Foel Fach Wind Farm Limited.

Foel Fach Wind Farm - Environmental Statement Volume II

Main Written Statement – Chapters 1 - 4

Project Reference: 664094

This chapter is summarised within the Non-Technical Summary of this Environmental Statement

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Energy for generations

Coriolis Energy

RSK

RSK GENERAL NOTES

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Author	Katie Symmonds and Ffion Perry	**Project manager**	Katie Symmonds
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Technical reviewer	Mark Cope
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CONTENTS

1 INTRODUCTION 1-1
1.1 Background 1-1
1.2 Definition of Environmental Impact Assessment 1-1
1.3 Legal framework for the Environmental Statement 1-2
1.4 The Project Team and Statement of Competency 1-7
2 PROPOSED DEVELOPMENT DESCRIPTION 2-1
2.1 Introduction 2-1
2.2 Need for the Proposed Development 2-2
2.3 Planning Application Boundary 2-3
2.4 Overview of the Proposed Development 2-4
2.5 Operational Design 2-5
2.6 Construction Design 2-15
2.7 Decommissioning 2-27
2.8 Embedded Mitigation and Enhancement 2-28
3 ENVIRONMENTAL CONTEXT AND REASONABLE ALTERNATIVES CONSIDERED 3-1
3.1 Introduction 3-1
3.2 Site Location 3-2
3.3 Current Land Use 3-2
3.4 Environmental Characteristics 3-3
3.5 Site Selection and Feasibility 3-5
3.6 Design Strategy 3-7
3.7 Project Design Evolution 3-9
3.8 Summary 3-11
4 APPROACH TO THE EIA 4-1
4.1 Introduction 4-1
4.2 Objectives of the EIA 4-1
4.3 Screening and Scoping 4-2
4.4 Consultation 4-8
4.5 Approach to the Assessment of the Proposed Development 4-9
4.6 Cumulative Effects 4-14
4.7 Environmental Enhancement 4-16
4.8 Difficulties and Uncertainties 4-16
4.9 Coordinated Assessment with the Habitats Regulations Assessment 4-16
REFERENCES 4-17

TABLES

Table 1.1 Information Required by the EIA Regulations 2017 to be included within the ES 1-4
Table 2.1 Proposed Turbine Locations and Maximum Heights 2-5
Table 2.2 Indicative Construction Programme 2-16
Table 2.3 Embedded (Environmental Design) Mitigation Measures 2-29
Table 4.1 Factors/Matters Scoped Out of Further Assessment 4-4

VOLUME III: SUPPORTING TECHNICAL APPENDICES

Appendix 1.1: EIA Scoping Report
Appendix 1.2: EIA Scoping Direction and Addendum
Appendix 1.3: EIA Project Team
Appendix 2.1: Outline Construction Environmental Management Plan (OCEMP)
Appendix 2.2: Outline Battery Safety Management Plan (OBSMP)
Appendix 4.1: Environmental Assessment of AIL Route
Appendix 4.2: Telecommunications Report
Appendix 4.3: Arboricultural Impact Assessment
Appendix 4.4: Shadow Flicker Assessment
Appendix 4.5: Air Quality Assessment
Appendix 4.6: Grid Connection Appraisal

VOLUME IV: SUPPORTING FIGURES AND PLANS

Figure 1.1: Site Location
Figure 1.2: Site Boundary
Figure 2.1: Development Layout
Figure 2.2: Indicative Wind Turbine Elevation
Figure 2.3: Indicative Wind Turbine Foundation Plan and Section
Figure 2.4: Indicative Cable Trench & Track Crossing Cross-Section
Figure 2.5: Indicative Substation, BESS and Control Building Plan
Figure 2.6: Indicative Substation, BESS and Control Building Elevations
Figure 2.7: Indicative Site Entrance Arrangement Plan
Figure 2.8: Indicative Site Entrance and Junction Visibility Splay
Figure 2.9: Indicative Access Track Cross-Section
Figure 2.10: Indicative Bridge Layout Plan and Bridge Cross-section
Figure 2.11: Indicative Bridge Cross-Sections
Figure 2.12: Indicative Watercourse Crossing
Figure 2.13: Indicative Construction Compound Plan and Elevation
Figure 2.14: Indicative Batching Plant
Figure 2.15: Indicative LiDAR Compound Plan and Elevation
Figure 2.16: Indicative Turbine Hardstand
Figure 2.17: Indicative Access Track Drainage Detail
Figure 2.18: Indicative Directional Signage
Figure 2.19: Construction Layout
Figure 3.1: Environmental Constraints
Figure 3.2: Alternative Site Development Options

GLOSSARY

alternatives	different design, layout and technological possibilities that could be considered during project development that have potential to fulfil the project objectives
ambient	of or relating to the immediate surroundings of something (e.g. ambient noise level)
ancient woodland	woodland that has existed continuously since at least AD 1600
appropriate assessment	process whereby projects, either alone or in combination, are considered to see if it can be ascertained that they will not adversely affect the integrity of a European protected site
assessment	process by which information about effects of a proposed plan, project or intervention is collected, evaluated, and used to inform decision making
baseline conditions	environment as it appears (or would appear) immediately prior to the implementation of the project together with any known or foreseeable future changes that will take place before completion of the project
baseline studies	work done to determine and describe the environmental conditions against which any future changes can be measured or predicted and assessed
biodiversity	variety of life forms; different plants, animals and microorganisms; the genes they contain; and the ecosystems they form
catchment	drainage/basin area within which precipitation drains into a river system and eventually into the sea
committed development	development projects that are either under construction or have valid planning permissions/consents
competent authority	authority responsible for determining the application for consent, permission, licence or other authorisation to proceed with a development
construction phase	period during which the building or assembling of a Proposed Development and its infrastructure is undertaken
consultation	process by which those organisations or individuals with an interest in the area associated with the proposed scheme are identified and engaged as part of the EIA process
consultation bodies	organisations that the competent authority is required to consult by virtue of the EIA Regulations
culvert	pipe or box-type conduit through which water is carried under a structure

cumulative impact	impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project A cumulative impact may arise as the result of (a) the combined impact of a number of different environmental topic-specific impacts from a single environmental impact assessment project on a single receptor/ resource or (b) the combined impact of a number of different projects within the vicinity (in combination with the environmental impact assessment project) on a single receptor/resource.
decommissioning	period during which a development and its associated infrastructure are removed from active operation
do-minimum scenario	also known as the 'do-nothing' scenario: the conditions that would persist in the absence of the implementation of a development
effect	term used to express the consequence of an impact (expressed as the 'significance of effect'), which is determined by correlating the magnitude of the impact with the importance (or sensitivity) of the receptor or resource in accordance with defined significance criteria. For example, land clearing during construction results in habitat loss (impact), the effect of which is the significance of the habitat loss on the ecological resource.
EIA Regulations	collective term for the various statutory instruments defining how the requirement and procedures for Environmental Impact Assessment is enacted and implemented in the UK
enhancement	measure that seeks to improve an environmental condition and is over and above what is required to mitigate the adverse effects of a project
environmental assessment	method and a process by which information about environmental effects is collected, assessed and used to inform decision-making. Assessment processes include strategic environmental assessment, assessment of implications on European sites, and environmental impact assessment.
environmental impact assessment	statutory process by which certain planned projects must be assessed before a formal decision to proceed can be made. Involves the collection and consideration of environmental information, which fulfils the assessment requirements of the EIA Regulations, including the publication of an environmental statement

environmental information	information that must be taken into account by the decision maker (the competent authority) before granting authorisation in any case where the EIA process applies. It includes the environmental statement, including any further information, any representations made by any body required by the Regulations to be invited to make representations, and any representations duly made by any other person about the environmental effects of the development
Environmental Management Plan	structured plan that outlines the mitigation, monitoring and management requirements arising from an environmental impact assessment
Environmental Statement	document produced in accordance with the EIA Regulations that reports the outcomes of the EIA process
European site	sites that make up the European ecological network (also known as Natura 2000 sites). These include sites of community importance (SCIs), special protection areas (SPAs) and potential SPAs (pSPAs), special areas of conservation (SACs) and candidate or possible SACs (cSACs or pSACs), and Ramsar sites.
evaluation	determination of the significance of effects. Evaluation involves making judgements as to the value of the receptor/resource that is being affected and the consequences of the effect on the receptor/resource based on the magnitude of the predicted impact.
existing environment	see ‘baseline conditions’
Habitats Regulations	The Conservation of Habitats and Species Regulations 2010, or more commonly known as the ‘Habitats Regulations’. The Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species', and the adaptation of planning and other controls for the protection of European sites.
Habitats Regulations assessment	assessment of the impacts of implementing a plan or policy on a European site, the purpose being to consider the impacts of a project against conservation objectives of the site and to ascertain whether it would adversely affect the integrity of the site
impact	change that is caused by an action; for example, land clearing (action) during construction that results in habitat loss (impact)
invertebrates	animals without backbones
method statement	document that sets out intended working or survey practices
mitigation	measures intended to avoid, reduce or compensate for adverse environmental effects

monitoring	continuing assessment of the performance of the project, including mitigation measures. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted.
non-statutory consultee	organisations and bodies that may be consulted on relevant planning applications
non-technical summary	information for the non-specialist reader to enable them to understand the main predicted environmental effects of the proposal without reference to the main Environmental Statement.
operation	functioning of a development on completion of construction
phase 1 habitat survey	Recognised methodology used for collating information on the habitat structure of a particular site.
photomontage	superimposing of an image onto a photograph to create a realistic representation of proposed or potential changes to a view
piling	installation of bored and driven piles into the ground
planning authority	local authority that is empowered by law to exercise planning functions for a particular area of the United Kingdom
pollution	any increase of matter or energy to a level that is harmful to living organisms or their environment (when it becomes a pollutant)
preferred option	chosen design option that most successfully achieves the project objectives and becomes subject to further design and assessment
programme	series of steps that have been identified by the applicant, or series of projects that are linked by dependency
project	one (or more) aspect of a programme or plan that has been identified by the applicant and usually involves a direct physical intervention
project objectives	objectives of the project, set by the applicant
Proposed development	a plan or project that the applicant or promoter seeks to implement
receptor	defined individual environmental feature usually associated with population, fauna and flora with the potential to be affected by a project
resource	defined but generally collective environmental feature usually associated with soil, water, air, climatic factors, landscape, material assets, including the architectural and archaeological heritage that has potential to be affected by a project
roosting site (birds)	place where birds rest or sleep
roosting site (bats)	place where bats live (e.g. built structures and trees)

run-off	precipitation that flows as surface water from a site, catchment or region and ultimately to the sea
Schedule 1 development	plans or projects listed in Schedule 1 of the EIA Regulations
Schedule 2 development	plans or projects listed in Schedule 2 of the EIA Regulations
scoping	process of identifying the issues to be addressed by the environmental impact assessment process. It is a method of ensuring that an assessment focuses on the important issues and avoids those that are considered not significant.
scoping direction	opinion provided by a competent authority that indicates the issues an environmental impact assessment of a Proposed Development should consider
screening	formal process undertaken to determine whether it is necessary to carry out a statutory environmental impact assessment and publish an Environmental Statement in accordance with the EIA Regulations
sediment	organic and inorganic material that has precipitated from water to accumulate on the floor of a water body, watercourse or trap
semi-natural	habitat, ecosystem, community, vegetation type or landscape that has been modified by human activity but consists largely of native species and appears to have similar structure and functioning to a natural type
significance of effect	measure of the importance of the environmental effect, defined by either generic significance criteria or criteria specific to the environmental topic
significant environmental effect	environmental effect considered material to the decision-making process
site of special scientific interest	main national conservation site protection measure in Britain designated under the Wildlife and Countryside Act 1981
special area of conservation	international designation implemented under the Habitats Regulations for the protection of habitats and (non bird) species
special protection area	sites designated under EU Directive (79/409/EEC) for the conservation of wild birds
stakeholder	organisation or individual with a particular interest in the project
statutory consultee	organisations that the competent authority is required to consult by virtue of the EIA Regulations
study area	spatial area within which environmental effects are assessed (i.e. extending a distance from the project footprint in which significant environmental effects are anticipated to occur). This may vary between the topic areas.
threshold	specified level in grading effects (e.g. the order of significance)

visual amenity	value of a particular view or area in terms of what is seen
wildlife corridor	linear habitats/landscape features such as hedgerows that may increase connectivity by acting as routes between habitat patches
worst case	principle applied where environmental effects may vary (e.g. owing to seasonal variations) to ensure the most severe effect is assessed

ABBREVIATIONS

AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic
AC	Alternating Current
ACoW	Archaeological Clerk of Works
ADBA	Archaeological Desk Based Assessment
AGL	Above Ground Level
AIA	Arboricultural Impact Assessment
AIL	Abnormal Indivisible Load
AILR	Abnormal Indivisible Load Route
AM	Amplitude Modulation
AMP	Access Management Plan
AMS	Arboricultural Method Statement
ANO	Air Navigation Order
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AQAL	Air Quality Assessment Level
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
AQS	Air quality standards
ASIDOHL	Assessment of the Significance of the Impact of Development on Historic Landscape
ASNW	Ancient and Semi-Natural Woodland
ATC	Automatic Traffic Counts
ATV	All-Terrain Vehicle
BAI	Bat Activity Index
BAT	Best Available Techniques
BBPP	Breeding Bird Protection Plan
BCT	Bat Conservation Trust
BEIS	Business, Energy & Industrial Strategy
BESS	Battery Energy Storage System

BGS	British Geological Survey
BLA	Blade Laydown Area
BNG	British National Grid
BoCC	Birds of Conservation Concern
BoP	Balance of Plant
BRF	Bat Roost Features
BS	British Standard
BSMP	Battery Safety Management Plan
BTO	British Trust for Ornithology
BWEA	British Wind Energy Association
CAA	Civil Aviation Authority
CB	Citizens Band
CCBC	Conwy County Borough Council
CCTV	Closed Circuit Television
cd	Candela
CDM	Construction Design and Management
CEH	Centre for Ecology & Hydrology
CEMP	Construction Environmental Management Plan
CERC	Cambridge Environmental Research Consultants
CEZ	Construction Exclusion Zones
CHP	Combined heat and power
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CIfA	Chartered Institute for Archaeologists
CIRIA	Construction Industry Research and Information Association
CITB	Construction Industry Training Board
CLe	Critical levels
CLo	Critical loads
cLWS	Candidate Local Wildlife Site
cm	Centimetre
CNALs	Construction Noise Assessment Locations
CO_2	Carbon Dioxide

COPA	Control of Pollution Act
COSHH	Control of Substances Hazardous to Health
CRAPW	Central Register for Aerial Photography Wales
CRDVNL	Clwydian Range and Dee Valley National Landscape
CREAM	Calculator for Road Emissions of Ammonia
CRM	Collision Risk Modelling
CRoW	Countryside and Rights of Way
CRZ	Collison Risk Zone
CSNP	Centralised Strategic Network Planning
cSPA	Candidate Special Protection Area
CTMP	Construction Traffic Management Plan
cWS	Candidate (Local) Wildlife Site
CZTV	Cumulative Zones of Theoretical Visibility
DAS	Discretionary Planning Advice Service
dB	Decibel
dB(A)	A weighted noise levels
DBA	Desk-Based Assessment
DBW	Daytime Bat Walkovers
DC	Direct Current
DCC	Denbighshire County Council
DECC	Department for Energy and Climate Change
DECCA	Diversity, Extent, Condition, Connectivity and Adaptability
DEFRA	Department for Environment, Food & Rural Affairs
DEM	Digital Elevation Model
DEMP	Decommissioning Environmental Management Plan
DESNZ	Department for Energy Security and Net Zero
DfT	Department for Transport
dGPS	Differential Global Positioning System
DIO	Defence Infrastructure Organisation
DIP	Driver Information Pack
DMP	Dust management plan
DMRB	Design Manual for Roads and Bridges
DNO	Distribution Network Operator

DNS	Development of National Significance
DOC	Dissolved organic carbon
DSM	Digital Surface Model
DTI	Department of Trade and Industry
DTM	Digital terrain model
DWPA	Drinking Water Protection Areas
EA	Environment Agency OR Environmental Appraisal
EAC	European Archaeological Council
EAM	Excess Amplitude Modulation
EC	European Community
EcIA	Ecological Impact Assessment
ECoW	Environmental Clerk of Works
EFT	Emissions Factor Toolkit
EHO	Environmental Health Officers
EHP	Environmental Health Perspectives
EIA	Environmental Impact Assessment
EIP	Environmental Improvement Plan
ELDP	Eryri (Snowdonia) Local Development Plan
ENP	Eryri (Snowdonia) National Park
ENPA	Eryri (Snowdonia) National Park Authority
EPUK	Environmental Protection UK
EQSD	Environmental Quality Standards Directive
ERP	Emergency Response Plan
ES	Environmental Statement
ESDAL	Electronic Service Delivery for Abnormal Loads
EU	European Union
FACP	Fire alarm control panel
FCA	Flood Consequences Assessment
FDS	Field Data Sheets
FEH	Flood Estimation Handbook
FI	Financial Involvement
FMfP	Flood Map for Planning
FoS	Factor of Safety

FTA	Freight Transit Association
GAT	Gwynedd Archaeological Trust
GC	Gwynedd Council
GCN	Great Crested Newt
GcNP	Glyndŵr candidate National Park
GCR	Geological Conservation Review
GHG	Greenhouse Gases
GIS	Geographic Information System
GLTA	Ground Level Tree Assessment
GLVIA3	Guidelines for Landscape and Visual Impact Assessment: Third Edition
GN	Guidance Note
GPG	Good Practice Guide
GPP	Guidance for Pollution Prevention
GPS	Global Positioning System
GRP	Glass-Reinforced Plastic
GSA	Geophysical Survey Area
GVA	Gross Value Added
GWDTE	Groundwater Dependant Terrestrial Ecosystems
ha	Hectares
HCR	High Collision Risk
HDV	Heavy Duty Vehicles
Heneb	Welsh Archaeological Trusts
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HLC	Historic Landscape Characterisation
HLCA	Historic landscapes
HMP	Habitat Management Plan
HRA	Habitats Regulations Assessment
HSA	Habitat Suitability Assessment
HSE	Health & Safety Executive
HSEQ	Health, Safety, Environment and Quality
HSI	Habitat Suitability Index

HSPP	Habitat Specific Protection Plans
HV	High Voltage
HVAC	Heating, ventilation and cooling
Hz	Hertz
IAQM	Institute of Air Quality Management
IBA	Important Bird Area
IEF	Important Ecological Features
IEMA	Institute of Environmental Management and Assessment
IFPs	Instrument Flight Procedures
IHBC	Institute of Historic Building Conservation
IIA	Important Invertebrate Area
INNS	Invasive Non- Native Species
IOA	Institute of Acoustics
IOF	Important Ornithological Features
IPS	International Peatland Society
IR	Infra-red
ISA	Inner Study Area
ISEP	Institute of Sustainability & Environmental Professionals
JLDP	Joint Local Development Plan
JNCC	Joint Nature Conservation Committee
JPEG	Joint Photographic Experts Group
km	Kilometre
KPI	Key Performance Indicators
kV	Kilovolts
LAQM	Local Air Quality Management
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Area
LCT	Landscape Character Types
LDP	Local Development Plan
LDV	Light Duty Vehicles
LFN	Low Frequency Noise
LGV	Light Good Vehicles
LI	Landscape Institute

LiDAR	Light detection and ranging
LIRM	Lightning-Induced Remnant Magnetisation
LLCA	Local landscape character Assessment
LPA	Local Planning Authority
LQAS	Land Quality Advice Service
LQSA	Agricultural Land Use & Soil Policy, Welsh Government
LSE	Likely Significant Effect
LT	Long Term
LV	Low Voltage
LVIA	Landscape and Visual Impact Assessment
LWS	Local Wildlife Site
m	Metres
m^2	Squared Metres
m^3	Cubic Metre
MAGIC	Multi-Agency Geographic Information for the Countryside
MBBS	Moorland Breeding Bird Surveys
Met	UK Meteorological
mm	Millimetres
MMP	Materials Management Plan
MoD	Ministry of Defence
mph	Miles per Hour
MS	Monitoring Station
MT	Medium term
MTAN	Minerals Technical Advice Note
MW	Megawatts
N	Nitrogen
NAL	Noise Assessment Location
NAM	Normal Amplitude Modulation
NATMAP	National Soil Map of England and Wales
NATS	National Air Traffic Service
NBB	Net Benefit for Biodiversity
NCN	National Cycle Network
NERC	Natural Environment Research Council

NERL	NATS En Route
NGET	National Grid Electricity Transmission
NGR	National Grid Reference
NH3	Ammonia
NL	National Landscape
NLCA	National Landscape Character Areas
NMEA	National Marine Electronics Association
NML	Noise Monitoring Locations
NMWTRA	North and Mid Wales Trunk Road Agent
NO2	Nitrogen dioxide
NOABL	Numerical Objective Analysis of Boundary Layer
NOx	Nitrogen oxides
NP	National Park
NPAP	National Peatland Action Programme
NRP	Natural Resources Policy
NRW	Natural Resources Wales
NRTF	National Road Traffic Forecast
NRW	National Resources Wales
NSA	National Scenic Areas
NSAP	Noise and Soundscape Action Plan
NSAP	Noise and Soundscape Action Plan
NSR	Noise Sensitive Receptor
NVC	National Vegetation Classification
N/A	Not Applicable
OAM	Other Amplitude Modulation
OAMP	Outline Access Management Plan
OBSMP	Outline Battery Safety Management Plan
OCEMP	Outline Construction Environmental Management Plan
OD	Ordnance datum
OEMP	Operational Environmental Management Plan
OHL	Overhead line
OHMP	Outline Habitat Management Plan
OS	Ordnance Survey

OSA	Outer study area
OSMP	Outline Soil Management Plan
PAC	Pre-Application Consultation
PAG	Procedure & Advice Guidance
PAMA	Public Access Management Area
PAS	Portable Antiquities Scheme
PC	Process Contribution
PCC	Powys County Council
PCH	Potential Collision Height
PDA	Proposed development Area
PEA	Preliminary Ecological Appraisals
PEC	Predicted environmental concentration
PEDW	Planning and Environment Decision Wales
PF	Public Footpath
PGW	Registered Park and Gardens Wales
PIA	Personal Injury Accident
PINS	Planning Inspectorate
PLC	Programmable Logic Controllers
PMP	Peat Management Plan
POC	Particulate Organic Carbon
POE	Port of entry
POI	Point of Interest
POW	Prisoner of War
PPA	Planning Performance agreement
PPE	Personal Protective Equipment
PPP	Pollution Prevention Plan
PPW	Planning Policy Wales
PRA	Preliminary Roost Assessments
PRF	Potential Roost Features
PRN	Primary Reference Number
PRoW	Public Rights of Way
pSAC	potential Special Area of Conservation
PSRA	Peat Slide Risk Assessment

PSRs	Primary Surveillance Radars
PVA	Population Viability Analysis
PWS	Private Water Supplies
PWSRA	Private Water Supply Risk Assessment
R&D	Research and Development
RAMS	Risk Assessment and Method Statement
RCAHMW	Royal Commission on the Ancient and Historical Monuments of Wales
RESP	Regional Energy Strategic Planning
RICS	Royal Institute of Chartered Surveys
RSA	Road Safety Audits
RSPB	Royal Society for the Protection of Birds
RSR	Route Survey Report
RTK	Real Time Kinetic
RUK	RenewableUK
RVAA	Residential Visual Amenity Assessment
RVAS	Residential Visual Amenity Study
RVAT	Residential Visual Amenity Threshold
SAAR	Standard Average Annual Rainfall
SAB	SuDS Approving Body
SAC	Special Area of Conservation
SBL	Seismic Background Level
SCADA	Supervisory Control and Data Acquisition
SHPP	Species and Habitat Protection Plan
SINC	Site of Importance for Nature Conservation
SLA	Special Landscape Area
SMR	Survey Magnetic Resonance
SMP	Soil Management Plan
SPA	Special Protection Area
SPALULPU	Soil Peatland and Agricultural Land Use Planning Unit
SPD	Supplementary Planning Document
SPEN	SP Energy Networks
SPG	Supplementary Planning Guidance

SPL	Sound Pressure Level
SPZ	Source Protection Zone
SQ	Special Qualities
SR	Scoping Report
SSA	Strategic Search Areas
SSEP	Strategic Spatial Energy Planning
SSNL	Site Specific Noise Limits
SSSI	Site of Special Scientific Interest
ST	Short Term
STA	Survey Test Area
STGO	Special Types General Order
sTMP	strategic Transport Management Plan
SuDS	Sustainable Drainage System
SWL	Sound Power Level
SWMP	Site Waste Management Plan
tCO2e	Tonnes of carbon dioxide equivalent
TA	Transport Assessment
TAN	Technical Advice Note
TCPA	Town and Country Planning Act
TGN	Technical Guidance Note
TMP	Traffic/ Traffic Management Plan
TPC	Travel Plan Coordinator
TPO	Tree Protection Order
TTF	True Terrain Following
TTRO	Temporary Traffic Regulation Order
UAV	Unmanned Aerial Vehicle
UK	United Kingdom
UKBAP	UK Biodiversity Action Plan
UKCP18	UK Climate Projections 2018
UKTAG	UK Technical Advisory Group
VCA	Vehicle Certification Agency
VP	Vantage Point
VSO	Vehicle Special Order

WAT	Welsh Archaeological Trusts
WCA	Wildlife & Countryside Act
WCBC	Wrexham County Borough Council
WelTAG	Welsh Transport Appraisal Guidance
WFA	Wind Farm Area
WFD	Water Framework Directive
WG	Welsh Government
WGNWT	Working Group on Noise from Wind Turbines
WSI	Written Scheme of investigation
WTG	Wind Turbine Generators
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

1 INTRODUCTION

1.1 Background

1.1.1 Foel Fach Wind Farm Ltd. (hereafter referred to as 'the Applicant'), a project company co-owned by development partners Coriolis Energy and ESB Asset Developments, is seeking to obtain full planning permission for the construction, operation and decommissioning of the Foel Fach Wind Farm (hereafter referred to as the 'Proposed Development'), located approximately 3.1 km north-east of the town of Bala, Gwynedd. The location of the Proposed Development is identified in **ES Volume IV, Figure 1.1: Site Location** and is described further in **ES Volume II, Chapter 3: Environmental Context and Reasonable Alternatives Considered**.

1.1.2 The Planning (Wales) Act 2015 and the Developments of National Significance (Procedure) (Wales) Order 2016 and subsequent regulations, provide the statutory basis for a Development of National Significance (DNS) (Welsh Government, 2015; Welsh Government, 2016). Any proposal to construct or operate a power generation scheme with a capacity over 10 megawatts (MW) falls under the DNS system and requires Welsh Ministers' consent.

1.1.3 The Proposed Development comprises the construction and operation of up to ten wind turbines and associated infrastructure. The Proposed Development is classed as a DNS as the combined installed capacity of the power generating elements will be greater than 10 MW. The Applicant is therefore seeking to secure full planning permission for the Proposed Development by way of an application made pursuant to section 62D of the Town and Country Planning Act 1990.

1.1.4 The planning application boundary for the Proposed Development is presented in **ES Volume IV, Figure 1.2: Site Boundary**; the area which it encompasses is hereafter referred to as 'the Site.' Further details on the Proposed Development are presented in **ES Volume II, Chapter 2: Description of the Proposed Development.**

1.1.5 The Proposed Development would be 'EIA Development' pursuant to regulation 2 of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (as amended) (hereafter referred to as the 'EIA Regulations 2017') (Welsh Government, 2017). This Environmental Statement (ES) is the written output of the Environmental Impact Assessment (EIA) process which has been undertaken in accordance with the EIA Regulations 2017. The ES is one of the supporting documents submitted with the DNS application to Planning and Environment Decisions Wales (PEDW) for determination by the Welsh Ministers).

1.1.6 RSK has been commissioned by the Applicant to carry out the EIA in support of the planning application. This has incorporated technical input from a number of experts, as outlined in this chapter. This chapter also outlines the legal framework and structure of the ES and supporting documents.

1.2 Definition of Environmental Impact Assessment

1.2.1 The term 'environmental impact assessment' or 'EIA' describes a procedure that must be followed for certain types of projects before they can be given 'development consent', also known as 'planning permission'. The procedure is a means of drawing

together, in a systematic way, an assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision.

1.2.2 According to Welsh Parliament Senedd Research: The Planning Series 10 – Environmental Impact Assessment (Welsh Parliament Senedd Research, 2022):

"An Environmental Impact Assessment (EIA) is a procedure that ensures environmental implications are taken into account before planning decisions are made. An EIA assesses the possible positive and negative impact a proposed project may have on the environment. This information is submitted to the local planning authority or the Welsh Government in the form of an Environmental Statement (ES) to be considered alongside a planning application. An ES must contain a non-technical summary."

1.3 Legal framework for the Environmental Statement

1.3.1 The EIA Regulations 2017 set out the types of development which must always be subject to an EIA (Schedule 1 development) and other developments which may require an assessment if they give rise to likely significant environmental effects (Schedule 2 development).

EIA Screening

1.3.2 The Proposed Development falls under Schedule 2, Category 3(i) 'installations for the harnessing of wind power for energy production (wind farms), of the EIA Regulations 2017, whereby an EIA may be required depending on characteristics of the Proposed Development, its location and its potential to generate significant environmental effects. Schedule 3 of the EIA Regulations 2017 outlines the criteria that should be applied when determining whether a Schedule 2 development requires EIA. The criteria are as follows:

- The characteristics of the Proposed Development (e.g., its size, cumulation with other developments, use of natural resources, production of waste, pollution and nuisances and the risk of accidents, having regard in particular to substances or technologies used);
- The location and environmental sensitivities of the geographical area (e.g., its existing and approved land use, the relative abundance, availability, quality and regenerative capacity of natural resources (including soil, land, water and biodiversity) in the area and its underground and the absorption capacity of the natural environment); and
- The characteristics of the potential impact, specifically the likely significant effects of the development taking into account:
- The magnitude and spatial extent of the impact (for example geographical area and size of the population likely to be affected)
- The nature of the impact
- The transboundary nature of the impact
- The intensity and complexity of the impact
- The probability of the impact

- The expected onset, duration, frequency and reversibility of the impact
- The cumulation of the impact with the impact of other existing and/or approved development, and
- The possibility of effectively reducing the impact.

1.3.3 The Applicant recognises that the Proposed Development is likely to give rise to significant environmental effects. As such, the Applicant has decided to voluntarily undertake an EIA, in accordance with Part 2, Regulation 5(2)(a) of the EIA Regulations 2017. Consequently, a formal request for a Screening Direction has not been made to PEDW.

EIA Scoping

1.3.4 An EIA Scoping Report was submitted to PEDW on 22 July 2024, as presented in **ES Volume III, Appendix 1.1: EIA Scoping Report**, together with a formal request for an EIA Scoping Direction, in accordance with Regulation 33(1) of the EIA Regulations 2017.

1.3.5 A formal Scoping Direction was subsequently received from PEDW on 5 December 2024 and an Addendum received on the 18 December 2024, as presented in **ES Volume III, Appendix 1.2: EIA Scoping Direction and Addendum**. Further details on the Scoping Direction and how it has informed this ES are provided in **ES Volume II, Chapter 4: Approach to the EIA**.

Environmental Statement

1.3.6 The findings of the EIA are presented in this ES which has been prepared in accordance with the EIA Regulations 2017. The ES is provided in four parts:

- Volume I: Non-Technical Summary
- Volume II: Main Written Statement
- Volume III: Supporting Technical Appendices, and
- Volume IV: Supporting Figures and Plans.

1.3.7 Other documents to be read in conjunction with the ES are:

- Planning Statement
- Design and Access Statement
- Socio-economic Statement, and
- Green Infrastructure Statement.

1.3.8 A common land consent is being submitted at the same time as this DNS application, and which should be read in conjunction with this ES. Where relevant, common land replacement land has been assessed within the relevant ES technical chapters.

Information Included within the ES

1.3.9 Schedule 4 of the EIA Regulations 2017 provides details of the information required for inclusion in an ES. **Table 1.1** summarises the requirements and where the information is located in this ES.

Table 1.1 Information Required by the EIA Regulations 2017 to be included within the ES

Para.	Required Information	Location within this ES
1	Description of the development, including in particular:	
	(a) a description of the location of the development	**ES Volume II, Chapter 3: Environmental Context and Reasonable Alternatives Considered.**
	(b) a description of the physical characteristics of the whole development, including, where relevant, requisite demolition works, and the land-use requirements during the construction and operational phases	**ES Volume II, Chapter 2: Description of the Proposed Development.**
	(c) a description of the main characteristics of the operational phase of the development (in particular any production process), for instance, energy demand and energy used, nature and quantity of the materials and natural resources (including water, land, soil and biodiversity) used	**ES Volume II, Chapter 2: Description of the Proposed Development.**
	(d) an estimate, by type and quantity, of expected residues and emissions (such as water, air, soil and subsoil pollution, noise, vibration, light, heat, radiation and quantities and types of waste produced during the construction and operational phases)	**ES Volume II, Chapter 4: Approach to the EIA.** **ES Volume II, Chapters 5 to 13.**
2	A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects	**ES Volume II, Chapter 3: Environmental Context and Reasonable Alternatives Considered.**
3	A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge	**ES Volume II, Chapter 3: Environmental Context and Reasonable Alternatives Considered.** **ES Volume II, Chapter 4: Approach to the EIA.** **ES Volume II, Chapters 5 to 13.**
4	A description of the factors specified in regulation 4(2) likely to be significantly affected by the development: population, human health,	**ES Volume II, Chapter 4: Approach to the EIA.**

Para.	Required Information	Location within this ES
	biodiversity (for example fauna and flora), land (for example land take), soil (for example organic matter, erosion, compaction, sealing), water (for example hydromorphological changes, quantity and quality), air, climate (for example greenhouse gas emissions, impacts relevant to adaptation), material assets, cultural heritage, including architectural and archaeological aspects, and landscape	**ES Volume II, Chapters 5 to 13.**
5	A description of the likely significant effects of the development on the environment resulting from, inter alia:	
	(a) the construction and existence of the development, including, where relevant, demolition works;	**ES Volume II, Chapters 5 to 13.**
	(b) the use of natural resources, in particular land, soil, water and biodiversity, considering as far as possible the sustainable availability of these resources;	**ES Volume II, Chapters 5, 6, 7, 9 and 13.**
	(c) the emission of pollutants, noise, vibration, light, heat and radiation, the creation of nuisances, and the disposal and recovery of waste;	**ES Volume II, Chapter 2: Description of the Proposed Development.** **ES Volume II, Chapter 4: Approach to the EIA.** **ES Volume II, Chapter 10: Noise and Vibration.**
	(d) the risks to human health, cultural heritage or the environment (for example due to accidents or disasters);	**ES Volume II, Chapter 2: Description of the Proposed Development.** **ES Volume II, Chapter 4: Approach to the EIA.** **ES Volume II, Chapter 8: Cultural Heritage.**
	(e) the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources;	**ES Volume II, Chapters 5 to 13.** **ES Volume II, Chapter 14: Cumulative Effects.**
	(f) the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;	**ES Volume II, Chapter 13: Climate.**

Para.	Required Information	Location within this ES
	(g) the technologies and the substances used.	**ES Volume II, Chapter 2: Description of the Proposed Development.**
6	A description of the forecasting methods or evidence, used to identify and assess the significant effects on the environment, including details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved	**ES Volume II, Chapters 5 to 13.**
7	A description of the measures envisaged to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on the environment and, where appropriate, of any proposed monitoring arrangements (for example the preparation of a post-project analysis). That description should explain the extent, to which significant adverse effects on the environment are avoided, prevented, reduced or offset, and should cover both the construction and operational phases	**ES Volume II, Chapters 5 to 13.**
8	A description of the expected significant adverse effects of the development on the environment deriving from the vulnerability of the development to risks of major accidents and/or disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to EU legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or UK environmental assessments may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies	**ES Volume II, Chapter 2: Description of the Proposed Development.**
9	A non-technical summary of the information provided under **paragraphs 1 to 8**	**ES Volume I, Non-Technical Summary**
10	A reference list detailing the sources used for the descriptions and assessments included in the Environmental Statement	**ES Volume II** in all ES chapters (where relevant)

1.4 The Project Team and Statement of Competency

1.4.1 In accordance with Regulation 17(4)(a) of the EIA Regulations 2017, the ES, and the technical assessments which inform it, have been undertaken by a suitably qualified project team with sufficient expertise to ensure its completeness and quality.

1.4.2 **ES Volume III, Appendix 1.3: EIA Project Team** lists the members of the EIA Project Team, their relevant expertise and qualifications. The Project Team are responsible for the scope, content and assessment of likely significant environmental effects of their respective technical chapters of the ES (where relevant).

1.4.3 RSK is responsible for the coordination, compilation and procedural review of the ES. RSK is registered under the EIA Quality Mark operated by the Institute of Sustainability & Environmental Professionals (ISEP, formerly the Institute of Environmental Management and Assessment or IEMA), which recognises our commitment to excellence in EIA activities. We have continued to maintain our EIA Quality Mark registration, following annual examination by ISEP in relation to our ongoing products, staff, innovation and promotion of EIA within the industry. RSK has and continues to support and lead nationally recognised guidance for EIA in the UK.

1.4.4 RSK has developed and applies an in-house set of processes, procedures and guidance for EIA based on sound project management principles.

2 PROPOSED DEVELOPMENT DESCRIPTION

2.1 Introduction

2.1.1 This chapter provides a description of all relevant information relating to construction, operation and subsequent decommissioning of the Proposed Development and what has been assessed through the EIA process.

Supporting Technical Appendices

2.1.2 This chapter is supported by the following technical appendices which are provided in **ES Volume III**:

- Appendix 2.1: Outline Construction Environmental Management Plan (OCEMP)
- Appendix 2.2: Outline Battery Safety Management Plan (OBSMP)
- Appendix 4.1: Environmental Assessment of AIL Route
- Appendix 4.6: Grid Connection Appraisal
- Appendix 5.4: Outline Habitat Management Plan (OHMP)
- Appendix 7.1: Flood Consequence Assessment
- Appendix 7.2: Watercourse Crossing Schedule.
- Appendix 7.4: Peat Management Plan
- Appendix 7.5: Peat Slide Risk Assessment
- Appendix 7.6: Borrow Pit Assessment
- Appendix 7.9: Outline Soil Management Plan (OSMP)
- Appendix 10.1: Wind Turbine Construction Noise Report
- Appendix 11.1: Transport Assessment

Supporting Figures

2.1.3 This chapter is supported by the following figures which are provided in **ES Volume IV**:

- Figure 1.2: Site Boundary
- Figure 2.1: Development Layout
- Figure 2.2: Indicative Wind Turbine Elevation
- Figure 2.3: Indicative Wind Turbine Foundation Plan and Section
- Figure 2.4: Indicative Cable Trench & Track Crossing Cross-Section
- Figure 2.5: Indicative Substation, BESS and Control Building Plan
- Figure 2.6: Indicative Substation, BESS and Control Building Elevations
- Figure 2.7: Indicative Site Entrance Arrangement Plan
- Figure 2.8: Indicative Site Entrance and Junction Visibility Splay
- Figure 2.9: Indicative Access Track Cross-Section
- Figure 2.10: Indicative Bridge Layout Plan and Bridge Cross-section

- Figure 2.11: Indicative Bridge Cross Sections
- Figure 2.12: Indicative Watercourse Crossing
- Figure 2.13: Indicative Construction Compound Plan and Elevation
- Figure 2.14: Indicative Batching Plant
- Figure 2.15: Indicative LiDAR Compound Plan and Elevation
- Figure 2.16: Indicative Turbine Hardstand
- Figure 2.17: Indicative Access Track Drainage
- Figure 2.18: Indicative Directional Signage
- Figure 2.19: Construction Layout

2.2 Need for the Proposed Development

2.2.1 The purpose of the Proposed Development relates to the generation of electricity from renewable energy sources and responds to the national energy policy and planning objectives.

2.2.2 The Environment (Wales) Act 2016 sets a target to reduce greenhouse gas emissions in Wales by 100% by 2050. Furthermore, the Welsh Government (and Gwynedd Council / Cyngor Gwynedd) have declared a climate emergency, and in March 2021 the Senedd Cymru approved a Net Zero target for 2050 (Welsh Government, 2022). Renewable energy is a key component to achieving greenhouse gas emission reduction.

2.2.3 In 2017, the Welsh Government announced a target of meeting 70% of Wales's electricity consumption from renewable electricity sources by 2030. This figure was updated in July 2023 when the Welsh Government committed to the target of ensuring that 100% of Wales annual electricity consumption will come from renewable sources by 2035, and to continue to keep pace with consumption thereafter (Julie James MS, Minister for Climate Change, 2023).

2.2.4 The 'Energy Generation in Wales' report (Welsh Government, 2023), sets out the energy generation capacity in Wales for each year and analyses changes over time. The purpose of the report is '*to support the Welsh Government in developing energy policy and help to evidence the economic, social, and environmental benefits of Welsh energy projects'*. According to the most recent version of this report, from 2025, renewable electricity generation in 2023 was equivalent to 58% of electricity consumption in Wales (excluding losses). However, the report highlights that in reality, only 34% of total electricity generated in Wales comes from renewable sources.

2.2.5 Of the electricity generated from renewable sources in Wales in 2023, approximately 68% came from onshore and offshore wind, with much of the remainder from solar PV and biomass electricity generation.

2.2.6 Future Wales: The National Plan 2040 (Welsh Government, 2021) provides a framework for planning change and development and is the highest tier of the Development Plan hierarchy in Wales. Policy 9 on resilient ecological networks and green infrastructure, Policy 17 on renewable and low carbon energy and associated infrastructure and Policy 18 on renewable and low carbon energy developments of national significance, provide the strategic spatial and detailed criteria-based policies for renewable and low carbon energy developments and these are the main

policies against which the Proposed Development will be considered. Policy 17 provides that:

"*The Welsh Government strongly supports the principle of developing renewable and low carbon energy from all technologies and at all scales to meet Wales's future energy needs.*

In determining planning applications for renewable and low carbon energy development, decision-makers must give significant weight to the need to meet Wales' international commitments and our target to generate 70% of consumed electricity by renewable means by 2030 in order to combat the climate emergency."

2.2.7 Planning Policy Wales (Edition 12, February 2024) (PPW) details the land use planning policies of the Welsh Government, with the objective to ensure the delivery of sustainable development (Welsh Government, 2024). PPW identifies that low carbon electricity must become the main source of energy in Wales. PPW also recognises that wind energy forms a key part of meeting renewable energy production due to Wales's considerable wind resource.

2.2.8 The national and local planning policy context applying to the Site has been considered in the iterative EIA design process, as set out in **ES Volume II, Chapter 3: Environmental Context and Reasonable Alternatives Considered**. The relevant planning policy framework has been described in **ES Volume II, Chapters 5** to **13**. A separate **Planning Statement**, as well as a **Green Infrastructure Statement**, is also provided as part of the DNS application.

2.3 Planning Application Boundary

2.3.1 All temporary and permanent activities relating to the construction and operational activities of the Proposed Development would be contained within the planning application boundary as illustrated in **ES Volume IV, Figure 1.2**. The offsite grid connection and the route from Port of Entry to the Site for the delivery of components, including Abnormal Indivisible Loads (AILs), do not form part of this DNS application and are excluded from the Site boundary.

2.3.2 An assessment of the AIL route has been included in the Transport Assessment provided in **ES Volume III, Appendix 11.1: Transport Assessment**. A high-level environmental assessment of the abnormal load's delivery route is provided in **ES Volume III, Appendix 4.1: Environmental Assessment of AIL Route**.

Grid Connection

2.3.3 Internal underground cabling from the proposed turbines would be brought together to the onsite substation at 33 kV cables likely routing adjacent to internal wind farm access tracks.

2.3.4 At present, it is anticipated that the grid connection will ultimately be made to a new transmission substation, provisionally referred to as the '*North Wales Connection Node A*' — with a broad area in the vicinity of Gwyddelwern (between approximately 9 to 15 km north-east of the Proposed Development), currently understood to be under consideration by National Grid Electricity Transmission (NGET). Further details on NGET's plans are understood to be released late 2025 and into 2026.

2.3.5 However, several ongoing processes and projects related to grid planning and upgrades—such as Connections Reform, Strategic Spatial Energy Planning

(SSEP), Regional Energy Strategic Planning (RESP), and Centralised Strategic Network Planning (CSNP) may still influence the final location, capacity, and/or optimal routing of the grid connection.

2.3.6 Given the uncertainty relating to the grid connection route, a high-level grid application appraisal has been carried out for completeness of the EIA (**ES Volume III, Appendix 4.6: Grid Connection Appraisal**).

2.4 Overview of the Proposed Development

2.4.1 The principal operational components of the Proposed Development are listed below illustrated in **ES Volume IV, Figure 2.1: Development Layout**, and are described more fully in the following sections:

- 10 no. three bladed horizontal axis wind turbines, up to 200 or 220 metres in height to the blade tip (where specified)
- wind turbine foundations and hardstanding areas which will include crane pad hardstanding areas and laydown/storage areas
- onsite substation
- battery energy storage system (BESS)
- permanent wind monitoring equipment (LiDAR)
- site access improvements, through the upgrading of the existing junction off the B4501
- onsite access tracks (new roads and upgraded existing roads/tracks), passing places and vehicle turning heads
- underground power cables linking the wind turbines to the substation
- watercourse crossings and associated infrastructure
- drainage systems
- micrositing up to 50 m
- onsite signage, and
- biodiversity enhancements proposals.

2.4.2 Individual design elements are further illustrated in **ES Volume IV, Figures 2.2** to **2.19.**

2.4.3 In addition, the following temporary components of the Proposed Development listed below are illustrated in **ES Volume IV, Figure 2.19: Construction Layout**, and are described more fully in **Section 2.6: Construction Design**:

- temporary construction and storage compound, located along the Site access track
- temporary working area north of the tracks leading to T09 and T10
- temporary concrete batching compound
- up to five temporary materials/ soil storage areas (if required)
- temporary peat storage area, and
- temporary borrow pit for the extraction of stone.

2.5 Operational Design

Infrastructure Layout

2.5.1 Each component of the Proposed Development is described in this section, with supporting figures provided in **ES Volume IV**. An overview of the layout of the Proposed Development is shown in **ES Volume IV, Figure 2.1: Development Layout**. Individual design elements are further illustrated in **ES Volume IV, Figures 2.2** to **2.19.**

Micrositing

2.5.2 Technical design of the Proposed Development will continue to be progressed at the detailed design stage, meaning that some design flexibility will need to be maintained going forwards. If planning permission is granted, the Applicant will commission further investigative surveys to inform the detailed design.

2.5.3 A 50 m micro-siting allowance is sought for the wind turbines and all other elements of the Proposed Development as illustrated on **ES Volume IV, Figure 2.1** Micrositing is a well-established principle in Wind DNS applications, as it allows for changes in design associated with technological advancements or turbine component manufacturing constraints to be incorporated into the development proposals.

2.5.4 Known environmentally constrained areas within the Proposed Development Site that were identified as part of baseline surveys have been avoided. Equally any unknown environmental constraints which might be revealed during later phases of investigation could also be avoided though micrositing. Further details on the environmental constraints that have been avoided when selecting micrositing areas are provided in **ES Volume II, Chapter 3: Environmental Context and Reasonable Alternatives Considered**.

Wind Turbines

2.5.5 The Applicant is seeking consent for the installation and operation of ten turbines, with an indicative generation capacity of 72 megawatts (MW) capacity (based on current turbine availability, but subject to final turbine selection). Please refer to **Table 2.1** which provides the co-ordinates and proposed maximum tip height for the proposed wind turbines.

Table 2.1 Proposed Turbine Locations and Maximum Heights

Turbine number	Easting	Northing	Maximum tip height (m)
T01	293056.7	340953.2	200
T02	293524.8	341484.1	200
T03	293653.3	340968.7	220
T04	294106.1	340505.7	200
T05	294515.1	342160.5	220
T06	294044.8	341858.3	220

Turbine number	Easting	Northing	Maximum tip height (m)
T07	294250.7	341483.7	220
T08	294492.6	341197.7	220
T09	294985.2	341545.4	220
T10	295070.7	341093.0	200

Wind Turbine Design

2.5.6 Each turbine is expected to consist of a tapered tubular steel tower, a combination of carbon fibre reinforced plastic, glass fibre reinforced plastic, balsa wood and foam blades, and a modular cast iron rotor hub. Dimensions of the indicative turbines are illustrated in **ES Volume IV, Figure 2.2: Wind Turbine Elevation**.

2.5.7 The maximum height of the turbines will be 200 m and 220 m from ground level to the tip of the blade in an upright position, herein referred to as the 'tip height'. An indicative turbine for the Proposed Development is shown in **ES Volume IV, Figure 2.2.**

2.5.8 The final choice of turbine model and the specification of the hub height and rotor diameter will be subject to a tender and selection process (prior to construction) considering technical, environmental and commercial aspects.

2.5.9 Each environmental factor assessment reported in this ES has assessed the Enercon E-175 EP5 as the candidate turbine. This is considered to represent a reasonable 'worst-case scenario' in terms of turbine dimensions/ characteristics to ensure a robust assessment has been undertaken.

Aviation Warning Lighting

2.5.10 Any structure exceeding 150 m in height is required to be lit in accordance with the requirements of the Air Navigation Order (ANO) and lighting requirements of the Ministry of Defence (MoD). It therefore proposed that turbines T01, T04, T05 and T10 are provided with 2000 candela (cd) lights at hub height (which will be dimmed to 10% of peak intensity when visibility exceeds 5 km and will only be switched on between the hours of sunset +30 minutes and sunrise –30 minutes). Additional infra-red (IR) lighting is also proposed on all turbines except T07 to satisfy MoD requirements.

2.5.11 It should be noted that the luminous intensity of lights mounted on the turbine nacelle reduces at vertical angles below the horizontal plane. This results in a reduction in light emitted by the light source below a 0° vertical angle. That is to say, the light would appear less bright to an observer looking up at the nacelle from below (and would not be directly visible below approximately 4°), than it would to an observer at the same elevation as the nacelle. In addition, light propagation over increasing distances leads to lower illuminance (which determines how bright it appears to the observer). Full details of the proposed lighting scheme and its rationale is provided in **ES Volume II, Chapter 12: Aviation**. Further potential impacts of aviation lighting on factors or the environment are considered further in **ES Volume II, Chapters 5, 6,** and **9**.

Wind Turbine Foundations and Hardstandings

2.5.12 The turbines will be installed on foundations comprising steel-reinforced concrete. The detailed design, sizing and specification for each foundation will depend on the final turbine type and the specific ground conditions encountered at each turbine location, which will be confirmed during pre-construction surveys. An illustration of a typical wind turbine foundation is provided in **ES Volume IV, Figure 2.3: Indicative Wind Turbine Foundation Plan and Section**. Indicative foundations would be circular with a diameter of up to 28 m and an embedment depth of up to 3.5 m.

2.5.13 Adjacent to each turbine, an area of hardstanding of approximate area c. 7,950 m^2 and depth of 750 mm of aggregates will be constructed for use as a crane pad hardstanding. An indicative turbine hardstanding is provided in **ES Volume IV, Figure 2.16: Indicative Turbine Hardstand.** The exact geometry and position of the crane pad hardstandings will depend on the turbine supplier's specifications, the crane selected for erection and detailed ground investigations prior to construction. In accordance with the turbine specification for the selected turbine model, additional laydown and storage areas may be required adjacent to the crane pad hardstanding. The EIA is based on indicative maximum crane pad hardstanding dimensions together with appropriate micrositing allowance. The area permanently affected will be smaller because some areas of the crane pad hardstanding will only be needed temporarily for instance for component laydown and storage during construction.

2.5.14 Where groundwater is encountered in the excavation for the turbine bases, the excavation will be lined with an impermeable membrane to prevent seepage of cementitious material into the sub-soil. Hardstanding areas at each turbine location will be retained for use during operation and decommissioning. Nevertheless, natural vegetation allowed to re-establish around the edges of hardstanding area.

Transformers and Cables

2.5.15 Each turbine would be expected to have an associated transformer, located either internally or externally to the turbine – with the Health & Safety Executive (HSE) having stated a clear preference for external housing. External transformers would be located within weather-proof housing which would have indicative dimensions of 2 m height by 8 m wide by 4 m deep. Transformer housing would be colour finished to blend in with the surrounding landscape.

2.5.16 The transformers will either be oil-filled with a bunded footing or oil collection tank to remove any risk of spillage or a solid cast resin type which is effectively non-polluting.

2.5.17 The transformers will increase the electrical voltage to 33 kilovolts (kV) and will be connected to the control building within the onsite substation via underground high voltage (HV) 33 kV power cables. These will be laid in trenches that run alongside the access tracks. Indicative cable trench details are provided in **ES Volume IV, Figure 2.4: Indicative Cable Trench and Track Crossing Cross-Section**.

2.5.18 The cable trenches will be excavated to a minimum depth of 0.9 m, locally deeper e.g. at switchgear, and backfilled. Typically, the number of power export cables in a section would be three (one per phase laid in trefoil). However, there will be sections where the power export cables need to run in parallel as they converge on the

substation, in which case there will be approximately 450 mm separation between each trefoil with the cable trench widened to suit the required number.

Wind Turbine Safety

2.5.19 Wind turbines have a proven track record for operating safety. A Supervisory Control and Data Acquisition (SCADA) system will be installed to gather information from individual turbines and provide facility to control them from a central location. A fibre optic communications cable will run alongside the power export cables to link the turbines to the SCADA system. The wind turbines can therefore be monitored remotely via a telephone or data connection to the SCADA system.

2.5.20 A very small number of wind turbines have been known to suffer from mechanical damage through lightning strikes or mechanical failure. Experience on existing sites has shown that allowing the public to access an operating wind farm does not lead to a compromise in safety.

2.5.21 Companies supplying products and services to the wind energy industry operate to a series of international, European, and British standards. A set of product standards for wind energy equipment has been developed by the International Electrotechnical Commission – IEC 16400. There are a number of British Standards that correspond to it, for example BS EN 61400-1: 1995 'Wind turbine generator systems – safety requirements'.

2.5.22 The applicant would commit to installing wind turbines and components that meet BS EN 61400-1: 1995 or IEC 16400 as appropriate. Public access to the Proposed Development area after construction has been completed would be improved with the provision of easily accessible multi-use tracks.

2.5.23 Appropriate warning, directional and identification signs would be installed on the turbines, transformers and onsite electrical control building, and access to these would be restricted to wind farm personnel. At all times these facilities would be locked. Additionally, safety and/or directional signs would be placed at strategic points across the proposed development, particularly on any Public Rights of Way to inform members of the public that they are entering a wind farm area, to make them aware of potential hazards and provide direction for emergency services should the need arise. Any signage would be agreed with the relevant authorities prior to installation.

2.5.24 No resulting safety risks are expected as a result of public access to the proposed wind farm site. Turbine models being considered for the Proposed Development would operate automatically and have sensors to detect any instabilities or unsafe operation during high wind speeds. Should sensors placed on the nacelle and tower of the turbine detect any other malfunction in operation or should wind speeds increase over maximum operational thresholds, the brakes would be automatically applied in order to rapidly shut the turbine down.

2.5.25 Vibrometers are located in the nacelles and would detect rotor imbalance in blades caused by icing and the wind turbine's control and monitoring system would shut the turbines down under these conditions. The turbines are also equipped with lightning protection equipment so that strikes will be conducted from the nacelle down the tower into the earth.

2.5.26 In cold weather, ice can build up on blade surfaces. The turbine can continue to operate with a very thin accumulation of snow or ice but would shut down

automatically should the build-up cause aerodynamic or physical imbalance of the rotor. The turbine would only start again once the ice or snow has thawed. At which point, there is a small possibility that fragments of the ice or snow drop within close vicinity of the turbine. However, due to the initial slow rotational speed of the turbine as it restarts, the risk to public safety is considered to be extremely low.

2.5.27 The safety features and record of wind turbines are identified above, and it is concluded that the proposed wind farm would not present a significant safety risk to the public.

Substation and Control Building Compound

2.5.28 The substation and control building compound will occupy an area of approximately 150 m by 75 m and will be surrounded by a 2 m – 2.75 m high 'palisade' fence. The palisade fencing will be painted in a colour that is to be agreed with Gwynedd Council. The compound would be located centrally on the Site (shown on the layout plan at **ES Volume IV, Figure 2.1.**

2.5.29 The compound will contain a control building and electrical equipment (including switchgear, transformers, communications equipment and protection equipment), vehicular access, and parking. The control building will contain an office space, welfare space, toilets and a storeroom. The finish of the substation and control building will be subject to Gwynedd Council approval prior to construction. An indicative plan and typical elevation of the compound and control building proposed is shown in **ES Volume IV, Figure 2.5: Indicative Substation, BESS and Control Building Plan** and **ES Volume IV, Figure 2.6: Indicative Substation, BESS and Control Building Elevations.**

2.5.30 The substation and control building would include a rainwater harvesting system, which would provide water for use within the operational phase welfare facilities. The control building will be constructed in keeping with the local vernacular, the appearance of the control building would be agreed with Gwynedd Council.

Battery Energy Storage System

Battery Units

2.5.31 An indicative BESS layout is shown in **ES Volume IV**, **Figure 2.5.**

2.5.32 The BESS Battery Units are proposed to consist of batteries housed in secure and weatherproof 'shipping container' style structures. They are designed to provide peak generation and grid balancing services to the electricity grid. The ability to store energy onsite is required to maximise the social value of electricity produced by the wind turbines and further to provide grid balancing services by allowing excess electricity generated from the wind turbines to be stored and dispatched as required. The BESS would also be capable of importing electricity from the national electricity network to store electricity in order to export this electricity to the national electricity network at peak times.

2.5.33 It is anticipated that each BESS Battery Unit would measure up to 6.06 m in length and 2.44 m in width and up to 2.9 m in height, including the concrete or stone base (shown on in **ES Volume IV, Figure 2.5**). Each BESS Battery Unit is fitted with associated heating, ventilation and cooling (HVAC) systems to ensure efficiency of the batteries, as well as in-built fire safety system comprised of sensors, monitoring PLC, fire alarm control panel (FACP), fire suppression, and deflagration mitigation.

The BESS would be located next to the substation in the central part of the Site and is anticipated to have a power capacity of 18.8 MW with an energy capacity of between 2 to 4 hours duration.

2.5.34 Sustainable Drainage Systems (SuDS) for the BESS component of the development would include filter drains and an attenuation basin. The proposed SuDS features would be designed to provide the required storage volume to retain the 1 in 100 plus 30% climate change event. The drainage system would also incorporate storage features, designed to contain the runoff contributed from the proposed firewater storage onsite in its usage during the unlikely event of a fire, as well as any additional runoff contributed by an intense rainfall event. The detailed design of any drainage system would be subject of approval via planning condition and so could have reference to latest industry guidance The runoff attenuation tank will be at a lower point to the BESS units and fitted with a penstock, which in normal operation is left open. The penstock is closed off in the event of a fire and runoff collected. The attenuation volumes should be a minimum of 228 cubes plus 1 in 10-year rainfall event.

BESS Inverter/Transformers

2.5.35 Batteries store and deliver electricity as Direct Current (DC). However, electricity is transmitted through the National Grid as Alternating Current (AC).

2.5.36 Inverter/transformers are needed to convert electricity bi-directionally from AC to DC when the batteries are charging, and from DC to AC in order to export electricity back to the National Grid.

2.5.37 The BESS Inverter/Transformers will be located adjacent to the BESS Battery Containers and measure a similar size of 12.2 m x 2.4 m x 2.9 m in height.

Other Elements

2.5.38 In addition to the BESS Units and Inverter/Transformers, there would be a a switchroom; control room, lower voltage (LV) room, spares and welfare unit; auxiliary and earth transformers; and water storage tanks. Indicative details are shown in ES Volume IV, Figures 2.5, 2.6 and 2.17. Full details relating to layout, materials, and other aspects would be agreed with Gwynedd Council through a planning condition.

BESS Safety

2.5.39 As the Proposed Development incorporates lithium-ion battery energy storage technology a variety of embedded safety procedures are included to minimise the likelihood of major accidents such as fire. Lithium-ion battery cells are governed by a range of international standards to ensure safety is incorporated in the design, manufacture and transportation of batteries, thus minimising the risk of potential hazards.

2.5.40 Each energy storage unit has multiple layers of prevention, protection and mitigation systems including systems ventilation, cooling, sensors, and fire suppression to minimise the risk of overcharge, overheating or mechanical damage that could result in a fire.

2.5.41 In the unlikely event of a fire, appropriate mitigation measures will be secured at the Site and specific information related to the Proposed Development will be passed to

Gwynedd Council and local emergency services to mitigate potential impacts. The Site's access track will allow ease of access for emergency services in the event of fires.

2.5.42 Potential fire risk associated with the BESS will be managed by a cooling system (see **paragraph 2.5.40**), designed to regulate temperatures to safe conditions and minimise risk of fire. Consultation will take place with the North Wales Fire and Rescue Service. An outline Battery Safety Management Plan (OBSMP) can be found in **ES Volume III, Appendix 2.2: Outline Battery Safety Management Plan.**

2.5.43 A full Battery Safety Management Plan to be prepared and submitted to Gwynedd Council for approval prior to construction will be secured by planning condition.

Access from the Public Highway

2.5.44 The Proposed Development will be accessed directly from the B4501. The access junction will provide the sole access to the Site for abnormal loads associated with the turbine equipment, as well as access for construction materials and ongoing operational traffic. The general arrangement of the Site entrance is provided in **ES Volume IV, Figure 2.7: Indicative Site Entrance Arrangement Plan** and **ES Volume IV, Figure 2.8: Indicative Site Entrance and Junction Visibility Splay.**

2.5.45 The Site entrance will be well maintained and monitored during the operational life of the Proposed Development. Regular maintenance will be undertaken to keep the Site access track drainage systems fully operational and the road surface in good condition and to ensure there are no adverse issues affecting the public road network. Wheel washing facilities will be provided at the Site entrance during construction, which further details provided in the OCEMP provided in **ES Volume III, Appendix 2.1: Outline Construction Environmental Management Plan**.

Site Access Tracks

2.5.46 From the Site entrance, approximately c.9.9 km of new Site access tracks will be constructed of compacted stone and geogrid as part of the Proposed Development. Approximately c.830 m of existing farm tracks will upgraded as part of the Proposed Development. Site tracks are required throughout the operational phase of the Proposed Development to permit access for maintenance and repair operations. They will also allow access during the decommissioning stage.

2.5.47 The Site access track layout has been designed to minimise environmental disturbance by avoiding sensitive features and keeping the length of track commensurate with the minimum required for operational safety. The full length of existing access track (830 m) will be widened to 7.5 m and an additional 2 km of 7.5 m wide access track will be constructed to provide a two-way access to the main wind farm. Within the main windfarm areas tracks will be minimum of 5 m in width with sections wider where required to accommodate bends in the road alignment.

2.5.48 The minimum construction thickness of access tracks would be approximately 550 mm. If the ground is found to be soft then thicker tracks may be required (up to approximately 900 mm).

2.5.49 A typical Site access track cross-section is shown in **ES Volume IV, Figure 2.9: Indicative Access Track Cross-Section**.

2.5.50 The Site access track layout from the public road to the main wind farm area will be a minimum width of 7.5 m for safe vehicular access and egress. In addition,

approximately five turning heads will be constructed at appropriate locations to accommodate turning.

2.5.51 Adjacent to the track will be assumed 3 m verges for cabling and an appropriate drainage verge which is subject to approval from the SuDS Approving Body (SAB). Clean water cut-off drains are proposed at the upslope edge of the Site access tracks. Intermittent cross drainage will allow runoff to flow from upslope to the downslope locations, maintaining the existing hydrological regime. Across areas of longitudinal fall, drainage channels will be stopped off intermittently to maintain the existing hydrological regime and limit stream power within each channel (**ES Volume IV, Figure 2.17: Indicative Access Track Drainage Detail**).

2.5.52 Generally, the sloping verges of access tracks will be reinstated through re-seeding with locally occurring species, top-soil reuse and/or turf replacement to blend in with the surroundings. Measures such as grass-reinforcement may be applied where the track widens on steeper bends and in passing places if suitable material is generated during the construction of the track. The adjacent grassland will be allowed to extend across the edges and middle, reducing the extent of the visibility of tracks in the landscape. The engineered appearance of any embankments will be smoothed out to ensure any landforms blend in with topography.

Drainage Systems

2.5.53 Drainage management of the Site tracks proposed by the applicant will seek to slow the flow of water and reduce flooding. Drainage attenuation measures will be designed by the contractor post-consent and approved by the relevant SuDS Approving Body (SAB) prior to construction.

2.5.54 The initial stripping of topsoil for the new tracks and placement of stone material for construction of new tracks has the biggest potential to release sediment into watercourses. Therefore, using methods consistent with industry best practice would be put in place ahead of the track construction activities. Sediment would be transported the furthest by existing surface water channels, therefore proactive mitigation measures would require these to be identified prior to the track construction. Within the channels, drains and any necessary settlement ponds, silt traps would be constructed prior to track construction. The silt traps would likely be constructed using straw/hay bales or specialised siltation fencing, pinned into place, allowing water to either percolate through the bale or flow over. Sediment transport mitigation drainage systems would be subject to regular maintenance during the lifetime of the proposed wind farm.

2.5.55 Excavated track would be used for the majority of the new access tracks, there would be a requirement for drainage channels or swales along one or both sides of each section of track depending on ground conditions to prevent the track itself acting as a watercourse. Tracks would be designed with a crossfall, towards the drainage ditches, to prevent build-up of water on the running surface. It is important that the water flowing along the track drainage ditches is not able to build up enough volume and velocity to act as a major sediment transport route. To prevent this happening, check dams will be placed across the swale at regular intervals and cross drainage pipes would be placed under the road. The drainage channel would also be blocked just above the cross-drainage inlet, thus preventing water from simply flowing past the inlet. The outlet of the cross drainage would allow the water to filter through the adjacent vegetation.

2.5.56 Depending on the height of the water table at the foundation location, a drainage system may be installed around the foundation to prevent the build-up of water pressure under the foundation. Alternatively, in locations that were particularly sensitive to hydrological disturbance, a submerged foundation design could be employed which would not require a drainage system around the foundation. It is anticipated that settlement ponds will be included at each turbine location to remove suspended sediment from the system.

Watercourse Crossings

2.5.57 As part of the Proposed Development, three new main crossings have been identified, with two new crossing locations and one existing crossing that will require upgrade. One crossing of a minor watercourse (a tributary of the Nant Cefn-coch) has also been identified. A schedule of the proposed watercourse crossings on the Site is presented in **ES Volume III, Appendix 7.2: Watercourse Crossing Schedule.**

2.5.58 Where watercourse crossings are required by new track, bottomless culverts will be used to prevent disturbance to the existing waterbed. **ES Volume IV, Figure 2.12: Indicative Watercourse Crossing** shows an indictive watercourse crossing design. Further information is presented in **ES Volume III, Appendix 7.1: Flood Consequence Assessment.** the final design of any watercourse crossings will be agreed with NRW prior to construction

2.5.59 A single span bridge is proposed to provide access to T09 and T10. An indicative bridge layout plan is presented within **ES Volume IV, Figure 2.10: Indicative Bridge Layout Plan and Bridge Cross-section** and **ES Volume IV, Figure 2.11: Indicative Bridge Cross Sections**. The bridge span would be approximately 20 m in length, consisting of steel beams and a hardwood timber bridge deck. The bridge deck would be supported on concrete reinforced abutments, up to 10 m in height, with supporting wingwalls. The running width of the bridge would be approximately 5.5 m in width, with post and rail parapets provided.

Permanent LiDAR Compound

2.5.60 The permanent LiDAR ("Light detection and ranging") unit dimensions and elevations are identified in **ES Volume IV, Figure 2.15: Indicative LiDAR Compound Plan and Elevation**. Access to the LiDAR facility will be via the onsite network of access tracks. The unit will be connected to the wind farm SCADA system. Power supply and data transfer will be via wind farm cabling (buried in the electrical cable trenches). A backup power system, data logger and a small storage facility will be sited at each LiDAR location. Security fencing with gated access similar to the substation compound will enclose the LiDAR unit compounds. The LiDAR installation would require a hardstanding area of approximately 8 m x 3 m for erection and ongoing maintenance. The LiDAR compound area will be surrounded by a 2.6 m high Palisade fence.

Utility Crossings/Removal

2.5.61 There is an existing overhead line and an underground electrical cable located at the Site access junction (**ES Volume IV, Figures 2.7** and **2.8**). Options to divert the overhead line and pole would be discussed and agreed with the utility provider pre-construction.

2.5.62 Similarly, an overhead 2 x 25 ACSR 11 kV line located at Llaithgwm, stretching east-west near across the access track to the Site entrance. Options to divert the overhead line would be discussed and agreed with the utility provider pre-construction.

PRoW Enhancements

2.5.63 The Proposed Development presents opportunities for access enhancements, including improvements to PRoWs within the Site. A package of enhancements in the Site (expected to be required pre-construction as a planning condition) include:

- improvement to / new signage
- interpretation boards, and
- seating areas (benches).

2.5.64 No permanent diversions are envisioned as a result of the Proposed Development. However, given some of the access tracks follow the routes of existing PRoW, there are opportunities for improvement to these routes. Any improvements or rationalisation of PRoW routes would be subject to discussion and agreement pre-construction with Gwynedd Council.

Operation and Maintenance

2.5.65 The expected operational life of the Proposed Development is 40 years from the date of commissioning. During the operation of the Proposed Development, maintenance work will involve visiting the Site regularly to undertake scheduled maintenance and operational checks. Maintenance work would include the following:

- Scheduled routine maintenance and servicing, usually conducted at least bi-annually, which will involve the undertaking of non-essential repairs on gearboxes and generators
- High voltage (HV) and other electrical maintenance
- Blade inspections, and
- Any necessary routine civil maintenance of tracks, drainage and buildings.

2.5.66 The operational phase of the Proposed Development is unlikely to generate significant amounts of waste except for minor quantities of material collected during routine maintenance inspections. Waste streams during this phase include relatively small quantities of municipal waste, waste chemicals, oils, and sewage. Measures will be put in place to ensure waste generated from the Proposed Development is kept to a minimum and does not have a significant cumulative effect on local waste management infrastructure. Such measures will be detailed fully within an operations stage Materials Management Plan which it is proposed will be secured as a condition of the planning application.

2.5.67 Wind farms and BESS facilities are designed to operate largely unattended. Each turbine at the Proposed Development would be fitted with an automatic system designed to supervise and control a number of parameters to ensure proper performance (e.g. start-up, shut-down, rotor direction, blade angles etc.) and to monitor condition (e.g. generator temperature). The control system would automatically shut the turbine down should the need arise. The mechanical braking

mechanism to protect against excessive windspeeds is fitted to the non-drive end of the turbine gearbox.

2.5.68 As noted in **paragraph 2.5.19**, the Proposed Development itself would have a sophisticated overall SCADA that would continually interrogate each of the turbines and the HV connection. An operator would be employed to operate and maintain the turbines, largely through remote routine interrogation of the SCADA system. The operator would also look after the day-to-day logistical supervision of the Proposed Development and would be onsite intermittently.

2.6 Construction Design

2.6.1 This section sets out the key construction activities of the Proposed Development. The construction arrangements described in this section provide the basis for the assessment presented in this ES.

Overview of the Construction Phase

2.6.2 The Proposed Development would be constructed over a period of approximately 21 months. Building and commissioning the Proposed Development will comprise the following general stages:

- site establishment (Including temporary compound and the concrete batching plant)
- construction of new access tracks, crane hardstanding and drainage infrastructure
- turbine foundations, watercourse crossings and bridge construction
- substation, energy storage electrical works and LiDAR installation
- cable trenching and installation
- crane delivery and demobilisation
- turbine delivery, erection and commissioning, and
- site finalisation works, including restoration.

2.6.3 An indicative construction programme illustrating likely periods for each of the core construction activities described above is provided in **Table 2.2**. A list of the expected plant and machinery is outlined in **ES Volume III, Appendix 10.1: Wind Turbine Construction Noise Report.**

Table 2.2 Indicative Construction Programme

Activity	Month																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Site Establishment (Including temporary compounds and the concrete batching plant)																					
Construction of New Access Tracks and Crane Hardstanding (Including drainage infrastructure)																					
Turbine Foundation, watercourse crossings and bridge construction																					
Substation, Energy Storage, LiDAR installation and Electrical Works																					
Cable Trenching and Installation																					
Crane Delivery and Demobilisation																					
Turbine Delivery, Erection and Commissioning																					
Site Reinstatement and Demobilisation																					

Construction Health and Safety

2.6.4 All construction activities will be managed in accordance with the requirements of the Construction (Design and Management) Regulations 2015 and the Health and Safety at Work etc. Act 1974. The Principal Designer has taken full account of these requirements throughout the design evolution of the Proposed Development. To further reduce possible health and safety risks, a Construction Phase Plan for the Proposed Development will be produced by the appointed Principal Contractor prior to construction commencing. All staff and contractors working on the construction will be required to always comply with the safety procedures and work instructions outlined in the plan.

2.6.5 Risk assessments will be undertaken for all construction activities, with measures put in place to manage the risk from any hazards identified to be as low as reasonably practicable.

Construction Environmental Management

Construction Environmental Management Plan (CEMP)

2.6.6 The main objective of the CEMP is to set out how construction works will be managed to avoid or mitigate adverse environmental impacts. The CEMP will provide a mechanism for implementing measures to reduce potentially adverse impacts to the environment insofar as reasonably practicable.

2.6.7 To support the Application, an OCEMP has been prepared and is provided as part of this ES, please see **Appendix 2.1**. The OCEMP has been informed based on the information in this ES.

2.6.8 It is the intention that that the approval of the final CEMP will be subject to a suitably worded planning condition The CEMP will be a live document onsite for use throughout the construction stage.

Materials Management

2.6.9 Materials imported to the Site will only be stockpiled within the borrow pit or temporary construction compound and these stockpiles will be kept to the minimum required to manage the construction activities. Excavated material from the turbine foundations and access tracks would be re-used where practical onsite for creating the required levels for the infrastructure and restoration/reinstatement of temporary works. Excavated materials (including soil, stone and peaty soil) may need to be temporarily stockpiled during the construction phase until ready to be reused. See **ES Volume IV, Figure 2.19: Construction Layout**, and **Appendix 2.1** for further details.

2.6.10 Up to five temporary materials storage areas as illustrated on **ES Volume IV, Figure 2.19** have been identified for the purpose of the EIA. These areas would be up to 150 m by 150 m in area, up to 5 m in height no more than 50,000 m^3 volume with slope gradients no greater than 1 in 2 (if required). The temporary materials storage areas will be restored to the pre-construction condition prior to the completion of the construction phase.

2.6.11 Onsite concrete batching would take place only within the concrete batching compound located near the BESS and substation (**ES Volume IV, Figure 2.1** and **ES Volume IV, Figure 2.14: Indicative Batching Plant**). The batching plant would comprise at least two silos for cement, possibly two for other dry additives, two mixers and a conveyor system to transport sand and aggregate from stockpile to weighing hoppers and into the mixer and a delivery system for mixed concrete to the trucks. This will reduce the concentrated transport effect on the public road during concrete pour days.

2.6.12 A Site Waste Management Plan (SWMP) and Materials Management Plan (MMP) will be developed by the main Contractor for implementation during construction. This would outline details of the requirements for materials and waste management during construction. All materials will be identified, classified, quantified and, where practicable, appropriately segregated. Any material that cannot be reused will be disposed of accordingly. Waste will be transferred using a registered waste carrier to a licensed waste disposal site or recycling centre.

Water

2.6.13 Washing out of concrete mixing plant would only be permitted in one designated location with protective bunding and a dedicated and contained drainage system prior to removal offsite by tanker for treatment and disposal at a suitably licensed location. Water sprays will be used for dust suppression in dry and windy conditions to control and minimise dust emissions generated during active excavation at the borrow pits.

2.6.14 Wastewater from welfare facilities would be held in a suitably sized containment tank and would be removed from site by tanker for treatment and disposal at a licensed facility. If suitable, surface water harvesting would be used to supplement the water requirements for the construction phase welfare facilities.

2.6.15 A water quality monitoring programme would be established at key locations around the Site as set out in **ES Volume II, Chapter 11: Land Soils and Water Section 11.9**.

Peat Management

2.6.16 The Proposed Development has been designed where possible to avoid areas of peat soils and minimise disturbance to habitats. Detailed assessment of impacts on peat is provided in **ES Volume II, Chapter 7: Land, Soils and Water**. A Peat Management Plan (**ES Volume III, Appendix 7.4: Peat Management Plan**) has been prepared to address the requirements for excavation of peat soil during the construction stage of the Proposed Development. A Peat Slide Risk Assessment (**ES Volume III, Appendix 7.5: Peat Slide Risk Assessment)** has been prepared to identify, assess and mitigate risks associated with peat soil instability within the Proposed Development.

Arboricultural Management

2.6.17 An Arboricultural Impact Assessment (AIA) has examined the potential impact of the construction on surveyed trees, tree groups, and hedgerows within the Site. The AIA concluded (**ES Volume III, Appendix 4.3: Arboricultural Impact Assessment**) that a total of 20 trees (category B; moderate value and category C: low value), one tree group (category C: low value) and five hedges (category C: low value) would be removed to facilitate construction. It is further estimated that two hedges would

require removal in part (category C: low value). With the adoption of good practice measures including suitable replacement planting which were outlined in the AIA, the impacts would not be detrimental to the overall arboricultural resource of the Site and would not be significant.

Borrow pit

2.6.18 The Proposed Development will require a sufficient volume of aggregate to provide construction materials for the proposed construction compound and access tracks from the public road to the turbines.

2.6.19 Preliminary civils design work has indicated that approximately c18,500 m^3 (22,200 m^3 including a contingency of 20% to account for under-estimation in the requirements and for some excavated material being unsuitable for construction use) of bulk fill materials would be required, which can be provided from a new borrow pit along the Site access track, east of the temporary construction compound. Please refer to Figure 7.6.1: Borrow Pit Development Plan and Borrow Pit Cross-section of **ES Volume III, Appendix 7.6: Borrow Pit Assessment**.

2.6.20 Excavation of rock from the borrow pit will be carried out using standard quarrying techniques, including ripping (i.e. no blasting is required). The borrow pit will be restored prior to the completion of construction. The general approach to the restoration of borrow pits is outlined in the borrow pit assessment provided in **Appendix 7.6**, which includes indicative restoration plans. Any upgraded track that leads to the borrow pit will be reinstated before operation of the Proposed Development and after all necessary material has been worked from these areas.

2.6.21 Water collecting in settlement ponds will be used for dust suppression where required during the construction of the Proposed Development. This is most likely to be of use in the borrow pit area, around the construction compound and along track sections during dry periods.

Construction Traffic

Introduction

2.6.22 During the construction period, the following traffic will require access to the Site:

- Staff transport
- Construction equipment and materials, deliveries of machinery and supplies such as crushed rock, and
- Abnormal loads comprising wind turbine components, grid infrastructure and also heavy lift crane(s).

Construction Staff

2.6.23 Staff would arrive in non-HGV vehicles (cars or minibuses). The construction workforce onsite will depend on the activities being undertaken at the time. It has been assumed that there will be a requirement of four staff per turbine during the short peak period of construction. Therefore, the maximum number of staff expected onsite at any one time is likely to be no more than 40 per day.

2.6.24 For the purposes of estimating traffic movements, it has been assumed that 60% of staff would be transported by minibus and 40% would arrive by car (single car occupancy was assumed as the worst-case at this stage with potentially fewer

movements through car sharing). Based on these assumptions, staff transport cars and light vehicles would account for a maximum of 52 vehicle trips (26 inbound trips and 26 outbound trips) per day during the peak period of construction.

Abnormal Indivisible Load Deliveries

2.6.25 The wind turbines are broken down into components for transport to the Site. The nacelle, blades and tower sections are classified as AILs due to their weight, length, width and height when loaded.

2.6.26 In addition to the turbine deliveries, two high-capacity erection cranes would be needed to offload a number of components and erect the turbines. The cranes are likely to be mobile cranes with a capacity up to 1,000 tonnes that are escorted by boom and ballast trucks to allow full mobilisation onsite. Smaller erector cranes would also be present to allow the assembly of the main crane and to assist with the overall erection of the turbines.

2.6.27 Escort vehicles would accompany the AIL convoys to support the traffic management measures. Up to three vehicles would be deployed and it is assumed that three turbine components would be delivered per convoy. This would result in 37 convoys on the network, with a total of approximately 224 escort vehicle movements (112 inbound trips and 112 outbound trips).

2.6.28 Wind turbine components that do not classify as AILs, would be delivered in addition to these, resulting in a further approximately 56 vehicle movements (28 inbound trips and 28 outbound trips). The escort vehicles have been assumed to be police cars and light goods vehicles. Motorcycles may be deployed, depending upon North Wales Police resources.

2.6.29 Exact numbers in each convoy will be subject to agreement with the relevant local police force.

2.6.30 Some minor works such as vegetation management would be needed at certain locations along the delivery route, including the blade transfer area and at the Site entrance to allow safe clearance and 'oversail or overrun' of the loaded AIL transporter. Environmental constraints at each location have been assessed in the AIL route environmental review **Appendix 4.1** and in relevant ES chapters where necessary. Any additional regulatory approvals required along the delivery route will be secured separately to the DNS. A detailed route survey assessment for the final chosen turbine model will be provided post consent and will form part of a suitably worded planning condition.

General Deliveries

2.6.31 Throughout the construction phase, general deliveries will be made to the Site by means of HGV. These would include fuel, Site office and staff welfare. Further details relating to the number of general deliveries are set out in **ES Volume II, Chapter 11: Traffic and Transport.**

Material Deliveries

2.6.32 Various materials will need to be delivered to Site to form the Site-based infrastructure. At the outset, HGV deliveries will deliver plant and initial material deliveries to the Site to enable the formation of the Site compound and to deliver construction machinery. For the purpose of the assessment in **ES Volume II,**

Chapter 11: Traffic and Transport, a worst case of no use of materials from the onsite borrow pit has been assumed, but in reality the majority of aggregates used to construct the access track and temporary construction compound are likely to be sourced from within the Site.

2.6.33 The volume of concrete required for the construction of the turbines, BESS and substation control building foundations is estimated to be approximately 9,891.48 m^3. The individual deliveries associated with the raw materials have been estimated and result in inbound trips of 22 cement tankers, 103 sand tippers, 210 aggregate tippers and 126 water tankers.

2.6.34 Steel reinforcement required in the foundations across the Proposed Development for wind turbines, substation etc. are estimated to total 20 tonnes, resulting in a total of two vehicle movements (one inbound trip and one outbound trip).

2.6.35 The tracks, crane pad hardstandings and compounds will require geotextile in the foundations. Geotextile will be delivered to Site in rolls. 218 large rolls may be required at Site and would be delivered by HGV resulting 22 journeys (11 inbound trips and 11 outbound trips).

Construction Traffic Management

2.6.36 A Construction Traffic Management Plan (CTMP) will be prepared and agreed with Gwynedd Council in advance of the construction phase. Approval of the CTMP will be subject to a suitably worded planning condition and it will demonstrate compliance with national and local policy guidance and will set out detailed descriptions of actions required by Contractors to meet during the construction process, following these objectives:

- Ensure that movements of people, plant and materials are achieved in a safe, efficient, timely and sustainable manner
- Ensure that any impact to local communities and the local economy is reduced as far as reasonably practical
- Seek to minimise the number of deliveries during network peak period
- Reduce and control construction vehicle trips where practicable
- Ensure that strategies and mitigation measures are implemented and adhered to through continued monitoring, review, and improvement, and
- Limit the effects of construction traffic on the Local Road Network.

2.6.37 An abnormal load Traffic Management Plan (TMP) is provided in Annex 2 of **ES Volume III, Appendix 11.1: Transport Assessment.**

Access Management

2.6.38 An outline Access Management Plan (OAMP) is provided as Annex 3 to the Transport Assessment (**Appendix 11.1**). The plan outlines the management of public access and recreational amenities during the construction, operational, and decommissioning phases of the Proposed Development.

2.6.39 Any passable Public Rights of Way (PRoWs) that do not lead directly into a construction area and are not used by construction vehicles will remain open, except when construction activities are occurring at specific crossing points. Formal consent for any temporary closure of PRoWs will be agreed with Gwynedd Council. Once construction is complete, these PRoWs can be re-opened. Where PRoWs are

closed, temporary path diversions will be implemented to ensure safe and efficient connections. A map showing the PRoWs within the Site are presented Annex 3 of **Appendix 11.1**.

Construction Compound

2.6.40 One construction compound is proposed for the scheme. The construction compound is located at the Site entrance will act as the main interface between the construction work sites and the public highway (**ES Volume IV, Figure 2.1** and **ES Volume IV, Figure 2.13: Indicative Construction Compound Plan and Elevation**). The construction compound will measure approximately 100 m x 120 m (12,000 m^2) and includes space for:

- concrete truck washing area
- temporary modular building(s) to be used as a Site office
- welfare facilities
- parking for construction staff and visitors
- reception area
- fuelling point or mobile fuel bowser, and
- secure storage areas for tools, materials and plant.

2.6.41 A second temporary works area will be located east of T08 (**ES Volume IV, Figure 2.1**) and will measure approximately 3,850 m^2, including space for equipment set-up and temporary material/ crane storage.

2.6.42 The construction disturbance associated with the temporary construction compound and temporary works areas would be minimal. Typically, surface soils will be stripped and stockpiled, and the surface would then be capped with geofabric and aggregate. The construction compound will be surrounded by a security fence and retained for the duration of the construction phase. Following completion of the construction phase, the compound area and temporary works areas would be reinstated to their original condition and use.

Construction Employment

2.6.43 The number of construction staff present onsite will vary according to the construction phase and activities being undertaken. Staffing levels will generally decrease as construction progresses through to the commissioning phase.

2.6.44 Overall, it is envisaged that the Proposed Development would generate employment for up to 60 people during the construction phase to include site contractors, onsite vehicle and plant operators, engineers, materials delivery personnel, environmental personnel, health and safety personnel.

2.6.45 During the operation of the wind farm, the turbine manufacturer, the Applicant or a service company will carry out regular maintenance of the turbines. During the life of the project, it is envisaged that at least two permanent jobs will be created locally in the form of an operator or maintenance personnel. In addition, operation and monitoring activities may be carried out remotely with the aid of computers connected via a broadband link. However, routine inspection and preventive maintenance visits will be necessary to ensure the smooth and efficient running of the wind farm and require a minimal presence.

2.6.46 In addition to direct employment opportunities, the construction Site will bring benefits to local businesses such as in the supply of materials or services for construction and in accommodation for workers and catering.

Site Working Hours

2.6.47 In general, working hours for construction will be from 08:00 to 18:00 Monday to Friday and 08:30 to 13:00 on Saturday. No work is proposed on Sundays and public holidays unless otherwise agreed with Gwynedd Council or in case of emergency.

2.6.48 Exceptions to the proposed working hours will be made for activities that require continuous working e.g. concrete pour, erection of towers/ blades etc. Concrete pouring for an individual turbine must take place continuously and so activity will only cease when the pour has been completed. Safe turbine erection can only occur during periods of low wind speeds and so lifting operation may need to be scheduled outside of the above hours. In addition, it may be necessary to complete a particular lifting operation to ensure the structure is left safe.

Construction Lighting

2.6.49 Artificial lighting will be required during the construction phase to promote safe working conditions and security, during periods of limited natural light. Examples include vehicle and plant headlights, construction compound lighting and mobile lighting units, to be used around specific construction activities. It is intended that the type of lighting would be non-intrusive (e.g. directed down and towards works activity and away from the Site boundary), to minimise impact on local properties and any other environmental considerations.

Construction and Upgrading of Tracks

2.6.50 As the track and infrastructure design has minimal overlap with peat soils, a cut track design is proposed for new tracks, which will be achieved by excavating through to a suitable formation.

2.6.51 During construction, vegetation, topsoil and subsoil will be placed in separate piles to the sides of the tracks. On overburden soil, suitably graded capping material approximately c.400 mm will be applied to form tracks and additional material will be applied where deemed necessary by the detailed design. On rock, suitably graded running layer of a minimum thickness of 150 mm will be applied. The total track depth will depend on the strength of the base formation and upon the gradient of the slope being traversed.

2.6.52 Where existing tracks require upgrading this will be undertaken by localised widening to match the width of adjoining new track.

2.6.53 Drainage ditches, aligned to SuDS standards, will be constructed alongside the access tracks. Excavated materials will be used to either create the required profiles of the infrastructure, or the landscaping profile between the new infrastructure and existing ground, or restoration of borrow pits or temporary hardstandings.

2.6.54 Final track drainage design will be determined prior to the commencement of construction of the relevant track section. However, typical details are provided in **ES Volume IV, Figure 2.9.**

Construction of the Single Span Bridge

2.6.55 In order to construct the single span bridge structure a temporary works area to the north will be required. Soil would be stripped and appropriately stored, with a geotextile layer and crushed rock laid to create a firm, level surface. The reinforced concrete abutments would be cast in situ, with the steel bridge beams lifted into place by crane. The area behind the concrete abutment and wingwalls will be infilled with suitable fill material.

Construction of Temporary Compound

2.6.56 The construction of the compound will be formed by stripping soil, which will be appropriately stored, geotextile and crushed rock laid to create a firm, level surface. CCTV will be installed within the construction compound as required and the perimeter secured by a temporary security fence.

Construction of Substation and Control Building Compound

2.6.57 The foundation of the substation and control building compound will be subject to investigation before construction; however, the assessment has assumed reinforced concrete strip foundations.

2.6.58 The ground floor of the control building will be a ground bearing slab and will incorporate ducts and trenches for the laying of power export cables. Security fence will be installed around the perimeter of the compound and CCTV will be installed on the control building and other locations within the compound as required.

Construction of Turbine Foundations and Crane Pad Hardstandings

2.6.59 Construction of turbine foundations, crane hardstandings and storage areas will require the excavation of soil. For turbine foundations this would be down to a competent subsoil or the underlying bedrock. The excavated material may be used to partially backfill the excavation and provide material for landscaping and surfacing reinstatement. It will be stored near to the excavation until required, with topsoil and subsoil stored separately. The formation level for the foundation of each turbine will be levelled to provide a workable platform for the assembly of reinforcing steel bars and formwork used to contain the poured concrete.

2.6.60 During construction, excavations may need to be drained (for example, if rainwater gets into construction areas). Suitable filtration systems will be employed to ensure that silt laden water does not contaminate surface watercourses and that extracted water is treated to remove silt before being returned to the surrounding area with a limited effect on local hydrology. The excavated area around the turbine will then be back filled with selected excavated material to the required design levels.

2.6.61 Soils that are excavated during construction would be set aside for backfilling of foundations and reuse in restoration of temporarily disturbed areas around the turbine locations and hardstandings. An outline Soil Management Plan (OSMP) is provided in **ES Volume III, Appendix 7.9: Outline Soil Management Plan**.

Cable Installation

2.6.62 The cabling connecting each turbine to the control building will be laid in a trefoil arrangement. Cables would be laid from a drum attached to a suitable vehicle. Each 33 kV cable would arrive as three insulated cores. These would be gathered in the trench and bound together along the entire length of the trench in a trefoil

arrangement. Communication cables and earth tapes would also be laid in the same trench. The cables would be protected from mechanical damage by a sand bed and surround. Two layers of marker tape and/or tiles would be buried above the cables to prevent accidental excavation. The developer will install route markers which are visible from each other with a maximum spacing of 30 m and at least 1000 mm in height.

2.6.63 Detailed construction and trenching specifications will depend on ground conditions encountered. Typically, power cables will be laid in a trench with minimum depth of 1.25 m and 1.25 m wide. To minimise ground disturbance, power cables will be routed along the side of the Site access tracks where practicable. Power cables will be laid within a sand or granular bedding to prevent damage to the power cables from sharp stones (with ducting is required for track crossings). Trenches will be backfilled with excavated material and the surface redressed to match the existing ground. If sand bedding is used, clay bunds will be placed at intervals within the bedding to prevent unnatural flows of ground water.

Signage

2.6.64 Due to the industrial operations occurring during construction, signs are required onsite for safe day-to-day navigation for works traffic and personnel; access for emergency vehicles; and for the health and safety of the public. To further protect the health and safety of all those visiting the Proposed Development, a comprehensive risk assessment for visitors will be produced. Signage would be bilingual and consist of non-illuminated post and panel sign locations and non-illuminated turbine identification signs with a maximum of three signs per post facing at the Proposed Development. Signs would also be placed on the turbines to help identify them as indicated in **ES Volume IV, Figure 2.18: Indicative Directional Signage**.

2.6.65 The implementation of bilingual signage would support the Well-being of Future Generations (Wales) Act 2015 goal – 'A Wales of vibrant culture and thriving Welsh language.'

2.6.66 The signage onsite would comprise of two elements; directional signs and roundels displaying the Site speed limit. The directional and speed roundel signs measure approximately 300 mm x 400 mm x 3 mm and 300 mm x 300 mm x 3 mm respectively and will be mounted on an approximately 2500 mm x 76 mm grey aluminium pole as shown on **ES Volume IV, Figure 2.18**. The poles will be set within approximately 585 mm deep concrete foundation. This will ensure the stability of the signs, in line with current guidance for such installations.

2.6.67 The sign fixtures allow back-to-back mounting and are used on sign locations where more than two signs are specified. The signs will be hard wearing using tamperproof fixtures, securing the signs in place. A high-quality typeface is used to maximise readability. The signage is uncluttered and designed to be legible from vehicle or from foot.

2.6.68 The exact number of signs required at any of the post locations will be decided prior to construction, following a full review of the health and safety requirements by the Principal Contractor.

Site Reinstatement

General Approach

2.6.69 Following construction, the Site will be reinstated by the Contractor. Areas subject to disturbance during construction will be reinstated as soon as is practicable (including reinstating sections of track verges as construction phases progress), while ensuring that any reinstated land would not be damaged by adjacent on-going works. The anticipated type and extent of reinstatement is outlined below:

- Where a re-turfing method is appropriate, such as along track verges, the surface layer of soil and vegetation will be stripped and stored separately from the lower soil layers and replaced as intact as possible;
- Local reinstatement will be carried out to retain the structure and composition of the original plant communities, as well as forming a stable area over reformed ground, thus reducing erosion by rain, run-off, and wind; and
- Bare soil areas will be allowed to revegetate naturally in combination with reseeding using a low-density seed mix which mirrors local vegetation to help bind the soil more quickly.

Site Access Tracks

2.6.70 Site access tracks are required throughout the operational phase of the Proposed Development to permit access for maintenance and repair operations. They will also allow access during the decommissioning phase.

2.6.71 Generally, the sloping verges of access tracks [and any associated bunds] will be re-seeded with locally occurring species, with top-soil reuse and/or turf replacement to blend in with the surroundings. Measures such as grass-reinforcement may be applied where the track widens on steeper bends and in passing places if suitable material is generated during the construction of the track. The adjacent grassland will be allowed to extend across the edges and middle of the tracks, reducing the extent of the visibility of tracks in the landscape. The engineered appearance of any embankments will be smoothed out to ensure any landforms form safe slopes and blend in with topography.

2.6.72 Within the Site there are 16 hedges, located along the access track near Llaithgwm and in fields to the east of the B4501 (south-west of the Site).

2.6.73 Hedgerows will be proposed to replace those lost as a result of the construction of the Site access track, including new hedgerow planting and hedgerow trees (in locations which will not interfere with the safe passage of turbine components).

Site Entrance

2.6.74 The Site entrance will be retained for future site access, however the fence line will be reinstated close to the proposed bound surface, with areas within the temporary widening area covered over with topsoil and re-seeded. A gate will be reinstalled to the width of the reinstated access track.

Turbine Foundations and Crane Pad Hardstandings

2.6.75 Turbine foundations will be capped with soil material and re-turfed with the removed material. Where vegetation is sparse or unlikely to regenerate, reseeding with an appropriate local seed mix may be undertaken as outlined above. The condition of turfs will be monitored regularly during the first few months following reinstatement. If necessary, water will be imported to the Site to ensure the re-establishment of this vegetation.

2.6.76 Hardstanding areas at each turbine location will be retained for use during operation and decommissioning. Edges will, as far as possible, be blended from the perimeter of the hardstanding to provide a safe slope from the finished hardstanding surface to the original ground level adjacent to new infrastructure [(subject to any bunding for visual or other mitigation)]. Natural vegetation will be allowed to re-establish.

Borrow Pit

2.6.77 Once construction is complete, the borrow pit will be reinstated to provide safe slopes and to blend edges into existing profiles before operation of the Proposed Development. The general approach to this is outlined in **Appendix 7.6.**

2.6.78 Any upgraded tracks that lead solely to the borrow pit will be reinstated to the pre-construction profile before operation of the Proposed Development and after all necessary material has been worked from this area.

Temporary Construction Compound

2.6.79 The temporary construction compound will be removed and the ground restored to its original condition as farmland once the construction phase is complete.

2.7 Decommissioning

2.7.1 At the end of the operational period the Proposed Development would be decommissioned. Decommissioning activities and sequence are envisaged to be broadly the reverse of the construction activities and would utilise similar equipment and personnel. Activities would likely take place in a shorter overall duration and would involve the following stages:

- Dismantling and removal of wind turbines and electrical equipment, and
- Restoration of the turbine hardstandings, working areas used temporary during decommissioning, and substation compound area.

2.7.2 Turbine components will need to be dismantled and removed in a similar fashion to their delivery and erection. Cranes will be used to split the turbines into sections which will then be transported from the Site by HGVs. These components will be reused, recycled or if appropriate disposed of in accordance with the relevant waste management regulations at the time.

2.7.3 The plinth and the top surface of the wind turbine foundations will be broken out to a depth of 1 m from the surface, and all cabling will be cut out at the same depth with the remaining concrete. Once the broken-out concrete has been removed, the area will be reinstated with a final layer backfilled with soil to an agreed method statement, as outlined in the restoration section above.

2.7.4 The high voltage and SCADA power export cables will be removed during decommissioning and recycled. The power export cables will be disconnected and removed from cable ducts, with ducting left in place to avoid further unnecessary ground disturbance.

2.7.5 Tracks and hardstandings can become amenities for the landowners and public access use over the duration of the project it is proposed that these will be left in situ for use by the landowner/public amenity or covered in topsoil. Watercourse crossings including the bridge would also be left in situ. No stone is proposed to be removed from the Site during decommissioning. This approach is considered to be less environmentally damaging than seeking to remove all track foundations, underground power export cables and tracks entirely.

2.7.6 A decommissioning strategy will be submitted by the Applicant for agreement with the Local Planning Authority prior to the decommissioning works taking place, and this is likely to be subject to an appropriately worded condition on any planning permission. Similarly, a Decommissioning Environmental Management Plan (DEMP) informed by appropriate survey work at the time will be secured by planning condition to be produced prior to decommissioning works taking place.

2.7.7 During the decommissioning phase of the Proposed Development wastes may include demolition waste (steel, crushed concretes and other building materials), broken down turbine components (steel and fibreglass), electrical cabling as well as municipal waste, waste chemicals, fuel and oil, sewage, and polluted water containing silt or hydrocarbons.

2.7.8 Currently between 85-95% of a wind turbine can be recycled. However, there are now a number of Research and Development (R&D) projects and programmes underway[1] which aim to increase the recyclability of wind turbine components.

2.8 Embedded Mitigation and Enhancement

Embedded (Primary) Mitigation

2.8.1 **Table 2.3**Table 2.3 describes the proposed 'embedded' (environmental design) mitigation measures that are considered to be an inherent part of the Proposed Development i.e., the project design principles adopted to avoid or prevent adverse environmental effects. These embedded (primary) mitigation measures should not be confused with additional (secondary and tertiary) mitigation proposed in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment, which are described within each technical chapter. Further details on embedded details can be found in **ES Volume II, Chapters 5 – 13.**

[1] https://ore.catapult.org.uk/wp-content/uploads/2021/03/CORE_Full_Blade_Report_web.pdf

Table 2.3 Embedded (Environmental Design) Mitigation Measures

Environmental factor to which the embedded (environmental design) mitigation measure relates	Embedded (environmental design) mitigation measure and associated benefit
Terrestrial Ecology	To reduce impacts on habitats and species associated with watercourses' infrastructure has been designed to minimise the requirement for land-take and the number of watercourse crossings. As part of the Proposed Development proposals a drainage system, separation of clean and dirty water and placement of settlement ponds during construction would be implemented. Preventing sediment entering watercourses and potentially adversely impacting on habitats and species associated with the watercourse. New watercourse crossings were reduced as far as practicable by using existing tracks where possible and minimising the number of crossings during initial design iterations. The clear span design for the new bridge crossing eliminates the requirement for instream works and the potential for resulting water pollution. The two arch culverts are also bottomless to ensure the watercourse substrate at these localities will not be directly impacted. A 50 m buffer from watercourses has been incorporated from an early design stage to avoid watercourses and watercourse crossings. Any new crossings will be sensitively designed to allow the continued movement of water and wildlife.
	Where the access track crosses watercourses, the track has been aligned to cross at around 90 degrees to the direction of flow. This minimises disturbance during construction and operation in the vicinity of watercourses and ensures separation from the watercourse buffer zones as much as possible.
	The length of access track within 50 m of mapped watercourses has been minimised as part of the sensitive Proposed Development design. Works within 50 m of watercourses has been restricted where possible to creation of some new areas of track (within 50 m of watercourses) and a number of watercourse crossings will

Environmental factor to which the embedded (environmental design) mitigation measure relates	Embedded (environmental design) mitigation measure and associated benefit
	be required. This has been done to reduce impacts on habitats and species associated with these watercourses.
	The layout of the Proposed Development has adopted a minimum 50 m 'stand-off' distance between bat habitat features and turbine blades to reduce collision risk with bat species and minimise affecting the most likely important habitats used by foraging/ commuting bats.
	The Proposed Development design has been sensitive to the River Dee and Bala Lake Special Area of Conservation (SAC) and River Dee SSSI and is offset from the SAC and Site of Special Scientific Interest (SSSI). To negate the potential for direct impacts on the SAC and SSSI (within the SAC/SSSI boundaries) from the Proposed Development.
	Design has largely avoided those areas of peatland, bog and heath and has avoided deep peat. These habitats are some of the most ecologically important onsite and with respect to certain peatlands may be considered as irreplaceable habitat, and thus prudent to avoid impacts.
	The Proposed Development's turbines are positioned ≥290 m from the identified Bat Roost Features onsite to reduce the risk to roosting bats from the Proposed Development.
	The length of new track construction has been minimised where possible with use of existing farm tracks used to minimise land-take.
Ornithology	Turbines offset from areas with the highest activity of target species, including red kite and golden plover. To reduce collision risk with target species and minimise affecting the most heavily used habitats for target species.
	Turbines have been appropriately offset from the identified breeding curlew territories to minimise the potential for displacing breeding curlew.

Environmental factor to which the embedded (environmental design) mitigation measure relates	Embedded (environmental design) mitigation measure and associated benefit
	The Proposed Development has been located away from potentially important habitat features including forestry habitat on the periphery of the Site to the south, and from the reservoir Llyn Maen Bras in the south of the Site. To minimise the potential for negative effects on birds.
	Design evolution resulted in avoidance of main areas of deeper peat where possible. Areas of deeper peat are predicted to be some of the best peatland habitat for birds, such as ground-nesting species.
Land, soils and water	Watercourse crossings have been kept to a minimum to reduce impacts upon watercourses.
	The watercourse crossing design, will be designed to accommodate the 1-in-100-year flow level plus allowance for climate change. To maintain the flow of the watercourses as near to their original state as possible.
	Watercourse crossings will make use of bottomless culverts or bridge structures where possible to minimise effects on the watercourse channel and banks.
	Infrastructure has been sited outside a 50 m buffer from all major watercourses within the Site to minimise works in close proximity to watercourses, minimising the risk of spillages of contaminating materials or release of sediment.
	The access track has been designed to promote good visibility where possible and include two-way access or passing places where visibility is restricted. To minimise the risk of vehicular collision and the associated potential for pollution incidents that could affect surface water and groundwater bodies.
	Private Water Supply (PWS) source locations within or in close proximity to the Site have been avoided carefully by infrastructure design to reduce the risk of PWS contamination.
	Incursion into areas of deep peat soils has been avoided by careful infrastructure design and minimised where complete avoidance is not possible. To reduce the loss of peat soils and their associated hydrological systems.

Environmental factor to which the embedded (environmental design) mitigation measure relates	Embedded (environmental design) mitigation measure and associated benefit
Cultural Heritage	The layout of the Proposed Development has been designed to avoid as far as is practical both designated and non-designated historic receptors recorded within the application area. To reduce the level of direct impacts caused by the Proposed Development.
Landscape and Visual	Reduction in turbine numbers from 11 (at scoping) to 10 turbines in final design to reduce the overall visual presence and cumulative landscape effects of the development.
	Avoidance of positioning of turbines on elevated areas of Foel Goch Uplands on ridges and plateau areas, to maintain consistency with the existing upland landscape character and utilise natural topographical screening.
	Maintaining separation from Eryri National Park boundary (approximately 1.9 km to nearest turbine T01) to minimise visual impacts on the National Park's special qualities and designated landscape.
	Four turbines reduced from 220 m to 200 m tip height to minimise visual impact from Eryri National Park and reduce prominence in views from sensitive receptors.
	Relocation of T04 further west to reduce landscape and visual impact near Moel Emoel and from Eryri National Park, and to reduce visual effects on Bala.
	Removal of a turbine from scoping design to avoid loss of peat soils and reduce risk of water pollution near watercourses.
	Turbines to be painted off-white colour with low reflectivity semi-matt finish to be least intrusive in the landscape when seen against the sky in various weather conditions typically experienced in Wales.
	A reduced lighting scheme is proposed in order to minimise the night time visual impact of the development on sensitive receptors. Provision of aviation lighting is proposed that turbines T01, T04, T05 and T10 are provided with dimmable 2000 candela (cd) lights at hub height.

Environmental factor to which the embedded (environmental design) mitigation measure relates	Embedded (environmental design) mitigation measure and associated benefit
	Siting of infrastructure to avoid areas of deep peat where possible to minimise landscape character change and maintain existing moorland characteristics.
	Maintaining 50 m buffer from major watercourses for infrastructure placement to preserve riparian landscape features and reduce visual intrusion near water features.
	Underground internal cabling following access track route to minimise additional landscape disturbance and visual clutter.
	Utilisation of existing farm track from B4501 to Llaithgwm farm where practicable to minimise new landscape scarring and maintain existing landscape patterns.
	Site entrance positioned to avoid areas of peat to reduce landscape impacts at the main access point.
	Access track design to minimise watercourse crossings to maintain existing hydrological patterns and landscape continuity.
	Design allows for reinstatement of track verges with locally occurring species to blend infrastructure into the existing landscape character. [In addition, a degree of roadside bunding (with soiling and revegetation) in order to further reduce visual impacts of access tracks.]
	Edges of hardstandings to be blended to adjacent contours to reduce the engineered appearance and integrate with natural topography.
	Natural vegetation allowed to re-establish at turbine locations and hardstanding edges to soften the visual impact of infrastructure over time.
Noise and Vibration	Maintaining a distance of at least 800 m from turbines to the nearest residential receptor during the design evolution process.

Environmental factor to which the embedded (environmental design) mitigation measure relates	Embedded (environmental design) mitigation measure and associated benefit
Traffic and Transport	To reduce the volume of aggregate material transported to / from the Site, the Site layout includes the use of one onsite borrow pit to provide material for the creation of the access track and construction compound base. Material won from the cut / fill exercise on Site will be used for creation of the tracks [and bunds] and hardstanding's bases.
	Batching of concrete for use onsite is considered feasible and reduces the requirement for ready-mix concrete to be delivered to the Site.
Aviation: Lighting	A reduced lighting scheme has been designed for the Proposed Development in order to minimise the nighttime visual impact of the development on non-aviation receptors. Further details are provided in **ES Volume II, Chapter 12: Aviation**.
Climate	Turbines and other infrastructure have been sited in areas that cause minimal peat disturbance reducing any associated greenhouse gas emissions. Turbines and other infrastructure have been sited in areas to optimize renewable energy generation as far as practicable within the range of environmental and technical constraints that influence the design. Given that nature of a wind farm development is to generate renewable energy, this is also considered embedded climate change mitigation.

2.8.2 Further embedded mitigation measures relating to aspects of the design of the Proposed Development where environmental constraints and potential environmental impacts have sought to be avoided are described in **ES Volume II, Chapter 3: Environmental Context and Reasonable Alternatives Considered.**

Enhancement

2.8.3 In addition to consideration and management of environmental impacts, in accordance with the requirements of both Future Wales and PPW12, the design has implemented the step-wise approach to avoid or minimise impact on biodiversity and adopted the DECCA Framework to seek biodiversity enhancement onsite. The approach and recommendations are provided in the Outline Habitat Monitoring and Management Plan (OHMP) and Net Benefit for Biodiversity report in **ES Volume III**, **Appendix 5:4: Outline Habitat Management Plan.**

2.8.4 The OHMP sets out five aims and related objectives of the Proposed Development, which will be achieved through the implementation of management prescriptions and habitat creation practices. The aims relate to enhancement of heathland, mire/ flush, woodland, tree and scrub habitats, as well as improvement of wetland habitats and increasing nesting and roosting opportunities for wildlife. Restoration measures would be undertaken to improve the condition of peatland and restore active peat soil development

3 ENVIRONMENTAL CONTEXT AND REASONABLE ALTERNATIVES CONSIDERED

3.1 Introduction

3.1.1 This chapter provides a brief description of the Site location, its features and existing land use. It also includes a description of the surrounding area and its environmental context; in particular, the sensitive receptors that could be affected by the construction, operation and subsequent decommissioning of the Proposed Development.

3.1.2 The key environmental constraints within the Site and surrounding area are illustrated in **ES Volume IV, Figure 3.1: Environmental Constraints**. There are several sensitive receptors that have been identified as relevant to the Proposed Development, and these have been taken into consideration within the assessments presented in **ES Volume II, Chapters 5** to **13** and the iterative design process which is discussed in this chapter. The key sensitive receptors include local residents (e.g. potential noise and visual amenity effects) and priority habitats and species (including bats and birds).

3.1.3 Schedule 4 paragraph 2 of the EIA Regulations 2017 states that an Environmental Statement (ES) must include (Welsh Government, 2017):

"*A description of the reasonable alternatives (for example in terms of development design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*".

3.1.4 This chapter recognises and fulfils this requirement in respect of the Proposed Development and describes the main alternatives to the Proposed Development, that have been considered by the applicant, together with the principal reasons for proceeding with the Proposed Development.

3.1.5 Given the nature of wind farm developments, EIA is likely to be required irrespective of where the development is sited. The consideration of alternatives has therefore focused on design evolution, with the aim of avoiding, preventing, reducing, or, if possible, offsetting likely significant adverse environmental effects (following the step wise approach), while ensuring operational efficiency of the wind farm, cost effectiveness, and in recognition of other relevant matters such as existing land use and planning policy (including the desire to "maximise renewable and low carbon generation" by delivering development "at all scales" which makes "best use of resources" (Welsh Government, 2021)). The design of the Proposed Development has evolved through engineering design work, in response to consultation feedback, and environmental survey work.

3.2 Site Location

3.2.1 The Site of the Proposed Development comprises an area of approximately 659 hectares (ha), and the Site boundary is located over three kilometres to the north-east of the town of Bala, Gwynedd. The Site location is illustrated in **ES Volume IV, Figure 1.1** and **Figure 1.2**.

3.2.2 The Site extends northwards across the Rhiwlas estate from the A494/A212 towards Llangwm, east and south of the B4501 to approximately c.6 km south of Cerrigydrudion.

3.3 Current Land Use

Land Use and Topography

3.3.1 Land use within the Site consists mainly of open moorland predominantly used for cattle and sheep grazing. There are areas of common land within and in proximity to the Site: two on the western slope of Moel Darren and two other areas of common land immediately north of the Site boundary (south of Garnedd Fawr) and to the south of the Site boundary (south of Moel Emoel).

3.3.2 There are 59 residential properties within 0.5 km of the Site. Properties within 100 m of the Site include Stabl, Ty'r Neuadd, Llaithgwm, Ty Capel Glan Yr Afon, Ty Cipar, Abermynach, Wern Fawr, Llwyn Y Brain, Tai'r Felic Cottage and Tai'r Felin.

3.3.3 The Site is located in an upland area, with elevations ranging from 250 m to 569 m AOD; the highest point onsite being Garnedd Fawr at 569 m AOD. The topography of the Site generally slopes to the south-east from a prominent ridge of high points including Cerrig Y Gordref (497 m AOD) to the north, Foel Goch (611 m AOD) to the north-east, Moel Darren (509 m AOD) to the east, Garw Fynydd (490 m AOD) to the south and Craig Y Garn (461 m AOD) to the west.

Access

3.3.4 The Site is generally accessed via an existing agricultural track that runs west to east from the B4501 at Glan-yr-Afon. The B4501 runs north of Frongoch, adjacent to the western and northern boundary of the Site before connecting with the A5 just south of Cerrigdrudion.

3.3.5 The majority of the Site is Countryside and Right of Way (CRoW) Act access land, and there are several Public Rights of Way (PRoW) within, and in vicinity of the Site:

- Llandderfel Footpaths 113, 114, 116, 120, 124, 128, 131, 175, 176, 177 and 182.

3.3.6 There are no Bridleways within the Site. The closest strategic PRoW is the Hiraethog Trail located several kilometres to the northeast of the Proposed Development.

3.3.7 A map showing the PRoWs within the Site are presented Annex 3 of **Appendix 11.1.**

3.3.8 There are no National Cycle Network (NCN) routes within 20 km of the Site.

3.4 Environmental Characteristics

3.4.1 Key environmental features are set out in **ES Volume IV, Figure 3.1** and summarised below, with further detail available in **ES Volume II, Chapters 5** to **13**.

Landscape Designations

3.4.2 The Site is not located within any internationally or nationally designated landscapes. Eryri National Park (NP) is located approximately 1.9 km to the west of the nearest proposed turbine (T01) location. Eryri is designated a Dark Sky Reserve by the International Dark Sky Association.

3.4.3 A new Candidate National Park Glyndwr NP is located 4.5 km to the south-east from the nearest point of the proposed boundary. It is proposed that the new NP would replace the existing Clwydian Range and Dee Valley National Landscape / Tirwedd Cenedlaethol Bryniau Clwyd a Dyffryn Dyfrdwy (NL) which is located 11 km from the nearest proposed turbine (T10) location.

3.4.4 The Site is located within the locally designated Bala Hinterlands Special Landscape Area (SLA), with the Afon Ceirw valley mosaic SLA located approximately 250 m north of the most northern turbine.

Statutory and Non-statutory Ecological Designations

3.4.5 There are 13 statutory designated sites with a 10 km radius of the Site (**ES Volume IV, Figure 3.1**):

- Afon Dyfrydwy/River Dee Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) located adjacent to the south-west boundary of the Site;
- Migneint-Arenig-Dduallt SSSI, SAC, Special Protection Area (SPA) and Important Bird Area (IBA) located approximately 805 m west of the Site;
- Tryweryn River Sections SSSI located approximately 2.45 km south-west of the Site;
- Cors y Sarnau SSSI located approximately 2.6 km south-east of the Site;
- Caerau Uchaf SSSI located approximately 3.2 km south-east of the Site;
- Llyn Tegid/Bala Lake SSSI, and RAMSAR Site which is located approximately 3.9 km south-west of the Site;
- Y Glyn-diffwys SSSI, 4.61 km north-east of the Site;
- Corsydd Nug a Merddwr, 6.12 km, north-west of the Site;
- Berwyn a Mynyddoedd De Clwyd / Berwyn and South Clwyd Mountains SAC and Berwyn SSSI, located 7.3 km south-east of the Site; and
- Coedydd Dyffryn Alwern SSSI, located 7.49 km north-east of the Site.

3.4.6 There are no designated historical receptors recorded within the application boundary and 23 designated historic assets recorded by Cadw within the 2 km of the Site. These consist of one scheduled monument, 21 Grade II listed buildings, and Bala and Bala Lakeside Registered Landscape of Special Historic Interest.

3.4.7 There are 26 non-statutory designated sites within the application boundary, predominantly relating to the post-medieval period.

3.4.8 There are 79 Gwynedd 'Wildlife Sites' (all Candidate Wildlife Sites) within 2 km of the Site. Of these, there are three Candidate Wildlife Sites within the Site (Llandderfel, Llwyn-y-brain heath and Llywyn-y-brain cottage).

Natural Resources

3.4.9 The Site lies within five catchment areas of the Afon Dyfrydwy/Dee River basin and is hydrologically linked to the Afon Dyfrydwy SSSI, SAC and SPA and the Tryweryn River sections SSSI via Afon Mynach, which drains the western portion of the Site and Afon Tryweryn. There is one small lake onsite, Llyn Maen Bras located towards the south of the Site. Llyn Maen Bras drains two unnamed watercourses from the north.

3.4.10 The Site is crossed by a number of watercourses, including Nant Cefn-coch which drains the eastern portion of the Site into Afon Meloch. The south-western area of the Site is drained via two unnamed watercourses conveying flow into Afon Tryweryn.

3.4.11 The Site lies within Flood Zone A meaning the majority of the Site is considered to be at little or no risk of fluvial flooding. A small area on the western edge of the Site lies within Flood Zone C2 indicating the area has a 0.1% likelihood of flooding from surface water, small watercourses and rivers in any given year. The Flood Risk Assessment Wales Map indicates there is a medium risk of flooding from rivers within the Site, with areas of flood risk confined to the main watercourse channels.

3.4.12 The Site is wholly located within the Dee Water Protection Zone which has a status of 'not at risk'. There are no lake or river catchment Drinking Water Protection Areas (DWPAs) that have hydrological links to the Site.

3.4.13 The groundwater body associated with the Site is the Dee Silurian/Ordovician. NRW identifies the groundwater body as having 'good' overall status. Within the southern part of the Site groundwater is likely to flow south into Llyn Maen Bras and the River Dee. For groundwater within the eastern part of the Site, flow would be towards the Nant Cefn-coch.

3.4.14 Within the Site, the groundwater has predominantly been assigned a vulnerability level of Medium.

3.4.15 There are two Private Water Supplies (PWS) within the Site. Although, 103 PWS have been identified within a 5 km radius of the Site Boundary, nine of which have potential links to the Site (**ES Volume III, Appendix 7.8: Private Water Supplies Risk Assessment**).

3.4.16 Most of the Site (approximately 78%) has soils or peaty soils under 0.3 m in thickness. Areas of peat soil are restricted to pockets of boggy ground, with a higher concentration in the north-eastern part of the Site (**ES Volume II, Chapter 7: Land, Soils and Water** and **ES Volume IV, Figure 7.4: Soils and Peat**).

3.4.17 There are a few small areas of woodland within the Site Boundary including a small area of restored ancient woodland in the north-western portion of the Site and an area of Broadleaved woodland to the south of Llyn Maen Bras. There are also a number of large areas of woodland immediately to the south of the Site Boundary

including Coed Foel-Emoel and Coed Penmaen Mawr both comprising a large area of ancient woodland as well as Coed Bwlch-y-Tyno, a coniferous woodland to the south-east of Moel Emoel (**ES Volume IV, Figure 3.1 Environmental Constraints**).

3.4.18 Based on the Predictive Agricultural Land Classification (ALC) Map 2 (Welsh Government, 2018), the majority of the land at the Site is recorded as agricultural land classification grade 5 (very poor quality agricultural land) and grade 4 (poor quality agricultural land), with smaller areas of non agricultural land recorded. No best and most versatile agricultural land is present on the Site.

Historic Environment

3.4.19 There are no designated historic assets recorded by Cadw within the Site Boundary. The Grade II listed buildings Llaithgwm, Llaithgwm Stable Block, Llaithgwm Carthouse and Wern Fawr have been excluded from within the Site Boundary and are located approximately c.900 m and c.1.7 km west of the nearest turbine at Llaithgwm and Wern Fawr respectively.

3.4.20 There are five other Grade II listed buildings within 1 km of the Site Boundary, namely Pont Llwyn y Brain, Coed-y-Foel Isaf and the Coed-y-Foel Isaf Carthouse, Pigsty, Outhouse and Brewhouse.

3.4.21 Llangwm Conservation Area is located approximately c.2.8 km north-east of the Site.

3.4.22 The nearest scheduled monument is Maen y Rhos Standing Stone, located approximately c.1.7 km to the east of the Site. See **ES Volume II, Chapter 8: Cultural Heritage**, **ES Volume IV, Figure 8.1: Cultural Heritage Outer Study Areas** and **Figure 8.2: Assessed Non-designated Heritage Assets within the Site Boundary**.

3.5 Site Selection and Feasibility

3.5.1 The Applicant has a well-established process for selecting sites and identifying land for wind farm development. Overall, the process and approach to considering sites for renewable energy development involves ensuring early assessment of the potential capacity for energy generation in balance with environmental and technical constraints, relevant policy, and project deliverability in-line with the urgency of meeting Net Zero targets for Wales.

3.5.2 The overall approach to wind farm site selection undertaken by the Applicant is to identify areas of land where the siting of a wind farm would result in minimal environmental effects, align with planning and renewable energy policy, be free from overriding technical constraints, and be economically viable. This initial site identification exercise involves:

- A review of current and emerging planning policy (at the National and Local level)
- Geographical Information System (GIS) constraints analysis
- A review of suitable site access points, grid viability and transportation issues

- Consideration of wind speeds and terrain characteristics, to understand whether these will be sufficient for optimal operation of wind turbines
- Desk-based assessment of site technical and environmental constraints
- Ground conditions for building of turbine foundations, access tracks and associated electrical infrastructure, and
- Ability for extant land use to be maintained as much as possible alongside the simultaneous operation of wind turbines, e.g. upland grazing land.

GIS Constraints Analysis

3.5.3 The GIS constraints analysis undertaken for the Site involved identifying and mapping environmental, technical, and engineering constraints to wind farm development. Constraints that were considered as part of the Site selection exercise for the Proposed Development included:

- Landscape designations: including National Parks, local landscape designations and maintaining appropriate separation distances from residential properties
- Aviation interests: Including; visibility to radars (both military and civilian) and Ministry of Defence (MoD) facilities and operations
- Ecological designations: including international designations (e.g., Special Protection Areas), National designations (e.g., Sites of Special Scientific Interest), and Local designations (e.g., Local Nature Reserves)
- Cultural heritage designations: including Registered Gardens and Designed Landscapes, Registered Battlefields, World Heritage Sites, Listed Buildings, Conservation Areas, and Scheduled Ancient Monuments
- The pattern of settlement and land use: including; residential properties and settlements, use of the Site, and existing infrastructure, and
- Other sensitive environmental receptors including public rights of way, habitats of principal importance, peatlands, ground water dependant terrestrial ecosystems, watercourses, surface flood risk areas, potential noise sensitive residential properties and telecommunications links.

3.5.4 The predicted wind resource in any given location is an important consideration in identifying potentially suitable wind farm sites. The electricity that can be generated by a wind farm is directly linked to wind speed. Wind speed generally increases with height above ground level. The amount of electricity generated increases disproportionately with increases in wind speed, this in turn affects the carbon emission savings and the commercial viability of a site. Potential wind farm sites are therefore reviewed in relation to a number of publicly available data sources in the first instance, including the Numerical Objective Analysis of Boundary Layer (NOABL) wind speed database.

Suitable Access Considerations

3.5.5 Given the size and scale of AILs associated with wind farm development, site selection also includes an appraisal of the Site's accessibility for construction traffic. The Applicant has conducted a Route Survey Report (RSR) (**Appendix 11.1**) from

the port of delivery to the Site, to help inform the likely issues associated with the development of the Proposed Development with regards to offsite transport and access for AIL traffic. The report identified the key issues associated with AIL deliveries and noted any requirement for remedial works, either in form of physical works or as traffic management interventions, will be required to accommodate the predicted loads.

Utilities

3.5.6 Regard has been had to potential impacts on existing utilities, particularly above ground electricity and telecoms lines. Since the nearest extra high voltage (EHV) 33 kV steel lattice tower line is over 1.1 km distant from nearest turbines, therefore it is concluded that there could be no adverse wakes turbulence or topple-height risk. Where new access from the B4501 crosses existing telecoms and 11 kV overhead lines, it is considered that if suitable clearance heights cannot be achieved then undergrounding of these at the Applicant's cost would be viable solutions.

3.6 Design Strategy

3.6.1 The design strategy defines the overall approach to the design of the Proposed Development. It provides the starting point for the Proposed Development's design, and subsequent alterations to this design that were made in response to various environmental considerations, together with wind yield, and feasibility of construction, as information emerged through the EIA process.

3.6.2 The overall aim of the design strategy was to create a wind farm with a cohesive design that is sympathetic in form and scale to the surrounding landscape context, whilst achieving an appropriate balance between maximising renewable energy yield and minimising other environmental and technical effects.

Design Objectives

3.6.3 The overarching objectives of the design strategy were as follows:

- To maximise the potential energy yield throughout the Site through the employment of wind technology in optimal locations
- To use the latest wind turbine technology, consisting of more efficient and larger turbines where these can be reasonably accommodated within the landscape
- To ensure that turbines respond to the scale of the underlying landscape and operational, consented and proposed turbines in the surrounding context
- To develop a turbine layout which avoids deeper peat where possible
- To make use of natural and topographical screening of turbines and other infrastructure in key views where possible
- To ensure that no turbine is overbearing in views from any individual residential property
- To explore opportunities within the Site to restore and enhance biodiversity and provide greater access and recreational opportunities, and

- To develop a layout that fulfils the above objectives whilst minimising or avoiding other environmental and technical constraints as far as possible, including noise, hydrology (watercourses), priority habitats, steep slopes, telecommunications links, and other technical constraints identified during the EIA process.

3.6.4 The main elements of the Proposed Development considered in the initial design iterations were the turbines. The locations of other infrastructure components were largely dictated by the positioning of the turbines and were designed around onsite environmental constraints. Later iterations to the turbine layout involved minor alterations to turbine and infrastructure locations, which were reviewed against all constraints.

Site Sensitivities and Constraints

3.6.5 Constraints analysis has been undertaken using a project-specific GIS workspace, based on ArcGIS Online, which has been developed specifically for the Proposed Development. This has allowed base-mapping to be overlaid with spatial data, such as environmental constraints and protected sites, and project-specific data to provide the Applicant with a means of interrogating environmental and project details in a single place at technical meetings and design workshops.

3.6.6 As a result, a number of technical and environmental constraints have been considered in the iterative design process and have guided the positioning of both turbines and infrastructure. These are outlined below:

- Landscape: Avoiding locations within or in close proximity to the Eryri National Park boundary (minimum 1.9 km offset maintained), minimising effects on LANDMAP Visual and Sensory Aspect Areas of High or Outstanding value, avoiding prominent ridgeline positions where turbines would significantly break the skyline when viewed from sensitive receptors including the National Park and nearby settlements, and maintaining appropriate separation distances from residential properties to protect visual amenity. The layout has been designed to reduce visibility from key visual receptors including the B4501 corridor, settlements around Bala, and elevated viewpoints within the National Park.
- Ecology: Avoiding ground water dependant terrestrial ecosystems and Annex I habitat types
- Residential Properties: Maintaining a buffer around residential properties to avoid breaching of any amenity thresholds
- Hydrology: Maintaining a 50 m buffer where possible from watercourses, designing Site infrastructure to minimise the number and extent of new watercourse crossings
- Peat: Avoiding areas of deeper peat where possible, and
- Public Rights of Way: Avoiding rights of way so far as practicable.

3.7 Project Design Evolution

3.7.1 The design strategy and principles outlined above have been taken into account as the design of the Proposed Development has evolved. The design process involved multiple workshops with technical team members to address potential constraints associated with one or more of the turbines or elements of the associated infrastructure. Workshops were held September 2024, November 2024 and April 2025.

3.7.2 Feedback from specialist and community stakeholders which was relevant to the design process have been given due regard during the evolution of the project design.

3.7.3 Key layouts from the Proposed Development's design evolution are presented in **ES Volume IV, Figure 3.2: Alternative Site Development Options** and discussed in the following sections.

Design 1: Pre-Scoping Layout

3.7.4 Following initial acquisition of the Site for development, preliminary layouts based on desk-based and GIS analysis were under consideration that included up to 17 turbines of potentially up to 250 m to blade-tip height.

3.7.5 Turbines were positioned across the Site to use its maximum potential and generate the highest capacity.

Design 2: Scoping Stage Layout

3.7.6 By the time of a request for EIA Scoping being submitted in July 2024, an 11 turbine layout had been developed with a with maximum height to blade tip of 220 m. This design was informed by preliminary results of onsite surveys (including phase 1 peat and phase 1 habitat survey), a Ground Water Dependant Terrestrial Ecosystem (GWDTE) desk-based assessment and consultant inputs. Some amendments were also made to the site boundary avoid environmental designations, including the Eryri National Park and River Dee and Bala Lake / Afon Dyfrdwy a Llyn Tegid (Wales) SAC and Afon Dyfrdwy (River Dee) SSSI.

3.7.7 At this stage the Site size was approximately c.1,000 ha. This layout was used to determine the scope of the assessments to be included in this ES and to obtain feedback on the layout.

3.7.8 The Scoping Direction (**Appendix 1.2**) contains a copy of all the consultee scoping responses. This consultation helped identify and clarify key stakeholder concerns relating to the design of the Proposed Development.

Design 3: Post-Scoping Layout

3.7.9 During an all-team design workshop held in September 2024, the locations of the turbines were adjusted where possible to further avoid areas of deeper peat, potential GWDTE and Annex 1 habitats. The turbine heights were unamended but were relocated to ensure they were outside of the watercourse buffers (50 m) to reduce the risk of water pollution. The appearance of the revised layout of turbines was reviewed within the computerised 3D model software that was available for the project.

3.7.10 The design team looked at options to the north and south of the Site for the entrance compound. The southern areas were discounted due to peat, and the upland area was avoided due to the steep gradient. The Site entrance compound was introduced north of the access track entrance, with close access to the public road.

3.7.11 An additional compound area was introduced between T01 and T02 and Substation/ BESS was added near T08 due to the suitable topography and proximity to turbines.

3.7.12 In addition, access tracks, foundation areas/hardstanding and crane pad hardstandings were added.

Design 4: Design Chill Layout

3.7.13 Following additional phase 2 peat surveys turbine locations and tracks were adjusted to avoid the identified peaty soils wherever possible. An undesignated local interest feature known as 'The Giants Pebble' was avoided in the track design alignment, and the track profile was lowered in this location to minimise the potential for any visual impact on this feature.

3.7.14 T01 and T05 were moved south to avoid peats soils and T04 was removed from the design to avoid the loss of peaty soils, which had been confirmed as present in the hardstanding area of the turbine. T04 was located near a watercourse and therefore the removal of this turbine from the design reduced the risk of possible water pollution incidents.

3.7.15 It was identified that the relationship of T08 to Moel Emoel in views from Bala would be of particular importance and so the design team assessed the benefits of moving T08 to the east and west and also at alternative tip-heights. Through this exercise it was determined that moving the turbine further west would require substantial earthworks and would move the turbine closer to a PRoW.

Design 5: Design Freeze Layout (Proposed Development)

3.7.16 The final design represents the final stage of design iteration and constitutes the Proposed Development, which included finalisation of turbine locations and siting and design of ancillary infrastructure. A temporary construction compound was included to the east of T08. The requirement for this separate compound was identified by the lead designer and pre-construction advisor.

3.7.17 The proposed concrete batching area was moved from the construction compound near the Site entrance to a new area opposite the substation. The concrete batching area now sits further away from the watercourses.

3.7.18 The LiDAR Compound area was introduced on the track leading to T08 (east of track).

3.7.19 Consideration of visual aspects found T08 would be better suited if moved further west in order to reduce the visual effects on Bala. Turbines T01, T02, T08 and T11 were reduced from 220 m tip height to 200 m to minimise visual impact from the Eryri National Park.

3.7.20 Access tracks were further optimised as a loop was added in to the access tracks between T05 in order to make delivery to T02 feasible. Tracks on site are two laned to allow for safe movement.

3.7.21 The turbines were then re-numbered T01 to T10, and the red line boundary bought in to arrive at the final layout design. The final site area is approximately c.659 ha.

3.7.22 Five additional temporary material storage areas were identified, avoiding key environmental constraints such as GWDTEs, watercourses and peat soils.

3.7.23 The final layout of the Proposed Development subject to this DNS application, including ancillary infrastructure, is shown on (**ES Volume IV, Figure 2.1**). Individual environmental factor assessment chapters (**ES Volume II, Chapters 5** to **13**) refer to design input in further detail and respond to specific matters.

3.8 Summary

3.8.1 This chapter sets out the process undertaken to identify the Site and the design strategy, objectives and evolution of alternative layouts to design the Proposed Development.

3.8.2 The inherent nature of wind turbines as tall, modern structures means that the form of the Proposed Development as a whole is important, and a clear design strategy is necessary. The overall aim of the design strategy was to create a wind farm with a cohesive design that is sympathetic in form and scale to the surrounding landscape context, whilst achieving an appropriate balance between maximising renewable energy yield and minimising other environmental and technical effects.

3.8.3 The careful design of the layout of the proposed turbines and associated infrastructure, and the reduction in the number of turbines from [15] (pre-scoping stage layout) to ten (final layout), has resulted in the avoidance or reduction of a number of potentially significant effects from the Proposed Development as far as is reasonably practicable.

4 APPROACH TO THE EIA

4.1 Introduction

4.1.1 This chapter outlines the approach to the EIA, in particular the objectives and overall strategy for the EIA developed by RSK and the wider project team.

4.1.2 The approach to consultation is also outlined in this chapter, together with the approach to proportionate assessment including the assessment criteria and the methodology for assessing cumulative effects.

4.1.3 The EIA has been undertaken in accordance with the EIA Regulations 2017 (Welsh Government, 2017), IEMA (2024) Guidelines: Implementing the Mitigation Hierarchy from Concept to Construction (IEMA, 2024), and guidance specific to the factors assessed (as listed in **ES Volume II, Chapters 5** to **13**).

4.1.4 A detailed overview of the Site's status in relation to relevant planning policy is discussed within the **Planning Statement**, in addition to **ES Volume II, Chapters 5** to **13** which refer to any planning policy which has informed the methodology of that factor assessment.

4.1.5 This chapter should be read in conjunction with the following appendices presented in **ES Volume III**:

- Appendix 1.1: EIA Scoping Report
- Appendix 1.2: EIA Scoping Direction and Addendum
- Appendix 2.1: Outline Construction Environmental Mangement Plan
- Appendix 2.2: Outline Battery Safety Management Plan
- Appendix 4.2: Telecommunication Report
- Appendix 4.3: Arboricultural Impact Assessment
- Appendix 4.4: Shadow Flicker Assessment
- Appendix 4.5: Air Quality Assessment.
- Appendix 7.1: Flood Consequence Assessment
- Appendix 7.5: Peat Slide Risk Assessment, and
- Appendix 11.1: Transport Assessment.

4.2 Objectives of the EIA

4.2.1 The key objectives of the EIA are as follows:

- Set the legal framework
- Document the consultation process
- Consider the alternatives to the Proposed Development
- Establish baseline environmental conditions at the Site and within the surrounding area

- Identify, predict and assess the environmental effects associated with the Proposed Development: beneficial and adverse; permanent and temporary; direct and indirect and short/medium/long term; significant or not significant
- Identify, predict and qualitatively assess the cumulative effects of the Proposed Development including those associated with the other developments
- Identify suitable mitigation measures to avoid, prevent, reduce or, if possible, offset likely significant adverse effects on the environment and identify the likely significant residual effects following the implementation of these measures, and
- Identify monitoring measures where likely significant residual adverse effects are identified.

4.3 Screening and Scoping

EIA Screening

4.3.1 As set out in **Section 1.3** of **ES Volume II, Chapter 1: Introduction**, the Applicant voluntarily undertook EIA, therefore a formal EIA Screening Direction was not sought.

EIA Scoping

4.3.2 EIA scoping is the process of identifying the content and extent of the environmental information to be included within an EIA based on the likely significant effects of a development. Scoping is undertaken at the start of the assessment and involves the production of a report (the EIA Scoping Report) which requests feedback from PEDW on the proposed scope of the EIA. However, it is also an ongoing process, which is documented within this chapter alongside the evidence base associated with those factors scoped out of further assessment.

4.3.3 As set out in **ES Volume II**, **Chapter 1: Introduction**, an EIA Scoping Report was submitted to the PEDW (on behalf of Welsh Ministers) on 22 July 2024 alongside a request for a formal Scoping Direction in accordance with Regulation 33(1) of the EIA Regulations 2017.

4.3.4 The EIA Scoping Report (**Appendix 1.1**) outlined that the Proposed Development has the potential to result in likely significant effects on the environment associated with the following factors, and therefore proposed to include the results of these assessments within this ES:

- Terrestrial Ecology (Chapter 5)
- Ornithology (Chapter 6)
- Land, Soils, and Water (Chapter 7)
- Cultural Heritage (Chapter 8)
- Landscape and Visual (Chapter 9)
- Noise and Vibration (Chapter 10)
- Traffic and Transport (Chapter 11)

- Aviation (Chapter 12), and
- Climate (Chapter 13).

4.3.5 A formal Scoping Direction was subsequently received from PEDW on 5 December 2024 and an addendum on the 18 December 2024, as presented in **Appendix 1.2.**

4.3.6 As part of PEDW's responsibility under Regulation 33(7) of the EIA Regulations 2017, consultation was undertaken with external consultees. Formal consultation was undertaken with the following consultees:

- Gwynedd Council
- Natural Resources Wales (NRW)
- Cadw
- Transport Directorate, Welsh Government
- Agricultural Land Use & Soil Policy, Welsh Government (LQAS)
- NATS
- Defence Infrastructure Organisation (DIO)
- Civil Aviation Authority
- Health and Safety Executive
- Dŵr Cymru, and
- North Wales Fire and Rescue Service.
- Additional consultation was undertaken with:
- Eryri National Park Authority (ENPA)
- Conwy County Borough Council (CCBC)
- Denbighshire County Council, and
- Wrexham County Borough Council.

4.3.7 PEDW also received additional submissions from SP Energy Networks (SPEN) and Motvind UK.

4.3.8 The written responses from these consultees are appended to the Scoping Direction in **Appendix 1.2**.

4.3.9 The factors identified in the Scoping Direction, and their associated likely significant environmental effects, have been taken forward and assessed within this ES, with the exception of those factors or matters subject to ongoing scoping as described in the following section. Further detail on how the issues raised in the EIA Scoping Direction are addressed is presented in the relevant technical chapter of the ES.

Ongoing Scoping

4.3.10 EIA is intended to be an iterative process that takes place alongside the design of the Proposed Development. As such, the process of scoping the assessment has been ongoing in response to design iteration of the Proposed Development. Since the submission of the EIA Scoping Report, the Proposed Development has been updated. The key amendments since scoping are:

- The overall area of the Site boundary was reduced by removing parcels of land on the northern and southern boundaries. An area of common land

located to the south-west of Garnedd Fawr was also excluded from the Site Boundary.

- The Proposed Development was reduced to a ten turbine scheme. T04 (scoping numbering) was removed to provide space for the movement of T08 (now T04) and the project substation in order to avoid areas of deep peat, and
- The location of T08 (now T04) was amended to reduce the landscape and visual impact in relationship to Moel Emoel and from the Eryri National Park.

4.3.11 Regulation 17(4)(c) of the EIA Regulations 2017 states that an ES "…*must be based on the latest scoping direction issued (so far as the Proposed Development remains materially the same*…". In this case, the Proposed Development has been revised and certain aspects of the Scoping Direction are no longer applicable. Nevertheless the remaining elements of the Proposed Development are materially the same.

4.3.12 During the assessment, additional information has become available, such as data from additional peat surveys, which is explained in **ES Volume II, Chapter 7: Land, Soils and Water**. Other information including technical modelling has further provided the opportunity to re-examine the scope of the assessment, but the scope in other respects has remained materially the same.

Factors Scoped Out of Further Assessment

4.3.13 Following receipt of the Scoping Direction, a number of factors have been scoped out of further assessment. **Table 4.1** summarises this aspect of the process and the justification for scoping out these factors/matters. The table refers to those factors which are not the subject of a standalone chapter within this ES.

Table 4.1 Factors/Matters Scoped Out of Further Assessment

Factor	Scoping Direction ID	Matters scoped out of further assessment/ where relevant information is provided
Air Quality	*ID.5*	PEDW agreed that this topic can be scoped out. An Air Quality Assessment has been carried out to support the DNS application, the results of which are presented in **ES Volume III, Appendix 4.5: Air Quality Assessment**. The results found that significant effects on local air quality or designated habitats are not anticipated during any phase of the Proposed Development.
Major Accidents and Disasters	*ID.6 – ID.10*	Major accidents and disasters only need to be assessed in the context of EIA where the existing design measures or legal requirements, codes and standards do not adequately control the risk of a major accident and/or disaster to occur and there would be likely significant effects on the environment as a result.

Factor	Scoping Direction ID	Matters scoped out of further assessment/ where relevant information is provided
		Fire was identified as a potential risk from the major accidents and disasters review. An OBSMP and an OCEMP have been provided and submitted as part of the Application to account for any potential safety risks and the relevant mitigation and management procedures, emergency preparedness and response (**Appendix 2.1** and **Appendix 2.2**). A full CEMP, Operational Environmental Management Plan (OEMP) and Decommissioning Environmental Management Plans (DEMP) will be secured by condition. Land contamination and flooding risk are discussed in **ES Volume II, Chapter 7: Land, Soils and Water**. A Flood Consequence Assessment has been carried out in support of the DNS application as per PEDW's request (**ES Volume III, Appendix 7.1: Flood Consequence Assessment**). The assessment provides an outline strategy for water and drainage management throughout all phases of the Proposed Development. A Peat Slide Risk Assessment has been carried as part of the application, providing recommendations on specific construction methods to minimise risks (**ES Volume III, Appendix 7.5: Peat Slide Risk Assessment).** It is considered that the proposed design, as set out in **ES Volume 2, Chapter 2: Proposed Development Description**, and adherence to legal safety procedures and standards would also minimise this risk to as low as reasonably practicable. A cooling system will form part of the facility, which is designed to regulate temperatures to safe conditions to mitigate the risk of fire. Turbines are designed and certified to engineering standards, with safeguards against structural failure. It is therefore concluded that no further assessment of major accidents and disasters is required in the context of the EIA.
Heat and radiation	*ID.12*	Factor has been scoped out with agreement from PEDW.
Shadow Flicker	*ID.14*	A shadow flicker assessment has been undertaken to support the DNS application (**ES Volume III, Appendix 4.4: Shadow Flicker Assessment**).

Factor	Scoping Direction ID	Matters scoped out of further assessment/ where relevant information is provided
		It is typical to consider shadow flicker effects at dwellings within 10 rotor diameters of a turbine. This is generally considered an appropriate zone for potentially significant effects based on the available guidance and because other features of the modelling are highly conservative. For this assessment, the 10-rotor diameter area has been extended to consider receptors within 11 rotor diameters. This is to account for dwellings close to the 10-rotor diameter boundary and for micrositing. This is line with the consultation feedback received from PEDW at the scoping stage. In total, five dwellings are predicted to experience shadow flicker effects for more than the threshold limits of 30 minutes per day and/or 30 hours per year, based on a conservative assessment where the model assumes clear skies during all sunlight hours. A shadow flicker control module is proposed to be installed on turbines that are predicted to cause an impact. It is therefore concluded that there will be no significant shadow effect on residential properties and no further assessment of shadow flicker is required in the context of EIA.
Telecommunications	*ID.15*	A telecommunications assessment has been undertaken and is presented in **ES Volume III, Appendix 4.2: Telecommunications Report.** As part of this assessment the Ofcom Spectrum Information Portal and Wireless Telegraphy Register was accessed to identify any fixed microwave telecommunications links in the vicinity of the Proposed Development. These searches determined that there are no such links within 2 km of any of the proposed turbine locations. In addition, consultations were carried out with Dŵr Cymru, the Joint Radio Company and Arqiva at scoping stage. All three consultees responded that they had no telecommunications infrastructure with the potential to be adversely affected by the Proposed Development. It is therefore concluded that there are no telecommunications facilities with the potential to be adversely affected by the Proposed Development and that no further assessment of telecommunications is required in the context of

Factor	Scoping Direction ID	Matters scoped out of further assessment/ where relevant information is provided
		EIA.
Population and Human Health	*ID.16*	PEDW agreed that population and human health can be scoped out as a standalone chapter but needs to be included proportionately within any relevant technical assessments. The potential for significant adverse effects on human health have been considered within: • **ES Volume II, Chapter 9: Landscape and Visual**; • **ES Volume II, Chapter 10: Noise and Vibration**; and • **ES Volume III Appendix 4.5: Air Quality Assessment.** The potential for impacts on users of PRoW has been considered within the following assessments: • **ES Volume II, Chapter 9: Landscape and Visual;** and • **ES Volume III Appendix 11.1: Transport Assessment.**
Socio-economic Impacts	*ID.17*	The Scoping Direction did not raise any concerns regarding socio-economic effects, which are unlikely to be significant, and therefore socio-economic impacts have not been considered further the ES. A **Socio-economic Statement** is however provided separately as part of the planning application.
Arboriculture and Forestry	*ID.26*	An Arboricultural Impact Assessment has been undertaken to support of the DNS application (**Appendix 4.3**). Commercial forestry is unaffected by the Proposed Development.
Utilities	*ID.84*	Proposals to divert utilities are discussed in **Paragraphs 2.5.61, 2.5.62** and **3.5.6**. Likely significant effects on the environment are not anticipated as a result of any diversions. The nearest National Grid overhead line is located to the south of the Proposed Development, over 1.6 km from T04, or approximately 300m from the Site boundary at the nearest point, as illustrated on **Figure 3.1 Environmental Constraints** provided in **ES Volume IV**. The Proposed Development would not therefore impact on the National Grid overhead

Factor	Scoping Direction ID	Matters scoped out of further assessment/ where relevant information is provided
		line.

Abnormal Indivisible Load Access Route Constraints

4.3.14 The construction of the Proposed Development will require the delivery of multiple AILs (approximately 285 deliveries), comprising mainly of turbine components. An outline Route Survey Report is provided in Annex 1 of **Appendix 11.1**. Temporary remedial works associated with the AIL deliveries will be required to accommodate the predicted loads. Any additional regulatory approvals required along the delivery route will be secured separately to the DNS. A detailed route survey assessment for the final chosen turbine will be provided post consent and will form part of a suitably worded planning condition.

4.3.15 The proposed abnormal load route to the Site would be from the Port of Liverpool through to the access route junction of the Site. The route will be subject to separate approval outside the DNS regime, with any required regulatory approvals secured under the appropriate statutory regimes. Further details regarding the AIL deliveries are provided in **ES Volume II, Chapter 2: Proposed Development Description.**

4.3.16 At the majority of locations which are likely to need physical mitigation works, no environmental constraints within 50 m of the works were identified. Where environmental constraints were identified, reference is made in **Appendix 4.1** to where further information can be found in the ES.

4.4 Consultation

4.4.1 Consultation has been integral to the design of the Proposed Development, identification of existing environmental constraints and sensitivities, and identification and assessment of the likely environmental effects of the Proposed Development. In addition to the formal consultation undertaken by PEDW as part of the EIA scoping process, technical and non-statutory public consultation has been undertaken by the Applicant. Details of any factor specific consultation are provide in the relevant ES technical chapters.

Technical Consultation

4.4.2 As part of the EIA process, technical consultation with a range of statutory and non-statutory consultees has been ongoing. Details of the technical consultation undertaken for each assessment is provided in the respective technical chapters.

Public Consultation

4.4.3 Exhibitions and forums were held at key stages in the development process to inform the general public and other interested parties of project alternatives and the emerging findings of the EIA, and to elicit comment and feedback on the Proposed Development.

4.4.4 Informal consultation took place with the public, statutory consultees, and community consultees between 16 September and 14 October 2024. An initial

public exhibition to raise awareness in the local community of the Proposed Development was held on 27 and 28 September 2024 at Neuadd Mynach, Cwmtirmynach and Canolfan Bro Tegid, Bala, at which the Proposed Development at scoping stage was described. The aim of these exhibitions was to introduce the community and statutory stakeholders to the project and seek their feedback on the early proposals to develop the Site.

4.4.5 The consultation events were promoted through the local press, posters and social media. Post cards were distributed to key residents and businesses located within 5 km of the Site Boundary. In addition, letters were distributed to tenant farms and commoners across the Site, with the first hour of the session on 27th September reserved for these parties. Community council presentations were also provided by the Applicant.

4.5 Approach to the Assessment of the Proposed Development

4.5.1 This section outlines the phases of the Proposed Development that have been assessed, together with the approach to assessment of the baseline conditions, future baseline conditions, cumulative and in-combination effects and design tolerances. It also sets out the overarching approach to the EIA, together with project specific requirements for the assessment of effects.

4.5.2 The method behind the EIA process considers the existing conditions of the area into which the development is being introduced (**the baseline**), providing a future baseline context for assessments where relevant (**the future baseline**), and makes reasonable worst case predictions of the likely change (**the impact – in terms of magnitude**) that may occur during construction, operation and decommissioning. The predicted impact is considered in terms of key environmental and social aspects (**receptors**) present within the Site and surrounding area, and based on their sensitivity to change, the scale of the resulting change experienced by the receptor/resource (**the effect**) is then determined, along with a statement on whether the effect is **significant** or not in accordance with significance criteria.

4.5.3 Any mitigation measures required to avoid, prevent, reduce or, if possible, offset adverse effects are then considered and assessed, with the resulting **residual effect** being determined as significant or not.

4.5.4 Effects resulting from the interaction and combination of different environmental residual (post-additional mitigation) effects from within the Proposed Development affecting a receptor (intra-project combined effects) and the combined residual (post-mitigation) effects of the Proposed Development and another project or projects on a single receptor/resource (inter-project cumulative effects) are also assessed. All the likely effects of the Proposed Development are reported within the Main Written Statement (this document - **ES Volume II**), in addition to **ES Volume III** (Supporting Technical Appendices) and ES Volume IV (Supporting Figures and Plans), as well as a Non-Technical Summary of the Environmental Statement (Volume I), with any likely significant environmental effects specifically highlighted.

4.5.5 The Proposed Development has been assessed against the description, design principles and tolerances and supporting plans as detailed in **ES Volume II, Description of the Proposed Developmen**t. The maximum extent of the planning

application boundary and turbine or building footprint/height has been assessed as the worst-case situation.

Baseline Scenario

4.5.6 Baseline information (environmental characteristics and conditions) has been collated for a defined study area, based upon surveys undertaken and desk-based information available at the time of the assessment. **ES Volume II, Chapters 5** to **13** provide details of the factor specific baseline information, and a summary is provided in **ES Volume II, Chapter 3: Environmental Context and Reasonable Alternatives Considered**. Any limitations experienced establishing the baseline are described in **ES Volume II, Chapters 5** to **13**.

4.5.7 Study areas have been defined individually for each environmental factor assessment, taking into account the geographic scope of the potential impacts relevant to that environmental factor and the information required to assess those impacts.

4.5.8 The baseline conditions for the purpose of the ES are representative of the existing onsite conditions (i.e. 2025). There are slight variances across the ES depending on the use of publicly available data sources and the dates when surveys were undertaken, which represent earlier or later baseline scenarios. This has been clearly outlined within **ES Volume II, Chapters 5** to **13**.

4.5.9 The dates of surveys and the dates when data sources have been accessed are provided within technical **ES Volume II, Chapters 5** to **13**. The data is considered to accurately reflect current baseline conditions, as such conditions have not been subject to any significant or material changes.

Future Baseline in the Absence of the Proposed Development

4.5.10 Schedule 4 paragraph 3 of the EIA Regulations 2017 requires an outline of the likely evolution of the current state of the environment (baseline scenario) without implementation of the Proposed Development, as far as natural changes from the baseline scenario can be assessed with reasonable effort based on the availability of environmental information and scientific knowledge. Whilst there are considerable limitations to the predictions that can be made about baseline conditions at a future point in time, some assessments require projections to account for future change, such as traffic growth.

4.5.11 Due to the aforementioned limitations, necessary assumptions and lack of evidence associated with the future baseline (i.e., it cannot be accurately measured), a detailed consideration of the effects of the Proposed Development against the future baseline would generally not result in a robust assessment. However, **ES Volume II, Chapters 5** to **13** provide a description of the future baseline scenario and the data sources that have informed it for each environmental factor.

4.5.12 It should be noted that other developments are not considered within the future baseline scenario, as other developments are not considered to be a ‘natural’ change from the baseline scenario. Instead, other existing development(s) and/or approved development are considered within the inter-project cumulative effects assessment presented in **ES Volume II, Chapter 14: Cumulative Effects**.

4.5.13 In general, environmental conditions at the Site over the lifetime of the Proposed Development are not expected to change markedly. The area would likely remain in mostly agricultural use and as such, may be subject to agricultural related small scale developments. If the area is not maintained under agricultural (light grazing) conditions, then it may incur a degree of natural or managed re-wilding by growth of shrubs and trees. The Proposed Development would not necessarily be mutually incompatible with such change.

4.5.14 The UK Met Office's UK Climate Projection 18 (UKCP18) projections (Met Office, 2022) suggest that climate change will lead to hotter drier summers, warmer wetter winters, increased likelihood of extreme weather events (e.g., heat waves, high rainfall events) and sea-level rise. Due to the embedded resilience of wind turbines to high heat and wind speeds, and the distance of the Site from the coastline, these factors are not expected to significantly impact on the construction, operation, or decommissioning of the Proposed Development. Flooding is not expected to have any significant impact on the Proposed Development, due both to the embedded resilience of wind turbines and the lack of recorded historical flooding within the Site boundary.

Assessment Assumptions

4.5.15 Assumptions adopted in the evaluation of impacts are reported in each of the environmental factor assessment chapters (**ES Volume II, Chapters 5 to 13**). The principal assumptions that have been made, and any limitations that have been identified, in undertaking the EIA are based on expert judgment and are set out below:

- Baseline conditions have been established from a variety of sources, including historical data and are accurate at the time of writing
- For the purpose of the EIA it is assumed that the Proposed Development would be constructed over a period of approximately 21 months, anticipated to commence in 2035, and be operational for 40 years. After 40 years of operation, it is assumed that the Proposed Development would be decommissioned.
- It is assumed that information received from third parties is accurate, complete and up to date
- Where detailed information has not been available, reasonable assumptions have been made, and have been clearly set out, based on experience of developments of similar type and scale to enable assessment of likely significant effects, and
- Other existing development and/or approved developments will be implemented substantially in accordance with information that is publicly available and subject to the same regulatory regimes and good practice management controls as this Proposed Development.

Design Tolerances

4.5.16 Although the permission sought for the Proposed Development is for a defined scheme, a degree of design tolerance has been implicitly and explicitly included.

Implicitly the assessment has considered the maximum design envelope of the Proposed Development so that slight variation including reductions in scale and extent, would be accounted for by the assessment. Explicitly a degree of variability in actual construction extent has been allowed by adopting a micro-siting approach (see **Section 2.5**).

Assessment Criteria

4.5.17 The classification of each effect identified has been assessed. Typically, within EIA, this assessment is based on the magnitude of change (or impact) due to the Proposed Development and the sensitivity/value/importance of the affected receptor to change, as well as a number of other factors that are outlined in more detail below. However, the method for assessing the significance of effects varies between environmental factors and as such, the assessment criteria has been set out within each assessment chapter (**ES Volume II, Chapters 5** to **13**).

4.5.18 Within each chapter, the classification of residual effects has been assessed with regard to the extent to which additional mitigation measures will avoid, prevent, reduce or, if possible, offset adverse effects.

4.5.19 The following criteria have been taken into account, as relevant, when identifying and determining the likely significant effects:

- The outcomes of consultations
- Relevant legislation and planning policy
- Relevant topic specific guidance and assessment criteria
- International, national, regional and local standards
- Likelihood of occurrence of the effect
- Geographical extent of effect
- Sensitivity, value and/or importance of the receptor
- Magnitude and complexity of impact
- Whether the effect is temporary or permanent
- Duration (short, medium or long-term), frequency and reversibility of effect
- Whether the effect is direct or indirect, secondary or transboundary, and
- Inter-relationship between different effects (both cumulatively and in terms of likely effect interactions).

Sensitivity, Value and Importance of Receptors

4.5.20 The sensitive receptors considered within this ES are identified within technical **ES Volume II, Chapters 5** to **13**. The sensitivity to change, value or importance of these receptors has been determined, where available and appropriate, by quantifiable data, the consideration of existing designations and professional judgement.

Magnitude of Impact

4.5.21 The magnitude of impact is the predicted change to the established baseline conditions, as a result of the Proposed Development. The magnitude of impact is also defined within **ES Volume II, Chapters 5** to **13** and has been determined where available and appropriate by quantifiable data, available appropriate national and

international standards or limits and where relevant, based on professional judgement.

4.5.22 The magnitude of impact identified is based on the peak potential magnitude of change, i.e., the greatest likely magnitude of change that may be experienced by a sensitive receptor (existing or proposed).

Determining Effects

4.5.23 Determining the significance of effects has been undertaken using accepted industry standards and guidance and professional judgements (assumptions). Typically, each effect has been assessed against the sensitivity/value/importance of the receptor and the magnitude of impact.

4.5.24 Tables summarising the potential effects associated with each factor, required mitigation measures and residual effects are provided in each technical chapter. The tables provide a clear distinction of the type of effect, namely:

- Beneficial or adverse
- Permanent or temporary
- Direct or indirect
- Short, medium or long-term
- Secondary, cumulative or transboundary, and
- Significant or not significant.

4.5.25 Unless otherwise stated in the environmental factor assessment chapters (**ES Volume II, Chapters 5 to 13**), effects that are classified as moderate or above are considered to be significant. Effects classified as minor or below are considered to be not significant.

Mitigation and Monitoring

Embedded (Primary) Mitigation Measures

4.5.26 Mitigation can be relied on to avoid or reduce potential significant environmental effects from the construction, operation and/or the decommissioning of the Proposed Development. The sequential steps of the mitigation hierarchy are as follows:

- Avoidance: Take measures to avoid creating impacts from the outset
- Minimisation: Measure taken to reduce the duration, intensity and extent of the impact if they cannot be avoided
- Restoration: Measures taken to improve ecosystems following exposure to unavoidable impacts, and
- Offset: Measure taken to compensate for any residual impacts.

4.5.27 As part of the EIA, an approach has been adopted where significant environmental effects have been avoided where possible in the first instance through design refinements and iterations. Where adverse environmental effects were identified through early assessment work, opportunities to reduce or control impacts and effects have been identified and incorporated into the Proposed Development. In

accordance with IEMA (2024) Guidelines: Implementing the Mitigation Hierarchy from Concept to Construction, this is known as 'primary' mitigation (hereafter referred to as 'embedded' mitigation) (IEMA, 2024). In addition, opportunities to enhance the beneficial environmental effects of the Proposed Development have also been sought and incorporated into the Proposed Development.

4.5.28 The Proposed Development has been through stages of design development which has resulted in the identification of measures that have been embedded into the design and layout of the Proposed Development.

4.5.29 For the purposes of this ES, embedded (primary) mitigation measures will form part of the design of the Proposed Development.

4.5.30 **ES Volume II, Chapter 2: Description of the Proposed Development** sets out the embedded (primary) mitigation required as part of the Proposed Development. The embedded (primary) mitigation measures relevant to each environmental factor are detailed in **ES Volume II, Chapters 5** to **13.**

Additional Mitigation Measures and Monitoring

4.5.31 Additional (secondary and tertiary) mitigation describes actions that will require further activity in order to achieve the anticipated outcome, and measures that will be required regardless of any EIA assessment, as it is imposed, for example, as a result of legislative requirements and/or standard sectoral practices. Examples of secondary mitigation include additional detailed design, for example to comply with proposed lighting limits or developing a travel plan for the Proposed Development. Examples of tertiary mitigation include considerate contractor's practices that manage activities which have potential nuisance effect (e.g., through the implementation of a Construction Environmental Management Plan).

4.5.32 Where likely significant adverse effects have been identified in the assessment, measures to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment are described.

4.5.33 In accordance with the EIA Regulations 2017, monitoring should be proposed (where appropriate) where significant adverse residual effects remain. In some cases, for instance where there is uncertainty of residual effects, it may also be appropriate to implement monitoring.

4.5.34 The additional (secondary and tertiary) mitigation and monitoring measures are set out within technical chapters where necessary. The mechanism by which the measures are to be secured and implemented and the party responsible for their delivery is also recorded.

4.6 Cumulative Effects

4.6.1 Schedule 4 paragraph 5(e) of the EIA Regulations 2017 states that the ES should include a description of the likely significant effects of the development on the environment resulting from:

"the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources."

4.6.2 Additionally, Regulation 4 paragraph 2(e) refers to the need to assess:

"the interaction between the factors listed in sub-paragraphs (a) to (d)."

4.6.3 Accordingly, the following types of cumulative effects have been assessed and reported in this ES:

- Intra-project combined effects – the interaction and combination of different environmental residual (post-additional mitigation) effects from within the Proposed Development affecting a receptor, and
- Inter-project cumulative effects – the combined residual (post-mitigation) effects of the Proposed Development and 'other existing development and/or approved development' on a single receptor/resource.

Intra-project Combined Effects

4.6.4 Intra-project effects, or effect interactions, are the combined or synergistic effects caused by the combination of effects of the Proposed Development on a particular receptor which may collectively cause a greater effect than individually.

4.6.5 The approach to the assessment of intra-project combined effects has considered the changes in baseline conditions at common sensitive receptors (i.e., those receptors that have been identified as experiencing likely significant effects by more than one environmental factor) due to the Proposed Development.

4.6.6 Further details regarding the scope and methodology of the assessment of intra-project combined effects, is provided in **ES Volume II, Chapter 14: Cumulative Effects**.

Inter-project Cumulative Effects

4.6.7 There is no widely accepted methodology or good practice guidance for assessing inter-project cumulative effects in EIA, although relevant guidance is available in the Planning Inspectorate Advice Note titled 'Nationally Significant Infrastructure Projects: Advice on Cumulative Effects Assessment' (Planning Inspectorate, 2024). The following approach has been adopted for the assessment of cumulative effects, based on previous experience, the types of receptors being assessed, the nature of the Proposed Development, the other developments under consideration and the information available to inform the assessment. The approach was outlined in the EIA Scoping Report (**Appendix 1.1**).

4.6.8 Through analysis of the Gwynedd Council, Conwy County Borough Council, Powys County Council, Denbighshire County Council, Flintshire County Council and Wrexham County Borough Council online Planning Portals, Developments of National Significance Casework Portal and the National Infrastructure Planning website, a number of committed developments have been identified and considered within this ES. These committed developments are presented in **ES Volume II**, **Chapter 14: Cumulative Effects**. Agreement upon these other developments has been sought from Gwynedd Council, who had no comments on the list of other projects.

4.6.9 Each environmental factor assessment has assessed the potential for these committed developments and the Proposed Development to result in a likely significant effect for a common receptor.

4.6.10 Further details regarding the scope and methodology of the assessment of cumulative effects, the identification of relevant approved developments and a description of those included within the assessment are provided in **ES Volume II, Chapter 14: Cumulative Effects**.

4.6.11 The assessment of cumulative effects is presented in **ES Volume II, Chapters 5** to **13** and summarised in **ES Volume II, Chapter 14: Cumulative Effects**.

4.7 Environmental Enhancement

4.7.1 Although not a requirement of the EIA Regulations 2017, opportunities for environmental enhancement are also explored. In particular, the EIA has considered the Net Benefit for Biodiversity within the context of the step-wise approach to the mitigation hierarchy (i.e. avoid, minimise, mitigate/restore, compensate onsite, compensate offsite) in accordance with PPW12 (Welsh Government, 2024). Environmental enhancement measures are generally not taken account of in the assessment of likely significant effects, except where an impact could arise as a result of implementing an enhancement measure.

4.8 Difficulties and Uncertainties

4.8.1 Schedule 4 paragraph 6 of the EIA Regulations 2017 states that an ES should include:

"... details of difficulties (for example technical deficiencies or lack of knowledge) encountered compiling the required information and the main uncertainties involved."

4.8.2 Where difficulties and uncertainties have been encountered within the EIA, these are identified in **ES Volume II, Chapters 5** to **13**.

4.9 Coordinated Assessment with the Habitats Regulations Assessment

4.9.1 Whilst the over-arching objectives of EIA and Habitats Regulations Assessment (HRA) are similar, the scope, level of detail and terminology used varies. As such, these processes have been undertaken separately. However, the scope presented within this ES has been developed to ensure that the needs of these processes have been considered to ensure a coordinated assessment compliant with Regulation 26 of the EIA Regulations 2017.

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