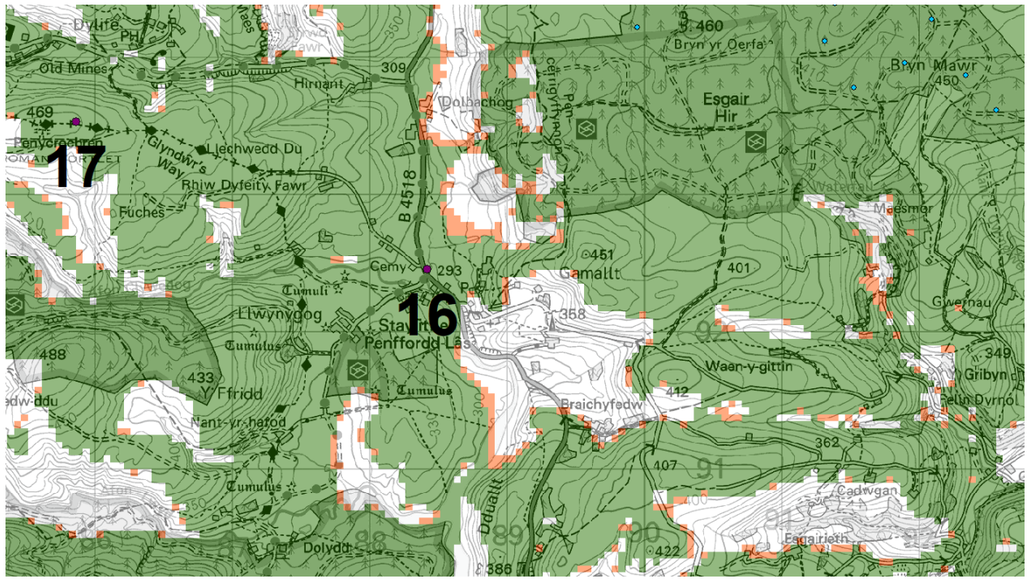
Image 6.20: View from River Carno Bridge (B4569) to West of Caersws (Copyright 2020 Google Earth Imagery)

6.22.81 Thus, despite the theoretical hub visibility indicated on Image 6.7 (see section on Caersws Basin, Landscape of Special Historic Interest), in reality it is considered additional views of the proposed development would be unlikely from the settlement of Caersws. A Moderate and not significant visual effect was identified in the ES for Caersws and changes from the proposed THE turbines would not increase that level of effect.

Staylittle

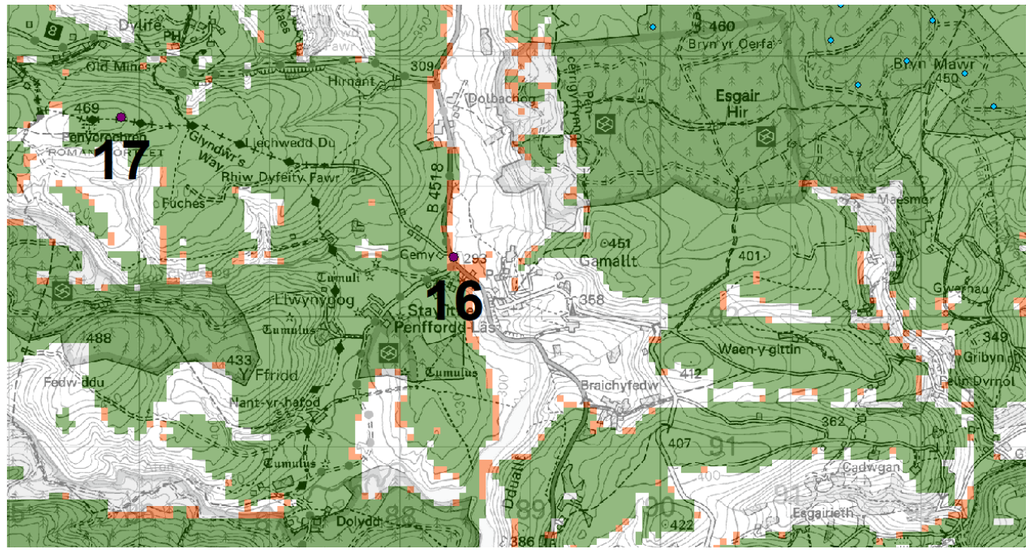
6.22.82 Effects at Viewpoint 16 were assessed in the ES but not directly in the SEI, which looked at the effects in the area between Pennant and Llawr-y-glyn. Additional theoretical visibility from the proposed development in Staylittle is minimal, although marginally greater to the north and south of the settlement as shown in Image 6.21. The ES assessed effects on the settlement with intervening forestry providing some screening and the potential effects of felling were examined in the ES in the visualisations for Viewpoint 16. A Negligible additional magnitude of change is anticipated with the proposed turbines appearing taller due to proximity but there would be no change to the level of effect assessed in the ES.

Image 6.21: Staylittle Blade Tip Comparative ZTV Detail (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)



6.22.83 A similar Negligible additional magnitude of change would occur in terms of additional hub visibility (Image 6.22) with the theoretical change only affecting a small number of properties, and the ES effect levels would not be altered.

Image 6.22: Staylittle Hub Comparative ZTV Detail (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)



6.22.84 The level of visual effect identified in Staylittle was Major in the ES for properties with views towards the wind farm. Intervening vegetation and orientation of properties provides a degree of screening.

6.22.85 The visualisation for Viewpoint 16 (Volume 3 of ES) indicated 4 blade tips and 2 hubs would be visible to generate a Major visual effect considered significant. The SEI scheme removed the two turbines whose hubs were visible from the view and although this change was not assessed in the SEI it is considered that this would reduce the magnitude of change from substantial (4 blade tips and 2 hubs in the ES) to medium for the consented layout (2 blade tips) resulting in a Major/moderate and significant visual effect. The proposed THE turbines would have 3 blade tips visible from Viewpoint 16 and the additional magnitude of change would be Slight resulting in a Moderate additional effect for residents from the additional change. It is considered that the Major/moderate and significant visual effect for the consented turbines would not be increased by the THE turbines.

Trefeglwys

6.22.86 Trefeglwys is a small settlement in the Trannon Valley and was not directly assessed in the ES or SEI due to the lack of theoretical blade tip or hub visibility for the original 18 turbine proposal or 13 turbine consented layout. Image 6.23 illustrates the additional blade tip visibility directly south-east of the settlement and across the far eastern edge of the settlement. Additional blade tip visibility is also shown to the north-west of the settlement.

6.22.87 Additional hub visibility is much further away from the settlement (as shown in Figure 6.29 b) and matches the hub visibility pattern of the consented scheme.

6.22.88 On investigation the additional tip visibility is caused by only one turbine (T15) in the THE proposal. Only the tip of that turbine would be visible and gradually becoming screened by the landform, as Trefeglwys is approached. Thus, by the time the centre of the settlement is reached the turbine would be screened.

Image 6.23: Trefeglwys Blade Tip Comparative ZTV Detail (© Crown Copyright 2020. All rights reserved. Ordnance Survey Licence 0100031673)

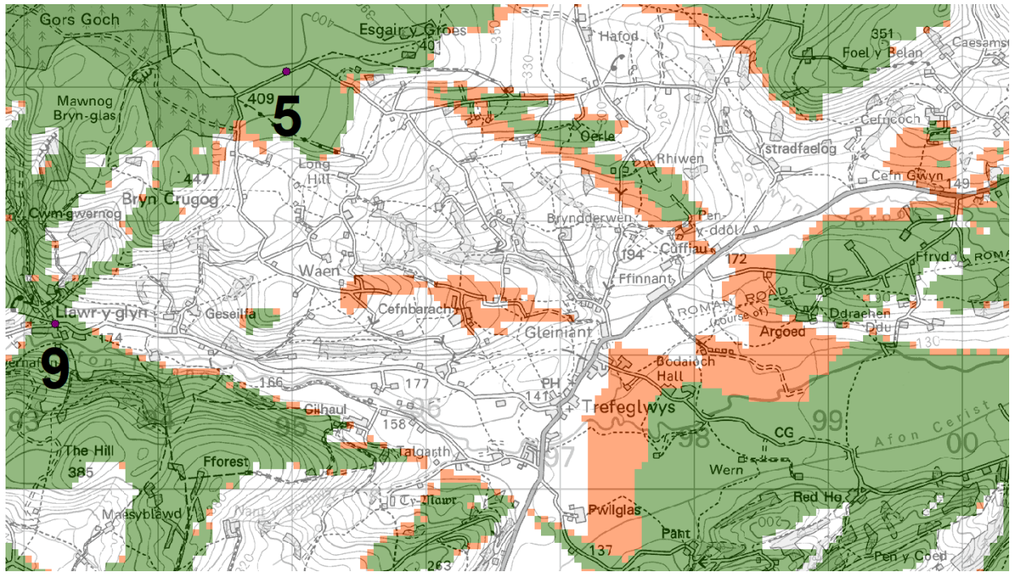
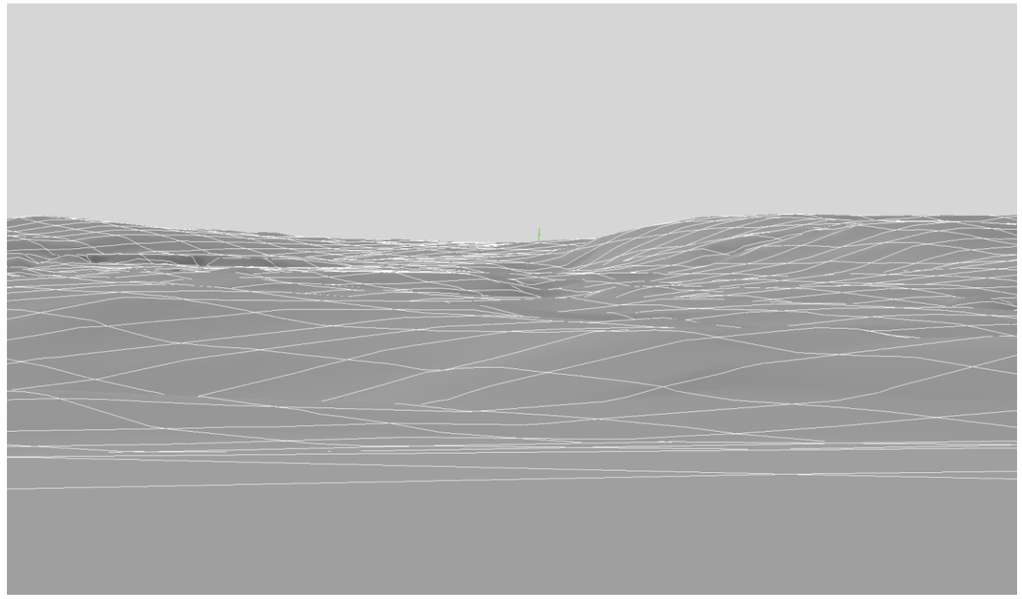


Image 6.24: View from Bodaioch Hall SE of Trefeglwys of THE Turbines (13.5 degree width of view)



6.22.89 Image 6.24 Illustrates the DTM Model view at Bodaioch Hall (E297769, N290750) where the single blade tip is most prominent above the skyline while still within the orange additional area of visibility shown on the comparative ZTV.

6.22.90 The area of hill side with additional visibility to the north-west of Trefeglwys is caused by the very tip of the same THE turbine (T15). The landscape within this area includes improved grazing land with hedgerows and trees as in Image 6.25, which illustrates the view from a public road just north of Cefnbarach (E296249, N291394). The degree of visibility of this single turbine would be marginal and is predicted to be screened by tree cover within the area at the centre of the additional area of visibility.

Image 6.25: View from near Cefnbarach North West of Trefeglwys (Copyright 2020 Google Earth Imagery)

6.22.91 The magnitude of change caused by the THE turbines within the Trefeglwys area is therefore considered to be Negligible for the area to the north-west, and Slight/negligible for the area to the south-east. High sensitivity receptors would include residents and walkers resulting in a Moderate and not significant effect, caused by the proposed development.

Transportation Routes

A470 Llanbrynmair to Llangurig

6.22.92 The overall magnitude of change for the A470 as a whole was identified in the ES as Moderate resulting in a Moderate and not significant sequential effect.

6.22.93 The additional visibility along this route includes sections of the road at Carno and Caersws, both of which have been reviewed in the section on settlements (Paragraph 6.22.55 onwards). The overall level of additional effect would be Negligible at most and not sufficient to increase the Moderate effect for users of the A470 identified in the ES.

A489 Caersws to Newtown

6.22.94 The identified additional hub visibility on the A489 would be visible at a distance of approximately 12 km, close to where the road bends to the south-east. Some screening is possible due to mature tree cover, but in general the landscape is open and views to the proposed THE turbines would be possible. However as indicated by the reviews of Viewpoints 2 and 12 at a distance of 10 km and over, the difference between the consented and proposed turbines would be difficult to perceive. Perception is likely to be limited to a sense of a group of structures present with related blade movement, but less likely to perceive an increased number of hubs appearing over the skyline.

6.22.95 It is therefore concluded that the proposed development would have a Negligible magnitude of change on views from this road. The ES identified a Moderate magnitude of change and Moderate and not significant visual effect from the overall route of the road. The limited additional hub visibility would extend the length of the route with theoretical visibility, but it is not considered this would be sufficient to increase the level of effect previously assessed and would remain not significant.

B4518 Llanbrynmair to Llanidloes

6.22.96 This route was assessed as undergoing a Substantial magnitude of change resulting in a Major/moderate and significant effect due to the fact that Carno III would occur between other visible wind farms along the route.

6.22.97 A Negligible magnitude of change is illustrated on the comparative ZTVs for this route as assessed for the settlement of Staylittle and additional visibility would be minimal. The overall Major/moderate and significant effect identified in the ES would therefore remain valid.

Unclassified road from the B4518 to Staylittle

6.22.98 A Major/moderate and significant effect was assessed in the ES for this route. A Negligible magnitude of change is illustrated on the comparative ZTVs for this route as assessed for the settlement of Staylittle and Llyn Clywedog LSHI and additional visibility would be minimal. The overall Major/moderate and significant effect identified in the ES would therefore remain valid.

Newtown to Machynlleth Railway Line

6.22.99 A Negligible magnitude of change would occur for users of the railway as illustrated by the comparative ZTVs for the route of the railway. Therefore, the Moderate magnitude of change and Moderate and not significant visual effect recorded in the ES is still considered valid for the proposed development.

National Trails/Long Distance Paths

Glyndwr's Way

6.22.100 Following the line of Glyndwr's Way on the comparative ZTVs maps indicates almost no change from the extent of visibility and therefore length of route likely to be affected for the consented development for either blade tips or hubs. The closest clear view is represented by Viewpoint 17 – Penycrocbren and the assessment of this viewpoint in the SEI for the consented development is Major and significant for walkers

and would not change as a result of the THE proposals. Appendix 6A.22 examines the effects at Viewpoint 17 in more detail.

6.22.101 As identified by the review of Viewpoint 17, no change is predicted to the assessed level of Glyndwr's Way in the ES (Major and significant).

Severn Way

6.22.102 After entering the 15 km study area from the west near Newtown, the Severn Way passes close to areas of additional visibility identified and discussed as part of the Caersws Basin LSHI near to Llwyn-y-gog and Rhydlydan. A small section of additional visibility of blade tips may be apparent as Caersws is approached at a distance of approximately 11 km, but the proposed development would be seen looking across the built structures of Caersws. The only other change of note on the comparative ZTVs is a small area of additional hub visibility to the north of Llanidloes. This occurs just north of the meeting of the Severn Way and Glyndwr's Way, and indicates a short section of additional hub visibility on a hilltop west of the B4569. This relates to a minimal appearance of one hub, level on the skyline, at a distance of approximately 8 km.

6.22.103 Overall the increase in visibility as a result of the proposed development is considered a Negligible magnitude of change within the context of the overall route within the study area. The level of visual effect identified in the ES was Moderate/minor and not significant and this would remain the same for the proposed development.

Wye Valley Walk

6.22.104 These routes are largely outside the 15 km study area. The few sections of the Wye Valley Walk within 15 km are almost entirely screened from the consented or proposed turbines. The comparative ZTVs indicate no additional visibility for tips or hubs. The visual effect on users of this route was recorded as Negligible and not significant in the ES and would remain the same for the proposed development.

Cycle Routes

National Cycle Route 8

6.22.105 The identified effects on NCR8 are described from Paragraph 6.5.156 of the ES onwards. The only area of visibility for the consented development is in the area of the Hafren Forest and Staylittle. Only minimal changes to theoretical visibility would occur due to the proposed turbine height increase, occurring within an area of extensive woodland and forest. It is predicted that no perceivable change would occur for either blade tips or hubs between the consented and proposed development.

6.22.106 The section on settlements examines the potential minimal changes at Staylittle and provides additional description of related effects.

6.22.107 The overall level of additional magnitude of change for the proposed development on users of NCR 8 is considered to be Negligible. A Moderate/minor and not significant effect on the route as a whole is identified in the ES and this would remain for the proposed development.

National Cycle Route 81

6.22.108 The identified effects on NCR81 are described starting from Paragraph 6.5.157 of the ES onwards. There would be no change to the areas where blade tips would be visible along the route, and no additional areas of visibility due to the proposed height increase in blade tips.

6.22.109 The one area of change would be where NCR81 passes through the settlement of Caersws, from just south of the bridge over the River Severn to near the confluence of the River Severn and River Trannon, to the west of Caersws. In this section additional hubs would be theoretically visible. However, views from the A470/A489 junction (for both consented and proposed hubs and blade tips) would be screened by trees and buildings all the way through Caersws until the end of the area of additional visibility is reached at the bridge over the River Carno, west of the settlement, where NCR81 turns south off the B4569 to follow an unclassified road.

6.22.110 The conclusion is that a Negligible additional magnitude of change would occur from the additional visibility along the route for the proposed development. A Moderate/minor and not significant visual effect to the route as a whole is identified in the ES and this would be the same for the proposed development.

General Public Rights of Way and Open Access Land

6.22.111 The main area of additional visibility identified by the comparison ZTVs is examined in the text for the settlement of Trefeglwys. Other areas have also been examined in the assessment of effects on the Caersws Basin and settlement of Caersws.

6.22.112 It is considered that any additional visibility arising from the proposed development would create no more than a Negligible additional magnitude of change to that created by the consented turbines and accordingly the level of effect on General Public Rights of Way and Open Access Land would remain the same as the consented development. Paragraphs 6.5.158 to 6.5.160 in the ES consider the levels of visual effects present which vary from Major/moderate and significant visual impacts as identified by Viewpoint 17 and Viewpoint 19 to lower levels of effect such as where the landform and or distance limits the magnitude of change predicted. No changes to the levels of visual effect, due to the proposed development, are predicted for Viewpoints 17 and 19 and it is therefore considered that no changes in effect levels would likely occur at greater distance or where more limited views occur.

6.23 SUMMARY AND CONCLUSIONS

6.23.1 The assessment has concentrated on identifying the additional magnitude of change and related additional effects caused by the proposed THE turbines, compared to the baseline of the consented development as assessed in the SEI. Where it is identified that the additional magnitude of change would be no greater than Slight, even for a high sensitivity receptors, such as residents, Major or Major/moderate and significant effects would not occur (a slight magnitude of change and high sensitivity resulting in a moderate and not significant effect, as per the methodology used: SEI Appendices 6A.3 to 6A.5).

6.23.2 In addition, the assessment has considered the magnitudes of change and overall effects for the proposed development and identified whether these have resulted in a change in assessment level compared to the consented development. It is concluded as set out below that the proposed development would not lead to additional significant effects above those already identified in the ES/SEI. The only exception would be the short term significant visual effects on residents caused by the access track proposals during the construction period.

6.23.3 A summary of each subject area of the assessment is included below.

Assessment of Effects on Landscape Fabric

6.23.4 There would be a minimal additional effect on landscape fabric due to the proposed development, comprising the additional area of disturbance for the larger foundations rand crane standings required for the taller turbines. Although there would be a quantifiable change in the disturbed area, it is considered that this would result in a minimal change to the overall effect on landscape fabric and not alter the level of landscape effect recorded in the ES/SEI.

Assessment of Effects on Landscape Character

6.23.5 Appendix 6A.22 sets out the assessment of the magnitudes of change on Landscape Character Areas based on LANDMAP Visual and Sensory Aspect Areas.

6.23.6 As summarised in Subsection 6.22 the additional effects of the proposed THE turbines would result in negligible and slight magnitudes of change. These levels of change would not be sufficient to increase the magnitudes of change and effects identified for the consented development, and therefore the effects on landscape character would remain as recorded for the consented development set out in Table 6.35.

6.23.7 These findings reflect the effect of the baseline which includes 126.5 m tall turbines to the landscape of the study area. The proposed THE turbines would not be adding anything new to the landscape in this general context. A number of limited areas of additional visibility would occur where the consented turbines would not be visible but the proposed THE turbines would as illustrated on the comparative ZTVs (Figures 6.29 b and 6.30 b) which have been reviewed as part of the FEI.

Landscape Effects on Landscape Related Designations

Caersws Basin, Landscape of Special Historic Interest (LSHI)

6.23.8 The conclusion is that the proposed THE turbines would result in an additional negligible magnitude of change on the Caersws Basin LSHI against the baseline of the consented Development. Viewpoints within the LSHI include Viewpoints 4 and 7 identify Negligible to Slight magnitudes of change respectively.

6.23.9 The overall level of visual effect for the proposed development is identified as Moderate. This would be the same level of visual effect as the Moderate magnitude assessed in the SEI for the consented development and therefore would remain valid for the proposed THE turbines.

Clywedog Valley, Landscape of Special Historic Interest (LSHI)

6.23.10 The effects are predicted to be minimal in terms of the geographical extent of the predicted change. Viewpoints within the LSHI include Viewpoints 10, 14, and 17 which illustrate the additional magnitude of change as being Negligible.

6.23.11 The overall magnitude of change for the proposed development is identified as Moderate which was also the conclusion for the consented turbines. The additional magnitude of change from the proposed development would not be sufficient to increase the assessment level of the consented effects (Major and Major/moderate and significant).

Gregynog, Historic Park and Garden

6.23.12 The additional magnitude of change is noted as Negligible for the proposed turbines and would not alter the Moderate/minor and not significant level of visual effect recorded for the consented development.

Plas Dinam, Historic Park and Garden

6.23.13 Existing woodland screens views from this location towards the THE turbines and no visual effects occur, and therefore no significant visual effects would occur.

Effects on Visual Receptors

Settlements

6.23.14 An additional extent of visibility has been identified at Carno and assessment of the additional magnitude of change predicted as Negligible and not sufficient to increase the level of effects identified for the consented development being, Major/Moderate and significant.

6.23.15 Larger additional areas of theoretical visibility were identified at Caersws but were found to be heavily modified by existing vegetation and screening. The Moderate and not significant visual effects identified for residents in the consented scheme would not be increased by the proposed development.

6.23.16 A Negligible additional magnitude of change has been assessed for Staylittle which would not be sufficient to increase the Major and significant level of effect identified for the consented development.

6.23.17 In the area of Trefeglwys some additional blade tip visibility would theoretically occur on the edge of the settlement and adjacent area but on examination this was found to be Negligible in terms of the magnitude of change and would therefore not result in a significant effect even for a high sensitivity residential receptor.

Transportation Routes

6.23.18 No significant effects or increases in level of effects predicted for the consented development would occur for any of the roads/railways considered in the FEI.

National Trails/Long Distance Paths

6.23.19 No significant effects or increases in level of effects predicted for the consented development would occur for any of the National Trails/Long Distance Paths considered in the FEI.

Assessment of Effects at Viewpoints

6.23.20 Table 6.36 summarises the additional magnitude of change from the proposed development in the context of the baseline formed by the consented turbines This table also identifies the overall magnitude of change for the proposed THE turbines and compares that with the consented magnitude of change. No changes in magnitude of change exist between the consented development and overall magnitude of change, and therefore no changes would occur to the various visual receptors e.g. road users, walkers or residents identified for the consented development.

6.23.21 Out of a total of the 13-viewpoint considered in this FEI (as identified in Table 6.36), 11 significant visual effects SEI were identified in the SEI for the consented development (including different receptors at the same viewpoint). These viewpoints would have significant effects for same receptor groups, with 11 significant visual effects identified. There is no change to the total level of visual effects that would occur as a result of the proposed development.

Landscape and Visual Effects of the Proposed Access Track

6.23.22 The high-level assessment of effects on the proposed access track is recorded in Appendix 6A.23.

6.23.23 Although the new access track (with the exception of the temporary loop) would be long-term, the period of disturbance and most effects would be limited to the construction of the track (estimated to be 4-6 weeks) and the delivery of turbines with traffic utilising the access track (estimated to be 3 months). In terms of landscape effects, it is anticipated that a worst case Moderate and not significant magnitude of change would occur to the local landscape. Mitigation by replanting lost vegetation and strengthening the existing field boundaries would help to reduce the impact in conjunction with natural weathering and grassland encroachment help the stone track to merge into the adjacent grassland and landscape.

6.23.24 Visual effects are generally limited due to the presence of riparian vegetation and the railway line vegetation and embankment, but some significant effects would occur during the construction period due to vehicles using the track. These would occur particularly in winter when filtered views through the riparian vegetation would occur and from the two properties with open views (Pertheiryn and Dolerw). These effects would not occur within the operational period.

Residential Visual Amenity Assessment

6.23.25 Significant effects were identified for four properties in the SEI. The RVAA concludes that although significant visual effects would still be likely to occur at these properties, close to the wind farm, the proposed development would not lead to even higher levels of effect where turbines might become overbearing in nature.

6.23.26 Utilising guidance on separation distances between wind turbines and residential properties no new significant effects are anticipated for the other residential properties examined in the SEI assessment.

Section 8

Hydrology, Geology and Hydrogeology

CONTENTS

8.14 INTRODUCTION

8.14.1 As part of the scoping exercise undertaken for the Carno III Tip Height Extension, it was agreed with consultees that the scope of this section of the Further Environmental Information (FEI) would cover the proposed access track to avoid Bontdolgoch, and also an update to the Peat Management Plan (PMP) to consider the modifications to the wind farm infrastructure. All other aspects of hydrology, geology and hydrogeology were scoped out on the basis that an increase in infrastructure dimensions would have no impact on the findings of the existing hydrological assessment, in particular all buffers have been maintained and no further mitigation to supplement those outlined in the ES will be required. For further details see Appendix 4 of this FEI which contains the scoping report and scoping opinions from consultees.

8.14.2 The proposed access track (the proposed route) has the potential to alter the local hydrological, hydrogeological and geological characteristics during the construction phase, and to a lesser extent during the operational phase. Potential negative environmental impacts may arise from exposed soils, spills of fuels and other chemicals, and alterations to existing hydrological regimes. This proposed route is assessed in this FEI as it is considered to be associated with the wind farm, however permission for this route will be sought via a separate Town and Country planning application.

8.14.3 This section outlines baseline conditions relating to hydrology, hydrogeology, geology, and soils within the area of the proposed route. Relevant receptors are identified, and the potential for significant effects due to the proposed access corridor is assessed, considering the anticipated mitigation measures.

8.14.4 The section concludes that providing risks to water resources are sufficiently considered, embedded mitigation and a site-specific Construction Environmental Management Plan will adequately mitigate against significant adverse effects upon the water environment, species, and habitats arising from the construction and operation of the proposed route.

Proposed Access Track Layout

8.14.5 Figure 13.4 shows the proposed route for the permanent track, which is approximately 1.5 km in length. The southern entry to the proposed route is accessed from Wig Lane (unclassified road). The proposed route enters private land and follows the new access track in a north to north-westerly direction, until reaching the northern entry point at an existing junction just north of the Pontdolgoch railway bridge on the A470. The route will follow an existing track for approximately 386 m which will be upgraded.

8.14.6 There is also a temporary trackway system to be placed before leaving the A470 and crossing the road to enter Wig Lan (see Figure 13.5). Given that the trackway is short and temporary and over agricultural land, this will have no impact on hydrology, geology or hydrogeology and therefore will not be considered further in this assessment and is scoped out,

8.15 RELEVANT LEGISLATION

8.15.1 This section takes into account the following legalisation

- The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017;
- Schedule 3 of the Flood and Water Management Act 2010; and
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

8.16 HYDROLOGY

Surface Water

8.16.1 The proposed route is situated within the catchment of the Afon Carno watercourse, which is part of the River Severn catchment. The main stem of the Afon Carno is immediately downgradient of the proposed access corridor. The route of the proposed access track runs follows the field boundary where possible and runs adjacent to the main stem of the Afon Carno. An appropriate buffer would be maintained to allow for mitigation to be implemented where required.

8.16.2 The proposed access track crosses two small unnamed watercourses at SO 01354 93041, and SO 01453 92667 marked as drains on 1:50,000 scale Ordnance Survey (OS) map. It is likely that flow within these watercourses will be ephemeral.

8.16.3 A number of small ponds are situated in proximity to the proposed route. A pond at SO 0115 9341 is marked on the 1:50,000 scale OS map, and it is adjacent to the proposed access track. The pond is in a naturally wet area but appears to be man-made mainly receiving run-off from fields via drainage pipes. A second pond at SO 0092 9360 is located 32 m to the west of the existing track to be upgraded.

8.16.4 The proposed access corridor lies predominantly on flat low-lying land which is likely to form the flood plain of the Afon Carno.

Flooding

8.16.5 The Natural Resources Wales long term flood risk maps[1] shows that the area of the proposed route is at a Medium to High risk of fluvial flooding (1 in 30 chance of flooding in each year[2]). The Development Advice Map shows an area of Zone B land within the proposed access corridor. Zone B land is defined as areas known to have been flooded in the past, as evidenced by sedimentary deposits[3].

Fisheries and Recreation

8.16.6 Severn River Fisheries notes that Wild Brown Trout are caught in the Afon Carno[4] in the area around Pontdolgoch, adjacent to the proposed route.

Water Quality

8.16.7 The Severn River Basin District includes waterbodies which are classified under the requirements of The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

8.16.8 The Afon Carno is part of the wider Severn River Basin District. 97% of the water bodies within the Severn District are classed as having Good Chemical Status, and 62% are classed as having Moderate Ecological Status[5].

8.17 GEOLOGY & HYDROGEOLOGY

8.17.1 The British Geological Survey online mapping service provides information on the geology[6] in the area of the proposed route. Information on aquifer classifications and groundwater vulnerability is provided by the BGS GeoIndex online mapping service[7]. This information is summarised below.

Bedrock

8.17.2 The proposed route is understood to be mostly underlain by the Caerau Mudstones Formation and the Rhayader Mudstones Formation. There is also a small area underlain by Glanyrafron Formation found in the north-west of the proposed route consisting of mudstone and sandstone.

8.17.3 The Glenyrafron Formation has a bedrock aquifer designation of Secondary A meaning it consists of permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. The Caerau and Rhayader Formation that makes up most of the site, has a designation of Secondary B meaning it predominantly consists of lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering[8].

8.17.4 According Groundwater Vulnerability Wales Map[9], the bedrock aquifers at the proposed route are considered high vulnerability. High vulnerability indicates that a bedrock formation is likely to be able to easily transmit pollution to groundwater due to an absence of low permeability superficial deposits[9]

8.17.5 Two faults which form boundaries between the Caerau, and Rhayader mudstone formations run south-west to north-east though the proposed route and across the Afon Carno River. Another fault separates these mudstone formations from the Glanyrafon mudstone and sandstone formation near the north-west end of the proposed route. Permeability can be greater along fault lines, which can act as pathways for contaminants.

Superficial

8.17.6 Quaternary sand and gravels overlay the bedrock mudstone formations discussed above. These sand and gravel deposits are likely to have a higher permeability than the underlying bedrock. The Afon Carno

[1] Natural Resources Wales, 2020, Long term flood risk maps, available at https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en (last accessed 30/01/2020)

[2] Natural Resources Wales, 2020, High risk of flooding from rivers and sea, available at https://naturalresources.wales/flooding/managing-flood-risk/flood-risk-map-guidance/High-risk-of-flooding-from-rivers-and-sea/?lang=en (last accessed 04/02/2020)

[3] Welsh Assembly Government, 2004, Technical Advice Note 15: Development and Flood Risk, available at https://gov.wales/sites/default/files/publications/2018-09/tan15-development-flood-risk.pdf (last accessed 30/01/2020)

[4] Severn River Fisheries, 2020, Afon Carno – Pont Dolgoch, available at https://www.severnfisheries.com/afon-carno-pontdolgoch/ (last accessed 31/01/2020)

[5] Environment Agency, 2016, Severn – Summary, available at https://environment.data.gov.uk/catchment-planning/RiverBasinDistrict/9/Summary (last accessed 31/01/2020)

[6] British Geological Survey, 2020, Geology of Britain Viewer, available at http://mapapps.bgs.ac.uk/geologyofbritain/home.html (last accessed 29/01/2020)

[7] British Geological Survey, 2020, GeoIndex, available at https://www.bgs.ac.uk/geoindex/ , (last accessed 29/01/2020)

[8] Environment Agency, What are the aquifer designations?, available at http://apps.environment-agency.gov.uk/wiyby/117020.aspx, (last accessed 15/04/2020)

[9] Environment Agency, New groundwater vulnerability mapping methodology in England and Wales, available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/660616/Groundwater_vulnerability_report_2017.pdf, (last accessed 15/04/2020)

floodplain immediately underlying the proposed route is understood to be composed of younger riverine deposits, and clay deposits may account for areas of lower permeabilities.

8.17.7 These superficial deposits have a designation of Secondary A meaning these deposits are permeable layers yielding limited amounts of groundwater, and are capable of supporting water supplies at a local scale[8].

8.17.8 According to the Groundwater Vulnerability Wales Map, the superficial formations are classed as a high vulnerability secondary aquifer, pollutants may be easily transmitted to groundwater within the superficial deposits due to high leaching soils[9].

Groundwater Flow Regime

8.17.9 Groundwater within the superficial deposits is likely to be the key groundwater unit underlying the proposed route. Perched water may be present within areas of Afon Carno floodplain where clay deposits may hinder vertical groundwater infiltration.

8.17.10 In absence of groundwater level information, it can be assumed the water table in the area of the proposed route lies below ground level and reflects the topography of the area. It is likely that groundwater flows downgradient towards the Afon Carno, and that groundwater within the superficial deposits is in hydraulic continuity with the Afon Carno.

Groundwater Dependant Terrestrial Ecosystems (GWDTE)

8.17.11 Aerial photographs show the land within the area of the proposed route appears to be in agricultural use (arable with a small area of pasture). Vegetation cover within the area also appears to be predominantly grass (see Section 9 for greater description on habitat found at the proposed route). This type of land use and vegetation cover is not associated with ecosystems which are strongly groundwater dependant. Therefore, impacts on GWDTE will not be considered within the scope of this section.

8.18 WATER RESOURCES

Public Water Supplies

8.18.1 Public water supply infrastructure maps were obtained from Hafren Dyfrdwy. The proposed route is likely to intersect a water main at approximately SO 00897 93737.

8.18.2 Excavation below ground level at the areas underlain by water mains will present a risk to the integrity of public water supply infrastructure. The exact layout of the water mains in these areas will be determined prior to works construction and sufficient distance maintained as required.

8.18.3 Ordnance Survey mapping does not show any drinking water supply reservoirs immediately downgradient of the proposed access track.

Private Water Supplies (PWS)

8.18.4 Powys County Council were contacted requesting information on Private Water Supplies (PWS) both within the area of the proposed route, and within a 1.5 km buffer.

8.18.5 Table 8.24 presents the list of PWS properties within the 1.5 km buffer of the proposed route which were identified by Powys County Council. Four PWS properties require further investigation prior to construction commencing, these are The Mill, Tŷ Coch B&B, Derwen, and Maesgwastad. The location of PWS sources and their associated infrastructure should be confirmed at these four properties and is further discussed in Subsection 8. 20..

Table 8.24: Private Water Supply Risk Assessment Summary

PWS Property Name	Type of Supply	Nearest Infrastructure to PWS Property (km)	Requires Further Consideration?	Additional Mitigation Recommendations
Crossgates	Borehole	1.47	No	Source is highly likely to be situated upgradient of the proposed access route corridor or separated from proposed access track by the Afon Carno and not in the same hydrogeological catchment.
Gwynfryn Isaf	Well	1.43	No	Well source is likely to be situated on the hillside upgradient of the property, and therefore upgradient of the proposed access track.
Llwydcoed	Borehole	1.06	No	Source is highly likely to be situated upgradient of the proposed access route corridor or separated from proposed access track by the Afon Carno and not in the same hydrogeological catchment.
Taeigwynion	Well	1.29	No	Well source is likely to be situated on the hillside upgradient of the property, and upgradient of the proposed access track.
Brynrhedyn	Well	0.86	No	Source is highly likely to be situated upgradient of the proposed access route corridor or separated from proposed access track by the Afon Carno and not in the same hydrogeological catchment.
Graig Farm / Badgers Holt	Spring	0.64	No	Spring source is likely to be situated on the hillside south west of the property, and upgradient of the proposed access track.
The Mill	Borehole	0.10	**Yes**	**Location of borehole source will be determined ahead of works.**
The Old Hall	Spring	0.49	No	Spring source is likely to be situated on the hillside west of the property, this is upgradient of the proposed access track.
The Rallt	Spring	0.78	No	Source is highly likely to be situated upgradient of the proposed access route corridor or separated from proposed access track by the Afon Carno and not in the same hydrogeological catchment.
Twll y Graig	Spring	0.76	No	Spring source is likely to be situated on the hillside south west of the property, and upgradient of the proposed access track.
Ty Coch B & B	Well	0.09	**Yes**	**Location of well source will be determined ahead of works. Source is likely to be on the hillside west of the property.**
Ty Marc	Well	0.94	No	Source is highly likely to be situated upgradient of the proposed access route corridor or separated from proposed access track by the Afon Carno and not in the same hydrogeological catchment.
Tyn y Wern	Spring	0.72	No	Spring source is likely to be situated on the hillside south west of the property, and upgradient of the proposed access track.
Derwen	Well	0.76	**Yes**	**Location of well source will be determined ahead of works.**
Maesgwastad	Well	0.53	**Yes**	**Location of well source will be determined ahead of works.**

8.19 SOILS AND PEAT

8.19.1 The Magic Map webservice provides information on designated sites[10]. With regards to soils and peat, there are no areas within the proposed route which are designated under statutory or non-statutory designations. There are also no areas of priority habitat which are identified in the Priority Habitat Inventory as published by Natural Resource Wales.

8.19.2 Aerial imagery and an initial walkover confirm that there is no peat within the proposed access corridor. Landcover within the proposed access corridor appears to be grassland used for crop production and grazing, this is not typically associated with wetlands and peatlands. Therefore, peat will not be considered within the current scope of this section.

8.20 MITIGATION MEASURES

8.20.1 This subsection outlines the risk of impacts on baseline conditions, taking into account pre-construction considerations and mitigation measures. Mitigation measures will include mitigation by design (embedded mitigation), and a site-specific Construction Environment Management Plan (CEMP).

Pre-Construction Considerations

8.20.2 Prior to works taking place the following will be considered to avoid negative impacts on the hydrological hydrogeological and geological environment.

Private Water Supplies – There is a possibility that the PWS sources of The Mill, Tŷ Coch B&B, Derwen, and Maesgwastad are situated in a location where they would be at risk due to construction of the proposed route. The locations of sources and infrastructure for these four PWS will be determined ahead of works. Risks posed to any PWS identified to be at risk will be addressed within the CEMP and monitoring carried out if required.

Public Water Supplies – The exact layout of the water mains in the area of the proposed access route will be determined before commencement of works through consultation with the water board and marked out on the ground if required. In addition, if necessary, the proposed route would be microsited to safeguard the water mains.

Flood Risk – The proposed route is situated on land at risk of fluvial and pluvial flooding as identified in Subsection 8.16. The proposed infrastructure and associated works may require permission from Natural Resources Wales under a Flood Risk Activity Permit[11] It is likely that further information regarding specific flood risk in the areas encompassed by the proposed access corridor and access track should be assimilated. This will ensure that the constructed track can withstand the required flood return period and associated discharge volume. It should also be ensured that the proposed access track will not increase the likelihood of flooding within the floodplain area of the proposed access corridor.

Watercourse Crossings – Paragraph 8.16.2 notes that two small watercourses of field drains are intersected by the proposed access track. Works within watercourses has the potential to alter channel morphology and generate potentially polluting and silty run-off. Details of the watercourse crossing would be included in the CEMP and agreed prior to construction, and culverting may require an impoundment licence form Natural Resources Wales[12.]

Excavations and Dewatering – Excavations below ground level present a pollution risk if groundwater is encountered. Dewatering also has the potential to alter groundwater flow conditions and generate potentially polluted silty run-off. Licensing from Natural Resources Wales may be required for dewatering requiring greater than 20 m^3 per day[12].

Monitoring - Further information should be collected to determine baseline water quality within the catchment. This can then be used as a comparison during any subsequent water quality monitoring regime which may be undertaken during the construction phase of the proposed route.

Drainage Management Plan - It is likely that a site-specific Drainage Management Plan (DMP) will be required to be approved by the relevant local planning authority and Natural Resources Wales in support of an environmental license or permit relating to drainage and run-off[13].

[10] Natural England, 2020, Magic Map Application, available at https://magic.defra.gov.uk/MagicMap.aspx, accessed 30/01/2020

[11] Natural Resources Wales, 2016, Environmental Permitting Guidance: Flood Risk Activity Quick Guide, available at https://cdn.naturalresources.wales/media/687865/qg-7-flood-risk-activity-permitting.pdf?mode=pad&rnd=131916869320000000, accessed 03/02/2020

[12] Natural Resources Wales, 2020, Find out if you need a water abstraction or impoundment licence, available at https://naturalresources.wales/permits-and-permissions/water-abstraction-and-impoundment/find-out-if-you-need-a-water-abstraction-or-impoundment-licence/?lang=en, accessed 11/02/2020

[13] Welsh Government, 2018, Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems, available at https://gov.wales/sites/default/files/publications/2019-06/statutory-national-standards-for-sustainable-drainage-systems.pdf, accessed 03/02/2020

Mitigation by Design (Embedded Mitigation)

8.20.3 The layout of the proposed route is described in Section 8.14 and also further discussed in Section 13 of this FEI. Due to the nature of the environment occupied by the proposed route, it is imperative that the design and infrastructure helps maintain or even improve the local hydrology. Poor design of development infrastructure can result in significant implications to the hydrological environment with secondary effects on ecology.

8.20.4 The proposed route has been designed to mitigate potential effects on the baseline conditions outlined in subsections 8.16 to 8.19.

8.20.5 The proposed access track will join with an existing track which runs for about 386 m south from farm buildings at Dolerw/Pertheiryn. The use of this existing track infrastructure will limit unnecessary disturbance to soil and pollution risks arising from works.

8.20.6 The proposed access track is situated with sufficient distance from the Afon Carno watercourse except where crossing of the two identified minor watercourses are required. Having a buffer zone will assist in the mitigation of pollution risks arising from run-off, and the risk of flooding from the Afon Carno.

Construction Environment Management Plan

8.20.7 A site-specific CEMP will ensure best practice measures are put in place and activities carried out in such a manner as to prevent or minimise effects on the water environment. The CEMP must take into account baseline conditions discussed in subsections 8.16 to 8.19 when considering pollutant sources, pollutant receptors, pollutant pathways, and monitoring methodologies. Planning condition 39 of the existing consent requires a site-specific CEMP to be approved prior to development. It is envisaged that a similar planning condition will be in place for the proposed route which is subject to a separate planning application.

8.20.8 The CEMP will be prepared prior to commencement of construction and will include the following information which will be made site specific:

Drainage – A site specific Drainage Management Plan (DMP) is likely to be required. All runoff derived from construction activities and site infrastructure will not be allowed to directly enter the natural drainage network. All runoff will be adequately treated via a suitably designed drainage scheme with appropriate sediment and pollution management measures.

Private Water Supplies – further assessment including the location of the four identified PWS will be included. Mitigation and monitoring methods would be included as required.

Watercourse Crossings - details of the method of and construction of the crossings of the two minor watercourse crossings will be included.

Water Mains – details of any pipework will be included and mapped, measures to protect infrastructure will be included in the CEMP if required.

Storage – All soil stockpiles as well as equipment, materials and chemicals will be stored well away from any watercourses. Chemical, fuel and oil stores will be sited on impervious bases with a secured bund.

Vehicles and Refuelling – Standing machinery will have drip trays placed underneath to prevent oil and fuel leaks causing pollution.

Welfare Facilities – On-site welfare facilities will be adequately maintained to ensure all sewage is disposed of appropriately.

Monitoring Plans - All activities undertaken as part of the proposed development will be monitored throughout the construction phase. Such monitoring will be to ensure environmental compliance. Water quality monitoring of surface waters and PWS sources will occur as required throughout each phase of the proposed development. This will help to maximise the effectiveness of both embedded, and pollution prevention mitigation measures whilst monitoring effects on the hydrological environment.

Contingency Plans – Plans will ensure that emergency equipment is available on site i.e. spill kits and absorbent materials, advice on action to be taken and who should be informed in the event of a pollution incident. Contingency plans will also consider possible effects on PWS if required.

Training – All relevant staff personnel will be trained in both normal operating and emergency procedures and be made aware of highly sensitive areas on site.

8.21 WIND FARM PEAT MANAGEMENT PLAN

8.21.1 An updated Peat Management Plan[14] (PMP) has been completed to account for the increase in proposed turbine height and correspondingly an increase in turbine foundation dimension, crane pad area and track width. The updated PMP provides information and guidance on the re-use and management of excavated peat at the proposed development. Since submission of the original PMP updates include increased

[14] Natural Power (2020) Carno III Wind Farm Peat Management Plan, Document Reference: 1019237

turbine and crane hardstanding foundation size, increased track width and the removal of the peat bulking factor.

8.21.2 The PMP estimates the total volumes of excavated peat likely to be produced by the proposed development and outlines suitable reuse methods in line with regulatory requirements and good practice methods. This strategy can be adopted to manage peat in a sustainable manner, minimising excavation via the adoption of appropriate construction methods. Targeted re-use of peat as part of the reinstatement works is also be a primary consideration. Excess peat can also be used on-site for ditch blocking within the Habitat Management Area identified in the Draft Habitat Management Plan[15]

Summary of Peat Balance

8.21.3 Table 8.25 presents a summary of the peat extraction and reinstatement values that have been estimated in the Carno II PMP.

Table 8.25: Peat balance for Carno III Wind Farm

Construction Element	Peat Extraction Volume (m^3)	Peat Reinstatement Volume (m^3)	Peat Surplus (+) or Deficit (-) (m^3)
Wind Turbine Foundations	7,323	5,069	2,254
Wind Turbine Crane Hardstandings	2,864	762	2,102
Access Tracks	10,895	12,022	-1,127
Construction Compounds	1,000	1,250	-250
Ancillary Infrastructure	0	0	0
Borrow Pits	3,075	5,000	-1,925
TOTAL	**25,157**	**24,103**	**1,054**

8.21.4 A peat extraction volume of 25,157m^3 has been estimated for Carno III Wind Farm. There is significant availability of space for this extracted peat to be re-used as part of the reinstatement of site infrastructure (available space: 24,103 m^3) or it could also be used for restoration works in the peat habitat management area (available space: 203m^3 - 4,053 m^3).

8.21.5 These volumes are indicative only at this stage. It would be expected that the magnitude of excavated and reuse volumes may change as a result of detailed site investigations that would be carried out prior to construction. Such investigations would help refine the layout within any micrositing tolerances, as well as update the detailed design of the infrastructure elements.

8.22 SUMMARY & RECOMMENDATIONS

8.22.1 Providing risks to water resources are sufficiently considered, embedded mitigation and a site-specific CEMP will adequately mitigate against significant adverse effects upon the water environment, species, and habitats arising from the construction and operation of the proposed route. Appropriate monitoring, and acquisition of permits relating to drainage and flooding will also form part of the mitigation measures.

8.22.2 The PMP has been updated to incorporate the increased foundation and track sizes associated with the increase in proposed turbine heights. Based on the peat balance calculations there is sufficient space for extracted peat as part of infrastructure reinstatement or peatland restoration. Whether the peat is used for restoration or reinstatement it will be stored and handled following the guidance outlined in the PMP.

[15] Natural Power (2015), Carno III Wind Farm Appendix 8A.5 DRAFT Habitat Management Plan. Document Reference: 1023248

Section 9

Ecology Assessment

CONTENTS

GLOSSARY

Term	Definition
Baseline	The existing conditions that prevail against which the effects of the proposed wind farm development are compared.
Environmental Impact Assessment	Environmental Impact Assessment (EIA) is a means of drawing together, in a systematic way, an assessment of the likely significant environmental effects arising from a proposed development.
Environmental Statement	A document reporting the findings of the EIA and produced in accordance with the EIA Regulations.
Habitats	The area or environment where a plant or species naturally occurs.
Important Ecological Feature	Species identified as being of importance in the context of the proposed development, assigned a geographical value level in accordance with CIEEM Guidelines and professional judgement.
Mitigation	Measures, including any process, activity or design to avoid, reduce, remedy or compensate for adverse effects of a development.
Protected Species	Animals or plants protected by European legislation – The Conservation of Habitats and Species (Amendment) Regulations 2012 – and/or national legislation – The Wildlife and Countryside Act 1981 (as amended).

LIST OF ABBREVIATIONS

Abbreviation	Description
BCT	Bat Conservation Trust
CCS	Current Conservation Status
CIEEM	Chartered Institute of Ecology and Environmental Management
EcIA	Ecological Impact Assessment
ES	Environmental Statement
ECoW	Ecological Clerk of Works
EPS	European Protected Species
FCS	Favourable Conservation Status
FEI	Further Environmental Information
GWDTE	Groundwater Dependent Terrestrial Ecosystem
HSI	Habitat Suitability Index
LPA	Local Planning Authority
NRW	Natural Resources Wales
NVC	National Vegetation Classification
SEI	Supplementary Environmental Information
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
SWDTE	Surface Water Dependant Terrestrial Ecosystem
TIN	Technical Information Note
VER	Valued Ecological Receptor

9.26 INTRODUCTION

9.26.1 This section provides an updated assessment of potential impacts on ecological receptors relevant to the proposed tip height extension for Carno III Wind Farm (known as proposed development). The Carno III Environmental Statement (ES) was submitted to the Local Planning Authority (LPA) in July 2010. A Supplementary Environmental Information (SEI), which included information in relation to ecology and ornithology, was submitted in July 2015 prior to the granting of planning permission by Powys County Council in 2017. This Further Environmental Information report (FEI) provides updated assessments for ecology based on the changes to the proposal and as identified following scoping responses from relevant consultees.

9.26.2 Other sections within the FEI of relevance to this Ecological Assessment are:

- Section 1: Introduction;
- Section 4: Project Description; and
- Section 11: Forestry.

9.26.3 Where required to inform or provide context to this ecological assessment, information from these sections is summarised. Otherwise, in order to avoid repetition, a reference to the relevant section and/or sub-section location is provided. Methods, results and assumptions provided in the ES and SEI are not repeated here, and only changes to the previously reported results arising from the new proposal are presented, along with updated impact assessment based on these results where relevant. For all other information refer to Section 9 of the Carno III ES.

9.26.4 As discussed later in this section, the updated assessment concludes that no significant effects have been identified as a result of the proposed tip height extension.

9.27 UPDATES TO LEGISLATION AND GUIDANCE

9.27.1 The ES was submitted in 2010, and the SEI in 2015, and there have been updates and new guidance relating to ecology and ornithology published in the interim time.

9.27.2 CIEEM provided an update to the Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal in September 2018 (Version 1.1 updated September 2019). Following review of the updates, there are not considered to be any changes within this updated guidance that alter the relevant assessment methodologies used in relation to the impact assessment conducted within the ES and SEI.

9.27.3 New guidance in relation to bats and onshore wind turbines was published by SNH in January 2019. This guidance does provide minor changes to the assessment of bat species, and this is discussed further within the relevant section of this FEI.

9.28 CONSULTATION

9.28.1 A scoping report was submitted to Natural Resources Wales (NRW) and the LPA in September 2019 (see Appendix 4 of this FEI). Details of the feedback from consultees to this report and Natural Power responses are provided in Table 9.28 and included in full in Appendix 4.

9.28.2 Only aspects of the application responses with relevance to ecology and ornithology are included below; other aspects will be addressed in the relevant sections. The questions listed in Table 9.28 are the questions raised by Natural Power in the scoping report.

9.28.3 No response has been received to date from the LPA ecologist.

Table 9.28: Summary of Responses to Scoping Request (2019)

Comments raised and recommendations	Relevant section/comments
Question 8: Do you agree that, following the completion of the updated Phase One habitat survey in 2019, no further habitat (vegetation) surveys are necessary?	
(NRW response) Yes, provided the description of the habitats is accurate.	Results of updated habitat survey provided in Section 9.31
Question 9: Do you agree that the scope of the assessment is confined to recalculating the habitat loss figures?	
(NRW response) Yes, provided the description of the habitats is accurate.	Habitat loss calculations provided in Section 9.33
Question 10: Do you agree that, following current guidance and the completion of a full year of surveys in 2019, that there is no requirement for further bat surveys in 2020	
(NRW response)	CCS and FCS provided in Paragraph 9.32.40 onwards. Amendments to mitigation provided in Sub-section 9.34

Comments raised and recommendations	Relevant section/comments
Yes, provided the statements justifying the approach are accurate and that subsequent Environmental Assessment reports consider: a. Current conservation status (CCS) and favourable conservation status (FCS) of each local population of bats. b. Consideration of incidental injury/killing during the operational phase of the scheme c. The ongoing bat survey work considers the increase in size of the turbines	
Question 11: Do you agree that further surveys (aside from pre-construction requirements) for protected species (excluding bats) are not required, and these species can be scoped out of further assessment based the reasons provided above?	
(NRW response) No, considering the age of the data. The data will need to be current at the time of its assessment and be based on current best practice guidance. The survey work will need to consider the increase in size of the wind turbines.	Following an updated walkover survey conducted in May 2019 (details in Table 9.43), no additional signs of protected species were identified that merited a full suite of updated surveys to be conducted. The ES stated that there is the potential for badger, water vole and otter to be present, and that pre-felling and construction checks should be carried out. No further assessment for protected species (aside from bats) was provided within the SEI. Planning condition 39 of the existing consent requires approval of a construction environment management plan to be agreed prior to commencement of construction. Planning condition 44 requires an Ecological Clerk of Wales to be employed prior to commencement of construction. Both these conditions

Comments raised and recommendations	Relevant section/comments
	provide commitment for the protection of protected species.
Question 12: Do you agree that should extended phase 1 find limited evidence of protected species presence on the proposed new access route, further surveys will be limited to pre-construction requirements and species can be scoped out of further assessment based the reasons provided above?	
(NRW response) Any requirement for additional survey work will be based on best practice guidance and current policy.	See above response to question 11.
Question 13: Do you agree that, following completion of the 2019 vantage point and nightjar surveys the need for further bird surveys can be scoped out, and that an assessment can be based on this data alongside the ES/SEI data and updated desk study data?	
(NRW response) Vantage Point Surveys: we require the data from the previous and 2019 vantage point surveys in tabular format as evidence to support the statement in Table 4.6 that '*it is likely that flight activity of target species would continue to be at low levels over the site* '. The format for this flight data will be date; species; no. of flights recorded; no. of flights recorded at Collision Risk Height for the revised turbine height. The flight information is also required to be displayed in map format, with the flight routes and direction clearly presented. GIS layers (shapefiles) of the flight data can be submitted to assist in facilitating review of the flight information. A copy of the survey schedule including weather conditions, personnel, dates and times of survey are also required. Wading Bird Surveys: We understand that wading bird surveys, including curlew and snipe, were completed between 2011 and 2014. It is quite	A summary of survey effort for VP surveys undertaken in 2019/20 is provided in Tables 9.30 and 9.31. Information on times, conditions and personnel for each survey is provided in Appendix 9A.30. Data summarising 2019/20 VP survey results is provided as requested in Tables 9.35 and 9.36. Flight activity recorded during 2019/20 VP surveys is provided in Figures 9.42 and 9.43. Collision risk modelling inputs and outputs for 2019/20 VP survey datasets are provided in Tables 9.37-9.39. GIS files of target species flight activity recorded during 2019/20 VP surveys will be provided to NRW and will be made available to other consultees upon request.

Comments raised and recommendations	Relevant section/comments
possible that the use of the site by breeding waders has changed in the previous five years; and although vantage point surveys can augment targeted wader survey, they can only indicate flights and do not provide a replacement for identifying active territory, that could be disturbed or displaced by development. The use of the existing survey data can be used to prepare a survey approach which follows guidance set out in Section 3.7.1 of the recommended bird survey methods to inform impact assessment of onshore wind farms (SNH, 2017; Version 2). We recommend that a method statement for the surveys including maps or survey areas up to 800 m from the all aspects of development (i.e. in addition to turbines, access tracks, borrow pits, compounds etc.), is prepared and that we are re-consulted prior to the start of survey to review the proposed survey approach. Within the method statement it will be useful to provide a copy of the previous survey effort including mapped areas to assist in trend analysis for the site. This will provide a robust evidence base on which the Environmental Statement can assess potential effects on current and future baseline for species, such as curlew, which are at high risk from wind farm development. In summary, we require further information on the survey effort and results as identified before we can confirm our agreement to the query regarding vantage points; and we do not agree that based on the information provided that there is sufficient up to date survey data for assessment of potential effects on breeding wading birds (specifically curlew) at this time. We advise that all data should be current (i.e. typically 2-3 years old maximum) at the time of assessment.	Additional wading bird surveys have been undertaken in the 2020 breeding season. The approach from these surveys has been informed by existing datasets, and methodology and areas t surveyed follow standard guidance. Areas covered include all open habitats within 800 m of proposed infrastructure (Figure 9.40). The results of breeding wader surveys undertaken in 2020 is presented in this FEI, along with a summary of previous survey effort and an analysis of breeding wader population trends at the site

9.29 CHANGES TO SITE

Site Design

9.29.1 Amegni Renewables is seeking to amend the existing consent to increase the tip height for all 13 turbines from 126.5 m to tip to a maximum of 149.9 m to tip. This represents a 23.4 m or 18.5% increase in the height of the turbines but does not alter the number or location of the turbines.

9.29.2 As a result of the increase in tip height there is expected to be an increase in civil infrastructure requirements with regards to crane pad area and turbine foundation size compared to the original proposal.

9.29.3 The proposed increase in tip height has resulted in the need to bring larger components to site. Investigations on the proposed route to the wind farm site has identified pinch points for delivering the larger components and therefore some modification is required to the consented access route. Figure 13.4 shows the alternative permanent access route proposed to avoid Bontdolgoch, based on an approximate 5 m wide track, and Figure 13.5 shows the temporary trackway. See Section 4 of the FEI for further information regarding these routes. The area for the proposed new permanent track has not previously been surveyed, therefore additional surveys were undertaken on the proposed access route plus a 250 m buffer. Due to temporary nature of the trackway and habitats present (agricultural fields semi-improved grassland) this has not been assessed.

9.29.4 In addition to changes in access route described above, there have been modifications to the traffic route as a result of increase over run and over sail of larger component parts. These works will also be temporary in nature and have been described in Appendix 9A.36.

9.29.5 Updates to the site design have been made considering the accessibility of larger infrastructure and are described in full in Section 4 of this FEI report and shown on Figures 4.15 to 4.120 A summary of the changes and how they relate to ecological features is provided below.

9.29.6 The updates to the project proposal have not resulted in any gaps in coverage of surveys conducted as part of the ES/SEI in relation to ecological receptors.

Land Management

9.29.7 As the proposed development consists predominantly of managed conifer plantation there have been changes within the site boundary in the interim time as land parcels are clear felled and replanted. Within the SEI 444.5[1] ha of the 605.84 ha site boundary was recorded as coniferous plantation. As of 2020, this value has reduced to 418.7 ha with some area being retained as bare ground following felling. See Figure 11.6 of the FEI for current forestry components. Although the forestry management is outside the control of the proposed wind farm, it is likely to have implications on the distribution of some species of birds within the site boundary. An updated habitat survey has been conducted in 2019 which has identified 305.31 ha of coniferous plantation now present within the site boundary. It is noted that this is lower than that presented in Section 11: Forestry, primarily because areas identified within the forestry assessment as bare ground, restock and young crop may have been recorded as different habitats within a Phase 1 survey depending on other species present.

Information Assumptions

Collision Risk Modelling Methodology

9.29.8 Normally when using the Collision Risk Model[2] (CRM), height bands are selected such that all flights within some bands are considered to be at potential collision height (PCH), i.e. the rotor-swept height, and all flights within other bands are considered to be above or below PCH. However, for the proposed development, the proposed turbine specifications, and thus PCH, were not known at the onset of the Vantage Point VP surveys undertaken for either the ES or the SEI. Within the ES, survey methodology was based on best practice at the time[3], and the height bands used during VP surveys were classified in three height categories, low (below turbine blade and sweep height), medium (within turbine blade swept height) and high (above turbine blade swept height). This was also used within the various surveys undertaken for the SEI, but with heights classified as low being below 30 m, medium being between 30 and 126.5 m and high being above 126.5 m.

9.29.9 Collision Risk Modelling (CRM) was not undertaken in the ES but was for the SEI Following more details in relation to the likely turbine specification becoming available, the assessment for this FEI is based on turbines with a tip height of 149.9 m, a hub height of 83.9 m and rotor diameter of 132 m (blade length of 64.5 m). This is based on the largest turbine rotor currently available to fit the tip height criteria and is therefore considered the worst-case scenario based on current data. As such, for the purposes of CRM, all flights at height bands 2 and 3 (2 = 20-40 m, 3 = 40-140 m) which spent a period of time in the collision risk zone (CRZ) are assumed to be at collision risk.

9.30 CHANGES TO THE IMPACT ASSESSMENT

9.30.1 Valued Ecological Receptors (VERs) and the reasons for their selection remain as discussed in the SEI Table 9.22 following best practice and industry guidelines.

9.30.2 The amendments to the proposed development will change the likely impacts to some of the VERs assessed in the ES and SEI. The ES and SEI Sections 9 assessed the potential impacts during construction, operation and decommissioning of the proposed development on ecological receptors via:

- Habitat loss due to land-take;
- Disturbance and/or displacement; and
- Collision with turbines.

9.30.3 Given the scope of the proposed changes to the development, it is considered that potential effects that require reconsideration will be limited to impacts on habitats, birds and bats, and these are discussed in turn below for each stage of the development (construction, operation, and decommissioning) where the conclusion differs from that presented within the ES/SEI.

9.30.4 All appropriate embedded mitigation as identified within the ES/SEI will be retained.

9.30.5 In addition, the cumulative impact assessment has been refreshed to allow consideration of any additional developments proposed, consented or becoming operational since the submission of the ES/SEI.

[1] Section 11, Forestry states that in terms of forestry felling, the area of forest within the Carno III application area extends to 467.6 ha. This area is likely slightly larger than that identified in the Phase 1 habitat survey due to the edges of parcels proposed to be felled exceeding beyond the area surveyed for Phase 1.

[2] Band, W., Madders, M. & Whitfield, D.P., (2007). *Developing field and analytical methods to assess avian collision risk at wind farms*. In: de Lucas, M., Janss, G.F.E. & Ferrer, M. (Eds.) *Birds and Wind Farms: Risk Assessment and Mitigation*, pp 259-275. Quercus, Madrid

[3] Survey methods for use in assessing the impacts of onshore windfarms on bird communities. Scottish Natural Heritage (2005)

Changes to guidance

9.30.6 Since the submission of the ES/SEI, new guidance in relation to wind farms and bats has been published by SNH[4]. The guidance has been prepared jointly by Scottish Natural Heritage (SNH), Natural England (NE) and NRW with input from other key stakeholders, and as such, is considered to be relevant UK-wide. There are two updates within the guidance relevant to this FEI; a change in the required level of survey effort, and changes to the valuation of bat species.

9.30.7 In order to comply with current survey guidance, static detectors are required on site for a minimum of 10 nights per season for three seasons between April and October with one detector at each turbine (up to ten turbines) and one third thereafter. Detector placement in 2014 targeted open areas, tracks and rides and recently felled areas, meaning the areas where the highest level of bat activity would be anticipated were sampled. Five to fifteen detectors were deployed in 2014 for five nights per month between May and September resulting in a total of 275 nights of survey. Current guidance requires sampling turbine locations, which at Carno III, are mainly located in the vicinity of existing tracks and rides or in (now) clearfelled areas. The detector placement and survey effort used in 2014 therefore is still sufficient to gain a representative sample of bat activity at consented turbine location habitats. The additional data gathered in 2019 was conducted to provide an updated assessment of the site given the length of time that has passed since the original surveys.

9.30.8 Within the ES, the assessment of the results of the bat surveys and assigning a valuation to bats was based on the current guidance at that time, as set out in Natural England's TIN051[5] and Valuing Bats in Ecological Impact Assessment[6]. Following this, two species previously identified as at medium risk (common and soprano pipistrelle) have been re-assessed as at high risk of turbine impact based on the evidence from the National Bats & Wind Turbines study[7] and Eurobats data[8]. Table 9.29 shows a comparison between both sets of guidance and the changes to impact assessment.

Table 9.9.30.29: Risk of turbine impact affecting Welsh bat populations

	TIN051[5] Assessment		**SNH 2019**[Error! Bookmark not defined.] **Assessment**	
Species	**Turbine Impact**	**Sensitivity of Population**	**Turbine Impact**	**Sensitivity of Population**
Nathusius' pipistrelle	High	High	High	High
Noctule	High	High	High	High
Leisler's bat	High	High	High	High
Common pipistrelle	Medium	Low	**High**	Low
Soprano pipistrelle	Medium	Low	**High**	Low
Barbastelle	Medium	Medium	Medium	**High**
Serotine	Medium	Medium	Medium	High
Lesser Horseshoe	Low	Low	Low	Low
Long-eared bats	Low	Low	Low	Low
Myotis species	Low	Low	Low	Low

Source: Natural England/Scottish Natural Heritage

9.30.9 The assessment provided within the SEI in relation to the importance of bats in the landscape was based on an evaluation of roosts and habitats as described by Wray et al[6], further enhanced by guidelines relevant at that time as outlined by IEEM[9] which placed this within a geographical scale. A similar matrix is outlined by SNH where two matrices are provided to assist with site-based evaluation. The first stage allows an initial site risk assessment based on habitat risk and project size (small, medium or large), and following this, stage two takes the risk level obtained from stage one and combines it with a bat activity category ranging from 0 (nil) to high (5). This then allows an overall assessment of a site based on location / habitats, project size and species activity resulting

[4] SNH (2019) Bats and onshore wind turbines: Survey, Assessment and Mitigation.

[5] Natural England (March, 2014), Technical Information Note TIN051 *Bats and onshore wind turbines Interim guidance*

[6] Wray, S., Wells, D., Long, E., Mitchell-Jones, T., (2010). *Valuing Bats in Ecological Impact Assessment*. IEEM In-Practice. Number 70 (December 2010). Pp. 23-25

[7] Mathews, F., Richardson S., Lintott, P. & Hosken, D. (2016) *Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management*. Final report. University of Exeter.

[8] Rodrigues, L. Bach, M.-J. Dubourg-Savage, B. Karapandza, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harsbuch, K. Park, B. Micevski, J. Minderman (2015): *Guidelines for consideration of bats in wind farm projects* – Revision 2014. EUROBATS Publication Series No. 6 (English version) UNEP/EUROBATS Secretariat, Bonn, Germany, 133 pp.

[9] IEEM (2006) Guidelines for Ecological Impact Assessment in the UK IEEM, Winchester

in a classification of risk from low (0-4), medium (5-12) and high (15-25). This assessment method is still valid, however has been reassessed to take into account the increased impact of turbines on common and soprano pipistrelle.

Habitat loss calculations

9.30.10 The preparation and construction phase of the proposed Carno III Wind Farm would result in some habitat loss due to the construction of access tracks, turbine bases, crane hardstandings, construction compound and substations. Some construction areas would be reinstated following construction (for example the borrow pits and construction compound) and therefore only represent temporary loss and have not been included in calculations. HLC was not included in either the ES or the SEI, and in order to allow a comparison from the amount of loss anticipated based on habitat surveys in 2009, a retrospective HLC has been carried out on mapping from 2009 with the current layout to allow a comparison with the 2019 data. Habitat loss has been recalculated based on the updated layout (larger infrastructure) and results are provided for all habitats meeting the criteria for VERs and taken on for impact assessment.

9.30.11 Amendments to site layout that have implications on the habitat loss calculations are restricted to an increase in the civil infrastructure requirements with regards to crane hardstandings and turbine foundation due to the increase in tip height. In addition, there are likely to have been changes in the habitat present within the site boundary in the interim time, primarily a reduction in plantation forestry and an increase in recently felled plantation. See Section 12 for summary of changes to forestry baseline.

9.30.12 As HLC are based on habitats classified as VERs, an area of loss is not provided for all habitats present on site, as the majority of the site consists of coniferous plantation or recently felled plantation which are not considered an VER.

9.30.13 Habitat loss is based on the total area of each VER Phase 1 habitat type within the proposed Carno III proposed site boundary. For context and where appropriate, a comparison has also been made to the amount of habitat present within the wider area.

9.30.14 A separate HLC has also been conducted for the proposed access track route.

9.31 SURVEY METHODOLOGY

Desk Study

9.31.1 An updated data search was requested from Aderyn[10] in April 2019, searching for all records within 5 km of the site boundary, and on the 20th January 2020 in relation to the proposed access track route

Ornithology

Vantage Point Surveys

9.31.2 Vantage Point (VP) surveys have been conducted from March 2019 through the breeding season to the end of August, and through the winter season (September 2019 to end of February 2020) For full dates and times, see Appendix 9A.30 of the FEI. Two VPs were used: VP1 (SN 92646 94426) and VP2 (SN 90765 95057). These VP locations were the same locations used during the 2014 surveys. Each season has a minimum of 36 hours of VP survey effort per VP, and each VP visit lasted three hours with consecutive visits separated by a minimum one-hour break. Surveys were organised to capture an even spread of time across the daylight hours, including dawn and dusk.

9.31.3 The VP survey method followed standard guidance to record the flight activity of birds using the airspace over the VP survey area. The VP survey data were used to carry out CRM using the Band et al. (2007)[11] model to assess the potential impact of collision risk.

9.31.4 Birds were recorded flying in four height bands: 1 = <20 m, 2 = 20-40 m, 3 = 40-140 m and 4 = >140 m. Weather conditions were recorded. Target species recorded were birds of prey and any other large species of conservation concern, as identified in Paragraph 9.5.8 of the ES.

9.31.5 Two hierarchical methods were used to record data: focal sampling for target species, which took priority over logging an activity summary for secondary species. Focal sampling for target species involved watching the target species until it landed or was lost from view, recording the start time and flight duration to the nearest second, and drawing the bird's flight line onto a field map. The height band in which the bird was flying was estimated at 15 second intervals. The activity summary for secondary species involved dividing the VP visit into five-minute periods, at the end of which the number and activity of secondary species were recorded. If a target species was being tracked

[10] Wales' Biodiversity Information & Reporting Database: Local Environmental Records Centre

[11] Band, W., Madders, M. and Whitfield, D. P., (2007). *Developing field and analytical methods to assess avian collision risk at wind farms*. In: de Lucas, M., Janss, G. F. E. and Ferrer, M. (eds) *Birds and Wind Farms: Risk Assessment and Mitigation*, pp 259-275. Quercus, Madrid.

at the end of a five-minute period, the activity summary for that period was abandoned and a new one begun once observation of the target species had ended.

Table 9.30: Breeding season VP survey effort (March to August 2019)

Season	Month	Hours per month		Hours per season	
		VP1	VP2	VP1	VP2
Breeding	March	6:00	6:00	36	36
	April	6:00	6:00		
	May	6:00	6:00		
	June	6:00	6:00		
	July	6:00	6:00		
	August	6:00	6:00		

Table 9.31: Winter season VP survey effort

Season	Month	Hours per month		Hours per season	
		VP1	VP2	VP1	VP2
Winter	September	6:00	6:00	36	36
	October	6:00	6:00		
	November	6:00	6:00		
	December	6:00	6:00		
	January	6:00	6:00		
	March	6:00	6:00		

Source: Natural Power 2019

Collision Risk Analysis

9.31.6 CRM was carried out for vantage point data collected at Carno III between March 2019 and March 2020 inclusive from VPs 1 and 2.

9.31.7 Bird flights considered to represent a potential collision risk were those that passed within the collision risk zone (CRZ); a 266 m buffer of the proposed turbine locations representing half the rotor diameter of the turbines to be used at the site plus a 200 m precautionary buffer zone. Since the height within which the proposed turbine blades will rotate (potential collision height – PCH) falls within all height bands, flights within all height bands were considered at potential collision risk. Collision risk modelling was only run for birds for which at least 3 flights or 10 individuals were recorded within the CRZ at PCH over the whole year of surveys. At Carno III, three target species fulfilled this criterion: kestrel, red kite and goshawk.

9.31.8 Collision risk modelling was carried out according to the Band et al. (2007) Collision Risk Model recommended by SNH. Data collected during flight activity vantage point surveys were used to predict the number of individuals per species expected to collide with the turbine rotors per season.

9.31.9 All of the species eligible for collision risk modelling according to the criteria above are species expected to spend time travelling within the site ('non-directional flight') rather than passing directly through. For these species, the observed time spent flying within the collision risk zone at PCH is calculated and extrapolated up to predict the number of transits through the rotor-swept volume per season. This analysis was used to predict kestrel, red kite and goshawk collisions during the breeding season (March 2019 to August 2019 inclusive) and non-breeding season (September 2019 to February 2020 inclusive and also including 03/03/2020).

9.31.10 For each species, the risk of collision for an individual given that it passes through the rotor swept area is calculated by estimating the likelihood of collision based on the characteristics of the birds and of the turbines. Where turbine specifications were not available, representative values were used. Bird parameters and wind farm specifications used in the model are provided in Tables 9.32 and 9.33 below.

Table 9.32: Wind farm attributes used in collision risk analysis

Attribute	Value
Number of turbines	13
Number of blades	3
Maximum chord length (metres)	4.2*
Pitch (degrees)	7.5*
Rotor diameter (metres)	132
Rotation period (seconds)	5.52
*Representative values	

Source: Natural Power 2019

Table 9.33: Bird attributes used in collision risk analysis

Attribute	Kestrel	Red kite	Goshawk
Bird length (metres)	0.34	0.66	0.55
Wingspan (metres)	0.76	1.95	1.5
Bird speed (metres/second)	8.3	12	11.3
Estimated nocturnal activity (as proportion of diurnal activity)	0	0	0
Calculated individual collision risk	0.17	0.14	0.14

Source: Natural Power 2019

9.31.11 The overall collision rate is calculated as a product of the number of birds passing through the turbine rotors and their individual risk of collision described above. This is then scaled using a parameter representing avoidance behaviour likely to be displayed by birds flying towards turbine blades[12].

Nightjar

9.31.12 Nightjar survey methodology followed standard guidance and the same methodology conducted within the ES. The aim was to record the presence of nightjars in the site boundary plus a 1 km buffer. The method was based on Gilbert et al. (1998)[13] with areas of suitable nightjar habitat checked while surveyors walked at a steady pace and stopped every few minutes to listen for churring. Visits took place in wind conditions not exceeding Beaufort force 3. The survey comprised two visits carried out in June and July 2019. For full dates and times, see Appendix 9A.32.

Waders

9.31.13 Breeding wader surveys were conducted in 2020 at Carno 3. Survey methodology follows standard guidance, aiming to record the presence of breeding waders within the site boundary and including a buffer, where required, to ensure surveys conducted within 800 m of proposed turbine locations.

9.31.14 Figure 9.40 shows the amount of suitable habitat known to be present within 800 m of turbines which would support breeding waders. Monitoring was undertaken in 2019[14] as part of the third year of monitoring outlined in the Habitat Management Plan (HMP) for Carno II Wind Farm which is adjacent to Carno III. During 2019, one single curlew was recorded calling during these surveys, with the conclusion stating that it was unclear whether this bird was part of a breeding pair. The report states that curlew have been declining on site consistently each year, with a similar situation occurring throughout mid-Wales. Recent research states that curlew numbers in Wales have declined by 63% between 1995 and 2016, primarily thought to be due to farming practices[15].

Ecology

Habitats and Protected Species

9.31.15 A walkover survey was conducted within the site boundary in June 2019 in order to ground truth the site in relation to any changes in habitat as a result of felling and to record any other significant habitat changes since baseline surveys were conducted in 2009. Notes were taken of potential for changes in habitats to support protected species, or any other signs of protected species use of the site (such as badger).

9.31.16 The access route was amended late in 2019, and as such an additional extended Phase 1 habitat survey was conducted on the new access track route plus a 250 m buffer of the route in February and June 2020.

9.31.17 Otter and water vole surveys were conducted on appropriate habitats following standard guidance.

Bats

9.31.18 Additional bat surveys were undertaken in 2019 with 11 static detectors (full spectrum Wildlife Acoustic SM2 and SM4 detectors) placed on site at eleven turbine locations (see Figure 9.41). Following the methodology outlined in the new guidance, a minimum of ten nights of survey was conducted during 2019 in each of the bat active seasons (Spring, Summer, Autumn). Due to the large number of data files, analysis was undertaken to species or genus using Kaleidoscope automatic identification software. Signal parameters were 15-120 kHz, 2-500 ms, 500 ms maximum inter-syllable gap and with a minimum of 3 pulses. All data was then collated into an excel spreadsheet. Myotis sp. were not identified further than genus due to the overlap between species frequency calls.

9.31.19 Manual checks of the auto-identified results were undertaken for quality assurance (10% of calls), as well as to confirm rarer species identification or species which did not fit to species parameters within the software.

[12] Furness, R.W. 2019. Avoidance rates of herring gull, great black-backed gull and common gull for use in the assessment of terrestrial wind farms in Scotland. Scottish Natural Heritage Research Report No. 1019.

[13] Gilbert, G., Gibbons, D. W. and Evans, J., (1998). *Bird Monitoring Methods – A Manual of Techniques for Key UK Species*. RSPB, Sandy.

[14] Monitoring of the Carno II wind farm in 2019. ADAS, October 2019

[15]The state of birds in Wales 2018. The RSPB, BTO, NRW and WOS. RSPB Cymru, Cardiff

9.31.20 The bat activity index (BAI) is calculated as bat activity per hour based on the number of calls per night of a given species and on the hours between sunset and sunrise. Using the BAI allows a relative comparison of activity levels at different locations over different time periods.

9.31.21 Survey data has been inputted into Ecobat online tool[16] which allows a comparison of activity levels within the site and other sites located within a similar habitat and within a set vicinity.

9.31.22 A review of distances to bat features has also been undertaken to confirm that the increased tip height of turbines will still maintain the required set back distance in relation to the proximity of turbine blade tips to bat features such as woodland, streams, stone walls etc. based on guidance and on the turbine models proposed.

Survey Limitations

9.31.23 The extended Phase 1 habitat survey of the proposed access track route was undertaken on the 18th February 2020. It is acknowledged that this is not within the recommended survey time for conducting Phase 1 surveys (April to October), however, as the habitats present on site are predominantly farmland (grazed pasture, arable) it is not considered that this would have resulted in a loss of data.

9.32 SURVEY RESULTS

9.32.1 Any relevant results from the baseline have been retained below for comparison; for full results of all baseline surveys, please refer to the ES and SEI.

Desk Study

Site Boundary

9.32.2 An updated data search was obtained from Aderyn in April 2019. The desk study conducted as part of the ES was requested from Powys Biological Information Service and consisted of a search of all records within a 2 km central grid reference but did not stipulate what time period was used for the search. In addition, the ES does not provide the desk study raw data, instead provides a presence/absence species list in Appendix 9, which may also include records obtained as a result of the surveys carried out for the ES. No updated data search was undertaken for the SEI. The 2019 desk study presents data from a search conducted from a 5 km radius of the site centroid and splits the available data into records from 2006-2014 (the time period for the ES and SEI) and records from 2015 to date, in order to provide a comparison between the data relevant at the time and additional records from the interim period. There were no additional species identified within the updated desk study that required additional surveys to be undertaken. Full results are available on request.

Proposed Access Track

9.32.3 Data search was requested from Aderyn (Local Environmental Records Centre) on the 20th January 2020. This provided 44 records within 1 km of proposed track from the last ten years (2010-2020). Of these, 35 records are for flowering plants located more than 430 m from access track, and as such are unlikely to be impacted by proposed works.

9.32.4 The remaining records include barn owl, otter and bat species. There are records of barn own breeding in a nest box located on a tree at Wig Farm (SO0192, no specific grid reference provided) but there are trees visible on aerial photographs immediately adjacent to the proposed track. There are also two records of otter, and records of bats roosting in buildings.

9.32.5 From OS maps, there are nine ponds present within 500 m of the access track, three of which have no barriers to the proposed route. These are:

- Pond 1 located 32 m west of existing track to be upgraded at SO00929360;
- Pond 2 adjacent to the proposed track at SO01159341; and
- Pond 3 located 134 m west of the proposed track at SO01159314.

9.32.6 The remaining ponds were:

- Single pond at SO00739383 separated from track by single track road located 174 m north-east of proposed track;
- Cluster of three ponds at Wig SO01449247, separated from track by small watercourse, located 110 m south of track to be upgraded and 85 m south of new track; and
- Single pond at SO00759390 located 174 m north of the proposed track and separated by single carriageway road.

[16] Available online from: http://www.ecobat.org.uk/ (last accessed: 06/05/2020)

9.32.7 The Afon Carno is located to the east of the proposed route, and at its closest point is currently 9m from the access track, although this is subject to micrositing following ground investigation.

Ornithology

Vantage Point Survey

9.32.8 As requested by NRW in their response to the scoping report, results of VP surveys undertaken in 2019 and 2020 are show alongside survey results from previous seasons, below. Table 9.34 summarises the number of flights and individuals recorded for each species in each season, and Table 9.35 summarises which of those flights passed through the proposed revised CRZ. Figure 9.42 provides the locations of flights in the breeding season, and Figure 9.43 during the non-breeding season.

Table 9.34: Total number of target species flights and individuals recorded during VP surveys in each season

	Period									
	Apr 06 – Sep 06	Oct 06 – Mar 07	Apr 08 – Sep 08	Oct 08 – Mar 09	Jul 10 – Sep 10	Jun 11 – May 12	Apr 14 – Aug 14	Sep 14 – Feb 15	**Mar 19 – Aug 19**	**Sep 19 – Feb 20**
No of VPs used	1	2	1	1	2	2	2	2	**2**	**2**
Total hrs per period	42	30	42	28	24	156	69	72	**72**	**72**
Species	No of flights (individuals) per period									
Red kite	1 (1)		6 (6) (+ 1)	2 (2)	1 (1)	14 (16) from 2012	12 (15)	4 (5)	**23 (23)**	**29 (1)**
Hen harrier	2 (2)				1 (1) - 2010					
Goshawk									**3 (3)**	**3 (3)**
Kestrel			1 (1)	3(3)		9 (9) from 2012		1 (1)	**6 (6)**	**2 (2)**
Merlin			2 (2)	0						
Curlew	1 (2)		2 from 2008	0 (1 from 2009)			1 (1)			
Snipe		1 from 2007, 8 from 2006/ 2007	1 from 2008 and 3 from 2007/ 2008	7 from 2008-2009					**2 (3)**	
Herring gull										**1 (2)**
Lesser-black backed gull										**1 (1)**
Lapwing								1 (1)		
Golden plover				1 from 2009		11 (502) from 2012				
Red grouse			1 from 2007/ 2008			1 (5) - from 2012				
Sparrowhawk			1 from 2008							
Short-eared owl			1 from 2008							
Barn owl				1 from 2009						

Table 9.35: Total number of target species flights and individuals recorded within CRZ during VP surveys in each season

	Period									
	Apr 06 – Sep 06	Oct 06 – Mar 07	Apr 08 – Sep 08	Oct 08 – Mar 09	Jul 10 – Sep 10	Jun 11 – May 12	Apr 14 – Aug 14	Sep 14 – Feb 15	Mar 19 – Aug 19	Sep 19 – Feb 20
No of VPs used	1	2	1	1	2	2	2	2	2	2
Total hrs per period	42	30	42	28	24	156	69	72	72	72
Species	No of flights (individuals) per period									
Red kite						5 (6) from 2012	7 (8)		11 (11)	13 (14)
Hen harrier										
Goshawk									2 (2)	3 (3)
Kestrel						5 (5) from 2012			5 (5)	
Merlin										
Curlew			1 from 2008							
Snipe										
Herring gull										
Lesser-black backed gull										1 (1)
Lapwing										
Golden plover						1 (16) from 2012				

Collision Risk Analysis

9.32.9 The total number of target species flights recorded, and flights and individuals observed passing through the CRZ at PCH during the breeding season and non-breeding season are shown in Tables 9.36 and 9.37 respectively. Collision risk modelling was carried out for species for which greater than 3 risk flights and/or greater than ten risk individuals were recorded.

Table 9.36: Number of flights and individuals observed passing through the CRZ at risk height during breeding season (March – August 2019) flight activity surveys

Species	Total Flights	Risk flights	Risk individuals	CRM carried out
Goshawk	3	2	2	Yes
Kestrel	6	5	5	Yes
Red kite	23	11	11	Yes
Snipe	2	0	0	No

Table 9.37: Number of flights and individuals observed passing through the CRZ at risk height during non-breeding season (September 2019- February 2020) flight activity surveys

Species	Total Flights	Risk flights	Risk individuals	CRM carried out
Goshawk	3	3	3	Yes
Herring gull	1	0	0	No
Kestrel	2	0	0	Yes
Red kite	29	13	14	Yes
Lesser black-backed gull	1	1	1	No

9.32.10 Estimated collision mortality for each species, along with species-specific avoidance rates as advised by SNH are presented in Table 9.38. Details of the calculations used to produce these estimates are provided in Appendix 9A.31. For the surveys undertaken to inform the ES, only one species was eligible for CRM at that time, red kite (breeding season only), and the conservative value calculated is provided in Table 9.39 below for comparison.

Table 9.38: Estimated number of collisions during the breeding season (March to August) and non-breeding season (September to February) – numbers in bold represent recommended avoidance rates[12].

Species	Model type	Season	Avoidance rate	Estimated mortality (2019)	Estimated mortality (2014)
Kestrel	Random	Breeding	95%	**0.27**	
Kestrel	Random	Non-Breeding	95%	**0**	
Red kite	Random	Breeding	99%	**0.22**	**0.143***
Red kite	Random	Non-Breeding	99%	**0.34**	
Goshawk	Random	Breeding	**98%**	**0.03**	
Goshawk	Random	Non-Breeding	**98%**	**0.03**	
***Based on the conservative value. Within the SEI avoidance rate for red kite was given as 98% based on guidance at the time, which gave a conservative rate of 0.285**					

Nightjar

9.32.11 Results from the 2019 surveys are shown in Figure 9.44 (with results from 2014 also provided). To summarise, during the two survey visits in June and July 2019 at least five males were seen or heard churring and at least two females heard/seen which indicated at least two probable nests in the western section of the site boundary. Given the areas where churring was heard, this indicated five likely territories in 2019; four in the western section of the site and one in the eastern section of the site within the site boundary. The four territories in the western section of the site were located close to Turbines 4, 5, 6 and 8 (within 150 m) with a probable nest site located adjacent to Turbine 5. The one territory recorded in July 2019 in the eastern section of the site was located approximately 220 m from Turbine 10.

9.32.12 Habitats surveyed for nightjar in 2019 included recently felled forestry, recently planted forestry and young forestry up to 15 years old, as well as an area of dry modified bog with scattered trees in the western section of the site. Due to the constant management being undertaken in the woodland, the exact locations and sizes of suitable habitat has varied throughout the years. Since 2014, more areas of the forestry have been felled, potentially providing more breeding nightjar habitat within the site boundary. However, the area with the most nightjar activity in both survey years, 2014 and 2019, is in the western section of the site and within an area of young forestry that had been recently felled and replanted in 2014 (see Figures 9.2, 9.27, 9.40, 9.44). The regenerating moorland vegetation in the field layer and the young trees provide ideal breeding habitat for nightjar plus the adjacent mature forestry to the south of the site boundary protects it from any prevailing winds. This is in contrast to the more open and exposed eastern section of the site where nightjar activity was low, even though there are quite large areas of potential breeding habitat.

Waders

9.32.13 Wader surveys were conducted during 2020 within 800 m of all turbines between April and July. During the four visits, no evidence was noted of any breeding waders. Details of all surveys are provided in Appendix 9A.33.

Ecology

Habitats

Site Boundary

9.32.14 The type of habitats present within the site boundary remain broadly similar to those discussed within the ES and SEI, however due to continuous land management of plantation forestry there has been a change in the distribution of habitat types present. The majority of the habitat surveyed within the proposed Carno III site boundary consists of plantation, with potential ground water terrestrial dependant ecosystems (GWTDE) habitats consisting of a total of 56.13 ha (9.27%). An updated habitat assessment is shown on Figure 9.40.

9.32.15 Based on habitats assessed within the Phase 1 habitat surveys within3 the site boundary, in 2009 71.3% of the habitat was classed as coniferous plantation, and in 2019 this has reduced to 50.46%. Areas of recently felled plantation (felled in last 10 years) has increased from 0% in 2009 to 17.05% in 2019. Table 9.39 below shows areas of all habitats on site in both 2009 and 2019.

Table 9.39: Phase 1 habitat types recorded within the survey area for the proposed development

Phase 1 habitat type	Phase 1 code	Extent within the site boundary 2009 (ha)	Extent within the site boundary 2019 (ha)	Potential GWDTE[17]
Broadleaved woodland, semi-natural	A1.1.1	3.24	18.54	Yes
Coniferous woodland, plantation	A1.2.2	431.56	305.31	No
Mixed woodland	A.1.3.1	0.00	0.71	No
Dense scrub	A2.2	0.03	0	No
Recently felled coniferous woodland	A4.2	0.00	103.18	No
Unimproved acid grassland	B1.1	14.74	16.14	No
Unimproved acid grassland/ scattered coniferous woodland	B1.1/A3.2	2.32	0.25	No
Acid grassland/ semi-improved neutral grassland/ dry heath mosaic	B1.1/D1.1/B2.2	0.00	0.64	No
Semi-improved acid grassland	B1.2	0.42	0.21	No
Semi-improved neutral grassland	B2.2	6.28	4.01	No
Improved grassland	B4	26.85	26.23	No
Marshy grassland	B5	16.92	21.50	Yes
Marshy grassland/ scattered broadleaved woodland	B5/A3.1	0.00	0.17	Yes
Marshy grassland/ scattered coniferous woodland	B5/A3.2	0.00	0.89	Yes
Poor semi-improved grassland	B6	40.67	42.36	No
Bracken, continuous	C1.1		0.22	No
Bracken, continuous/ scattered scrub	C1.1/A2.2		1.39	No
Dry dwarf shrub heath, acid	D1.1	7.20	1.18	No
Dry dwarf shrub heath, acid/ scattered scrub/ scattered broadleaved woodland	D1.1/A2.2/A3.1		0.27	No
Dry dwarf shrub heath, acid/ scattered woodlands	D1.1/A3.1/A3.2/A3.3		7.5	No
Wet dwarf shrub heath	D2	0.12	0.12	Yes
Wet dwarf shrub heath/ scattered broadleaved woodland	D2/ A3.1		0.23	Yes
Dry heath and acid grassland mosaic	D5		0.26	No
Dry heath and acid grassland mosaic/ scattered coniferous woodland	D5/ A3.2		0.59	No
Blanket bog	E1.6.1	5.27	2.62	No
Blanket bog and wet modified bog mosaic	E1.6.1/ E1.7	1.86	1.29	
Wet modified bog	E1.7	12.61	11.11	No
Dry modified bog	E1.8		0.66	No
Dry modified bog/ scattered coniferous woodland	E1.8/A3.2	14.19	14.19	No
Flush, acid/neutral	E2.1	6.51	6.51	Yes
Flush, acid/neutral and marshy grassland mosaic	E2.1/B5	0.30	0.43	Yes
Flush, acid/neutral and wet modified bog mosaic	E2.1/E1.7	1.09	1.09	Yes
Valley mire	E3.1	8.34	5.95	Yes
Basin mire	E3.2		0.26	Yes
Swamp	F1		0.40	Yes
Standing water, oligotrophic	G1.3	0.04	0.04	Yes
Quarry	I2.1		0.92	No

[17] Scottish Environment Protection Agency (SEPA), (09/2017) Land Use Planning System Guidance Note 31: *Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems*

Phase 1 habitat type	Phase 1 code	Extent within the site boundary 2009 (ha)	Extent within the site boundary 2019 (ha)	Potential GWDTE[17]
Bare ground (existing track)	J4	1.94	9.17	No
Un-surveyed	NA	4.18	0.14	NA
Total		606.68	606.68	

Source: Natural Power 2014, 2019

Proposed Access Track

9.32.16 Extended Phase 1 habitat survey was undertaken within 200 m of the proposed route on the 18th February 2020, see Figure 9.46 which also shows the locations of target notes (full details of the target notes are found in Appendix 9A.35).

9.32.17 Habitats present within the proposed permanent access track and a 250 m buffer include;

- Semi-natural broadleaved woodland;
- Planted broadleaved woodland;
- Planted coniferous woodland;
- Dense scrub;
- Neutral grassland;
- Semi-improved neutral grassland;
- Improved grassland;
- Poor semi-improved grassland;
- Standing water;
- Running water; and
- Arable.

9.32.18 Field surveys of the ponds identified that one pond (pond 1) had standing water, while ponds 2 and 3 did not exist. There was one additional pond observed at SO 01056 93458.

9.32.19 The proposed route crosses three watercourses/ditches, one of which had potential for water vole (TN24, 9A.34). The Afon Carno runs to the east of the proposed route, and in places is approximately 9 m from the proposed track (although may be closer following ground investigation and micrositing), there were no signs of otter at the time of survey.

9.32.20 Within the site boundary, a number of trees were identified that have potential to support roosting bats (See Figure 9.46) and a barn owl nest box was noted on one tree.

Protected Species

Proposed Access Track

9.32.21 Two ponds present within 250 m of the proposed access track were subject to a Habitat Suitability Index(HSI) assessment to identify whether they had potential to support great crested newt. Both ponds were assessed as poor, primarily due to the lack of water at the time of survey (16th June 2020), additional information which contributed to the HSI is provided in Appendix 9A.34. As such, no further consideration is given to this species.

9.32.22 During the extended Phase 1 habitat surveys, the riverbanks of the Afon Carno (TN 4, 9A.34) and a single ditch (TN24, 9A.34) were identified as having potential to support water vole. A further survey was undertaken on the 23 June 2020. The riverbanks of the Afon Carno consist of suboptimal habitat for water vole being predominantly vegetated with trees and scrub with only small stretches of grassy banks. The ditches/streams observed to be full of water during the Phase 1 habitat survey undertaken in a very wet spell in February 2020 were dry during the June 2020 survey. No signs of water vole were observed at either location during the survey.

9.32.23 The Afon Carno was assessed as having potential to support otter and water vole during the extended Phase 1 habitat survey (TN 4, 9A.34, Figure 9.46). A follow up survey was undertaken on the 23rd June 2020, with one old spraint observed (TN 1, 9A.34, Figure 9.46). No signs of holts or lay ups were observed at the time of survey. One definite otter spraint was discovered on an area of shingle. It did not appear to be recent although it still retained a fishy smell and scales were observed. A second decomposed spraint was discovered 50 m downstream on a prominent rock in the river. Along the banks of the river there are potential resting places for otter with undercut banks and tree roots, including an area of woods with no stock or human disturbance.

9.32.24 As there are habitats present that could support both species, it is recommended that pre-construction checks are undertaken no more than six weeks before the start of construction.

Bats

9.32.25 In 2019, static detectors were placed at eleven turbine locations during three surveys periods (Spring, Summer and Autumn[4]) (locations provided in Figure 9.41). Detectors used were a mixture of frequency division (Anabat express) and full spectrum (SM2 and SM4). There was failure of two detectors in Spring due to issues with the detector settings and one detector in Summer which did not record due to a faulty microphone. Both of these issues were not identified until after the survey season was completed during analysis. Two detectors failed in Autumn as a result of insufficient battery, however, this was noted at the time of collection, and both were placed out again for a second Autumn deployment. A summary of the available data is shown in Table 9.40 below.

9.32.26 For both the ES and the SEI, a number of bat surveys have been undertaken on site between 2006 and 2014. The most appropriate data to use as a comparison is the static detector surveys conducted in 2014, as these used a similar suite of detectors and analysis programme, and followed a broadly comparable survey methodology.

Table 9.40: Summary of available bat data 2019 (number of recording nights per season)

Turbine	Season Dates				Total number of nights recorded			
	Spring	Summer	Autumn	Autumn*	Spring	Summer	Autumn	Autumn
1	28/05-03/06	02-18/08	23/09-07/10	NA	7	16	15	NA
3	20/05-03/06	2-4/08, 09-15/08	23 and 30/09 only	17/10-27/10*	15	10	2	10
4	20/05-03/06**	02-18/08	23/09-07/10	NA	15**	16	15	NA
6	20/05-03/06	02-18/08	23/09-07/10	NA	15	16	15	NA
8	20/05-03/06**	02-18/08	23/09-07/10	NA	15**	16	15	NA
10	20/05-03/06	Microphone failed	23/09-07/10	NA	15	0	15	NA
11	20/05-03/06	02-18/08	23-28/09 and 30/09-05/10	NA	15	16	12	NA
12	20/05-03/06	02-03/08, 09-17/08	23-28/09 and 30/09-05/10	NA	15	11	12	NA
13	20/05-03/06	02-18/08	23/09-07/10	NA	15	16	15	NA
14	20/05-03/06	02-17/08	23/09-06/10	NA	15	14	14	NA
15	20/05-03/06	02-16/08	23-24/09 and 30/09	17/10-27/10*	15	15	3	10
				Total	**127***	**146**	**133**	**20**

*Additional Autumn data recorded at T3 and T15 due to battery failure

**Detector on wrong settings, data not included in analysis as not comparable

Source: Natural Power 2019

9.32.27 As the habitats have changed in the interim time as a result of forestry management, results obtained from static detectors located in the same or similar areas in both years is not necessarily directly comparable. As a result, comparisons have been drawn in bat activity indexes (BAI) from static detectors which are located in similar habitats as close to each other as possible. Full details of the 2014 static detector locations are provided within the SEI, Appendix 9. Table 9.41 provides a summary of the locations of 2019 and the comparable 2014 static detectors.

Table 9.41: Static detector locations and references to detectors in same locations 2014

Turbine location	Grid reference	Habitat type 2019	2014 detector reference	Grid reference	Habitat type 2014
1	SN 91701 94597	Woodland edge	8	SN91436 93750	Open
3	SN 91311 94120	Open	NA		
4	SN 90575 94469	Open	3	SN90574 94486	Open
6	SN 89979 94758	Woodland edge	2	SN90070 94654	Open
8	SN 89944 94221	Open	4	SN89955 94231	Tree top
10	SN 92091 94276	Open	NA		

Turbine location	Grid reference	Habitat type 2019	2014 detector reference	Grid reference	Habitat type 2014
11	SN 91913 93922	Open	10	SN92865 93597	Forest ride
12	SN 91475 93782	Edge	9	SN 92581 93624	Edge
13	SN 92337 93870	Open	NA		
14	SN 92562 93616	Edge	11	SN92973 93705	Open
15	SN 92989 93728	Edge	13	SN92973 93705	Open

Source: Natural Power 2014, 2019

9.32.28 In 2019, a total of c. 11,775 bat passes were recorded over 426 nights, consisting of a minimum of six species / species groups (soprano pipistrelle, common pipistrelle, Nathusius' pipistrelle, Myotis sp., noctule and brown long-eared bat).

9.32.29 In 2014 up to 15 static detectors were installed each month and left for five consecutive nights at locations shown in SEI Figure 9.35. Detectors used were a mixture of frequency division (Anabat express) and full spectrum (AM2+ and Anabat SD1). Five bat species were recorded (common pipistrelle, soprano pipistrelle, Myotis sp., brown long-eared and noctule bat). The majority of bat activity was common and soprano pipistrelle, with peak activity in May and September. Low numbers of noctule bats were recorded (0.01 bat passes per hour for the five surveys). Most activity was located along forest edge habitats.

9.32.30 During the 275 nights of static detector surveys in 2014, a total of 25,938 bat passes were recorded of the same suite of species, the only exception being Nathusius' pipistrelle. This species may have been present in 2014 but has been historically under-recorded. Advances in both call identification technologies and species-specific research have been made in the interim time. Bat activity varied by species and location, but overall, higher activity was seen at edge habitats than in internal edge (forest rides) or open habitats.

9.32.31 The exact locations for highest activity differ between 2014 and 2019 due to the changes in habitat in the interim time, however detectors with the highest amounts of activity were located in both years beside edge habitats such as woodland rides/tracks or the edge of forestry blocks.

9.32.32 Activity level charts for bat species recorded during 2019 by sample locations and season are provided below in plates 9.1-9.5, with the values by species groups provided in Table 9.42.

Table 9.42: Bat activity index (average number of passes per hour) in 2019 with comparison to 2014 by site (refer to SEI Table 9.39 for comparable locations)

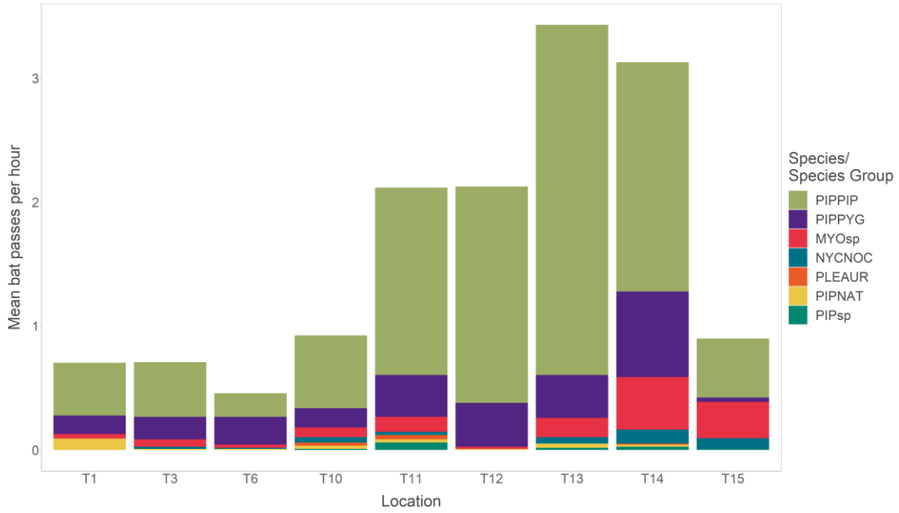
Month/ Year	Pipistrelle sp.	Common pipistrelle	Soprano pipistrelle	Nathusius pipistrelle	Myotis sp.	Noctule	BLE#
May 2014		0.33	0.01		0.01	0.00	0.00
June 2014		13.79	12.94		0.47	0.03	0.03
July 2014		15.10	24.44		0.26	0.03	0.15
August 2014		0.14	0.30		0.01	0.01	0.01
September 2014		0.61	0.59		0.09	0.00	0.08
Mean 2014		***5.81***	***7.35***		***0.16***	***0.01***	***0.05***
May-June 2019*	0.01	1.12	0.27	0.02	0.13	0.04	0.01
August 2019*	0.01	3.73	2.16	0.08	0.16	0.17	0.02
Sept-Oct 2019*	0.00	0.41	0.19	0.00	0.04	0.00	0.01
Mean 2019	**0.01**	**1.75**	**0.87**	**0.04**	**0.11**	**0.07**	**0.01**

#Brown long-eared bat

*20/05-03/06, 02-18/08, 23/09-07/10, 17/10-27/10

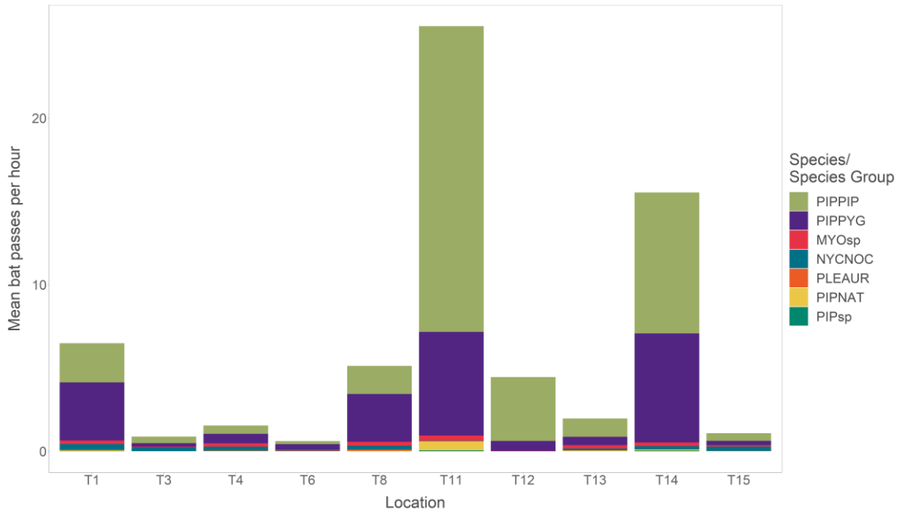
Source: Natural Power 2015, 2019

Image 9.4: Bat activity by species for each detector location Spring 2019



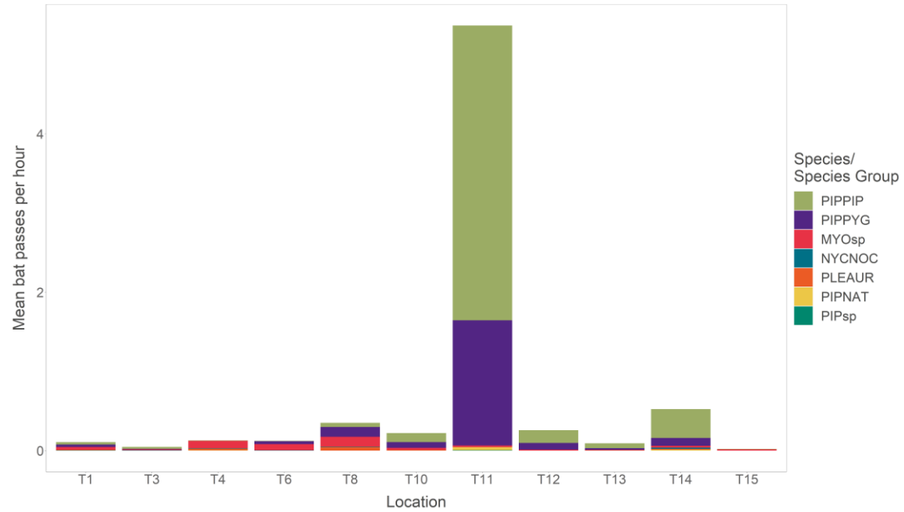
Source: Natural Power 2019

Image 9.5: Bat activity by species for each detector location Summer 2019



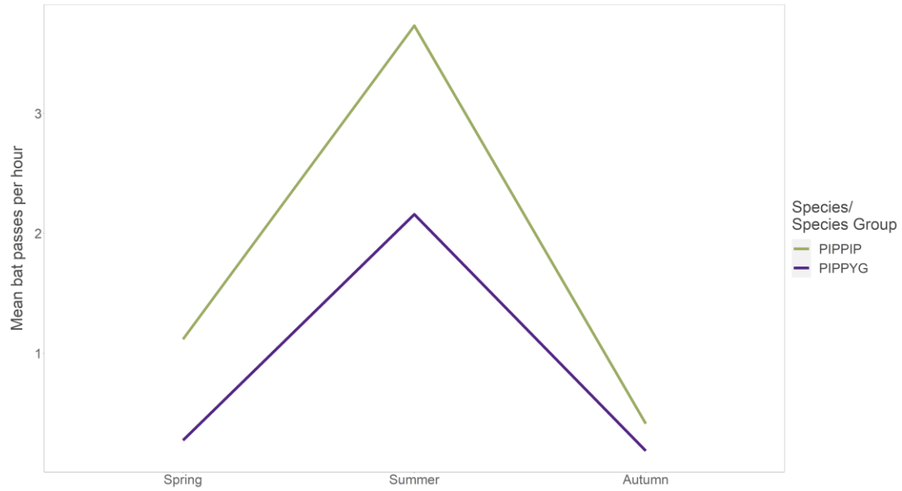
Source: Natural Power 2019

Image 9.6: Bat activity by species for each detector location Autumn 2019



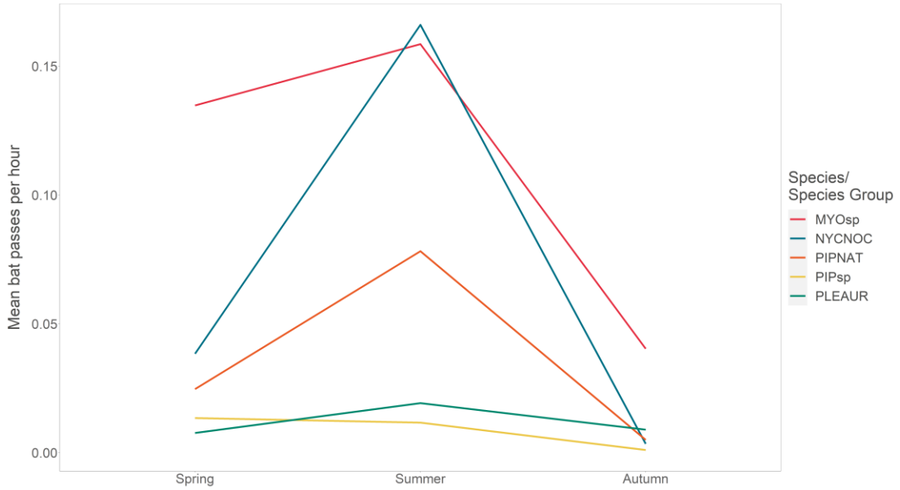
Source: Natural Power 2019

Image 9.7: Bat activity by species by season 2019 (Common and soprano pipistrelle only)



Source: Natural Power 2019

Image 9.8: Bat activity by species by season 2019 (other species)



Source: Natural Power 2019

Species summary

9.32.33 Accounts for each species are provided below.

Pipistrelle species

9.32.34 In 2019 common pipistrelle were recorded more frequently than soprano pipistrelle, with the highest numbers in summer at T11 and T13. T11 is the same location as detector 10 in 2014, which also had a high level of activity at that time (BAI of 14 for common pipistrelle and 9 for soprano pipistrelle respectively).

9.32.35 Activity for both species was considerably lower in 2019 than recorded in 2014, however the pattern of activity on site was similar, with a peak in summer and lower numbers recorded in Spring and Autumn. This reduction in records may be due to changes in the habitat over time as a result of planned felling which is likely to have moved the location of edge habitats.

9.32.36 In 2019 the additional category of Pipistrelle sp. was analysed which included calls for all three pipistrelle species with overlapping variables and therefore could not be identified to exact species. When combining the results from all 2019 pipistrelle categories, the results show a reduction in the number of calls recorded between 2014 (BAI 13.61) and 2019 (BAI 2.67).

Nyctalus species (Noctule)

9.32.37 Similar to 2014, in 2019 noctule were recorded in low numbers at all locations with the BAI for this species slightly higher in 2019 (0.07 compared to 0.01). Activity was highest in Summer.

Brown long-eared and Myotis species

9.32.38 The activity levels for both Myotis species and brown long-eared bat have reduced slightly in 2019 compared to 2014, with a peak of activity in Summer for both species. Both species / species groups were recorded at similarly low levels at all locations in 2019.

Ecobat: Relative Abundance

9.32.39 Following mandatory requirements, data from all seasons was run through Ecobat[16] in order to provide an assessment of relative bat activity when compared with bat activity at sites within 100 km and in similar habitats. Ecobat recommends that in order to have high confidence in the relative activity level category, more than 2000 nights should be used as a comparison.

9.32.40 As Ecobat has only been available since late 2018 and has only been a required assessment tool within guidelines since 2019[4], at present the data available within the system for a 100 km radius around Carno III amounts to less than the recommended number of nights to allow a high level of confidence in the comparison. At the time of assessment (11 May 2020) there were only 7-161 nights of data available from similar habitats within 100 km. As such, the relative activity level and associated assessment has not been included in this report as it is likely to represent a skewed result which is not relative.

Current and Favourable Conservation Status

9.32.41 In addition to assessing the activity levels of bat species groups locally, an assessment is provided below per species group in relation to current conservation status and whether they are at favourable Conservation Status (FCS). Data provided in paragraphs 9.32.22 to 9.32.30 below is extracted from the most recent report into the population and conservation status of UK mammals to provide context[18].

[18] Mathews F, Kubasiewicz LM, Gurnell J, Harrower CA, McDonald RA, Shore RF. (2018) *A Review of the Population and Conservation Status of British Mammals*. A report by the Mammal Society under contract to Natural England, Natural Resources Wales and Scottish Natural Heritage. Natural England, Peterborough. ISBN 978-1-78354-494-3.

9.32.42 Common and soprano pipistrelle are both widespread in the UK, and are cited on the IUCN red list, with Nature Conservation Status of Favourable in all countries. The UK population of common pipistrelle is estimated at 3,040,000 with a plausible interval of between 991,000 and 7,510,000. The Welsh estimate is between 96,600 and 732,000. The UK population of soprano pipistrelle is estimated at 4,670,000 with a plausible interval of between 1,970,000 and 8,400,000. The Welsh estimate is between 202,000 and 862,000.

9.32.43 Common and soprano pipistrelle are the most abundant species in the UK. As they were not classified as two separate species until 1995, it is not possible to compare population size with historic estimates. Recent studies show an increase in acoustic records for both species, but a decline in roost size. As such, the population status for both species is currently unknown. Collision with turbines and road vehicles are considered to be a driver for population change, as is loss of maternity roosts and predation by cats.

9.32.44 There is a general lack of information on the Nathusius' pipistrelle bat in Great Britain, and until very recently it was considered a vagrant. Only five maternity roosts have been identified in England, and none in Scotland or Wales. It is cited on the IUCN red list, with a Nature Conservation Status of unknown in all countries. Records for the Nathusius' pipistrelle bat are highly dispersed which reflects the relatively short time for which appropriate acoustic recording equipment has been widely available and also the localised nature of concentrated survey effort. Population estimates for the UK are not currently available.

9.32.45 Noctule is widespread in Wales and the South-West of England. It is cited on the IUCN red list, with a Nature Conservation Status of Favourable in the UK but not known for individual countries. The UK population estimate is not provided, but the population for Wales is estimated at 91,900 with a plausible interval of between 2,880 and 304,000. There was not enough data available to make an assessment on trends in population size, however the sole driver for population change is the potential for collision with wind turbines.

9.32.46 As a group, Myotis species present in Wales include Whiskered/Brandt's, Daubenton's and Natterers bat.

9.32.47 Daubenton's bats are widespread in the UK and Wales. It is cited on the IUCN red list and has a Nature Conservation Status of Favourable in all UK countries. The UK population is estimated at 1,030,000 with a plausible interval of between 27,000 and 4,440,000. The Welsh estimate is between Natterer's bats are widespread in the UK and Wales. It is cited on the IUCN red list and has a Nature Conservation Status of Favourable in all UK countries. The UK population is estimated at 973,000 with a plausible interval of between 510,000 and 1,360,000 for woodland habitats.

9.32.48 For both Daubenton's and Natterer's it is acknowledged that the population estimate intervals provided are very high due to lack of knowledge in a number of areas in relation to both species. Collison from turbines is not stated as a driver of population change, main threats are in relation to loss of roosts during works, decline in prey and artificial lighting of commuting/foraging corridors.

9.32.49 Estimation of population for whiskered and Brandt's bats is not known in the UK due to lack of data, and it's on the IUCN red list but assessed as favourable in the UK (unknown for Wales). Drivers for population change and threats to the population have not been assessed. However, Myotis species are not as a group considered to be high risk from turbines due to the low flight height and as such it is unlikely that collusion with turbines would be listed should additional data become available.

9.32.50 Brown long-eared bat is widespread in Wales and the South-West of England. It is cited on the IUCN red list, with a Nature Conservation Status of Favourable in all countries. The UK population is estimated at 934,000 with a plausible interval of between 51,900 and 2,200,000. The Welsh estimate is between.5,370 and 228,000. Collison from turbines is not stated as a driver of population change; main threats are in relation to loss of roosts, collisions with vehicles, decline in prey and artificial lighting of commuting/foraging corridors.

9.33 ASSESSMENT OF EFFECTS RESULTS

Ornithology

Nightjar

9.33.1 Surveys in 2019 identified indicated five likely territories; four in the western section of the site (located within 150 m of Turbines 4, 5, 6 and 8 and a probable nest site located adjacent to Turbine 5) and one in the eastern section of the site (c. 220 m from Turbine 10). Surveys conducted in 2014 identified that the clearfell areas are likely to be used by nightjar, where they will remain while the forest structure is suitable.

9.33.2 When surveys were undertaken in 2009, 71.3% of the habitat was classed as coniferous plantation, and in 2019 this has reduced to 50.46%, a 25% reduction in coniferous plantation cover, which will have led to an increase in the amount of habitats present that are suitable for nightjar. Although restocked clearings are abandoned by this species as the tree canopy closes over the open ground, this is not considered to occur until around seven to eight years after planting, with clearings still

used by this species if the crop is slow growing for up to 12 years[19]. The increase in nightjar is therefore considered to be a result of the changes in forest structure under on-going forestry management, and in the wider area nightjar are likely to be moving around the areas of clearfell and utilising suitable habitats as they become available.

9.33.3 Recent work undertaken at Pen y Cymoedd Wind Farm[20] has indicated no evidence of displacement of territorial birds as a result of operational works. A post construction nightjar monitoring protocol was developed for Pen y Cymoedd and agreed with nature conservation stakeholders. In the first year of survey (2018) five nests were located, the closest of which was within 60 m of the base of a turbine. Two young fledged from this nest, and a further four nests were located within 400 m of turbine bases, two of which were successful. The protocol implemented will form the basis of further monitoring at the site to determine if this trend continues throughout operation. As such, it is likely that the distribution of nightjar may be more dependent on available habitat than the proximity of an operating turbine. Given the increase in 2019 of the numbers of this species recorded within the site boundary, it is likely that impacts are most likely during construction, and the mitigation outlined in the SEI Sections 9.22.2-23 to negate this impact is still considered to be appropriate. In addition, it is proposed that post construction nightjar monitoring protocol should be conducted in operational years 1, 2, 3 and 5.

9.33.4 Nightjar have not been recorded flying over the development during any of the VP surveys conducted for the ES, SEI or FEI, although it is acknowledged that standard VP surveys are unlikely to pick up flights of nightjar. As this species does not tend to fly at PCH and monitoring at Pen y Cymoedd has demonstrated successful breeding within close proximity to turbines, no significant impacts are predicted from collision with operating turbines.

Vantage Point Surveys: Collision Risk Modelling

9.33.5 Goshawk activity remains low on the site, with collision risk assessed as 0.03 for both the breeding and the non-breeding season (one bird every 33 seasons).

9.33.6 Red kite flight activity appears to have increased across the survey area during the span of surveys, which has led to a reduction in estimated collision mortality rates when based solely on comparable data from the breeding season from 0.285 (one bird every 3.50 breeding seasons) to 0.22 (one bird every 4.55 breeding seasons). Due to an increase in red kite flights in the non-breeding season 2019/2020, additional data has allowed the calculation of risk in this time period, giving it as 0.34 (1 bird every 2.94 non-breeding season).

9.33.7 Red kite numbers have dramatically increased in Wales which is likely to account for the increase in flights, particularly in the non-breeding season when birds are not maintaining territories, and when juveniles are dispersing from nest sites. While within the Wales red kite are still listed as an amber species[21], more recent research from 2018 has identified that the Welsh population of red kite has increased by 368% between 1995 and 2016, and red kite is not listed on the UK red or amber list[22]. As such, it is considered that the collision risk resulting from an increase in blade length will not have a significant impact upon the population.

9.33.8 Kestrel flight activity also appears to have increased across the survey area during the span of surveys. CRM was not undertaken for kestrel in 2014, but data has allowed the calculation of one bird every 3.70 breeding seasons. Kestrel are common and widespread throughout Wales and the UK with a recent breeding population estimate of c 31,000[23], and it is not considered that the collision risk resulting from an increase in blade length will have an impact upon the population.

9.33.9 In summary, following additional survey work and assessment, the proposed changes for tip height extension have not resulted in significant impacts on any bird species.

Ecology

Habitats

Site Boundary

9.33.10 The results of the updated HLC are provided in Table 9.43 below and shown in Figure 9.40. Habitats present in 2009 are provided in the ES Figure 9.2.

[19] Available online from: https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/advice/conservation-land-management-advice/nightjars/#AHTWG1y0uUozvrR8.99 (last accessed 06/05/20)

[20] Available online from: https:/www.bsg-ecology.com/wp-content/uploads/2019/04/Project-Profile_Pen-y-Cymoedd-Nightjars.pdf (last accessed: 06/05/2020)

[21] Birds of Conservation Concern in Wales 3 (2016)

[22] 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

[23] Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, S. & Noble, D. 2020. APEP 4 - Population estimates of birds in Great Britain and the United Kingdom. British Birds 113 : 69-104

Table 9.43: Habitat loss from construction of wind farm (VER habitats only)

Habitat type	Habitat code	ES 2009	2019 (ha)	+/- difference (ha)	+ / - difference of all habitat (%)
Broadleaved woodland, semi-natural	A1.1.1	0	0.04	+0.04	+0.22
Coniferous woodland, plantation	A1.2.2	11.09	5.95	-5.14	-1.68
Recently-felled woodland*	A4.2	0	3.23	+3.25	+3.15
Unimproved acid grassland	B1.1	1.53	0.91	-0.62	-3.84
Acid grassland/ semi-improved neutral grassland/dry heath mosaic	B1.1/D1.1/ B2.2	0.01	0.01	0	0
Semi-improved neutral grassland	B2.2	0	0.01	+0.01	+0.25
Improved grassland*	B4	0	1.34	+1.34	+5.10
Marshy grassland*	B5	0.22	0.39	+0.17	+0.79
Poor semi-improved grassland	B6	0.48	0.48	0	0
Blanket bog	E1.6.1	0.02	0.02	0	0
Wet modified bog	E1.7	0.29	0.05	-0.24	-2.16
Blanket bog and wet modified bog mosaic	E1.6.1/E1.7	0.05	0.00	-0.05	-3.89
Flush, acid/neutral	E2.1	0.85	0.17	-0.68	-10.45
Valley mire	E3.1	0.08	0.08	0	0
*Habitats shaded in grey have an increase in loss from 2009 to 2019. All other habitats have a reduction in loss					

Source: Natural Power 2019

9.33.11 As a result of changes in habitats over the interim time, two habitats will result in more than 1 ha loss as a result of the proposal (recently felled plantation and improved grassland) however, as neither of these habitats are considered to be valued ecological receptors. The impact is not considered significant.

Proposed Access Track

9.33.12 The results of the updated HLC are provided in Table 9.44 below and shown in Figure 9.40. Habitats present in 2009 are provided in the ES Figure 9.2.

Table 9.44: Habitat loss from construction of access track (VER habitats only)

Habitat type	Area present within 250 m of proposed route(ha)	Area to be lost (ha)	Percentage of total habitat
Semi-natural broadleaved woodland	8.5479163	0.005	0.059
Planted broadleaved woodland	0.10255979	0	0
Planted coniferous woodland	0.64077332	0	0.025
Dense scrub	0.10317355	0	0
Neutral grassland	0.47509168	0	0
Semi-improved neutral grassland	2.24117073	0	0
Improved grassland	55.34313	1.053	1.903
Poor semi-improved grassland	0.53220225	0.087	16.404
Standing water	0.13010708	0	0
Running water	2.54376673	0	0
Arable	19.8206579	0.132	0.665

9.33.13 One habitat, improved grassland, will result in more than 1 ha loss as a result of the proposal, however as this habitat is not considered to be a valued ecological receptor the impact is not considered to be significant.

9.33.14 The loss of semi-natural broad-leaved woodland/planted coniferous woodland is restricted to hedgerow boundaries between fields and will not include any individual trees or the woodland bank of the Afon Carno.

Bats

9.33.15 In both the SEI and in the 2019 assessment all pipistrelle species were assessed as having a probable impact of moderate magnitude with all other bat species were assessed as unlikely impact of low magnitude. Following mitigation, no significant effects were expected. The 2019 assessment has not changed the significance of effects of any species identified within the site, and the mitigation proposed within the SEI is considered to remain in line with mitigation recommendations provided within the most recent guidance[Error! Bookmark not defined.].

9.33.16 Looking solely at the number of calls registered on site, and the bat activity index per hour of survey, bat activity has reduced within the site boundary between 2014 and 2019, however this does not change the assessment made for this species as provided within the ES. Impacts for common and soprano pipistrelle species as a result of operation were assessed as moderate and significant. There are no changes to the impact levels for all other species.

9.33.17 It is recommended that the results from the 2019 surveys are used as the baseline for bat activity within the site boundary, and that construction and operational monitoring surveys should use similar full spectrum detectors in order to provide comparable data.

9.33.18 The updated buffer distance based on new turbine specifications will be implemented through embedded mitigation to ensure turbines are situated an appropriate distance from habitats that may support bats and as such no increase in collision risk associated with proximity to habitat features is anticipated.

9.33.19 As mentioned in Paragraph 9.22.32, specific mitigation during operation remains as discussed in paragraphs 9.22.32 of the SEI which includes a post-construction monitoring regime with corpse searches under and around all turbines, and that an appropriate mitigation strategy will be agreed and implemented in consultation with the LPA and NRW. Such mitigation strategy may include operational cut in speed.

9.33.20 Following the additional surveys in 2019, and the implementation of the recommended mitigation, it is concluded that the assessment of the ES remains the same, with no residual significant impacts identified. Details of the assessment and a summary of predicted impacts of the proposed development in comparison with the ES is provided in Table 9.45 below.

9.34 AMENDMENTS TO MITIGATION

9.34.1 All mitigation identified within the ES is retained as described within Section 9.

9.34.2 There are no additional mitigation requirements within the site boundary aside from those already retained during the pre-construction or construction periods.

9.34.3 The proposed track will be subject to a separate planning application. There is the potential for some protected species (otter, water vole) to be present on site, however prior to the start of works pre-construction checks will be undertaken with appropriate mitigation implemented as required. This will include micrositing to avoid sensitive locations and altering the timing of construction.

Operation

Ornithology

9.34.4 No additional mitigation is proposed for birds during the operational period.

Ecology

Habitats

9.34.5 No additional mitigation is proposed for sensitive habitats during the operational period.

Bats: turbine buffers

9.34.6 Standard guidance states that areas of open-ground around turbines will be managed so that they remain free of tree and tall shrub growth in order to maintain a minimum 50 m buffer between potential bat features and the rotor blade tips.

9.34.7 The maximum turbine blade length and hub height would require the turbines to be located 72.1 m from a wall or 86.2 m from a tree to minimise the risk to bat populations[24]. Distances from turbines to plantation cannot be considered in relation to the stand-off distances for trees as active forest management will result in the forest edge moving further from the turbines maintaining an

[24] Natural England, (2014). Technical Information Note TIN051 *Bats and onshore wind turbines interim guidance*, 3rd Edition

appropriate buffer. As such at time of construction, all turbines will maintain appropriate distances from bat features.

9.35 CUMULATIVE IMPACTS

9.35.1 In order to identify whether there are any predicted cumulative impacts on ecological features from the amended proposed Carno III Wind Farm along with all other developments within an appropriate Zone of Influence (ZoI) (5 km) an updated assessment has been undertaken. There has been no change of status or additional wind farms within 5 km.

9.36 SUMMARY

9.36.1 The changes in impact upon ecological features as a result of the tip height extension compared to the consented development are minimal.

9.36.2 In terms of habitats, no impacts are anticipated on sensitive habitats.

9.36.3 In terms of ornithological receptors, no additional impacts are anticipated. The conclusions that applied to the consented development presented within the ES and SEI remains the same, even in light of changes to guidance and assessment.

9.36.4 In terms of bats, consideration is only given to changes in operational impact, as there is no change to the potential impact on bats during construction. The conclusions that applied to the consented development presented within the ES and SEI remains the same, even in light of changes to guidance and assessment.

9.36.5 In relation to ecological interests the assessment concludes that both the consented development and the proposal for increased tip height will not create any significant effects.

Table 9.45: Summary of predicted impacts of the proposed development on Important Ecological Features (operation only)

IER	Consented Carno III development				Proposed Carno III increase in tip height			
	Nature of pre-mitigation effect and probability of impact	**Specific mitigation proposed**	**Magnitude of residual effect**	**Residual significance**	**Change due to increase in tip height**	**Any further mitigation required**	**Magnitude of residual effect***	**Residual significance**
Red kite	Potential risk of collision; disturbance from operational noise and/or maintenance	N/A	Low	Not significant	Increase in potential collision risk	Nothing in addition to that proposed in the ES.	Negligible	Not significant
Hen harrier	Potential risk of collision; disturbance from operational noise and/or maintenance	N/A	Low	Not significant	Increase in potential collision risk	Nothing in addition to that proposed in the ES.	Negligible	Not significant
Kestrel	Potential risk of collision; disturbance from operational noise and/or maintenance	N/A	Low	Not significant	Increase in potential collision risk	Nothing in addition to that proposed in the ES.	Negligible	Not significant
Goshawk	Potential risk of collision; disturbance from operational noise and/or maintenance	N/A	Low	Not significant	Increase in potential collision risk	Nothing in addition to that proposed in the ES.	Negligible	Not significant
Pipistrelle species	Potential risk of collision: moderate	Curtailment of turbine 8 or micrositing to ensure appropriate standoff Felling of trees along watercourse/ bat feature at turbine 12 Site wide post-construction monitoring of site (corpse search) and mitigation if required for example potential curtailment Conifer control to ensure open ground it maintained between turbines and woodland edge HMP planning of broadleaved woodland along riparian corridor >100m south T12	Low	Not significant	Potential risk of collision: probable	All previous mitigation retained. Full spectrum detectors to be used in future monitoring.	Low	Not significant
Noctule	Potential risk of collision: low	As pipistrelle	Low	Not significant	Potential risk of collision: probable	All previous mitigation retained. Full spectrum detectors to be used in future monitoring.	Low	Not significant

Section 10

Noise Assessment and Shadow Flicker

CONTENTS

10.19 INTRODUCTION

10.19.1 This noise assessment section has been prepared by Ion Acoustics Limited. The proposed development is using the same number of turbines in the same locations as per the consented scheme, however utilising larger blades and taller hubs. In terms of operational noise, it is proposed that the same limits would be met as for the consented scheme, as noted in the Scoping Report dated 30th September 2019 (see Appendix 4 of this Further Environmental Information (FEI)). Therefore, it has not been necessary to revise the noise impact assessment for operational noise. This was agreed with the Environmental Health Officer as per correspondence dated 7th November 2019 (also found in Appendix 4 of this FEI).

10.19.2 Furthermore, construction noise levels on site is unlikely to be altered as a result of the proposed tip height extension, and noise emitted during the construction and decommissioning phases will be temporary and short-term in nature and can be minimised through careful construction practices. Therefore, the construction noise assessment in relation to on-site noise levels is not being revised for the proposed development.

10.19.3 However, a route analysis for the transportation of the turbines to the site has found that abnormal indivisible loads (AILs) carrying the larger turbine components cannot negotiate an existing railway underbridge at Pont Dolgoch on the A470. To avoid the bridge, a new access route will be built over existing agricultural farm land and using an existing level crossing at Wig Lane. The construction of the alternative access route was not assessed in the original noise section in the Environmental Statement (ES) and Supplementary Environmental Information (SEI) and therefore, for completeness, an assessment is provided in this section for the potential noise impact as a result of this proposed new access route. See Section 13 (written statement and figures) of the FEI for further detail on location of new access route.

10.19.4 Normal Heavy Good Vehicles (HGV) loads will be using the same route as previously identified, so these will not use the diverted route around Pont Dolgoch. It is only the larger elements (e.g. turbine blades and towers) that will use this alternative access track. The assessment in this note relates to the construction of the track and the abnormal load movements.

10.19.5 Shadow flicker was scoped out of the FEI as noted in the Scoping report (see Appendix 4). As a result of increasing the rotor diameter for the tip height extension, the shadow flicker assessment was re-run. Based on the expected maximum rotor diameter of 132 m, plus 50 m micrositing, properties within 130 degrees either side of north, relative to the turbines, and within ten rotor diameters of an existing occupied building were identified. Trannon Farm lies within this range, however this property is financially involved and had outbuildings limiting the potential impact of shadow flicker. Cwm Mawr may also be potentially affected however this lies approximately 1,275 m (almost at the 10 rotor diameter limit) from the nearest turbine. There appears to be a window on the south-south-western gable of Cwm Mawr but there are trees surrounding the property, in addition to topography which would likely eliminate shadow flicker occurring. Furthermore, planning condition 47 of the Carno III consent requires a scheme to be submitted and approved by Powys County Council for a protocol for the assessment of shadow flicker in the event of a complaint from owner or occupier of Trannon Farm. Amgeni Renewables would be happy to extend the condition to cover Cwm Mawr property as well.

10.20 ASSESSMENT CRITERIA

10.20.1 There are no noise limits within the main text of BS 5228-1: 2009[1] and in fact, the preferred approach is to use 'best practicable means' to reduce noise rather than setting limits. This means that everything should be done to reduce noise subject to practicality, programme and cost. This strategy will be adopted here.

10.20.2 However, Annex E of BS 5228 Part 1 gives example criteria for the threshold of potential significant noise effects e.g. for use in Environmental Statements. For quiet areas, where the existing ambient noise levels are low, a significant noise effect is deemed to occur if the construction noise (plus the ambient noise) exceeds the following threshold values:

- 65 dB L_{Aeq} Daytime (07.00–19.00) and Saturdays (07.00 – 13.00);
- 55 dB L_{Aeq} Evenings & Weekends (19.00–23.00 Weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays); and,
- 45 dB L_{Aeq} Night-time (23.00–07.00).

10.20.3 The construction work for the access will occur during the daytime normal working hours only in accordance with condition 24 of the existing consent, and therefore the 65 dB L_{Aeq} significance threshold is most likely to be applicable for quiet areas. For noisier locations, specifically, those where existing noise levels (when rounded to the nearest 5 dB) are already equal to the thresholds above then higher significance threshold can be used. For the daytime values, a higher significant threshold of 70 dB L_{Aeq} would apply. This threshold will be used for properties on the A470 which will already be significantly affected by existing traffic noise levels.

[1] British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 1 – Noise.

10.20.4 BS 5228 also states:

'If the site noise level exceeds the appropriate category value, then a potential significant effect is indicated. The assessor then needs to consider other project-specific factors, such as the number of receptors affected and the duration and character of the impact, to determine if there is a significant effect.'

10.20.5 Therefore, the exceedance of the threshold does not necessarily indicate a significant effect.

10.21 PREDICTED NOISE LEVELS - ACCESS FORMATION

10.21.1 To construct the diversion, a haul route must be formed over existing farm land. The turning and holding area leaving the A470 will be a temporary access track using metal trackways, whereas the access route leaving Wig Lane will be permanent and constructed from compacted hard core in a similar fashion to the wind farm access tracks. A typical plant list is given below together with the expected sound power levels taken from BS 5228-1[2] (and as used for the original Carno III calculations).

Table 10.16: Proposed Plant List

Plant List	BS 5228 Ref.	No.	L_{pA} at 10m	on-time (%)	Effective Sound Power L_{WA} dB
Excavator 25t	C2 19	1	77	50	102.0
Roller	C2 37	1	79	50	104.0
Dozer 20t	C2 12	1	81	10	99.0
Flatbed Lorry	C4 53	1	77	10	95.0
29t Dump Truck	C2 30	1	79	30	101.8
	Total Effective Sound Power dB L_{WA}				108.3

10.21.2 It is possible that occasionally more than one item of plant will be active over the entire length of the new access route. However, they would be expected to be distributed across the site and it is unlikely for the purposes of the calculation that the plant list working at any one point will exceed that listed above.

10.21.3 Predicted noise levels have been carried out using the calculation method in BS 5228-1. The predictions are made for the closest part of the new access route, but only for where a new track is being constructed. The soft ground assumption within BS 5228-1 has been used. It is not expected that the work at the closest location will take more than a few days. So, the noise predicted here are for short durations only.

10.21.4 The predicted noise levels are shown below together with the minimum distance assumed.

Table 10.17: Predicted Noise Levels

Location	Easting	Northing	Distance to New Access Track (metres)	Significance Threshold	Predicted Construction Noise Level dB L_{Aeq}
Pertheirin	300884	293595	33	65	72
Dolerw	300873	293502	121	65	58
Housing on the A470	301066	293689	100	70	60
Craigfryn	301505	293250	226	65	51
Wig Farm	301453	292450	129	65	57
Maesteg	301618	292688	104	65	60
Bungalow by Level Crossing, Wig Lane	301822	292902	38	70	70
Blackhall	301771	292980	41	70	69

10.21.5 The predicted noise levels above are all within the respective significance threshold with the exception of the farmhouses at Pertheirin/Dolerw at the end of the proposed new access track. In this case, the farm is a landowner associated with the new route and the farm already has a large chicken shed on the land. Therefore, lorry movements will already occur at the property at regular intervals. It is doubtful that short-term construction noise will be significant in this context, particularly as the haul track is on this farmer's own land.

10.21.6 Predicted noise levels are quite high for some properties at the southern end of the route close to the A470, albeit with noise just within the higher significance threshold. However, these will already be affected by traffic noise and by occasional passing trains. In this context and bearing in mind the short duration and daytime restrictions, there will be no significant effect from the short-term construction of the new haul route.

10.22 NOISE FROM TRANSPORT MOVEMENTS

10.22.1 The proposed development will also see the components taken over onto Wig Lane and crossing the Wig Bridge. This part of the route is on an existing road so no new construction work is required here but the

[2] British Standard BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 1 – Noise.

components will pass Maesteg Farm on Wig Lane. This is set back approximately 19 metres from the road. There is also the bungalow by the level crossing which lies directly adjacent to the road.

10.22.2 There are likely to be 130 Abnormal Indivisible Load (AIL) deliveries resulting in 260 movements during an 11-week period. This relates to less than one movement every two hours and therefore predicted noise levels from the actual movement of abnormal loads will be very low and much lower than the significant thresholds identified above. The number of movements is likely to be much lower than this as it is envisaged that the return movements won't be classified as AILs and would therefore travel on the public highway, along the A470.

10.22.3 It is possible the abnormal loads will result in tangible vibration at properties very close to the route. However, these properties will already experience vibration from the railway line.

10.23 NOISE CONCLUSION

10.23.1 This section sets out the predicted noise impact of a proposed new access route on farm land near Pont Dolgoch. The route is required so that AIL have a viable route to site as they cannot pass under the railway bridge. The route will see new access tracks constructed from compacted hardcore over agricultural fields and also a temporary metal trackway. The construction activity will be a short-term activity carried out during normal working hours only in accordance with condition 24 of the existing consent. Predicted noise levels will be less than the significance thresholds identified in BS 5228-1 except for the farm associated with the landowner at Pertheirin/Dolerw. A short-term effect is not considered a significant impact in this context. Other HGV movements will continue to use the A470 which has already been assessed. Predicted noise levels from the abnormal movements themselves will be very low. Some vibration may be perceived but only at locations where railway vibration would also be expected. The AILs will be managed in accordance with the agreed management plan.

10.23.2 Best Practicable Means will be used to reduce noise during the construction of the access route and the construction will be managed in accordance with the Construction Environmental Management Plan (CEMP).

Section 11

Forestry Assessment

CONTENTS

11.19 INTRODUCTION

Purpose and Scope

11.19.1 This section of the Further Environmental Information (FEI) was produced by Pryor & Rickett Silviculture. The purpose of this section is to update the state of the current forest structure and revise the forest felling requirements for the proposed Carno III Tip Height Extension (hereafter referred to as the 'proposed development'). The changes to current forest structure and felling requirements are also reflected within Figure 11.6: Forestry Components Plan (as of 2020) and Figure 11.7: Forestry Felling Plan in Volume 2 of the FEI.

11.19.2 Reference to the previous forestry assessment , as reported in Section 11 of the original 2010 Environmental Statement (ES) and 2015 Supplementary Environmental Information (SEI), is made where the information provided is still relevant.

11.19.3 The activities that have resulted in changing the composition of the forest areas following the delivery of forestry management activities over the period 2015 to 2020 include:

- Clearfelling of mature crops;
- Preparation of felled sites for replanting;
- Replanting with productive conifers and mixed broadleaves, with areas of ecological interest retained as appropriate;
- Applications for and approval of further felling operations provided by Natural Resources Wales (NRW) under Felling Licence Regulations.

11.19.4 The result of the recent forest management activity presents a different picture in relation to the total volume of mature timber remaining to be felled prior to construction of the wind farm, and the area of young crops required to be cleared when compared to the original 2010 ES and 2015 SEI Section 11.

11.20 PLANNING POLICIES AND GUIDANCE

11.20.1 An overall policy for forestry in Wales is set out in the Woodlands for Wales: strategy[1]. Within this document, it is recognised that upland forest sites are, and will be in areas where wind farms are to be located. Guidance for top-level planning of forestry operations are contained in the UK Forestry Standard[2] (UKFS), which covers broad aspects such as felling and infrastructure. Other operational guidelines cover key aspects of forest management such as soil conservation[3] and the management of water[4] within the forest environment.

11.21 FORESTRY MANAGEMENT PLAN

Baseline Information

Ownership and Management

11.21.1 The forestry contained within the Carno III application area is divided into four ownerships; Gribyn, Dolbachog, Allt Ddu and a number of fragmented blocks surrounded by agricultural land. Each are owned by different private individuals and Figure 11.1 of the ES shows the forestry ownerships.

11.21.2 Of the four ownerships, only Gribyn and Dolbachog are managed professionally and with timber production as the principle objective. Day to day operations are delivered on behalf of the owner by Pryor & Rickett Silviculture & Tilhill Forestry, with wider investment planning and strategy being provided by Gresham House Ltd.

Summary Description

11.21.3 The area of forest within the Carno III application area extends to 467.6 ha. At present, approximately 15% of the area comprises of unplanted ground unsuitable for trees where soil type or topography do not favour timber production, or ground occupied by road and track infrastructure. The primary species component is Sitka spruce, which is present on over 75% of the forest area. Smaller components of mixed broadleaves, larch and other minor conifer species account for the remaining balance.

11.21.4 Except for a small proportion of southern part of Gribyn, the site occupies a plateau with a variation in elevation between 410 – 450 metres (m).

[1] Woodlands for Wales –The Welsh Government's strategy for Woodlands and Trees. Welsh Government (2018). Available online from: https://gov.wales/woodlands-wales-strategy (last accessed 30/10/2019).

[2] UK Forestry Standard – The Governments Approach to Sustainable Forestry. Forestry Commission (2017). Available online from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/687147/The_UK_Forestry_Standard.pdf (last accessed 27/01/2015).

[3] UK Forestry Standard Guidelines: Forests and Soil Conservation. Forestry Commission (2011).

[4] UK Forestry Standard Guidelines: Forests and Water. Forestry Commission (2011).

11.21.5 A detailed description of each forest ownership, including the species proportions and ages, as it appeared in 2010 can be found in paragraphs 11.2.2 – 11.2.5 of the ES. Changes resulting from management activities during the period 2010-2020 are detailed as follows:

Woodland Description – Gribyn Forest

11.21.6 First felling commenced in 2002, and during the period 2002-2010, 47% of the forest was felled and replanted. During the period 2011-2015, a further 15% was felled and replanted. This excludes the felling approved and being carried out in 2015, which accounts for an additional 8% of the forest area. Thus, in total, at the end of 2015, 70% of Gribyn had been felled, of which 62% was replanted with mainly Sitka spruce. A further 30% has been felled and replanted with Sitka spruce between the period of 2015 – 2019. See Table 11.13 for 2015-2020 figures.

Woodland Description – Dolbachog

11.21.7 Dolbachog now comprises of a young forest in its second rotation. A second phase of felling in 2012 removed the last of the mature crops planted in 1966. Sitka spruce forms the highest proportion of trees planted, though areas of open space were included in the restocking design to provide contiguous areas without trees between Trannon Local Wildlife Site and Allt Ddu. There has been a small (7.26 ha) area of spruce cleared, with 2.26 ha being left unplanted for bog land restoration.

Woodland Description – Allt Ddu & Agricultural Woodland Blocks

11.21.8 Only a very small area (7.26 ha) of the Allt Ddu area (representing 0.02% of the woodland area) has been felled since 2015.There has been no change to the baseline for the agricultural woodland blocks.

11.22 RECENT FELLING ACTIVITY

Felling Undertaken Since 2015

11.22.1 The management of the forest crops within Dolbachog and Gribyn (see Figure 11.1 for their locations from the original ES) has continued in accordance with management plans in place or approved subsequent to the submission of the SEI in 2015. In all cases, felling approvals detailed within grant schemes or obtained under felling licence were consented by NRW and were compliant to the current standards and guidance set out in Paragraph 11.1.3 of the ES. No felling has taken place in the small agricultural woodland blocks to the west since the ES submission in 2010. Table 11.13 shows the comparison of baseline forestry land use from 2010-2014 (when the ES and SEI was pulled together) and 2015-2020. .

Table 11.13 Forestry Baseline Comparison

	Area (ha)		% of Total Forest Area	
Category	**2010 - 2014**	**2015 - 2020**	**2010 - 2014**	**2015 - 2020**
Felled & restocked	97.0	112.0	20.8%	24.0%
Felled & retained as bare ground	15.7	3.0	3.4%	0.6%
Remaining Mature Crops	141.8	89.2	30.4%	19.1%
Existing Young Crops	205.7	217.5	44.2%	46.5%
Existing Bare Ground	5.7	45.9	1.2%	9.8%
TOTAL	**465.9**	**467.6***	**100%**	**100%**

* Minor variation in total area values due to recent re-digitisation of forest crops using updated aerial imagery

11.22.2 Felling proposals remain the same as the proposals in 2015, however as outlined in Table 11.13, there is a change in the percentage to the felling of mature crop and clearance of young crops due to more mature cover being cleared since 2015.

11.22.3 The restocked areas have been planted with young trees, primarily Sitka spruce. Smaller proportions of mixed broadleaves and open ground have been incorporated around features of ecological interest. These are all shown on Figure 11.6 and 11.7 in Volume 2 of the FEI.

Proposed Felling Programme

11.22.4 Due to the fact that the location of the wind turbines has not changed, and the original felling proposals allowed for a greater than minimal clearance zone, there will be no change to the total area of tree cleared within the main forest block. Table 11.14 shows the revised areas and percentages of the crop types which will now require clearance.

Table 11.14: Revision to tree clearance requirements prior to construction

Clearance Category	Area (hectares)	Percentage of total proposed clearance area (300.71 ha)	Percentage of total forest area (467.64 ha)
Felling mature crops	46.03	15.30%	9.84%
Cleared young crops	254.68	84.69%	54.46%

Clearance Category	Area (hectares)	Percentage of total proposed clearance area (300.71 ha)	Percentage of total forest area (467.64 ha)
Retained crops	118.02	-	25.24%
Retained bare ground/ sparse tree cover	48.91	-	10.46%

11.22.5 As a significant proportion of the mature crops at Dolbachog and Gribyn have already been felled, and those that have not would be due to be felled before 2031 at the latest, the most significant requirement, by area, is the removal of young crops aged 15 year or less. These areas are summarised in Table 11.15.

Table 11.15: Summary of clearance requirements by crop type

Forest Property	Mature timber to be felled (hectares)	Premature removal aged < 15 years (hectares)	Total Area Retained (including areas of open ground/sparse tree cover) (hectares)*	Total Forest Property Area (hectares)
Dolbachog	0	70.4	11.56	81.96
Gribyn	28.45	184.28	132.62	345.35
Allt Ddu	17.14	7.26	12.5	36.92
Allt Ddu West	0	0	1.98	1.98
Agricultural Woodland Blocks	0.44	0	0.99	1.43
Total	**46.03**	**261.94**	**159.65**	**467.64**

11.22.6 The revised felling strategy allows for the retention of two functional areas of productive forestry that can continue to be managed as normal (i.e. without consideration for wind farm requirements). These are located at Gribyn (south) (53 ha), and Gribyn (east) (64 ha).

Revised Timber Volumes Produced from the Felling Proposals

11.22.7 With the normal forestry business tree felling which has taken place since 2015, there is a reduction in the total volume of timber produced resulting from felling prior to construction. These volumes are summarised in Table 11.16, which forms a revision to Table 11.7 previously included in the 2015 SEI. The total number of lorries has reduced significantly from 905, as quoted in the SEI in 2015, to only 440, as noted in Table 11.16 below.

Table 11.6: Revised summary of felling requirements prior to construction, excluding felling already approved

Product Type	Volume (m^3)	No. of Lorries	Percentage of felled volume
Timber	10,650	353	80.0%
Brash	2,600	87	20.0%
Total	**13,250**	**440**	**100.0%**

11.23 CONCLUSIONS

11.23.1 A brief summary has been provided below which details the main findings in this section:

- The proposed tip height extension will reduce the impact on forestry compared to the impact assessed in the SEI in 2015, as the volume of timber and therefore number of lorries has been reduced due to more premature crop's clearance required rather the mature crops.
- The clearance of 46 ha of mature crops and 262 ha of premature crops would be required prior to construction of the wind farm. The clearance of the mature crops would form part of normal forestry practice irrespective of the wind farm proposal.
- A total of 10,650 m^3 of timber is expected to be produced, supplying existing timber markets in Wales.
- A further 2,600 m^3 of brash could be recovered from the felled areas, for supply to Welsh biofuel power plants.

Section 12

Cultural Heritage Assessment

CONTENTS

12.19 INTRODUCTION

12.19.1 This section presents the Cultural Heritage Assessment for Carno Wind Farm Extension Phase III tip-height extension (also referred to as proposed development) and associated access track at Pontdolgoch as part of further environmental information (FEI) to support a Section 73 planning application. This section has been prepared by SLR Consulting Ltd. The purpose of this assessment is to identify significant effects of the proposed development on the historic environment in which the development is located, specifically for seven designated assets which have been agreed with consultees during the scoping process, and the difference that higher turbines might make to these effects compared to a baseline which was set when the original application was consented by Powys County Council in 2017 (referred to as consented development). The heritage impact assessment follows national policy and best practice guidance in order to establish a robust and transparent approach to assessing the assets in their setting and the potential impact from the proposed scheme.

12.19.2 The proposed changes are to seek an increase in tip height for all 13 turbines from 126.5 m to tip to a maximum of 149.9 m to tip. This represents a 23.4 m or 18.5% increase in the height of the turbines but does not materially alter the number or location of the turbines. Although the increased height would entail a very slight change in dimensions to turbine bases, this would not result in a perceptible change from the consented development sufficient to indirectly effect heritage assets. Mitigation for potential direct effects have already been accepted as part of the consented development.

12.19.3 As discussed later in this section, the updated assessment concludes that no additional significant effects have been identified as a result of the proposed tip height extension, over and above the significant effects previously identified for the consented development.

12.20 POTENTIAL SOURCES OF IMPACT

12.20.1 Potential effects on cultural heritage associated with the construction and/or operation of the proposed development includes direct physical change to potential buried remains, and indirect effects through development within the settings of designated historic assets harming heritage significance, including those resulting from intervisibility between an asset and the proposed development.

12.21 LEGISLATIVE, POLICY AND NATIONAL GUIDANCE FRAMEWORK

12.21.1 The consented development was one which required an Environmental Impact Assessment under the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2011, which has since been updated to the 2017 regulations. The current Section 73 application is supported by an assessment which complies with Welsh legislative and planning policy frameworks, and applies Cadw's relevant guidance, to ensure the assessment has been undertaken in a proportionate manner. The following list includes key statutory, policy and national guidance that have relevance to this assessment:

- The Historic Environment (Wales) Act 2016 is the primary statutory tool for protecting historic assets and sustainable management of the historic environment. It is designed to enable greater transparency into decisions taken on the historic environment and to make it a statutory requirement for information on the historic environment to be safe-guarded for the public good.

- National policy within Wales is set out in by *Planning Policy Wales Edition 10, December 2018* ("PPW"), in which Section 5.7 states the importance of Renewable Energy, and Section 6.1 The Historic Environment (within the chapter on Distinctive and Natural Places) explains the need for a reasonable and proportionate impact assessment to ensure proposed development is sustainable and to prevent unnecessary harm to historic assets.

- PPW is supported by *Technical Advice Note 24: The Historic Environment* (May 2017) which is designed to assist local authorities with developing their local plans and for determination of planning applications or listed building consent in relation to historic assets. The Welsh Ministers and Planning Inspectors will consider these guidance documents when considering the proposal.

- The two principal guidance documents that have been followed in this assessment are those produced by Cadw on behalf of the Welsh Government for managing historic assets: *Heritage Impact Assessment in Wales* (May 2017) and the *Setting of Historic Assets in Wales* (2017).

- Cadw's *Conservation Principles for the sustainable management of the historic environment in Wales* (March 2011) has also been used to establish objective assessment of the value and significance of historic assets within and surrounding the proposed development site.

12.22 SCOPING CONSULTATION

12.22.1 The scoping process undertaken as part of the Section 73 process included an exercise in filtering designated historic assets within the landscape surrounding the proposed wind farm (as listed by Cadw), to identify those assets most likely to be affected by the increase in height. The national data download was checked to establish whether any new scheduled monuments or listed buildings had been added to the list of designated historic assets, and a comparative Zone of Theoretical Visibility (ZTV) for blade-tips between the consented development and the increased heights was modelled to identify any potential new designated assets which would not have been affected by the consented development.

12.22.2 Initial presentation of the results from this scoping assessment included wireline screenshots from six scheduled monuments which was included in the scoping report (see Appendix 4.1 in Volume 1 of this FEI), and agreed via consultation with Cadw (see Appendix 4.2) to scope these out, based on the ZTV for the

increased height and actual conditions on the ground (such as intervening vegetation) which would make intervisibility unlikely. The scoping report identified seven historic assets of high sensitivity, which was agreed to form the basis of the proportionate assessment of potentially significant effects arising from the proposed changes. This was agreed with Cadw as part of the scoping consultation (see Appendix 4.2).

12.22.3 This FEI assessment is supplementary to previous studies which were included as part of the consented development, the Environmental Statement (ES) chapter (2010), ASIDOHL (2010), additional ASIDOHL2 (2015) and Supplementary Environmental Information (SEI) (2015). The assessment will be confined to a comparison between the consented and proposed development to determine whether the significance of effect would be increased by the tip-height extension.

Table 12.22: Scoping Consultation

Consultee	Summary of Key Issues	Where Addressed in Section
CADW	Cadw agreed with proposed Methodology and Scope. They listed potential assets that could be affected by the Proposed Development and wanted assurance that assessment of those turbines with hubs visible from the designated historic assets would include the full length of the rotor blades.	The methodology was confirmed to include assessment of the full rotor blade length for all turbines with at least the hubs visible from designated historic assets. The list of potential assets that might be affected was examined with the aid of a comparative ZTV for hubs and blade tips for the consented and proposed development, and seven designated historic assets were identified as requiring assessment. See 12.23 Assessment Methodology.
Clwyd-Powys Archaeological Trust (CPAT)	No issues raised. CPAT agreed with Methodology	12.23 Assessment Methodology

12.23 ASSESSMENT METHODOLOGY

12.23.1 Cadw's Conservation Principles[1] (page 18) states in Managing change to an historic asset: 'Changes to historic assets are inevitable …. To ensure the long-term future of historic assets, change needs to be managed to ensure that their significance is not diminished as a consequence' and Paragraph 47 'When considering the severity of potential impacts upon an historic asset, there should always be proportionality and reasonableness". The heritage assessment has used these key aims of the guidance to ensure the results of the study are focused on a proportionate response to potential impacts on historic significance from the degree of change between the consented development and the proposed tip height extension. The most visual element will be when turbine hubs, proposed at up to 92 m height and full blades, proposed at up to 64.5 m length become visible against the skyline, and this has been agreed by Cadw as the focus for the impact assessment, as per the scoping consultation.

12.23.2 Historic significance was included as part of previous studies for the consented development; however, this has been re-examined (see below) for those assets to be assessed as part of this FEI for the proposed tip height extension. The original impacts on these assets have been reviewed, and wireline visualisations have been produced based on bare-earth models to help in understanding the potential magnitude of impact, with a site visit to appreciate and experience the assets in their setting as necessary. Analysis of the designated historic assets has enabled the heritage significance to be established in accordance with Cadw's *Heritage Impact Assessment in Wales*[2] (section 4.2) and *Conservation Principles for the sustainable management of the historic environment in Wales*. This analysis has also articulated the general setting for the designated historic assets, and what elements of that setting contribute to how the asset is experienced, understood and appreciated, through application of Cadw's *Managing: Setting of Historic Assets in Wales* four stage process:

- Stage 1: Identify the Historic Assets
- Stage 2: Define and Analyse the Setting
- Stage 3: Evaluate the Potential Impact of Change or Development
- Stage 4: Consider Options to Mitigate the Impact of a Proposed Change or Development

12.23.3 Assessment of the historic significance (sensitivity) of the asset used the criteria in the following table:

Table 12.23: Levels of Historic Significance

Historic Significance	Explanation
Highest	World heritage sites Scheduled monuments Grade I and II* listed buildings Grade I and II* registered parks and gardens

[1] Cadw (March 2011) *Conservation Principles for the sustainable management of the historic environment in Wales,* Welsh Government

[2] Cadw (May 2017) *Managing Heritage Impact Assessment in Wales*. Welsh Government

Historic Significance	Explanation
	Designated battlefields Protected wrecks Non-designated assets of equivalent national significance
High	Grade II listed buildings Grade II registered parks and gardens Conservation areas Non-designated assets of equivalent significance Archaeological sites which are of particular individual importance within the regional archaeological resource
Medium	Archaeological sites of local importance
Low	Sites that are of minor importance or with little remaining to justify a higher category
Negligible	Negligible or no heritage significance
Unknown	Further information is required to assess the potential of these sites

12.23.4 Where necessary a site inspection was carried out to identify the contemporary existing environment (including historic and modern developments, vegetation and land-use) and to test the validity of the wireline models, so that the setting of designated historic assets and the degree of change from the baseline that the proposed tip-height extension might introduce, was professionally assessed.

12.23.5 Magnitude of impact has been assessed with reference to the criteria set out in the table below:

Table 12.24: Magnitude of Impact

Magnitude of impact	Definition
High beneficial	The development would considerably enhance the heritage significance of the affected asset or the ability to appreciate it
Medium beneficial	The development would enhance to a clearly discernible extent the heritage significance of the affected asset or the ability to appreciate it
Low beneficial	The development would enhance to a minor extent the heritage significance of the affected asset or the ability to appreciate it
Very low beneficial	The development would enhance to a very minor extent the heritage significance of the affected asset or the ability to appreciate it
Neutral / None	The development would not affect, or would have harmful and enhancing effects of equal magnitude, on the heritage significance of the affected asset or the ability to appreciate it
Very low adverse	The development would erode to a very minor extent the heritage significance of the affected asset or the ability to appreciate it
Low adverse	The development would erode to a minor extent the heritage significance of the affected asset or the ability to appreciate it
Medium adverse	The development would erode to a clearly discernible extent the heritage significance of the affected asset or the ability to appreciate it
High adverse	The development would severely erode the heritage significance of the affected asset or the ability to appreciate it

12.23.6 Following on from the previous stages, Stage 3 included assessing the potential indirect effects from the operational phase, principally noise, flicker and intervisibility, to designated historic assets. Significance of effect was based on a combination of heritage significance (in other disciplines sometimes referred to as sensitivity of the receptor) and magnitude of impact. The significance of effect matrix is presented in the table below and relates the historic significance to the magnitude of impact (incorporating contribution from setting where relevant) to establish the likely significance of effect. Dark Grey cells would be significant effects, light grey cells might be significant, based on professional judgement. These criteria have developed since the 2015 SEI so that a slightly more refined matrix can be used to calculate the significance of effect.

Table 12.25: Significance of Effect Matrix

Magnitude of Impact	Heritage Significance				
	Highest	**High**	**Medium**	**Low**	
High beneficial	Substantial	Substantial	Moderate	Slight	Enhancements
Medium beneficial	Substantial	Moderate	Slight	Very slight	
Low beneficial	Moderate	Slight	Very slight	Very slight	
Very low beneficial	Slight	Very slight	Negligible	Negligible	
Neutral/nil	Neutral / nil	Neutral / nil	Neutral / nil	Neutral / nil	Neutral/nil
Very low adverse	Slight	Very slight	Negligible	Negligible	Harm

Magnitude of Impact	Heritage Significance				
	Highest	**High**	**Medium**	**Low**	
Low adverse	Moderate	Slight	Very slight	Very slight	
Medium adverse	Substantial	Moderate	Slight	Very slight	
High adverse	Substantial	Substantial	Moderate	Slight	

12.23.7 Mitigation and residual effect are the final stages that have been considered, although the options for mitigating the effects of the turbines through visual impacts are largely limited to introducing screening vegetation.

12.24 DESCRIPTION AND COMPARATIVE ASSESSMENT OF IMPACT ON DESIGNATED HISTORIC ASSETS

12.24.1 Stage 1 of *Cadw's Managing: Setting of Historic Assets in Wales* guidance requires identification of the assets to be assessed. Several iterative steps have been taken through the original EIA, consultation with stakeholders and the SEI process which led to permission for a 13 turbine scheme up to 126.5 m tip height. The proposed tip height extension to 149.9 m to tip maintains the permitted locations for the turbines, and therefore filtering of the assets as described in section 4.1 of the Cadw guidance has been undertaken during scoping, so that an agreed number of assets would be assessed. The following paragraphs summarise the assets (see Figure 12.35 for location of designated historic assets and comparative blade-tip ZTV, Figure 12.36 for location of assets assessed in the FEI, with comparative ZTV for turbine hubs shown in Figure 12.37), their setting and potential impact, the scheduling or listing description, and the results of the site visit which was conducted on 29th November 2019 to complete Stage 2, "Define and Analyse the Setting".

Y Gribyn (83707)

12.24.2 Asset description: This house is a grade II* Listed Building, which was originally a 3-unit cruck-framed hall-house, substantially remodelled in the C17. It is a vernacular farmhouse which shows the transition from timber to stone construction, with a well preserved exterior and interior detail. The unusual plan-form may relate to its origin as a medieval hall-house.

12.24.3 Asset setting: Y Gribyn is situated within pastural farmland surrounded by a mix of mature woodland and planted conifers. The building is situated within a valley with a river running to the west of Y Gribyn. The building is approached by telephone lines and a modern road, which is verged by hedgerows. The ZTV shows that six of the turbine hubs and full length rotor blades (Turbines 1, 10, 11, 13, 14 and 15) of the proposed tip-height extension would be visible from the historic asset although the proposed development would not directly impact the asset itself.

12.24.4 Comparative assessment: The potential significance of effects as a result of the consented development was assessed as moderate in the SEI (Paragraph 12.13.21 onwards) based on low adverse impact to an asset of high value. The tip-height extension would result in a slight perceptible increase in the visibility of the hubs and full-length rotor blades against the skyline (see Appendix 12A.15: VP01), but this small change would not result in any greater impact on the historic significance of the listed building through development within its setting, than was assessed for the consented development.

Cefn Carnedd Camp (MG016)

12.24.5 Asset description: The scheduled monument comprises the remains of an Iron Age hillfort and Cross-Dyke (possibly of a different period). Cefn Carnedd Camp is a strongly defended multi-vallate hillfort, which has been conjectured as the possible site of Caradoc's defeat by the Romans in AD51. It includes c.15 acres as a defended area, with triple banks and ditches around the ends and NW side. The ramparts on the SW, N and NE sides remain as scarp slopes up to 3.5 m high. No defences remain on SE; they may not have been necessary here because of the steepness of the slopes or may have been disturbed/ removed in recent times.

12.24.6 Asset setting: The current setting of the monument is grazing land, with patches of mature woodland and conifers to the north, west and south of the monument (Image 12.7). The monument is divided by a hedgerow visible on the 1885 Ordnance Survey Map, which is still in place on current aerial photography (Google Earth™). The asset overlooks the confluence of the Rivers Severn and Trannon, establishing this hillfort as a strategic control point on a prominent hill in the wider landscape of the Caersws Basin, with long views down the valleys, especially towards any threat from the east. The relationship to three other hillforts within the assessment, MG031, MG085 and MG020, which all lie to the west of Cefn Carnedd in the Clywedog Valley, forms an important part of its setting, as part of the evidence for social structure, land ownership, mineral wealth, and defence during this period.

Image 12.7: Cefn Carnedd in foreground, Trannon Valley middle distance and view of Carno III on Trannon Moor in the far distance (Copyright 2020 Google earth imagery)

12.24.7 Comparative assessment: The potential significance of effects as a result of the consented development was assessed as moderate in the SEI (Table 12.21 based on low adverse impact to an asset of high value. The consented development would form only a small-scale addition, at considerable distance within the wider landscape as viewed from Cefn Carnedd. It was argued that the consented development would not affect important views towards other hill forts or the valleys and Caersws Basin to the south and south-east. The tip-height extension would result in a barely perceptible increase in the visibility of eight of the hubs and full-length rotor blades against the skyline (see Appendix 12A.15: VP03 (Turbines 1, 2, 3, 10, 11, 13, 14 and 15)), whilst another three (Turbines 4, 6 and 12) would just project their hubs above the landform at the additional height. In reality these hubs would probably be hidden by intervening trees, and therefore it is concluded that there would be no significant change to the effect from the consented development, which was assessed as moderate significance, but not a significant effect.

Dinas Camp (MG020)

12.24.8 Asset description: The scheduled monument comprises the earthwork remains of an Iron Age hillfort, which enclose a large area on the north facing slope of Dinas Hill measuring c.650 m x 100 m north-east -south-west (Image 12.8). The east side falls away very steeply and there are no defences except for some scarping towards the north. On the west side a bank runs along the side of the hill and in places an external ditch is visible. At the northern end a rampart follows the base of the hill. The area between this and the western bank is very marshy. A second rampart and ditch are visible further down the northern slope but has been disturbed in parts by ploughing and trackways. The earthworks at the higher southern end of the site appear to be incomplete.

Image 12.8: Dinas camp vertical Google earth image from 2006 (Copyright 2020 Google earth imagery)

12.24.9 Asset setting: The monument is located to the north of the Clywedog reservoir, which flows into the River Severn to the south. This valley and the ancient routeway now followed by the B4518 would have enabled transport of mineral working from mines further west. The B4518 runs east-west to the north of the monument, with modern conifer forestry plantation to the north as well as telephone poles. The site is used for pastural grazing with fence lines and hedgerows crossing the monument.

12.24.10 Comparative assessment: Although all 13 turbines would be theoretically visible from the monument, the potential significance of effects as a result of the consented development was assessed as moderate in the SEI (Table 12.21) based on low adverse impact to an asset of high value. The assessment for the consented

development argued that, due to the distance of the turbines from the monument, the turbines would be likely to blend into the skyline with little impact on the setting of the monument. Dinas Camp has associative relationships to the other hillforts at MG016, MG031 and MG085, and the tip height extension would not intrude into views between these features. The tip-height extension would result in a hardly perceptible increase in the visibility of the hubs and full-length rotor blades against the skyline (see Appendix 12A.15: VP04), and therefore it is concluded that there would be no significant change to the effect from the consented development which was assessed as moderate significance, but not a significant effect..

Pen y Clun Camp (MG031)

12.24.11 Asset description: The scheduled monument comprises the remains of an Iron Age hillfort, situated on the south-east slope of Pen-y-Clun Hill which is precipitous to north and east. It covers an area c.2 acres, and the protected area includes potential features outside the defences.

12.24.12 Asset setting: The monument lies on a raised knoll to the south of the Clywedog reservoir, in rough grazing land with sparse trees and bushes (Image 12.9). The monument overlooks the reservoir, which prior to 1961 was the valley of the Clywedog River, and linked Pen y Clun with Dinas Camp (MG020), whilst on the other side of the river from Pen Y Clun another hillfort Pen y Gear (MG085) is located c.1.5km to the west. The B4518 road runs east-west to the south of the monument, whilst to the north Bryn y Fan hill partially intervenes between the monument and Carno wind farm.

Image 12.9: Pen y Gaer and Pen y Clun forts vertical Google Earth image from 2006 (Copyright 2020 Google earth imagery)

12.24.13 Comparative assessment: The potential significance of effects as a result of the consented development was assessed as moderate in the SEI (Table 12.21.) based on low adverse impact to an asset of high value. All 13 turbines would be visible from Pen y Clun, but the tip height extension would result in a barely perceptible increase in the visibility of the hubs and full-length rotor blades against the skyline (see Appendix 12A.15: VP05), and therefore it is concluded that there would be no significant change to the effect from the consented development which was assessed as moderate significance, but not a significant effect.

Pen-y-Gaer Camp (MG085)

12.24.14 Asset description: The scheduled monument comprises the remains of an Iron Age hillfort and comprises a circular enclosure on the summit of Pen y Gaer (Image 12.9). There is no sign of a surrounding ditch, but the whole summit is surrounded by a collapsed, dry-stone wall which has spread to a width of c.10-13 m and up to 0.5 m high internally, although in most places it is level with the interior. The enclosure measures c.68 m north-south internally, and 44 m east – west, enclosing an area of c. 0.3 ha. An entrance is visible in the south. There are very steep natural slopes to east and west, with more gentle approaches to north and south, defended by outworks. A modern cairn 4 m diameter x 1.4 m high occupies the highest point in the south-western corner of the enclosure.

12.24.15 Asset setting: The monument lies on a raised knoll to the south of the Clywedog, strategically placed to overlook the Clywedog River valley and ancient route connecting the mineral-rich lands to the west, with the Severn Valley. Together with Pen y Clun on the opposite side of the river, it would have controlled movement along the river valley and ridgeway routes.

12.24.16 Comparative assessment: The potential significance of effects as a result of the consented development was assessed as moderate in the SEI (Table 12.21.) based on low adverse impact to an asset of high value. Turbines 2 and 3 have hubs which theoretically would have been visible above the landform, but in reality, they would be masked by surface vegetation. Eight of the remaining turbines would be theoretically visible from Pen y Gaer (Turbines 1, 4, 10, 11, 12, 13, 14 and 15) but the tip-height extension would result in a barely perceptible increase in the visibility of the hubs and full-length rotor blades against the skyline (see Appendix 12A.15: VP02), and therefore it is concluded that there would be no significant change to the effect from consented development and the significance would remain as moderate, and so not a significant effect.

Pen y Crogben Round Barrow (MG105) and Pen y Crogben Earthwork (MG106)

12.24.17 These two scheduled monuments are treated together as an asset group, as they are located in very close proximity to one another c.4-5 km west of the proposed development (Images 12.10 and 12.11). From the barrow it is possible to look over the earthwork enclosure (Roman signal station) and see the turbines of the existing wind farms on Trannon Moor in the distance (Carno I and II).

Image 12. 10: View east looking over Pen y Crogben Round barrow and Earthwork towards Carno III and Trannon Moor (Copyright 2020 Google earth imagery)

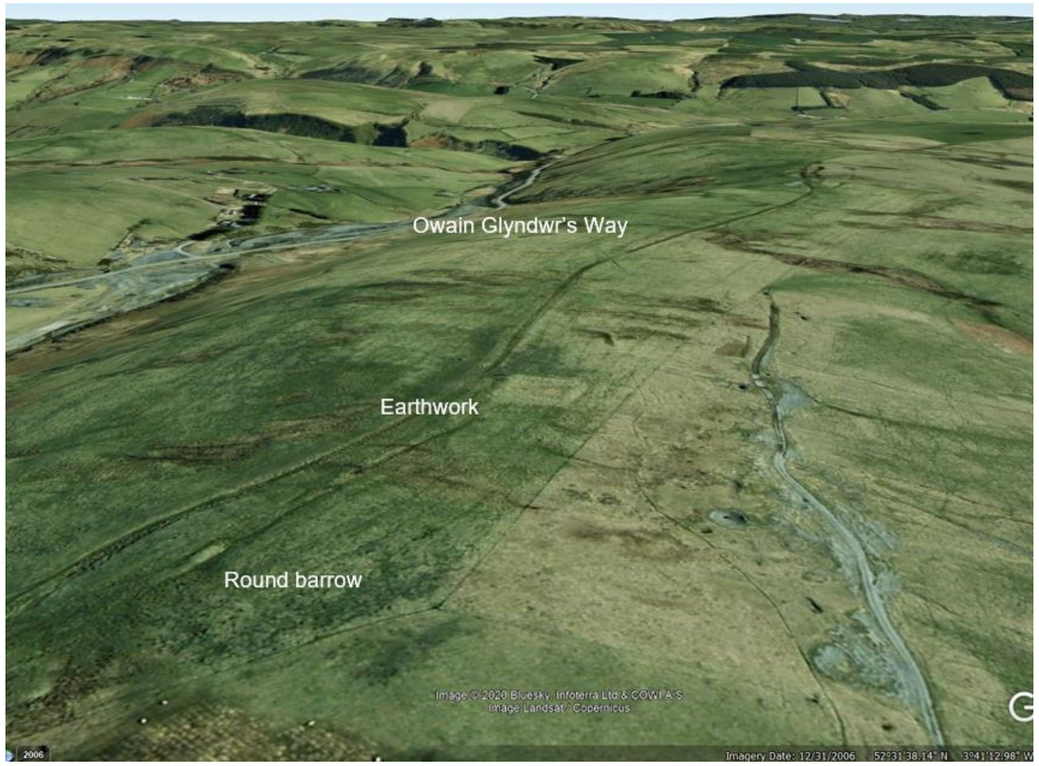
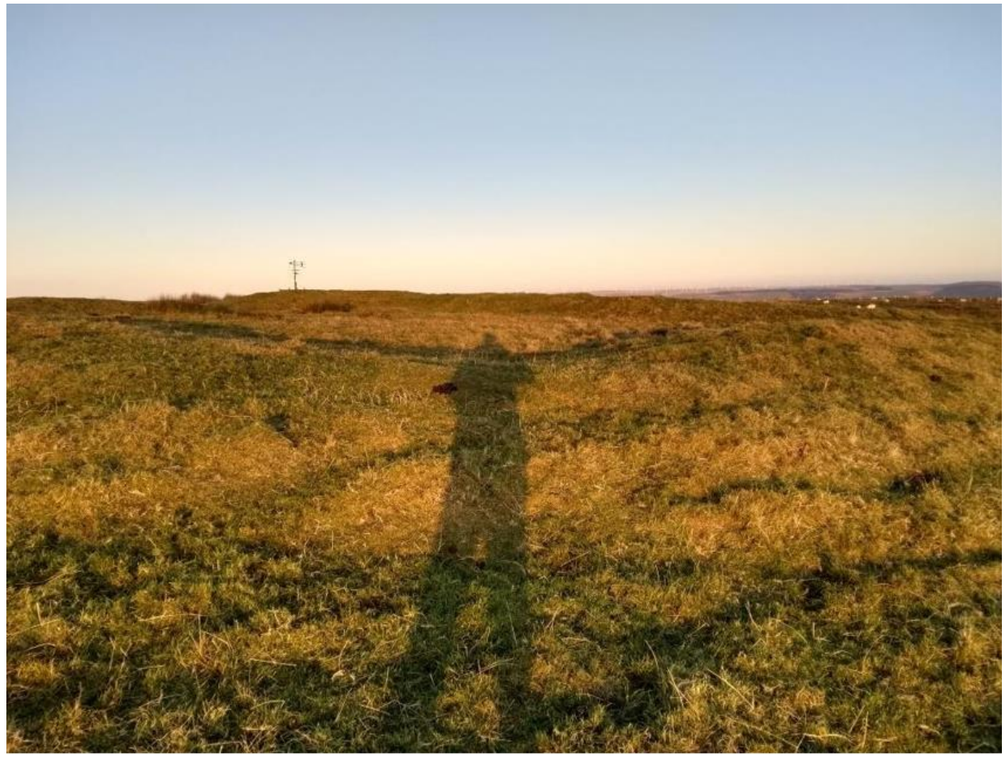


Image 12.11: View east across Pen y Crogben Round barrow to the Earthwork Enclosure, Trannon Moor in distance

12.24.18 Asset description: Pen y Crogben Enclosure (MG106) consists of a sub-rectangular turf-built bank, c.0.6 m high, c.26.5 m north - south by 23.5 m east - west, enclosing a level central area (Image 12.12). There is a single entrance in the north. Excavation in 1961 showed the interior to be covered with a layer of rough metalling and divided by a central roadway. Four large posts at the entrance way are thought to have supported a tower.

Image 12.12: Pen y Crogben Earthwork Enclosure from the south-west, with met mast in view



12.24.19 Asset description: The Round Barrow (MG105) comprises the remains of a circular rock-cut ditch c.56 m in diameter, surrounding a low mound with central hollow (Image 12.13). The monument probably originated as an earthen built round barrow, dating to the Bronze Age (c.2300 - 800 BC). However, excavation and place-name evidence also confirm its later use as a seventeenth - eighteenth century gibbet.

Image 12.13: Pen y Crogben Round Barrow looking south-west

12.24.20 Asset setting: The current setting of the monuments is within upland rough pasture, and the sites may have been disturbed through proximity to the Dyngwn/Castle Rock Lead Mine. The sites lie to the south of Dylife, a small hamlet located on the B4518. The west – east running Owain Glyndwr path lies immediately to the north, which follows an ancient routeway with which the monuments would have had a direct associative relationship. The function of both monuments was to have visibility in all directions, and for the barrow to have been visible when it was approached along the routeway.

12.24.21 Comparative assessment: The potential significance of effects for both these monuments as a result of the consented development was assessed as moderate in the SEI (Table 12.21.) based on low adverse impact to an asset of high value. In fact, very few of the consented turbine hubs and full-length rotor blades would be visible from the barrow (see Appendix 12A.15: VP06), with Turbine 8 slightly more visible than Turbine 1 which would theoretically just lie above the landform, and Turbine 5 would be on the edge of the landform. The tip-height extension would make these turbines marginally more visible, but not sufficient to increase the significance of effect from moderate. From the earthwork enclosure all 13 turbine hubs and blades were visible for the consented development, and the tip height extension would make the closest turbines more obviously visible against the skyline (especially Turbines 5, 6 and 8), whilst for the remaining turbines the change would range from slightly to barely perceptible. Overall it is concluded that there would be insufficient change from the consented development due to the tip-height extension, to increase beyond a moderate significance, and therefore not a significant effect.

12.25 ACCESS TRACK

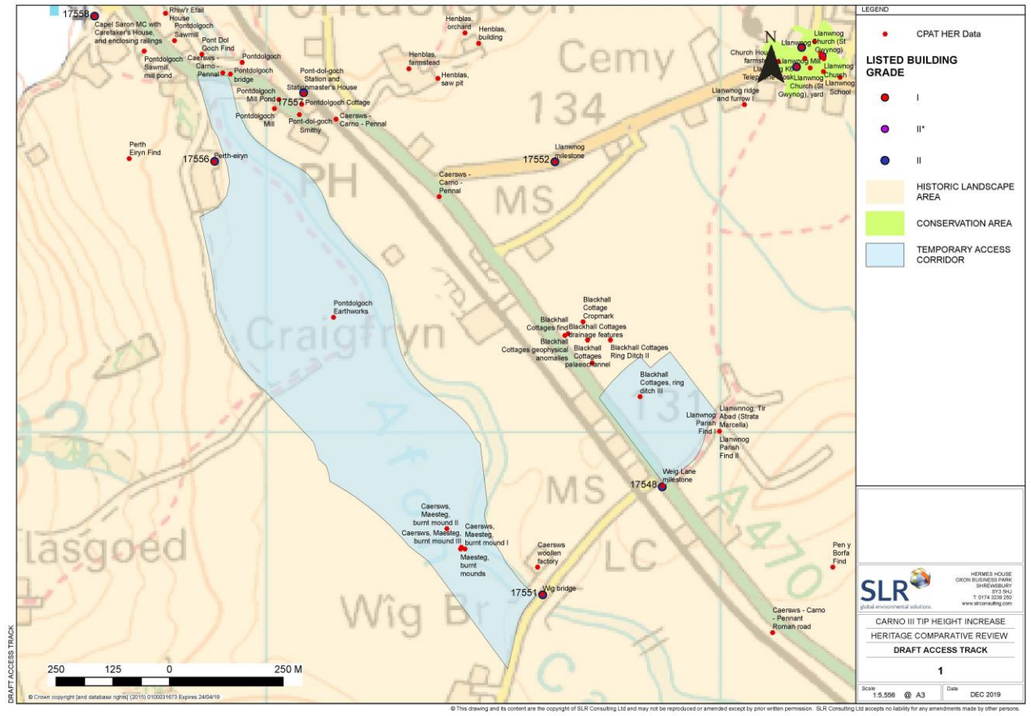
Historic Environment & Potential Impacts from Track Construction

12.25.1 Transporting the component parts of the turbines including the blades for the proposed development, would largely make use of the same route proposed in the ES and SEI utilising existing roads and tracks, however due to the larger blades proposed a short section of an alternative route is proposed to avoid the railway bridge on the A470 at Pontdolgoch. There is a sharp bend beneath a railway bridge, which would be impossible for the large blades to safely navigate underneath. Therefore an alternative route is proposed (called the 'Access Track') to exit the main road at Wig Lane south of Pontdolgoch using a temporary metal trackway so that abnormal indivisible loads (AILs) can park until safe to cross the A470 and the railway, before travelling along Wig Lane over the River Carno, and then entering a new permanent access track that runs through fields on the west side of the river, before re-joining the A470 just north of Perth Eiryn property (Appendix 12A.16, Figures 13.4, 12.38 and 12.39 in Volume 2 of the FEI).

12.25.2 Cadw's online data for designated historic assets identifies nine listed buildings which might be indirectly affected through factors such as visual change, noise or vibration (Figure 12.38), and as a consequence designated historic assets such as Grade II Listed Buildings, (17548 Milestone, 17551 Wig Bridge, 17556 Perth Eiryn farmhouse) in closest proximity to the alternative route and access track have been assessed. A thorough examination of The Historic Environment Record provided by CPAT, allowed assessment of potential direct impacts and the potential for unknown buried archaeology within the route corridor prior to final decision on the route alignment within the option areas (Image 12.14 represents the initial route corridor – also shown in full in the scoping report Appendix 4.1).

12.25.3 Once constructed the main access track would remain in situ during the operational period, should there be a need for replacement blades to be transported to site. All other maintenance traffic would use the main road. As discussed above, on the east side of the A470 a temporary turning area is necessary for the transporters to access Wig Lane from the main road. This would comprise an aluminium laydown track, which would be removed after construction, and temporarily replaced if and when new blades were required for the site. The aluminium temporary road surface would simply be placed on the ground with some modifications to the exit and entry point from the tarmacked A470 points (see Section 13 for further details), therefore impacts are expected to be minimal for this parcel of land east of the main road.

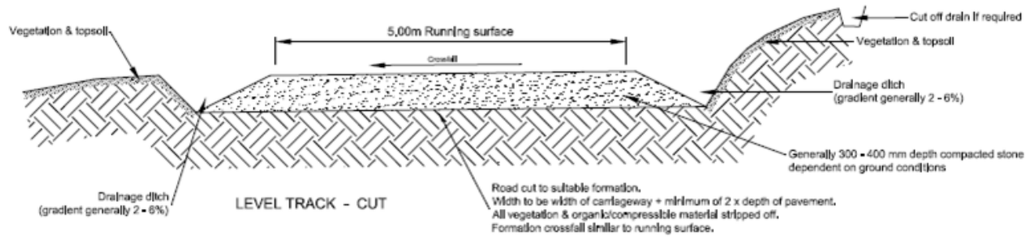
Image 12.14: Historic assets in close proximity to the search area for the Access Track



12.25.4 The general access track design for the permanent track would be similar in nature to what is proposed for the wind farm access tracks, as originally indicated in the 2010 ES, and duplicated in Image 12.15. In essence it would comprise a road c.5 m in width, with a hard core foundation of up to 400 mm. The foundation would be set within a cut that removes all organic matter or soft material, up to c.300 mm depth. At a distance of c.2.5 m either side there might need to be drainage areas, such as swales or trackside drainage. As these ground-works could have a direct physical impact to buried archaeological remains it has been necessary to assess the known, and potential for previously unknown, remains along the route so an appropriate mitigation strategy can be designed.

12.25.5 As per Figure 13.4 in Volume 2 of the FEI, sections of the access track are existing with some upgrade required, as indicated by hatched area on the figure, therefore further minimising the potential impact of this route.

Image 12.15: Schematic cross-section of access track construction



Baseline Survey

12.25.6 There are 17 listed buildings of which two are Grade II* and 15 Grade II, as well as the conservation area of Llanwnog, within a 2.5 km search area (Appendix 12A.17 and Figure 12.38 in Volume 2 of the FEI).

12.25.7 Within the 2.5 km search area of the access corridor there are 226 HER sites, as well as eight scheduled monuments, all relating to Roman camp activity (Appendix 12A.17 and Figure 12.39 in Volume 2 of the FEI). These assets help provide an understanding of the type and density of archaeological remains within the search area and help predict the potential probability for unknown assets to lie within the access track route, which would be susceptible to damage. Specifically, there are three main zones of activity related to non-designated historic assets which might experience direct (physical) impacts from the access track construction and these are briefly discussed below.

Burnt Mounds (72248, 110491, 110492, 110375)

12.25.8 Burnt Mounds are a prehistoric phenomenon of mainly Bronze Age attribution but can range from the Neolithic to the Iron Age. The main element of a Burnt Mound is that water is heated within the inner trough. There is substantial evidence for thermal shock due to shattered stones indicating that the rocks were dropped into the hot water to create steam, and it is the remains from this activity which have given rise to the term “Burnt Mound”. There are many different interpretations given for a Burnt Mound ranging from cooking and saunas to ritual connotations. Regardless of their actual function they are a direct indication of Bronze Age activity in the area.

12.25.9 The burnt mounds within the access track corridor were monitored in 1998 for a gas pipeline (Figure 12.40 in Volume 2 of the FEI). The sites were not destroyed through the pipeline works, however, other smaller mounds were uncovered by it and as these did not hold the correct materials associated with Burnt Mounds such as high charcoal deposits, and as the dimensions were smaller, they were interpreted as fire pits rather than burnt mounds.

Medieval field system (7092)

12.25.10 Medieval field system is a complex of adjoining linear cropmarks and earthworks, probably field boundaries. The access track runs through these and would have a direct impact on the remains. The definite function and significance of these remains are unclear, and some form of site investigation would help to clarify the nature of this archaeological site (Image 12.16) (see Paragraph 12.25.20 below).

Image 12.16: Aerial Photograph showing earthwork remains within the field bordering the Carno River (CPAT HER)

Title : PONTDOLGOCH
Showing : EARTHWORK ?;ENCLOSURE ?
Filename : CPAT/85-023-0022.jpg

Blackhall Cottages, ring ditch (142539)

12.25.11 The Blackhall Cottages ring ditch was identified in 2016 through aerial photography, with a potential central pit or grave. This is likely a potential Bronze Age barrow or alternatively a round house. Bronze Age barrows are funerary monuments and often found near to watercourses or along watersheds on the crest of hills. Alternatively, if the site is a round house it would be in accord with the domestication in the area discussed as fire pits within the corridor (72248). In this interpretation, the central pit could potentially be a hearth with the internal postholes ploughed out.

Potential Impacts and Mitigation within the Access Track Corridor: Designated Historic Assets

Milestone south of Wig Lane (17548) Grade II

12.25.12 The Milestone is a standard sandstone pillar indicating the Newtown to Machynlleth road (now the A470). The Newtown to Machynlleth road was managed by the First Division Turnpike Trust, established in 1779. This section of the turnpike road appears to have been marked out with mile stones after the alteration of the route from Aberhafesp to that through Caersws.

12.25.13 Although not on the route of the access track, the milestone is close proximity to the existing road (in the verge) and a direct threat to the monument is posed from accidental damage. It is advised that mitigation of the asset would be through fencing it off during the turbine deliveries with clear signage in order to protect the monument.

Wig Bridge Grade II (17551)

12.25.14 The bridge is made of squared and coursed rubble, dating to 1847 (Images 12.17 and 12.18). The bridge is a Grade II Listed Building to the south of the proposed access track, and the AILs would need to drive over it to reach the access track. A condition survey by structural engineers would be undertaken to advise the strength of the extant bridge assumed to be as part of a planning condition, but the fact that it already takes heavy agricultural loads makes the case for its use a viable option. Mitigation for the asset would be via clear marking out, and monitoring, to ensure potential damage to the structure would be avoided.

Image 12.17: Wig Bridge looking west

Image 12.18: Wig Bridge arch structure looking east

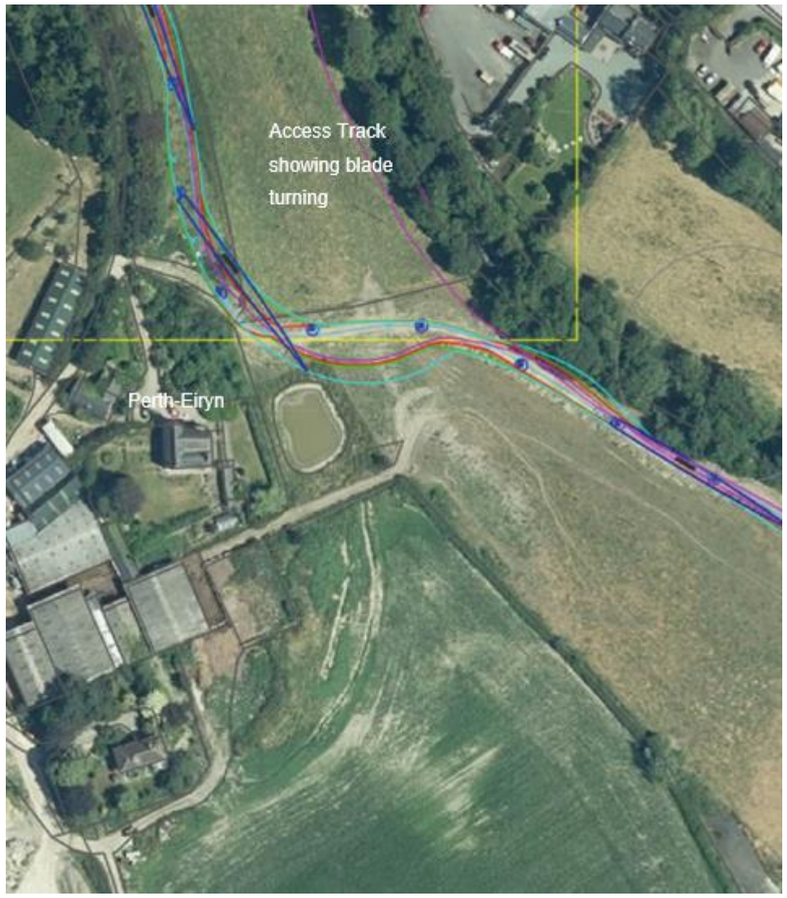
Perth-Eiryn (17556)

12.25.15 A timber framed farmhouse dating to the 17th Century (Image 12.19). The house has been owned by many renowned people, such as the family of Lewis Price family descendants of Blaenau of Gregynog and David Davies MP in 1875.

12.25.16 As shown in Image 12.20 the asset would be avoided by construction traffic. Although there would be visual change and noise from the construction of the access track (which does utilise an existing farm track in the vicinity of the farmhouse) and passing AILs in close proximity, this would only be for a short period of approximately 3 months, and it is not considered that such a temporary impact would result in any significant adverse effect to the listed building or its setting.

Image 12.19: Perth Eiryn listed building east face showing fine timber-frame construction

Image 12.20: Detailed aerial view showing Access Track in relation to listed building at Perth-Eiryn



Potential Impacts and Mitigation within the Access Corridor: Non-designated Historic Assets

Blackhall Cottages, ring ditch (142539)

12.25.17 Construction activities would include ground disturbance which would cause physical damage to any buried remains. Existing information is poor, so that the exact nature of the archaeological remains need clarification before their significance can be fully appreciated, however, we should assume that the significance could be high due to potential for human remains contained within a burial monument. This might represent a funerary monument, but it could also relate to a domestic structure, of Bronze Age or possibly later date, and as an asset of medium significance but with a potential high adverse impact, the effect would be moderate. Prior investigation or an archaeological watching brief of this ring ditch during

construction is recommended as mitigation, and micrositing could be adopted to avoid harm once the full extent of the monument has been established so the effect would not be significant.

Burnt Mounds (72248, 110491, 110492, 110375)

12.25.18 The access track would be constructed through a landscape with partially identified archaeological activity, and there is a high chance that construction groundworks could cause physical damage to buried archaeological remains. Burnt mounds generally have a local significance, but depending on how well preserved they are, this significance could be higher. Even if considered of local significance, however, the potential impact from groundworks would be high, resulting in a moderate effect. Prior investigation or archaeological monitoring during construction is recommended so that an appropriate investigation of any remains discovered allows the damaged archaeology to be recorded accurately for posterity, which would make the residual impact a not significant effect.

Medieval field system (7092)

12.25.19 The earthworks and buried archaeological remains within this field system are poorly understood, and of uncertain date. The access track would cross these remains and construction activity is likely to cause some damage to them, and as medium significance with a high adverse impact, the effect would be moderate. An investigation prior to or during construction would enable an enhanced record of these remains to be achieved, and appropriately mitigate the degree of likely damage, which would make the residual impact a not significant effect.

Potential for Unknown Archaeology

12.25.20 The potential for unknown archaeology is assessed through looking at the HER within the 2.5 km search area for the access track (Appendix 12A.18 and Figure 12.39). There are four find spots which have been categorised as Neolithic in date as well as two crop mark features (4578, 72248) which could potentially date to the Neolithic. There are 13 cropmark features which are described as Bronze Age burnt mounds, round barrows or ring ditches, and six Iron Age hillforts within the 2.5 km search area. Also, within the search area there are 51 Roman features detailed on the HER, and 15 medieval sites, plus 73 post-medieval sites.

12.25.21 Based on the archaeological evidence within the search area, as well as the likely direct impacts, the probability of discovering previously unknown prehistoric remains is high. Prior archaeological site investigation or an archaeological monitoring exercise along the access track route, is considered to be appropriate mitigation.

12.25.22 Based on the archaeological evidence within the search area the probability of Roman and medieval, and post-medieval sites to be impacted is moderate. Prior archaeological site investigation or an archaeological monitoring exercise along the access track route, should be appropriate mitigation to minimise any risks to buried remains.

12.26 CONCLUSIONS

12.26.1 The assessments for the tip height extension compared to the consented development, and for potential impacts from the access track, have been undertaken using relevant guidance and professional judgement. In accordance with Planning Policy Wales, the assessment undertaken and reported in this section has been designed as a proportionate approach to compare the consented development with the potential effects from the proposed tip height extension.

12.26.2 Scoping identified those heritage assets that were most likely to experience any significant effect from the tip height extension, comprising a single listed building and six scheduled monuments. Comparative wireline modelling of the consented turbines and their proposed extended tip height has been completed for each of the seven designated historic assets assessed. In addition, a site visit was undertaken to those assets on publicly accessible land and which required surface inspection, to understand the asset in their setting and to what degree the proposed higher turbines would change that setting. In summary, the assessment concludes that for the tip height extension there would be no significant change from the effects already identified for the consented development.

12.26.3 The access track would pass over and near to several listed buildings, including Wig Bridge, a milestone, and Perth-Eiryn farmhouse. The construction and operation of the track would result in some change to the existing visual and acoustic baseline setting, but construction and initial use of this would be of a temporary nature. Such change is not assessed as significant.

12.26.4 The weight and length of the AILs have been assessed in respect to the structural robustness of Wig Bridge which already carries heavy agricultural vehicles, and there is no expected additional load that would damage the structure of the bridge through vehicle weight, width, turning, or vibration. Therefore, no significant effect would occur. In addition, it is expected that a planning condition will ensure that a pre-construction survey of this bridge is to be undertaken prior to its use for AILs.

12.26.5 Construction of the access track has a moderate – high probability of disturbance to buried archaeological remains. The potential impact would be high adverse on assets of local importance, and if remains were found application of the matrix in Table 12.8 equates to a moderate effect. Mitigation to minimise this risk in the form of archaeological investigation and recording, however, would adequately compensate for the potential harm to the assets as it provides an opportunity to learn more about their significance and the residual effect would not be significant.

12.26.6 In conclusion the updated assessment concludes that no additional significant effects have been identified as a result of the proposed tip height extension, over and above the significant effects previously identified for the consented development. In addition, the potential for direct impacts along the route of the access track have been assessed, and overall there are no significant effects to the historic environment once the proposed mitigation measures have been implemented.

Section 13

Traffic Assessment

CONTENTS

13.8 INTRODUCTION

13.8.1 An original Environmental Statement (ES) was submitted for the Carno Wind Farm extension Phase III in July 2010 and consisted of 18 turbines. Supplementary Environmental Information (SEI) was submitted in July 2015 which considered the impact of reducing the number of turbines to 13. In May 2017 consent was granted for the 13 turbines extension with a maximum tip height of 126.5 m.

13.8.2 This section of the Further Environmental Information (FEI) supplements the original Traffic Assessment Section of the 2010 ES and the 2015 SEI. The objective of this section is to assess the impact of the increase in turbine size on the public road network, including physical constraints through an updated access route assessment, management of construction traffic through an updated preliminary Traffic Management Plan, and impact on existing traffic levels through an updated Traffic Impact Assessment. The updated assessment undertaken for the FEI, as detailed within this chapter, demonstrates the average daily movements assessed in the original ES and SEI has been reduced, and is considered worst case scenario assessment in terms of significance for the Carno III Wind Farm tip height extension (also referred to as the proposed development). The predicted vehicle movements during the construction programme have been amended to reflect the increased construction period from 11 months reported in the SEI based on the 13 turbine consented development, to potentially 15 months; this increase remains less than the 16 months reported in the original ES programme based on the original 18 turbine proposal.

13.8.3 When taking account of the general upward trend in traffic levels across Wales, as forecast in the *Department for Transport Road Traffic Forecasts 2018*, we would likely see a reduction in traffic impact associated with the proposed wind farm due to the higher levels of baseline traffic, including HGV traffic, expected at the time of construction.

13.8.4 The transport and traffic issues described in the following planning advice and guidance documents have been taken into account in this assessment:

- Planning Policy Wales Technical Advice Note 18. Transport (2007), Welsh Government;
- Strategic Traffic Management Plan for Mid Wales Wind Farms (2012): RenewableUK Cymru;
- Guidelines for the Environmental Assessment of Road Traffic (1993), Institute of Environmental Assessment (IEA);

13.9 CONSULTATION

13.9.1 Further to the scoping responses detailed in Appendix 4 of this FEI, below is a table of additional consultation held with regards to the Traffic Assessment.

Table 13.10: Consultation

Consultee/subject	Response/Discussion	Actions
Powys County Council		
Transport	Agreement with Powys County Council that specific project details not currently available e.g. vehicle types, axle loadings etc would be provided at pre-construction stage and form part of the planning conditions.	Provide 'typical' information as part of the planning submission.

13.10 BASELINE CONDITIONS

13.10.1 Data for the baseline counts on the A489 and A470 for the FEI was taken from the Department for Transport (DfT) website based upon estimated counts for 2018, which is the most up to date data currently available. The data used represents the closest traffic count locations at Caersws (A470/A489) and Carno (A470) to that originally undertaken for the Carno 3 consented development.

13.10.2 Traffic flows for the C2176 (from Carno village to site) and C2068 (Wig lane) were not included in the assessment for the consented development. Data for the C2176 and C2068 is unavailable from the Department for Transport website. The FEI assessment has been undertaken during the COVID-19 pandemic, as a result traffic counts are not able to be commissioned, nor would the results be accurate due to lockdown measures in place and significant reduction in traffic flows.

13.10.3 Due to the classification of the C2176 road and nature of the surrounding dwellings i.e. working farms and residential houses, we understand that there will be a mixture of Heavy Goods Vehicles (HGV), Light Goods Vehicles (LGV) and light traffic using the route, however, traffic flows are likely to be relatively low and mainly serving the existing windfarms of Carno 1 and Carno 2. Therefore, during the construction period of the wind farm, it is anticipated that there will be a temporarily significant impact on the C2176, as is typical for minor roads at this phase of a wind farm development. This is no greater impact than for the consented development or that whilst construction the existing sites. Appropriate measures will be put in place in accordance with an approved Traffic Management Plan (TMP) to reduce the temporary impact caused by construction of the proposed development and will include correspondence with the local residents by Amegni Renewables. Draft TMP can be found in Appendix 13 of this FEI.

13.10.4 The use of a short section of the C2068 will be restricted to abnormal load and associated escort vehicles delivery only. All other construction traffic will not be permitted to use this route and will use the A470, as such it is anticipated that there will be a low temporary impact during the scheduled delivery period and

therefore Not Significant. To ensure the impact to other road users is kept to a minimum, the delivery of abnormal loads will be managed through an approved Traffic Management Plan.

13.10.5 To facilitate delivery of the Abnormal Indivisible Loads to the wind farm, a new track will be constructed over private land at Pontdolgoch, this will be approximately 1.4km in length. Due to the scale of these enabling works required by this scheme, along with the assumption that material required for these will be imported, the traffic movements anticipated for these have been included in the assessment to assess their impact.

13.10.6 Table 13.11 shows the updated average daily flows and estimated HGV traffic for the A470 and A489. These flows indicate an increase in both the baseline Total Traffic flow and HGV movements from that used as baseline flows in the consented ES Table 13.3.

Table 13.11: Annual Average Traffic Flows for the A470 and A489

	Figures in 2010 ES (Table 13.3)		**Current FEI Assessment (2018 Data)**	
	Annual Average Daily Traffic (Total Traffic)	**Annual Average daily Traffic (HGV Traffic)**	**Annual Average Daily Traffic (Total Traffic)**	**Annual Average daily Traffic (HGV Traffic)**
A470 South of Carno	2601	250	3761	476
A489 West of Newtown (ES data was previously assessed at Caersws A470 / A489)	4972	438	7915	709

13.11 PREDICTED VEHICLE MOVEMENTS

13.11.1 The main element which has resulted in an increase to predicted traffic numbers from those assessed in previous submissions, is the increased turbine foundation size requirements for the larger turbines proposed. As a result of the required increase in foundation size, it is expected that the number of concrete and steel reinforcement deliveries will be higher than previously predicted.

13.11.2 The increase to foundation size results in an increase to the predicted construction programme for these elements. Combined with the current restrictions on AIL delivery convoys which has increased the expected delivery programme, the construction period is now indicatively 15 months. An increase from the 11 months proposed in the SEI but a reduction from the 16 months originally proposed by the development.

13.11.3 The traffic numbers are spread over the increased construction period resulting in the maximum predicted vehicle movements during a single month being less than that indicated in the original ES and SEI.

13.11.4 Table 13.4 presented in the ES contained the predicted vehicle movements within the construction period for the original 18 turbine scheme and Table 13.9 in the SEI was based on the consented 13 turbine development. This has been updated in Table 13.12 within the FEI to reflect the changes to turbine tip height and construction period.

Table 13.12: Predicted Vehicle Movements

Activity	Month																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Heavy Goods Vehicles Movements (including abnormal loads)																			
Mobilisation to site	60																		60
Offsite AIL Enabling Works	100	100	100	100	90	60	60												610
Access / site tracks and crane pads			It is assumed that on-site borrow pits will be utilised, therefore no movements on to the public roads																0
Crane Hard-Standing																			0
Turbine foundations (Readymixed Concrete)				420	420	420	420	420	420	420	414								3354
Substation			20	20	20	20	20	20											120
Cabling						180	180	180	180	176									896
Turbine transformers								8	10	8									26
Turbine deliveries									74	96	96	96	94						456
Demob / Site clearance														30	30				60
Monthly Totals (Ready mixed concrete)	**160**	**100**	**120**	**540**	**530**	**680**	**680**	**628**	**684**	**700**	**510**	**96**	**94**	**30**	30	0	0	0	**5582**
Light Vehicle Movements (car, minibuses and small van deliveries)																			
	433	650	867	866	866	866	866	866	866	866	866	866	434	434	432				11044
Monthly Totals (Readymixed Concrete)	593	750	987	1406	1396	1546	1546	1494	1550	1566	1376	962	528	464	462	0	0	0	16626
Average Daily Movements (assumes 5 working days per week)	27.0	34.1	44.9	63.9	63.5	70.3	70.3	67.9	70.5	71.2	62.5	43.7	24.0	21.1	21.0	0.0	0.0	0.0	
Average Daily HGV Movements (assumes 5 working days per week)	7.3	4.5	5.5	24.5	24.1	30.9	30.9	28.5	31.1	31.8	23.2	4.4	4.3	1.4	1.4	0.0	0.0	0.0	

13.11.5 Table 13.13 shows the predicted increase based upon assessing the estimated busiest construction month.

Table 13.13: Estimated traffic increase for the busiest construction month (month 10)

Description of location	Annual Average Daily Traffic (Total Traffic)	Annual Average Daily Traffic Increased Flow (Total Traffic)	Annual Average Daily Traffic (Total Traffic) - % increase	Annual Average Daily Traffic (HGV Traffic)	Annual Average Daily Traffic Increased Flow (HGV Traffic)	Annual Average Daily Traffic (HGV Traffic) - % increase
A489 West of Newtown	7915	7987	0.9%	709	741	4.7%
A470 South of Carno	3761	3833	1.9%	476	508	6.9%

13.11.6 As shown in Table 13.12, increasing the tip height of the turbines will increase the total number of vehicles over the lifespan of the project relative to the SEI, however the relative impact on baseline traffic will be less than the findings presented within the original 2010 ES or 2015 SEI.

13.11.7 These updated findings do not alter the conclusion of the consented project, and as shown, the increase for both HGV and 'Total Traffic' falls well below the thresholds set out in the Institute of Environmental Assessment (IEA) Guidelines. As such, it is considered that the impact on the A489 and A470 from the proposed development is Not Significant.

13.12 AIL ACCESS ASSESSMENT

13.12.1 The abnormal route will continue to follow the majority of the route previously identified in the ES and SEI, with the addition of the use of the newly constructed Newtown bypass (avoiding passage through Newtown), and a diversion on to 3rd party private land, via a field off the A470 and Wig Lane, to avoid the restrictions at Pontdolgoch railway bridge (see Figure 13.4). An Access Assessment, including swept path analysis of the route, has been undertaken for the abnormal load route based on turbine candidate that fits the tip height criteria. This identified pinch points and details of any upgrade requirements and deviations to the originally suggested route. The Access Assessment report is included in Appendix 13.

13.13 EMBEDDED BEST PRACTICE

13.13.1 Although the impact during construction is Not Significant for the A489 and A470, as these are the roads that will be utilised most by other road users it is important to keep local residents and people visiting the area informed of potential traffic issues that may delay or otherwise affect their journey. Typically, the slower turbine delivery vehicles would have the largest effect on other road users on these major routes. The temporary impact on the minor roads is likely to affect a smaller number of people, however the relative impact will be greater for that period of time. Therefore, the Traffic Management Plan presented in Appendix 13 should be developed and secured through an appropriate planning condition to ensure any impact is minimised as low as reasonably practicable.

Section 14

Existing Infrastructure

CONTENTS

14.10 INTRODUCTION

14.10.1 This FEI section outlines the proposed changes as a result of the increase in tip height on public rights of way within close proximity to site infrastructure, including any mitigation proposed.

14.10.2 Consultation was undertaken between the developer, Natural Power Consultants and Powys County Council Public Rights of Way (PROW) officers which resulted in an agreed scope for this FEI section. The consultation can be found in Appendix 4 within Volume 1 of the FEI.

14.11 TRAILS AND PATHS

Public Rights of Way

14.11.1 A number of public rights of way (PROW) cross the Carno III proposed development. These are shown on Figure 14.4 within Volume 2 of the FEI.

14.11.2 As noted in the scoping report (Section 4.10, found in Appendix 4 of this FEI), there are four turbines that do not meet the tip height setback distance (of 149.9 m) or recommended 200 m setback from a bridleway, which is the standard setback distances recommended. Amegni Renewables has committed to funding improvement works to PROW in the vicinity of the wind farm, reinstatement of PROW during construction, construction of a car park, and creation of alternative bridleway route (as mitigation for proximity to T12) and PROW permissive route from the new car park.

14.11.3 The construction of the new access route to avoid Bont Dolgoch Bridge (as discussed in Section 13 of the FEI) it will potentially be affecting the public footpath (25 Caersws). The proposed route crosses this at one point, as well as running adjacent to the track for a length of it.

Consultation

14.11.4 In response to the scoping opinion received by Powys County Council on 2nd January 2020 an email was submitted to Ms Sian Barnes, Professional Lead, Countryside Access and Recreation (dated 28th April 2020) summarising the current situation regarding PROW and our proposal in safeguarding PROW

14.11.5 The email noted, that as per planning condition 41 of the consent a Rights of Way Management Plan will be submitted and approved by Powys County Council which will include detail of the way public access will be managed during construction, and its safeguarding for the life of the development. Although the permission for construction of this access track to divert around Bont Dolgoch Bridge will be via a separate planning application (as it is outside the current Carno III planning application boundary) a similar planning condition to planning condition 41 is expected to provide details for the management of this footpath and its safeguarding. It is expected that the footpath will be managed during construction based on the following (as relayed in an email to Powys County Council dated 28th April 2020):

- Installation of barriers/fencing between the footpath and access track to segregate pedestrians from construction works and construction traffic where the access track runs parallel to the footpath.
- Provide information signage on the footpath to warn members of the public to be aware of the construction works and traffic.
- Brief site staff (via site induction, Risk Assessment Method Statement, and toolbox talks) on the interface with the footpath, and the need to be vigilant during works in this area and respect the segregation installed, and to adhere to site rules including speed limits.
- Installation of signage to warn site personnel of the presence of the footpath and members of the public.
- Where the footpath is to cross the access track, a temporary footpath closure may be required during construction of this section of access track (c. 1 day anticipated), which would be applied for via Temporary Traffic Restriction Order (TTRO). Closure time would be minimised as far as possible and works programmed to have as little impact on use of the footpath as possible.
- The crossing point would be barriered and clearly signed to inform pedestrians that they are about to cross a live track used by construction vehicles, and to inform construction traffic that pedestrians may be crossing. A site wide speed limit for construction traffic will also be implemented and enforced, and this could be reduced in the vicinity of the crossing point if required.
- During turbine deliveries, abnormal load vehicles would be escorted, and escort drivers briefed to be aware and manage the interface with the footpath and members of the public.

14.11.6 A video call was held on 7th May 2020 to further discuss the proposed development. This resulted in agreement on suitable further mitigation to minimise the impact of the taller turbines on PROW users by offering the following proposed routes as shown on Figure 14.4 within the FEI (that was submitted to Powys County Council via email 20th May 2020):

- Alternative footpath route to avoid having to be less than topple distance to T14 – this would be located along the fence line.
- Permissive footpath route along existing access track to avoid having to be less than topple distance to T13.
- Permissive footpath route along existing access track to avoid having to be less than topple distance to T15.

14.11.7 Powys County Council confirmed via email dated 27th May 2020 that they were content with the additional paths and also the proposed management of the footpath which will be affected by the proposed new access route avoiding Pont Dolgoch. All correspondence can be found in Appendix 4 of this FEI.

National Trail and National Cycle Route

14.11.8 As noted in the scoping report, as it isn't considered that the increase in tip height extension would change the outcome from the original assessment, national trail and national cycle routes were successfully scoped out of the FEI and not discussed further in this section.

14.12 OTHER EXISTING INFRASTRUCTURE

14.12.1 With regards to aviation, mitigation was already proposed in the ES and SEI and as the proposed development does not exceed the 150 m threshold for other aviation lighting requirements this was scoped out of the FEI as per scoping report Paragraph 4.10.4 and is not discussed further,

14.12.2 With regards to TV transmission network and communication links, it is not expected that a 23.4 m increase in tip height will alter the findings in the original assessment and therefore was scoped out of the FEI and is not discussed further.

14.13 CONCLUSION

14.13.1 Powys County Council are in agreement with the additional mitigation proposed to mitigate against impact of the proposed tip height extension on public rights of way. This includes construction of additional permissive paths to mitigate the taller turbines proposed on site, and that the management of the footpath near Bont Dolgoch would be covered by a suitably worded planning condition, similar to planning condition 41 of the existing consent.

Section 15

Summary, Residual Effects and Mitigation

CONTENTS

15.6 INTRODUCTION

15.6.1 This section summarises the findings of the Environmental Impact Assessment (EIA) presented in this Further Environmental Information (FEI) report and considers the material changes between the consented 13 turbine 126.5 m to tip and the proposed 149.9 m to tip wind farm. This section also includes a summary of the residual effects of the proposed Carno III Tip Height Extension (known here after as proposed development).

15.6.2 As part of the scoping process discussed in Section 1 of this FEI the following disciplines were scoped out, including

- Needs and Benefits;
- Site Selection, Site Design & Approach to EIA;
- Planning Policy;
- Socio-economics and Tourism; and
- Shadow Flicker.

15.6.3 As well as providing a description of the proposed development the FEI also includes the following assessments;

- Landscape and Visual;
- Hydrology, Hydrogeology and Geology;
- Ecology;
- Noise;
- Forestry;
- Cultural Heritage;
- Traffic and Transport; and
- Existing Infrastructure.

15.7 SUMMARY OF ASSESSMENT

Introductory

Project Description (Section 4)

15.7.1 Section 4 outlines the detail of the changes from the original consented development to the proposed development.

15.7.2 Formal scoping and discussions took place with statutory consultees including Powys County Council (PCC), Natural Resources Wales (NRW, Welsh Government (WG) and Cadw amongst others to agree the scope for FEI. Scoping responses received in relation to the proposed development are set out in Appendix 4.

15.7.3 The proposed changes for the tip height extension which is considered as part of a Section 73 application of the Town and Country Planning (Wales) 1990 Act include:

- Increase in tip height of the turbines from 126.5 m to 149.9 m;
- Increase in height of anemometer mast from 80 m to 90 m;
- Increase in area for crane hardstandings from (40 m x 20 m) to (70 m x 50 m);
- Increase in turbine foundations from 18 m wide base, to 28 m; and
- Some additional widening works to the on-site access tracks

15.7.4 In addition, the following proposed changes are included as part of a separate Town and County Planning Act application:

- Creation of new access track at Pontdolgoch approximately 1,546 m length for use of Abnormal Indivisible Loads.
- Further modifications to route from Carno village to site to accommodate larger turbines.

15.7.5 The access modifications listed, although subject to a separate application and not the Section 73 application, they have been considered in this FEI as they are associated with the wind farm and therefore assessed in this updated EIA.

15.7.6 An alternative off-site grid connection is also proposed and because of the nature of the works required this was scoped out of the FEI.

Biological Environment

Ecology Assessment (Section 9)

15.7.7 Section 9 of the FEI contains assessment of the potential additional ecological effects associated with the proposed development.

15.7.8 The assessment was designed to identify valued ecological receptors (i.e. species and habitats associated with the proposed development that might be affected by the tip height extension. The ecological assessment was carried out on the understanding that recommendations regarding species and habitats will be incorporated into the updated project design, construction and operation of the wind farm.

15.7.9 The changes in the impact upon ecological features as a result of the tip height extension compared to the consented development are minimal.

15.7.10 There are no significant impacts anticipated on sensitive habitats.

15.7.11 In terms of ornithological receptors, no additional impacts are anticipated, and the tip height extension has not resulted in significant impacts on any bird species. The conclusions that applied to the consented development presented within the ES and SEI remain the same, even in light of changes in guidance and assessment.

15.7.12 In terms of bats, consideration is focussed on changes in operational impact, as there is no change to the potential impact on bats during construction. The conclusions that applied to the consented development presented within the ES and SEI remain the same, even in light of changes to guidance and assessment, and no significant effects are expected following mitigation.

15.7.13 In relation to ecological interests the assessment concludes that the proposal for increased tip height will not create any significant effects, as was the conclusions for the consented development.

Physical Environment

Landscape and Visual Assessment (LVIA) (Section 6)

15.7.14 Section 6 of the FEI examines the landscape and visual effects that would arise as a result of the tip height extension. This concluded that the larger turbines are not predicted to give rise to any higher levels of significance of effect than the consented turbines. The only exception would be the short term significant visual effects on residents caused by the access track proposals at Bontdolgoch during the construction period which is considered via a separate Town and Country Planning application and not directly considered as part of the Section 73 application

15.7.15 The Landscape and Visual Impact Assessment (LVIA) takes account of the effects of the proposed development on the landscape within and outside of the proposed site. The study area for the assessment was based on a 15 km offset in each direction from the outermost turbines, as agreed with the relevant consultees as part of the scoping process. Viewpoints, study area and scope of potential cumulative impacts were chosen in consultation with consultees.

15.7.16 The Zone of Theoretical visibility (ZTV) (refer to Figure 6.29a) illustrates only a number of limited areas of additional visibility within the 15 km study area (35 km extent shown for context) as a result of an increase in blade tip height from 126.5 m to 149.9 m.

15.7.17 When considering the assessment of effects on landscape fabric, although there is a quantifiable change in the disturbed area (from larger foundations etc.), this would result in a minimal change to the overall effect on landscape fabric and not alter the level of landscape effect recorded in the ES/SEI.

15.7.18 The additional effects of the proposed development on landscape character would result in negligible and slight magnitudes of change. These levels of change would not be sufficient to increase the effects identified for the consented development, and therefore the significance of effects on landscape character would remain as recorded for the consented development.

15.7.19 The landscape effects on Caersws Basin and Clywedog Valley both Landscapes of Special Historic Interest (LSHI) would be no more significant than what was assessed in the SEI. Additional magnitude of change from the proposed development would not be sufficient to increase the significance level of the consented effects.

15.7.20 The proposed development would not cause an increase in the level of significance of landscape effects on Historic Parks and Gardens at Gregynog and Plas Dinam from what was reported for the consented development.

15.7.21 Assessment of effects at viewpoints concluded that there would be no changes in magnitude of change between the consented development and overall magnitude of change, therefore no changes in significance would occur to the various visual receptors e.g.; road users, walkers or residents identified for the consented development.

15.7.22 A total of 13 viewpoints are considered in this FEI, 11 significant visual effects were identified in the SEI for the consented development (including different receptors at the same viewpoint). These viewpoints would

have significant effects for same receptor groups, with 11 significant visual effects identified. There is no change to the total level of visual effects that would occur as a result of the proposed development.

15.7.23 Significant effects were identified for four properties in the SEI. Although significant visual effects would still be likely to occur at these properties, close to the wind farm, following the increase in blade tip height to 149.9 m, the proposed development would not lead to higher levels of effect where turbines might become overbearing in nature. Utilising guidance on separation distances between wind turbines and residential properties no new significant effects are anticipated for the other residential properties examined in the SEI.

15.7.24 With regards to effects on other visual receptors; the conclusions were that for the settlements of Carno, Caersws, Staylittle and Trefeglwys any additional magnitude of change would not result in a significant effect even for high sensitivity residential receptors. No significant effects or increases in level of effects predicted for the consented development would occur for any of the roads/railways and National Trails/Long Distance Paths considered in the FEI.

15.7.25 It is anticipated that a worst case moderate and not significant magnitude of change would occur to the local landscape as a result of the proposed access track at Bontdolgoch. Mitigation by replanting lost vegetation and strengthening the existing field boundaries would help to reduce the impact in conjunction with natural weathering and grassland encroachment help the stone track to merge into the adjacent grassland and landscape.

15.7.26 Visual effects from the new track are generally limited due to the presence of riparian vegetation and the railway line vegetation and embankment but some temporary significant effects would occur during the construction period due to vehicles using the track. These would occur particularly in winter when filtered views through the riparian vegetation would occur and from the two properties with open views (Pertheiryn and Dolerw). These effects would not occur within the operational period.

Hydrology, Geology and Hydrogeology (Section 8)

15.7.27 Section 8 contains assessment of the potential hydrological, geological and hydrogeological effects associated with the proposed development.

15.7.28 Providing risks to water resources are sufficiently considered, embedded mitigation and a site specific Construction Environment Management Plan secured under the consented development will continue to adequately mitigate against significant adverse effects upon the water environment, species, and habitats arising from the construction and operation of the proposed development including the additional proposed route. Appropriate monitoring and acquisition of permits relating to drainage and flooding are also proposed as part of the mitigation measures.

15.7.29 The Peat Management Plan for the consented development has been updated to incorporate the increased foundation and track sizes associated with the increase in proposed turbine heights. Based on the peat balance calculations there is sufficient space for extracted peat as part of infrastructure reinstatement or peatland restoration. Whether the additional peat is used for restoration or reinstatement it will be stored and handled following the guidance in the updated PMP.

Cultural Heritage Assessment (Section 12)

15.7.30 Section 12 of the FEI included an assessment on the potential impact of the increased tip height turbines on cultural heritage.

15.7.31 The scope of the cultural heritage assessment was undertaken in accordance with Planning Policy Wales, where the assessment was designed as a proportionate approach to compare the consented scheme with the potential impacts from the proposed tip height extension.

15.7.32 Heritage assets that were most likely to experience any significant effect from the tip height extension were identified through scoping, comprising a single listed building and six scheduled monuments. Comparative wireline modelling was prepared, and a site visit undertaken on those assets on publicly accessible land and which required surface inspection, to understand the asset in their setting and to what degree the proposed higher turbines would change that setting. In summary, the assessment concludes that for the tip height extension there would be no significant change from the effects already identified for the consented development.

15.7.33 The access track would pass over (a listed bridge) and near to several listed buildings, including Wig Bridge, a milestone, and Perth-Eiryn farmhouse. The construction and operation of the track would result in some change to the existing visual and acoustic baseline setting, but construction and initial use of this would be of a temporary nature. Such change is not assessed as significant.

15.7.34 The weight and length of the abnormal indivisible loads have been assessed in respect to the structural robustness of Wig Bridge which already carries heavy agricultural vehicles, and there is no expected additional load that would damage the structure of the bridge through vehicle weight, width, turning, or vibration. Therefore, no significant effect would occur. In addition, it is expected that a planning condition will ensure that a pre-construction survey of this bridge is to be undertaken prior to its use.

15.7.35 Construction of the new access track at Bontdolch has a moderate – high probability of disturbance to buried archaeological remains. The potential impact would be high adverse on assets of local importance, and if remains were found equates to a moderate effect. Mitigation to minimise this risk in the form of archaeological investigation and recording, however, would adequately compensate for the potential harm to the assets as it provides an opportunity to learn more about their significance and the residual effect would not be significant.

15.7.36 The updated assessment concludes that no additional significant effects have been identified as a result of the proposed tip height extension, over and above the significant effects previously identified for the consented development. In addition, the potential for direct impacts along the route of the access track have been assessed, and overall there are no significant effects to the historic environment once the proposed mitigation measures have been implemented.

Population and Human Health Environment

Noise Assessment (Section 10)

15.7.37 This section of the FEI provides information on the predicted noise impact of the proposed new access route on farm land near Bontdolgoch. The construction of the new access route will be a short-term activity carried out during normal working hours only in accordance with condition 24 of the existing consent. Predicted noise levels will be less than the significance thresholds identified in BS 5228-1 except for the farm associated with the landowner at Pertheirin/Dolerw. A short-term effect is not considered a significant impact in this context. Predicted noise levels from the abnormal movements themselves will be very low. Some vibration may be perceived but only at locations where railway vibration would also be expected.

15.7.38 Best practicable means will be used to reduce noise during the construction of the access route and the construction will be managed in accordance with the Construction Environmental Management Plan (CEMP).

15.7.39 Operational noise has not been reassessed as it is proposed the same noise limits would be met as for the consented scheme.

15.7.40 Furthermore, construction noise levels on the proposed wind farm site are unlikely to be altered as a result of the proposed tip height extension, and noise emitted during the construction and decommissioning phases will be temporary and short-term in nature and can be minimised through careful construction practices. Therefore, the construction noise assessment in relation to on-site noise levels is not being revised for the proposed development.

Forestry Assessment (Section 11)

15.7.41 Section 11 of the FEI updated the state of the current forest structure and presented the revised forest felling requirements for the proposed development.

15.7.42 The proposed tip height increase will not increase the impact on the forestry structure as assessed in 2015. In fact, the volume of timber and therefore number of lorries has been reduced due to more premature crop clearance required rather than mature crop clearance.

15.7.43 A total of 10,650 m^3 of timber is expected to be produced, supplying existing timber markets in Wales. A further 2,600 m^3 of brash could be recovered from the felled areas, for supply to Welsh biofuel power plants.

Traffic Assessment and Safety (Section 13)

15.7.44 Section 13 of the FEI supplements the original Traffic Assessment section of the 2010 ES and 2015 SEI.

15.7.45 The updated assessment undertaken demonstrates the average daily movements assessed in the original ES and SEI has been reduced and is considered worst case scenario assessment in terms of significance.

15.7.46 The predicted vehicle movements during the construction programme have been amended to reflect the increased construction period from 11 months reported in the SEI based on the 13 turbine consented development, to potentially 15 months; this increase remains less than the 16 months reported in the original ES programme based on the original 18 turbine scheme.

15.7.47 When taking into account the general upward trend in traffic levels across Wales, as forecast in the *Department for Transport Road Traffic Forecasts 2018*, we would likely see a reduction in traffic impact associated with the proposed wind farm due to the higher levels of baseline traffic, including HGV traffic, expected at the time of construction.

15.7.48 It is expected that during the construction period of the wind farm that there will be a temporarily significant impact on the C2176 (which runs from Carno village to site), as is typical for minor roads at this phase of a wind farm development. This is no greater impact than for the consented development and similar to what would have been experienced whilst constructing the now operational Carno wind farms. Appropriate measures will be put in place in accordance with an approved Traffic Management Plan to reduce the temporary impact caused by construction of the proposed development and will include correspondence with the local residents by Amegni Renewables.

15.7.49 The use of a short section of the C2068 (Wig Lane) will be restricted to abnormal loads and will utilise associated escort vehicles delivery only. As such it is anticipated that there will be a low temporary impact during the scheduled delivery period and therefore not significant. To ensure the impact to other road users is kept to a minimum, the delivery of abnormal loads will be managed through an approved Traffic Management Plan.

Existing Infrastructure (Section 14)

15.7.50 This section of the FEI summarises mitigation measures proposed to mitigate impact of the proposed tip height extension on existing infrastructure.

15.7.51 Powys County Council are in agreement with the additional mitigation proposed on public rights of way which includes construction of additional permissive paths to mitigate the taller turbines proposed on site,

and that the management of the footpath near Bontdolgoch would be covered by a suitably worded planning condition, similar to planning condition 41 of the existing consent.

Synergistic Effects

15.7.52 Synergistic effects are when several individual impact factors combine to have an effect on a receptor which is greater than the sum of the individual impacts. The structure of the FEI demonstrates this approach with grouping of assessments on the biological environment (Ecology), physical environment (Landscape and Visual, Cultural Heritage) and population and human health (noise, traffic and transport, forestry and existing infrastructure) It is acknowledged that there are also some potential overlaps between the biological environment, the physical environment and the human environment. As such, impacts which may be non-significant in isolation may have an additive effect, and lead to an overall negative impact even if each impact in isolation is considered unlikely to.

15.7.53 The inclusion of Population and Human Health in EIAs was introduced in the 2017 EIA Regulations and so was not specifically covered in the ES and SEI. As part of the scoping process other sections that apply to population and human health (e.g. shadow flicker, health and public safety etc.) were scoped out due to their non-significant impact proposed as a result of the increase in tip height and was not discussed further in the FEI. Conclusions drawn on visual amenity provide further evidence that significant adverse impacts on human health are not predicted. The increase in tip height will however deliver more renewable power from the site and in doing so generate more benefits to the surrounding area as well as a greater contribution to addressing climate change.

15.7.54 Overlaps between the various elements of the physical and biological environments have been considered in the assessments undertaken for this FEI. As these have been shown not to have given rise to any additional significant effects for the topic under these headings from the current consent, it is similarly concluded that there are no significant additional synergistic effects arising under these headings.

15.7.55 Various mitigation measures were proposed in the original ES and SEI (and would still apply for the proposed tip height extension) to control both individual, cumulative and synergistic effects, and monitoring measures and reporting mechanisms have been proposed to ensure these are effective. These have been secured through the relevant planning conditions which were applied to the current consent and with the exception of those which the application seeks to alter can be replicated for the proposed development. Similar conditions could also be applied to secure the necessary controls over the new access track whilst also ensuring that both consents are implemented in a coordinated and consistent manner.