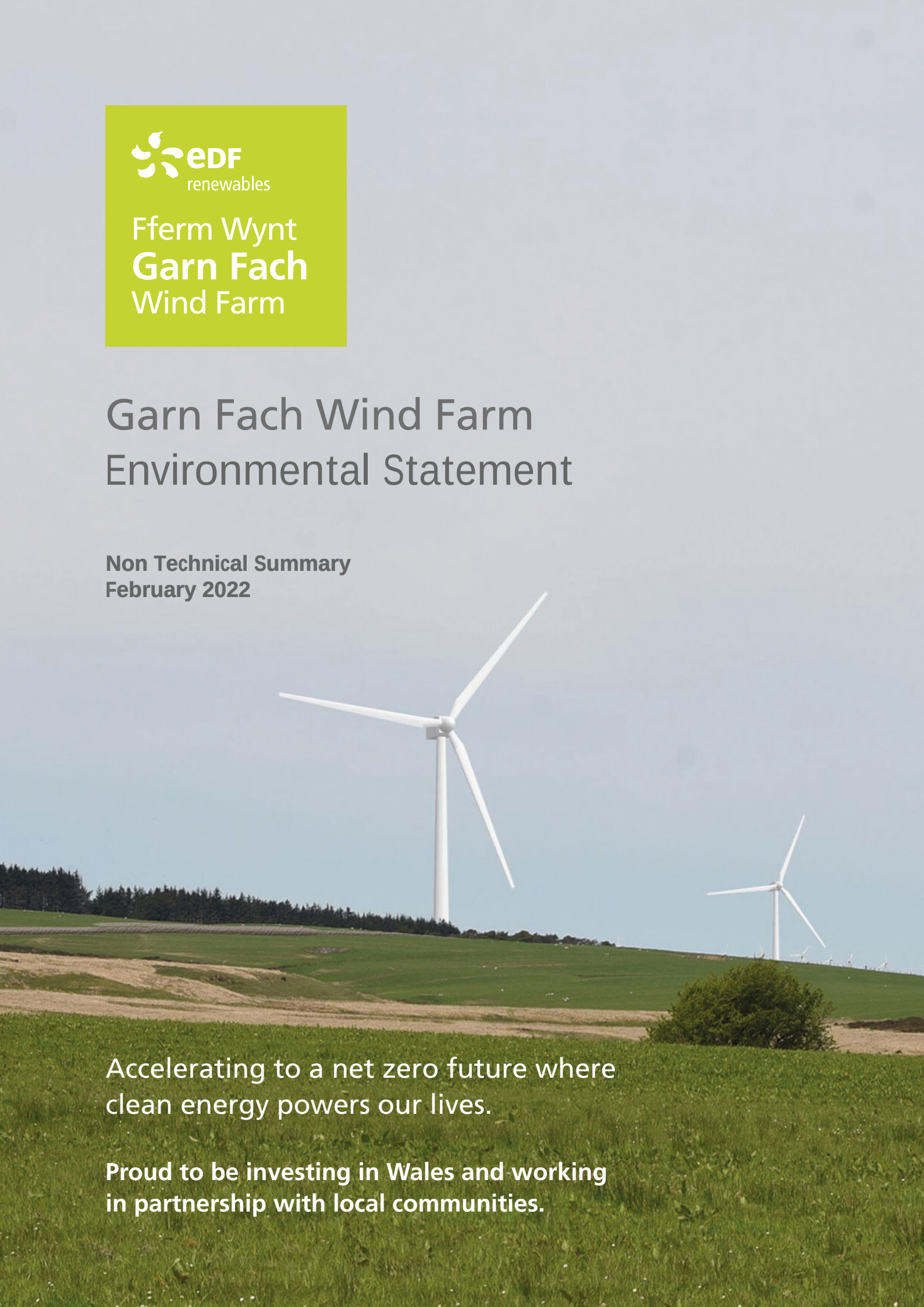
EDF renewables

Fferm Wynt
Garn Fach
Wind Farm

Garn Fach Wind Farm Environmental Statement

Non Technical Summary
February 2022



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PREFACE

1. This Non Technical Summary (NTS) forms part of the Environmental Statement (ES) submitted to accompany a planning application to the Welsh Ministers for the proposed Garn Fach Wind Farm, a Development of National Significance (DNS). The proposed wind farm scheme is located approximately 2km west of Llaithddu, 5km north-west of the village of Llanbadarn Fynydd and 8km to the south of Newtown in the County of Powys, Wales (the 'Site'). See Figure 1: Site Location.

2. The Applicant is EDF Energy Renewables Ltd (EDF-R), a leading renewable energy developer in the UK and Europe. EDF-R currently operates 37 renewable energy sites including onshore and offshore wind with a total installed capacity of approximately 1GW.

3. The ES has been compiled on the basis of the statutory Environmental Impact Assessment (EIA) requirements for DNS and comprises the following separate volumes:

   - Non-Technical Summary (this document);
   - Volume 1: Written Statement;
   - Volume 2: Plans and Figures; and
   - Volume 3: Technical Appendices (supplementing the content of Volume 1).

4. Supporting documents to the planning application have also been prepared, including a Planning Statement, Design and Access Statement, Collaborative Benefits Report and Consultation Report.

5. These documents and the ES are available for viewing via the project website – https://www.edf-re.uk/our-sites/garn-fach and via the Planning and Environmental Decisions (PEDW) website https://gov.wales/planning-and-environment-decisions-wales. Electronic copies are available on a USB. Contact garn.fach@edf-re.uk to request ES copies.

6. The EIA process and production of the ES has been managed and compiled by Dulas Ltd, a dedicated renewable energy company based in mid Wales. Dulas and the Applicant have consulted with the PEDW, Powys County Council, and a wide range of statutory and special interest consultees in prescribing the requirements of the ES. The preparation of the ES has been supported by the following specialist environmental assessors:

Organisation	**Environmental Planning Topic**
Barton Wilmore**,** Studio 117, The Creative Quarter, 8a Morgan Arcade, Cardiff CF10 1AF	Planning Policy
Land Use Consultants, 12th Floor, Beacon Tower, Colston Street, Bristol BS1 4XE	Landscape and Visual Impact Assessment; Residential Amenity Assessment
Hayes McKenzie Partnership, Lodge Park, Tre'r-ddol, Machynlleth SY20 8PL	Noise Assessment

Organisation	**Environmental Planning Topic**
Environment Systems, Science Park, Cefn Llan, Aberystwyth SY23 3AH	Ecology and Ornithology
Clwyd Powys Archaeological Trust, The Offices, Welshpool SY21 8RP	Archaeology and Cultural Heritage
Wavehill Consulting, 21 Sgwar Alban, Aberaeron SA46 0DB	Socio-economic Assessment
Wallingford Hydro Solutions, Castle Court, 6 Cathedral Road, Cardiff, CF11 9LJ	Hydrology, Hydrogeology and Geology Assessment; Peat Assessment
Pell Frischmann, 93 George Street, Edinburgh EH2 3ES	Design, Civils and Transport
Wind Power Aviation Consultants Ltd, Hazards, 38 Hadrian Way, Chilworth, Southampton SO16 7HX	Air Safeguarding

7. For the purposes of preparing and compiling this ES, Dulas undertakes annual appraisals through the Institute of Environmental Management and Assessment (IEMA) on its process and quality of EIA services; with such accreditation the company is therefore a Competent Assessor. The specialist assessors are either accredited through IEMA or carry professional standards or qualifications that ensure the standards and quality of their work.

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1 INTRODUCTION

1.1 Brief Description of the Application Site

1.1.1 The application site ('the Site') comprises upland grazing land and commercial forestry stretching from Waun Ddubarthog in the north to Brondre Fawr Hill in the south. It is formed of three principal land parcels: the northern parcel to the south and east of the operational Llandinam (P&L) Wind Farm comprising open upland moorland; the middle and largest parcel of land located to the south of the Garn Fach forestry characterised by open upland moorland, enclosed improved grazing and also defined by small blocks of forestry and coniferous shelterbelts; and the southern parcel formed by open upland moorland to the southern end of the Brondre Fawr ridge. See Figure 1: Site Location at the rear of this NTS.

1.1.2 In a wider context, this upland area of Powys is characterised by an extensive undulating plateau bisected by incised valleys with steep-sided slopes. The surrounding landscape is also generally open moor and farmland with conifer plantations and other operational wind energy schemes.

1.1.3 The proposed Development area is situated within the headwaters of two river catchments, the Afon Marteg and River Ithon, both of which are tributaries of the River Wye and lie within the wider River Severn catchment.

1.1.4 The small hamlets of Llaithddu and David's Well, as well as a number of farmsteads and isolated properties, are situated eastwards of the Site above the River Ithon.

1.1.5 The height above sea level of the Site varies from 520m in the north to 450m in the south.

1.2 Proposed Development

1.2.1 The proposed Development would comprise 17 wind turbines up to 149.9m to blade tip, an energy storage facility and associated infrastructure which would operate for 30 years. Temporary infrastructure will also be required for the construction of the wind energy scheme, specifically two construction compounds, laydown areas, and borrow pits for winning on-site aggregates.

1.2.2 Further technical details are provided in Section 5: Project Description.

1.2.3 The proposed Development will contribute to renewable energy and decarbonisation targets for Wales, as follows:

- Annual electricity output of 260,610 Megawatt Hours based on seventeen 5MW wind turbines and an expected 35% capacity factor[1];
- Annual offsetting reduction in carbon dioxide (CO_2) emissions, ranging from an estimated 66,085 tonnes to 117,275 tonnes[2] dependent upon the composition of fuel types (gas, nuclear, renewables etc) in UK energy production at the time of estimation;
- Total offsetting reductions in CO_2 emissions equivalent to a maximum potential 3,518,250 tonnes over the 30-year lifetime of the proposed Development;

[1] 35% capacity factor - conservative figure based upon measurements collected from the on-site 90m met mast.
[2] Based upon the findings of the Garn Fach Wind Farm Carbon Balance Assessment, Appendix 10.8 of the ES.

- Predicted payback of the carbon balance of the proposed Development ranging from 0.7 to 6.5 years, as modelled in the Carbon Balance Assessment. The expected figure will be influenced by a range of factors at the time of installation, but it is realistic to expect the scheme, based on current factors, would repay it's carbon debt within 1.3 years, resulting in a scheme that will be carbon positive for the mainstay of its operational lifetime; and
- Clean electricity generation equivalent to the domestic requirements of 69,000 homes annually[3].

2 CONSULTATIONS AND KEY ISSUES

2.1 Pre Notification Consultation

2.1.1 Consultation with statutory and key non-statutory bodies is recognised as being critical to the preparation of the EIA. It focuses attention on key environmental issues and opens a dialogue to discuss methodologies for undertaking further investigations and possible mitigation throughout the development of a proposal.

2.1.2 Pre-scoping consultation was conducted with statutory and non-statutory advisors on early stage aspects of the preliminary development phase. These consultations were conducted primarily through written exchanges with advisors to determine the scope and detail for early stage surveys, such as ornithology and ecology. Consultations included:

- Natural Resources Wales:
    - Pre-application advice and meeting regarding Ornithology, Protected Landscapes, Peat, Geology, Pollution Prevention Plan, Protected Sites and Protected Species
- Powys County Council:
    - Including Landscape & Visual (viewpoints, methodology) and noise (background noise monitoring locations)

2.1.3 In addition, early engagement community consultations were initiated by the Applicant in 2019/20, prior to the statutory consultation process.

2.1.4 Formal pre-application consultation (PAC) on a draft DNS application with accompanying draft ES was undertaken by the Applicant over a 10 week period end of June and September 2021. In accordance with procedural requirements, the Applicant publicised and consulted on the proposed application through notifying and distributing relevant documentation to community consultees, specialist consultees and all other relevant persons; in addition written notice was served on the owners or occupiers of land adjoining the site; site notices were placed near to the site, and notices placed in the Powys County Times and the Mid Wales Journal prior to commencement of the consultation exercise.

2.1.5 The Applicant has accounted for the outcomes of the PAC exercise in preparing revised and updated details within the ES and the DNS application documents. Details of this exercise and how consultees have been responded to are set out in the Consultation Report.

2.2 EIA Scoping

2.2.1 Formal EIA Scoping was undertaken with PINS Wales in January – February 2020. PINS Wales

[3] Average household consumption from Energy consumption in the UK - GOV.UK (www.gov.uk), ECUK: Consumption data Tables (OCU), table C9 - Domestic; average consumption (2019) of 3,772 kWh

issued the Scoping Direction on behalf of the Welsh Ministers in March 2020 (DNS: EIA Scoping Direction 3244499: Garn Fach Windfarm). In accordance with Regulation 33(7) of the EIA Regulations, formal consultation was undertaken with the following bodies:

- Powys County Council (PCC)
- Natural Resources Wales (NRW)
- Cadw
- Health & Safety Executive
- Community Councils

2.2.2 The scoping exercise, statutory and public consultations have identified the key, potentially significant, environmental issues as described and assessed in the subsequent sections of this NTS. The environmental impacts and subsequent effects of the scheme, whether beneficial or adverse, are categorised generally in each of the environmental topics as Major, Moderate, Minor or Negligible predictions of change. Effects deemed to be Moderate or Major are typically seen as significant, but this is qualified in such instances by relevant site specific factors and professional judgement. Where appropriate and achievable, mitigation measures are proposed to reduce the impacts of the Development and thereby lessen adverse residual effects.

3 PLANNING POLICY CONTEXT

3.1 International & UK Context

3.1.1 There is clear scientific evidence that global warming is driving climate change across the planet and the primary cause is the burning of fossil fuels, whereby the resulting CO_2 emissions lead to increases in global temperatures. Such concentrations have caused the planet's average surface temperature to rise by over 2 degrees Fahrenheit since the late 19th century[4], with ten of the warmest years on record taking place since 2002[5]. It is now widely accepted that greenhouse gas emissions (GHG) need to be significantly reduced.

3.1.2 A series of international and national legislative commitments to reduce greenhouse gas emissions have arisen since the Kyoto Protocol came into effect in 2005, including:

- The Climate Change Act 2008, which committed the UK to reducing its greenhouse gas emissions by 80% by 2050 compared to 1990 levels and the creation of the independent Committee on Climate Change (CCC);
- The Paris Agreement in December 2015 (COP21) which committed all nation signatories to undertake more ambitious efforts to combat climate change and adapt to its effects, committing signatories to holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the increase to 1.5 °C above these levels;
- Declaration by UK government of climate emergency and the legislation of long term climate targets (with Wales and Scotland having declared such emergencies in April 2019). The resultant legislation amended the Climate Change Act 2008 (c.27) and introduced a legally binding target to achieve 'net zero' by 2050; and

[4] https://climate.nasa.gov/evidence/

[5] https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2019/state-of-the-uk-climate-2018

- In April 2021 an announcement was made by UK government to further bring into law emission reductions by 78% by 2035 compared to 1990 levels[6].

3.2 Welsh Planning Policy & Context

3.2.1 In April 2019, the Welsh Government accepted a CCC recommendation and set a carbon reduction target of 95% with an ambition to get to net zero by 2050. Following the CCC's December 2020 report, in February 2021 the Welsh Government made a legal commitment (through The Environment (Wales) Act 2016 (Amendment of 2050 Emissions Target) Regulations 2021) to achieve net zero emissions by 2050, but with a desire to "get there sooner".

3.2.2 The latest figures on GHG emissions in Wales were published in December 2020[7] and these show that an overall reduction of 31% has been achieved since 1990, confirming that there is still a considerable way to go to meet the net zero target by 2050. PCC declared a climate emergency on 24th September 2020.

3.2.3 Relevant Welsh primary legislation on the delivery of renewable energy projects includes:

- The Environment Act 2016 – which sets in place an obligation on Welsh Government to reduce greenhouse gas emissions by 80% against 1990 levels by 2050 (now Amended).
- The Wellbeing of Future Generations (Wales) Act 2015 - primary legislation requiring all Wales' based public bodies to put long-term sustainability at the forefront of thinking and actions.
- The Planning (Wales) Act 2015 – among the provision of which is the powers now given to Ministers to determine strategic energy projects 10 - 50MW.
- Wales Act 2017 – further enables Ministers (from 2019) to determine onshore energy generating projects up to 350MW alongside new electricity distribution infrastructure up to 132kV.

3.2.4 Prosperity for All: A Low Carbon Wales (March 2019) seeks to cut emissions and increase efficiency in a way that maximises wider benefits for Wales, ensuring a fairer and healthier society. It sets out a hundred policies and proposals that directly reduce emissions and support the growth of the low carbon economy. These include Policy 26 which expands Welsh Ministers' decision-making remit for DNS from the upper limit of 50MW onshore to 350MW both on and offshore (excluding onshore wind, the consenting for which is already fully devolved) and Policy 31 to deliver the 2017 Renewable Energy Targets announced by the Welsh Government (see below).

3.2.5 Welsh Planning Policy for DNS is set out in Future Wales – the National Plan 2040 (February 2021), the highest tier of the development plan against which the proposed Development will be determined. It sets out a strategy for addressing key national priorities through the planning system, including achieving decarbonisation, climate-resilience and achieving net zero. It acknowledges the climate change emergency is actively changing our environment and directly affecting communities and emphasises its role as "an important lever to deliver the change we need".

3.2.6 Future Wales confirms previous policy commitments to achieve 70% of electricity consumption to be generated from renewable energy by 2030, for one gigawatt of renewable energy capacity to be locally owned by 2030 and for new renewable energy projects to have at least an element

[6] https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035
[7] Climate Change Commission, *Progress Report: Reducing emissions in Wales*, December 2020

of local ownership from 2020.

3.2.7 Policy 17 of Future Wales states that the Welsh Government strongly supports the principle of developing renewable and low carbon energy from all technologies and at all scales to meet future energy needs and to combat the climate emergency. The Proposed Development is partially located within a Pre-Assessed Area for Wind Energy, where there is a presumption in favour of large-scale wind energy development, subject to the criteria in Policy 18. The Welsh Government has already determined (through modelling) that the landscape is capable of accommodating wind development in these areas in an acceptable way. Applicants are required to demonstrate the net benefits a scheme will bring in terms of social, economic, environmental and cultural improvements to local communities.

3.2.8 Policy 18 states that DNS applications for renewable and low carbon energy projects will be permitted subject to a range of detailed criteria on effects to designation sites, nearby communities, ecology etc.

3.2.9 Planning Policy Wales (PPW), 11th edition (February 2021) establishes the energy hierarchy for Wales and is a material consideration in the decision-making process for the Proposed Development. PPW enshrines the Welsh Government's targets for renewable energy and decarbonisation in planning policy and includes policy to deliver these. It seeks to reduce fossil fuel usage in energy generation but recognises the need for an appropriate mix of energy provision, which maximises benefits to the economy and communities whilst minimising potential environmental and social impacts.

3.2.10 Welsh policy identifies that renewable energy is an abundant resource, with associated economic potential, that "… is a key part of our commitment to decarbonisation and tackling the climate emergency"[8]. Renewable energy, dominated by wind and solar technologies, is regarded as the most significant clean energy source contributing towards the achievement of the net-zero target in the short to medium term; such sources of power do not create CO_2 emissions during operational life, displace other fuel sources generating greenhouse gas emissions, and are the most technically and commercially mature renewable energy technologies available.

3.2.11 Renewable energy now accounts for over 40% of UK power generation, has been a critical element in reduced carbon emissions compared to 1990 levels, and is presently one of the least costly forms of power generation in the UK. If the UK and Welsh targets for renewable energy and decarbonisation are to be met, this will require a substantial increase in the current generation capacity of renewables, placing a substantial reliance on new schemes to be delivered. Deployment of renewables in the next 10 – 15 years is critical to the achievement of the next carbon reduction budgets for the UK and Wales.

3.3 Local Planning Policy Context

3.3.1 The policies in the adopted Powys Local Development Plan (LDP) (April 2018) will be given weight as material considerations in the determination of the application. The LDP provides a supportive context to the development of large-scale renewable energy and recognises that proposals over 10MW will be determined by the Welsh Government. Policy RE1 states that proposals for renewable energy development within or close to Strategic Search Areas (SSAs) (now discontinued under Future Wales) will be permitted, subject to certain criteria:

[8] Future Wales: the National Plan (February 2021)

- The proposals shall comply with all other relevant policies in the LDP (either on their own, cumulatively, or in-combination with existing, approved or proposed development);
- Satisfactory mitigation shall be in place to reduce the impact of the proposal. Provision should also be made for the restoration and after-care of the land for its beneficial re-use;
- Where necessary, additional compensatory benefits will be sought by agreement with applicants.

3.3.2 In April 2019, PCC adopted Supplementary Planning Guidance (SPG) on Renewable Energy to be read alongside the LDP policies. The SPG includes advice on how LDP Policy RE1 should be applied, together with a section on the criteria for determining renewable energy schemes. Powys also published a Landscape SPG to supplement the LDP at the same time, setting out detailed guidance on the landscape considerations for development proposals and submission requirements for applications in order to inform the determination process. It emphasises that proposals should avoid sensitive landscapes and views, maintain distinctiveness/ sense of place and make a positive contribution to the locality.

4 SITE SELECTION AND PROJECT EVOLUTION

4.1 Site Selection

4.1.1 Site selection and the final layout of the wind turbines and associated infrastructure has been developed through, firstly, a site screening process based on commercial, technical, planning and environmental criteria and secondly with regard to national planning policy on renewable energy. The Site demonstrated strong attributes for wind energy generation on account of the wind resource, and is sited within areas largely identified as acceptable for large scale wind in national guidance.

4.1.2 The Site was subject to a previous planning application as the Llaithddu Wind Farm and is adjacent to Strategic Search Area C (SSA C), one of the areas identified within Technical Advice Note 8 (TAN8) as an area suitable for large scale wind development. Whilst TAN8 is now discontinued, the introduction of Future Wales in February 2021 addresses spatial planning in Wales for large infrastructure projects, including wind energy schemes greater than 10MW. The Garn Fach scheme is located partly within pre-assessed area 4, for which Policy 17 forms part of the national development plan and is a material consideration.

4.1.3 On account of the historical national planning context and current status of the Site under Future Wales, there are strong grounds to acknowledge that the spatial location of the Garn Fach scheme is within an area within which national planning policy indicates a scheme of this proposal scale can be satisfactorily accommodated.

4.2 Wind Farm Design Evolution

4.2.1 Upon confirmation of the feasibility of the Development, an iterative design process has been applied based upon the technical, planning and environmental constraints to the Site. Through the course of consultations with local residents, the planning authority and statutory consultees, and the environmental assessment process, the design and layout of the project has been informed and amended in response to potential issues identified by the independent specialist consultants.

4.2.2 The Applicant has sought to minimise the potential significant environmental and technical effects identified through this process and embed the principal impact avoidance and mitigation

measures within the project design and layout.

5 PROJECT DESCRIPTION

5.1 The Proposed Development

5.1.1 The Garn Fach Wind Farm (the 'proposed Development') is shown in Figure 2: Site Layout to the rear of this NTS and comprises:

- Seventeen (17) three-bladed wind turbine generators up to 149.9m to blade tip (each with external transformer);
- Wind turbine foundations – each requiring an excavated area of up to a maximum 22m diameter and up to 4.5m in depth (dependent on required ground improvements). The foundations typically have dimensions of up to 20m diameter, up to 2m thickness plus a concrete upstand for mounting the turbine tower.
- Crane hardstandings – formed of crushed stone laid down to form the hardstanding located adjoining each generator, typically up to 65m by 25m in dimension.
- Improved and new access tracks – to provide full access to all the turbine locations the following works will be undertaken:
    - up to 9.79 km of new on-site access tracks
    - upgrading of up to 3.08 km of existing farm tracks
    - upgrading of up to 584 m of existing forestry tracks
    - all tracks will be 5m in width, slightly wider at bends.
- Substation and Control building – to accommodate the electrical switchgear, fault protection and metering equipment required to connect the wind farm to the electrical network, and to allow automatic remote control and monitoring of the wind farm. Final design will be subject to site specific conditions and consultee guidance.
- Energy storage facility - located adjacent to the substation compound, this facility would allow the import/export of power to the grid as required; enabling the system to cope with supply and demand events.
- Two temporary construction compounds, each up to a maximum 7,200m^2 in area, to be reinstated following construction.
- Up to four borrow pits for the winning of on-site stone for construction aggregates.
- On-site underground electrical cables.

5.1.2 When the wind speed sensors mounted on each turbine determine there is a sufficient wind speed for operation, the yaw mechanism turns the turbine so that the blades face into the wind. Wind turbines start operating when the wind speed reaches the 'cut-in' wind speed (typically 3 to 4 m/s). The blades of each of the turbines on the site would rotate in the same direction. In the event of extreme wind speeds (typically in excess of 25m/s) the turbines would shut down until the wind speed has dropped to a level where it can safely start operating again.

5.1.3 In the interests of air safety, as requested by the Ministry of Defence (MOD), all perimeter turbines shall be fitted with 25 candela omni-directional red lighting or infrared aviation lighting.

5.2 Construction, Operation and Decommissioning

5.2.1 It is anticipated that construction will be completed over an 18 month period, with three months for ground clearance and preparation and 15 months for wind farm construction.

5.2.2 The wind farm will be designed with an operational life of 30 years. At the end of this period, unless further planning permission is sought, the wind farm would be decommissioned. The full requirements would be established as part of a specific Restoration and Decommissioning Plan for the wind farm in accordance with planning policy and best practice guidance prior to ceasing operation.

6 LANDSCAPE AND VISUAL

6.1 The Site and Study Area

6.1.1 This assessment considered the likely significant effects on the landscape and visual resources of the Site and the surrounding 40km study area associated with the construction and operation of the proposed Garn Fach Wind Farm.

6.1.2 The Site is located within an area of exposed upland plateau. The Ithon Valley lies to the east of the Site, incising moorland plateaux and rolling uplands on either side of the valley. A number of minor river valleys are located throughout the Study Area, including the Marteg Valley to the south-west of the Site. The Cambrian Mountains rise above the Severn and Wye Valleys to the south-west, west and north-west of the Study Area.

6.1.3 Blocks of coniferous forestry are located throughout the Study Area, typically at higher elevation uplands and upper valley slopes. Areas of open moorland and rough grazing are found at higher elevations, including on upper valley sides, whilst a more complex farmed landscape exists on lower valley sides and valley floors.

6.1.4 The Site does not fall within any nationally or locally designated landscapes but is located approximately 11 km west of the Shropshire Hills Area of Outstanding Natural Beauty (AONB).

6.1.5 The Site can be described in three parts: the northern parcel of land is located to the south and east of the operational Llandinam Wind Farm (consisting of 102 turbines at 45.5m tip height), on the Waun Ddubarthog ridge which runs north – south at a height of approximately 520m. Land cover comprises open upland moorland. To the east the land falls into the valley of the Blue Lins Brook, which drains into the larger Ithon Valley. There is forestry to the east of the parcel at Garn Fach, which is land owned and managed by NRW (a section of access track is proposed through the plantation linking the northern and middle parcels). Numerous small streams cross the parcel, some in narrow wooded valleys, draining eastwards into the Blue Lins Brook. Bridleways run north-south and east-west across the parcel. There are no properties within the northern parcel of the Site; the closest being a derelict cottage (Pabyllwyd Ganol) and The Barns approximately 1km and 1.1km to the east of the nearest proposed turbine, respectively. Eight turbines (T1-8) are proposed within this parcel.

6.1.6 The middle and largest parcel of land is located to the south of forestry at Garn Fach, it includes parts of the Brondre Fawr ridge, at a height of approximately 500m AOD, and several valleys including Custogion Brook and Cwm Craf. Land cover comprises a combination of open upland moorland and enclosed improved grazing, defined by small blocks of forestry and coniferous shelterbelts. Numerous small streams cross this parcel of land, draining eastwards into the Ithon Valley. Footpaths and bridleways cross the site from north-south and east-west. There are several

properties in proximity to the middle parcel, the closest being Ddullui Bank (landowner) and Custogian (landowner), with both properties located approximately 0.8km east of the nearest proposed turbine. Nine turbines (T9-17) are proposed within this parcel.

6.1.7 The southern parcel is the smallest and consists of open upland moorland at the southern end of the Brondre Fawr ridge, separated from the middle parcel by forestry. The ridge rises to approximately 470m and is dissected by the narrow valley of the Cwm Nant-y-stabl which flows east to west, draining into the valley of the Afon Marteg to the west of the Site. A bridleway crosses the northern part of the parcel. There are several properties at Brondre Fach (landowner), approximately 100m to the west of the Site boundary (and over 2.5km from the nearest proposed turbine), and at Newhouse (landowner) approximately 800m to the east (and over 2km from the nearest proposed turbine). No turbines are proposed within this parcel, but it will be managed for habitat restoration.

6.1.8 A number of key road routes are located within a 10km radius from the outermost turbines of the proposed Development, including:

- A483 to the east of the Site, between Newtown to the north and Crossgates to the south;
- A489 to the north of the Site, between Caersws to the west and Newtown to the east;
- A470 to the west and north-west of the Site, between Caersws to the north and Cwmbelan to the west; and
- B4518 to the west of the Site, between Staylittle, Llanidloes and Rhayader.

6.1.9 A network of minor and rural roads connect residential properties and hamlets within 5km of the Site boundary.

6.1.10 Recreational routes located within a 15km radius from the outermost turbines of the Project include the following:

- Glyndŵr's Way long distance footpath and national trail (135 miles), passing within approximately 1.5km of the Site boundary to the south;
- Kerry Ridgeway long distance footpath (15 miles), passing within approximately 7km to the north-east of the Site;
- The Severn Way long distance footpath, approximately 5km to the north and west of the Site at its closest point;
- Wye Valley Walk long distance footpath, approximately 15km to the south-west of the Site at its closest point; and
- National Cycle Network Route 825, approximately 3km to the south of the Site at its closest point.

6.1.11 The pattern of settlement within a 15km radius of the outermost turbines of the Project is typically defined by compact linear villages, together with a small number of larger nucleated, valley towns at river crossing points. Settlements which are mapped as 'small urban areas' include:

- the linear low density hamlets of David's Well and Llaithddu, located between 880m and 2.3km from the outermost turbines of the Project respectively, to the south-east of the Site boundary;
- the hamlet of Bwlch-y-Sarnau, located 4km from the outermost turbines of the Project to the south-west of the Site boundary; and

- the hamlet of Pentre, located approximately 3.9km from the outermost turbines of the Project, to the north-east of the Site boundary.

6.1.12 There are a number of operational and one under construction wind energy developments located within the 40km Study Area, the closest being:

- Llandinam (P&L) (102 turbines at 45.5m tip height) located 0.6km from the nearest Garn Fach turbine) to the north and west;
- Esgairdraenllwyn (2 turbines at 34.6m tip height) located 3.3km to the east from the nearest Garn Fach turbine;
- Garreg Lwyd Hill Wind Farm (17 turbines at 126.5m tip height) located approximately 8.2km to the east of the nearest Garn Fach turbine.

6.2 Significance of Effects

6.2.1 The following potentially significant adverse effects of the scheme on the principal landscape and visual receptors have been identified:

- Landscape Units (within 5km)
    - Waun Ddubarthog Wind Farm, Moderate – Major
    - Improved upland, west of upper Ithon, Moderate – Major
    - Upland moor, north & west of Abbeycwmhir, Moderate – Major
    - Kerry Ridgeway – Moderate (applies only up to 2.5km from the turbines).
- Visual Receptors
    - David's Well – Moderate-Major
    - Bwlch-y-Sarnau – Moderate
    - Motorists on the minor road network around the eastern side of the Site (between the Site and the A483) – Moderate-Major
    - Motorists on the minor road network around the southern side of the Site (between the A483 near Llananno and the B4518 at Pant-y-dwr) – Moderate
    - Users of Public Rights of Way (PRoWs) and open access land within the Site – Major
    - Users of PRoWs and open access land within 5km of the turbines – Moderate-Major but applies only to limited open elevated sections
    - Users of PRoWs and open access land within 5-15km of the turbines – Moderate but applies only to limited open elevated sections 5.5-8km to the north-east and south-east of the Site
    - Users of Glyndŵr's Way long distance footpath and national trail (between Waun Marteg and Abbeycwmhir) – Moderate
    - Users of Glyndŵr's Way long distance footpath and national trail (between Ysgwd-ffordd and A483) – Moderate
    - Users of Glyndŵr's Way long distance footpath and national trail (between A483 and B4355) – Moderate
    - Users of Kerry Ridgeway long distance footpath (specific to users on the western section on Kerry Hill travelling westwards) – Moderate

- Visitors to Gors Lydan – Moderate

6.2.2 In terms of the cumulative effects of the proposed Development, there will be an addition to the overall number of turbines in the area, which will intensify the local influence of wind energy development in the area around the Llandinam Wind Farm in the Pre-assessed area for wind energy (Area 4). Two of the landscape units that will be directly affected are already affected by operational wind energy development: Llandinam Wind Farm is located within Waun Ddubarthog Wind Farm landscape unit; and the twin turbine development at Esgairdraenllwyn (35m tip height) and single turbine at Ddulley Bank (20m tip height) are located within Improved upland, West of Upper Ithon landscape unit. Although the proposed Development will introduce turbines into one landscape unit that is not currently directly affected by wind energy development (Upland moor, north & west of Abbeycwmhir), this area is already indirectly affected by views of the existing wind energy developments at Llandinam, Bailey Bog, Bryn Cwmrhiwdre, Esgairdraenllwyn, Garreg Lwyd and Bryn Titli.

6.2.3 Should the Llandinam Repowering be installed, there will be an increase in the size of turbines in the area. This is likely to result in a further significant adverse change when considered against the existing wind energy landscape and Garn Fach, although it should be noted that under this scenario there will be fewer turbines when compared to the current situation. Critically, there are uncertainties in providing a judgement of cumulative effects at this time due to the unknown position of the potential Llandinam Repowering scheme at the current time. However, the assessment concludes that the scale of Garn Fach turbines beside the repowered Llandinam Repowering turbines would be more compatible than the scale of the Garn Fach turbines beside the existing Llandinam turbines, although significant cumulative effects are still predicted.

6.2.4 Overall, it is also concluded that the proposed Development will not prejudice the values or integrity of the Special Qualities of the Shropshire Hills AONB and no significantly adverse effects are predicted.

6.2.5 There are a number of isolated properties and farms in the vicinity of the Site and these have been subject to a separate residential amenity assessment. A total of 20 properties were identified as lying within 2km of the proposed turbines and having a potential view of the turbines. Six of the 20 properties are judged to experience a 'high' magnitude of change; ten are judged to experience a 'medium' magnitude of change and four are judged to experience a 'low' magnitude of change.

6.2.6 All properties with a high magnitude of change were assessed in terms of potential effects on 'living conditions' by judging whether the scheme will breach the standards for protecting residential visual amenity thresholds. The assessment concludes that the threshold will not be breached at any of these properties, whereby the turbines, given the separation distances, will not render the property an unpleasant place to live.

7 NOISE

7.1 Context of Assessment

7.1.1 An operational assessment of the proposed Garn Fach Wind Farm has been carried out according to the recommendations of ETSU-R-97, *The Assessment and Rating of Noise from Wind Farms*, and the best practice guidance published by the Institute of Acoustics (IoA), *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise* (GPG).

7.1.2 Background noise measurements were undertaken at nine properties in the vicinity of the

proposed Development, agreed with PCC, and correlated with on-site wind speeds. These properties are in most cases the closest to the scheme, and are representative therefore as the 'worst-case' for noise predictions in respect of all properties in the surrounding area.

7.1.3 A cumulative assessment of the combined noise levels resulting from the proposed Development has also been undertaken. This takes into account potential operational noise associated with the existing Llandinam (P&L) wind farm and the consented Llandinam Repowering development (which would replace the 102 turbines of Llandinam (P&L) with 34 larger turbines).

7.1.4 Noise limits have been identified, informed by the ETSU / IoA guidance and background monitoring, against which noise levels should not be exceeded at each of the assessed properties, in order to protect the amenity of residents. If exceedances are predicted, then mitigation may be required and curtailment of selected wind turbines would be implemented to reduce noise emissions to acceptable levels.

7.2 Significance of Effects

7.2.1 Predictions of the noise levels associated with the operation of the proposed Development, based on the installation of the candidate Vestas V136 wind turbines, have been compared with the derived noise limits. The predictions show that operational noise levels from the Garn Fach scheme will not exceed the limits identified at any residential property.

7.2.2 An assessment of the combined noise levels resulting from the proposed Development operating at the same time as the existing P&L development, or the alternative consented Llandinam Repowering development, has also been undertaken. The cumulative assessment showed that predicted noise levels from the combined effect of the proposed Development and existing P&L development met the relevant noise limits at all residential properties except one where there was an insignificant exceedance of the daytime noise limit at one wind speed. The alternative cumulative assessment shows that predicted noise levels from the combined effect of the proposed Development and consented Llandinam Repowering development meets the relevant noise limits at all residential properties with the potential for some mitigation required.

8 ECOLOGY

8.1 Context of Assessment

8.1.1 An assessment of the potential effects that the proposed Garn Fach Wind Farm could have on the ecological resources of the local environment has been undertaken. The purpose has been to assess the baseline data for the development site in the context of the wind farm proposal, and thereafter identify through design changes and appropriate mitigation and compensation, measures to prevent, reduce or offset potential adverse ecological effects. Ecological enhancement measures are also identified, where available and achievable.

8.2 Habitats and Protected Areas – Baseline

8.2.1 The effects of the proposed Development include direct loss of habitat as a result of permanent (i.e. the turbines) and temporary (i.e. construction compounds, borrow pits) land-take requirements. Impacts on habitats can also be indirect through increased habitat fragmentation, or changes caused by pollution, or effects to supporting systems such as groundwater or water-table levels.

8.2.2 The following principal habitats and protected areas within and in proximity to the Site were identified:

- three sites holding statutory designation for their conservation interest within 2km of the Site:
    - the River Ithon Site of Special Scientific Interest (SSSI) and River Wye Special Area for Conservation, which occupy the same boundary, located 1.9km to the east of the Site, protected for their freshwater vegetation and variety of faunal species;
    - Coed Hafod Fraith SSSI, 1.9km to the west of the Site, protected for its sessile oak and rowan woodland; and
    - Rhos Cwmderw SSSI, directly adjoining the Site in the south-west corner, designated for meadow and other marshy grassland species.
- Two non-statutory designated sites within 2km of the Site:
    - Bwlch y Sarnau Hill Road Verge Nature Reserve along the southern strip of the central parcel of the Site, recognised for its wildlife value (inclusive of vascular plants, moss, liverwort, lichen and fungi of local and national importance) and role as wildlife corridor;
    - Craig Dugwm Site of Importance for Nature Conservation / Local Wildlife Sites (SINC / LWS) situated 1.4km to the north-east of the northern parcel of the Site and is an example of ffridd pasture.

8.2.3 A variety of habitats across the Site area were recorded, with the majority of the Site survey area (732 hectares) being composed of coniferous woodland (c. 6,3%), improved grassland (c. 32.5%), marsh or marshy grassland (c. 18.3%), poor semi improved grassland (c. 6.5%), blanket bog (c. 2.6%), and wet modified bog (c. 8.3), all considered to be of relatively low value ecologically.

8.2.4 The total area of habitats to be lost for the purposes of the proposed Development is 17.2 ha. Temporary land-take will be required for the compounds and laydown areas amounting to approximately 3.81 ha.

8.3 Habitats and Protection Areas – Significance of Effects

8.3.1 Following an assessment of predicted effects to these protected areas and habitats, the primary focus of mitigation measures has been upon protecting watercourses hydrologically linked to the River Ithon SSSI and River Wye SAC.

8.3.2 The imposition of these measures as part of a pre-agreed Construction Environmental Management Plan (CEMP) and Habitat Management Plan (HMP) will result in the following residual effects of the proposed Development scheme on key habitats and protected features as follows:

River Ithon SSSI & River Wye SAC

8.3.3 The mitigation strategy includes prevention measures against the introduction of pollutants into the water courses on the Site which may then feed into the River Ithon SSSI and the River Wye SAC. A water quality monitoring programme will also allow prompt detection and rectification of any pollution incidents during construction.

8.3.4 Provided that the mitigation measures are implemented properly and are monitored to ensure continued effectiveness, residual effects on the protected sites during construction are considered to be Slight adverse, and not significant.

8.3.5 Effects during operation of the Development were considered to be Slight beneficial and not significant, resulting from the proposed additional tree planting along riverbanks in at-risk areas.

Coed Hafod-Fraith SSSI

8.3.6 Situated to the west of the Site boundary, Coed Hafod-Fraith SSSI is a good example of sessile oak woodland in the upper reaches of the Afon Marteg. The proposed Development is considered extremely unlikely to cause any adverse effects on the habitats for which the SSSI is designated and it has not been considered further in the assessment.

Rhos Cwmderw SSSI

8.3.7 The Rhos Cwmderw SSSI is located 540m to the south-west of the nearest wind turbine and is designated for its fen-meadow vegetation and other marshy grassland species. Construction phase effects from the Development on the SSSI are considered to be Slight adverse and not significant, and operational effects will be Neutral, with no mitigation required.

Bwlch-y-Sarnau Hill Road Verge Nature Reserve (RVNR)

8.3.8 The mitigation strategy includes prevention measures against the parking of vehicles on the verge near to the Bwlch-y-Sarnau Hill RVNR. If the measures described are implemented properly and maintained, residual effects on the site during construction are considered to be Neutral and not significant.

8.3.9 Effects during operation of the proposed Development were considered to be Neutral and not significant, with no specific mitigation considered necessary.

Craig Dugwm Site of Importance for Nature Conservation / Local Wildlife Sites (SINC / LWS)

8.3.10 The proposed Development is extremely unlikely to cause any adverse effects on the habitats for which the SINC / LWS is designated. The site is therefore not considered further in the assessment.

Habitats

8.3.11 Residual effects on wet modified bog and blanket bog following construction are considered to remain minor adverse and not significant. Where restorative measures as proposed in the Habitat Management Plan are applied effects, following construction, are considered to be moderate beneficial and significant at the Local level.

8.4 Species

8.4.1 Potential direct effects to protected species arising from the scheme include: the loss of individuals, such as through mortality; loss of key habitat; disturbance of key habitats; displacement from key habitat; barrier effects preventing movement to/from key habitats; and general disturbance. Indirect effects on protected species may include loss or change to food resources; and fragmentation, degradation or alteration of key habitats, e.g. because of pollution or hydrological disturbance.

8.4.2 Following are descriptions of the key species identified across the Site and a summary of predicted effects. In no instances are effects predicted to be significantly adverse and requiring mitigation or compensation.

8.5 Species - Significance of Effects

Bats

8.5.1 The Site was categorised as high risk for Nathusius' pipistrelle, Leisler's and Serotine bat species, owing to the variety of terrain, habitats and potential roosting features within and surrounding the Site and their potential to fly within blade sweep areas; a further six species were low risk, inclusive of Common pipistrelle, Soprano pipistrelle, , Noctule, , Myotis and Brown long-eared.

8.5.2 Construction impacts to bats are considered to be Slight beneficial but not significant, on account of the increased amount of edge habitat predicted through selective felling of the Garn Fach plantation to accommodate the access track linking the northern and middle parcels.

8.5.3 With regard to operational impacts, it is known through several studies that operational wind turbines can have negative impacts on bat populations through blade collision, where foraging or commuting bats collide with wind turbine blades, and to a lesser degree barotrauma due to the sensitivity of bats to change in air pressure around the wind turbine blades. Accordingly, predicted effects to such bat species have been conducted based upon activity levels recorded, the vulnerability of the specific bat population and the risk posed by the proposed Development. Through the implementation of the proposed mitigation measures to improve some of the forest edges, it is acknowledged that although some bat fatalities may still arise, losses are likely to be low. Post construction monitoring of the operational development at turbine locations through the April to October season will determine whether any significant losses are arising and what measures can be implemented to reduce them.

8.5.4 Taking the above into account, owing to the iterative design process which considers the edge habitats, and the implementation of a Post-Construction Monitoring Plan, residual effects overall on bat populations are considered to be Slight adverse and not significant.

Great Crested Newt (GCN)

8.5.5 Several ponds were identified with the potential for Great Crested Newt, but only one pond had a recorded presence. Construction impacts to GCN were considered to be Large adverse to the pond and GCN and therefore potentially significant at the County level on account of its isolation in the landscape and lack of dispersal options to other ponds. If all mitigation measures are implemented properly with respect to the closest borrow pit, then residual effects are considered to be Moderately beneficial and significant as a result of the proposed creation of additional terrestrial habitat to strengthen connectivity between the existing ponds.

8.5.6 Operational impacts to GCN were considered to be Neutral and not significant at the County level, due to the very low frequency of vehicular traffic predicted on site.

Otter

8.5.7 Evidence of otter was observed on the Site, where four potential otter resting sites (couches) were recorded around the Blue Lins Brook watershed and along the Custogion Brook; in addition, numerous spraints were identified in similar locations. No holts were identified.

8.5.8 Indirect construction impacts to otter were considered to be Moderate adverse, where run-off or pollutants entering water courses may negatively impact populations as well as bioaccumulate in prey items. Mitigation measures included in the strategy for the River Ithon SSSI and River Wye SAC are considered to alleviate this in conjunction with their own impacts. If all other mitigation measures relating to individual otters through construction activity and road collision are

followed, residual effects are considered to be Neutral and not significant.

8.5.9 Operational impacts to otter, where road collisions at water course crossing points were assessed to be the main risk, were considered to be Neutral and not significant due to the very low frequency of site traffic.

Badger

8.5.10 [redacted]

8.5.11 Construction impacts to badger were considered to be Moderate adverse and significant at the Site level, where individual badgers may become trapped in deep excavations, as well as road collisions where badgers cross the Site. If mitigation measures are followed and implemented, residual effects are considered to be Neutral and therefore not significant.

8.5.12 Operational impacts to badger, where road collisions on the access track were assessed to be the main risk, were considered to be Neutral and not significant due to the low volume of site traffic.

Atlantic salmon and Brown trout

8.5.13 Indirect construction impacts to Atlantic salmon and Brown trout were considered to be Moderate adverse and significant at the County level, on account of the impacts that potential pollution events may have on all life stages of the species. No species-specific mitigation measures were recommended due to the mitigation measures proposed for the River Ithon SSSI and the River Wye SAC, and if these mitigation measures are implemented and monitored to ensure effectiveness, residual effects are considered to be Neutral and therefore not significant.

8.5.14 Effects during operation of the scheme were considered to be Slight adverse and not significant on account of rare/unpredictable impacts, arising from which potential effects would not occur if the Development had not gone ahead. These events, if they occur are likely to be localised and discrete, and therefore no specific mitigation is recommended nor is it possible to recommend. Residual effects are therefore likely to be Neutral, and not significant.

8.5.15 There are no predictions of significant adverse effects cumulatively with other wind farm schemes in the study area.

8.6 Outline Habitat Management Plan

8.6.1 An Outline Habitat Management Plan (OHMP) is included within the draft ES that details a series of habitat enhancement/restoration measures which, if implemented, would result in positive outcomes for the ecology across the development site, including peatland restoration. Peatland restoration would be delivered through ditch blocking in certain specified areas which would re-wet the bog allowing bog vegetation and associated species to thrive.

8.6.2 The OHMP includes measures whereby the enhancement of existing habitats and the creation of new habitats should deliver multiple benefits through adopting an ecosystem services approach, benefiting flood protection (wetlands and bog habitats), water quality (siltation, diffuse pollution), carbon storage (bog habitats), and enhanced habitat networks.

8.6.3 Subject to negotiations on the final provisions of the agreed HMP, a net gain to biodiversity overall over the lifetime of the Development would be achieved.

9 ORNITHOLOGY

9.1 Context

9.1.1 An ornithological assessment has been undertaken that identifies and assesses the potential effects the proposed Garn Fach Wind Farm may have on bird populations using or overflying the Site, from construction through to decommissioning.

9.1.2 A number of species of conservation interest have been identified, including breeding passerines, curlew, red kite, golden plover, kestrel, hen harrier, peregrine and goshawk. Potential effects to these species could arise during construction and operation as a result of several factors, including loss of foraging habitat, collision with wind farm infrastructure, displacement of species to other areas, destruction to nests and disturbance of breeding birds.

9.2 Significance of Effects

9.2.1 Potentially significantly adverse **construction phase** effects to the following species have been identified:

- Breeding Passerines
    - The breeding bird population is considered likely to be of interest at a Site level. The overall direct and indirect disturbance effects are assessed as minor adverse and not significant at any geographical level.
- Curlew
    - Breeding and/or foraging curlew may be displaced from the Site during construction, either by disturbance or direct habitat loss. Curlew are of High nature conservation, and unfavourable conservation status whereby their numbers are in a serious decline.
    - The breeding bird survey effort in 2018 returned five records with three individual birds and two occasions where two birds were seen in suitable habitat. The significance of effect is considered to be minor adverse and not significant at any geographical level.
- Red Kite
    - Breeding or foraging red kite may be displaced from the Site during construction, either by disturbance or direct habitat loss. Red kite effects also require consideration within the context of the Elenydd-Mallaen Special Protection Area (SPA). Red kite is of very high nature conservation value, with a favourable conservation status.
    - Based on the observations made in each breeding season, red kite is a regular breeder in the area, with at least one nest in or in close proximity to the site boundary each year. Red kite are tree nesters and it is not anticipated that there will be a direct loss of their nesting habitat as a result of the construction of turbines.
    - The unmitigated effect is considered to be moderate adverse prior to mitigation and therefore potentially significant; through the imposition of the mitigation measures, including the relocated of nest sites, these effects will be reduced to minor adverse and not significant.

- Golden Plover
    - Foraging golden plover may be displaced from the Site during construction, either by disturbance or direct habitat loss. Golden plover are present in large numbers in the winter, flying over the upland areas of the site. Disturbance effects on wintering and passage birds will be localised and short-term and, given the absence of use of the site recorded for this species, the local conservation status of these species is likely to be minor adverse and not significant at any geographical level.
- Kestrel
    - Foraging kestrel may be displaced from the Site during construction, either by disturbance or direct habitat loss. Kestrel is of High nature conservation value. Foraging birds may be temporarily displaced as a result of construction phase disturbance, but effects are likely to be very localised, minor adverse and not significant at any geographical level.
- Hen Harrier
    - The site is considered to be of importance at the Local level for hen harrier. Foraging birds may be temporarily displaced as a result of construction phase disturbance; however, effects are likely to be very localised (around active machinery), minor adverse and not significant at any geographical level when taken with the area of foraging habitat available locally.
- Peregrine
    - The population of peregrine using the site has been considered to be of Local importance. Disturbance effects are also assessed as being minor adverse and not significant at any geographical level given that there are no known breeding sites within 2km of the site.
- Goshawk
    - The value of the site to goshawk is considered to be negligible, given the low number of flights observed during the two years of survey. Disturbance effects could be minor adverse and not significant at any geographical level in terms of the local and favourable conservation status of goshawk.

9.2.2 In relation to the **operational phase**, effects can result from displacement or mortality through collision with the turbine blades:

- Displacement
    - Significant effects have only been identified in relation to ked kite, whereby it is concluded that very localised displacement of red kite may occur in the immediate vicinity of turbines. The unmitigated effect of displacement is considered to be moderate and is therefore significant, however, following the imposition of mitigation measures, which include discouraging red kites from nesting in the site boundary through locating artificial sites elsewhere, these effects are reduced to Minor adverse and not significant.
- Collision
    - The potential for the collision of bird species with the wind turbine blades has been modelled and assessed based upon the acquired data over 2 years.
    - Moderate and therefore potentially significant effects at the Local level, if unmitigated, could arise for red kite and golden plover.

- Moderate and therefore potentially significant effects at the Local level are predicted for kestrel although it is acknowledged that in general the discernible impact would be minimal.

9.2.3 Specific methods to mitigate impacts on ornithological features are presented in the ES, which will form elements of a pre-construction CEMP to be secured by way of an appropriate planning condition. The provisions will include construction phase surveys for active nests ahead of groundworks and protection if found, ensuring that there are no active red kite nests within 1km of turbines, by removing a nest with the provision of an artificial nest sited more than 1km away from turbines.

9.2.4 Following the satisfactory imposition of the proposed mitigation measures, effects to species of conservation interest, particularly red kite, will be reduced to Minor adverse and assessed as not significant.

10 HYDROLOGY AND GEOLOGY

10.1 Context

10.1.1 The likely significant effects on hydrology, hydrogeology, geology and peat associated with the construction and operation of the proposed Garn Fach Wind Farm have been assessed. Where necessary, mitigation measures have been proscribed to alleviate those impacts that are identified as potentially significant or harmful.

10.1.2 The proposed development area is situated within the headwaters of two river catchments, the Afon Marteg and River Ithon, both of which are tributaries of the River Wye and lie within the wider River Severn catchment. As aforementioned, four SSSIs relevant to the proposed Development have been identified, including Coed Hafod-Fraith SSSI, but all have been assessed as unlikely to be sensitive to the construction and operation of the wind farm.

10.1.3 British Geological Survey mapping indicates that the proposed development area is underlain predominantly by two bedrock geologies. The majority of the Site is underlain by sandstone and mudstone of the Penstrowed Grits formation, with the geology along the eastern margins of the site underlain by mudstone and siltstone of the Nantglyn Flags formation. The Dolgau Mudstones formation underlies a small portion to the west of the central site area.

10.1.4 In terms of soils 75% of the proposed development area is composed of peaty soils, which are either slowly permeable wet very acid upland soils with a peaty surface or very acid loamy upland soils with wet peaty surface. Some other soil classes are also present including a region of freely draining acid loamy soils which runs across the central site area and through the west of the southern site area. A small area of slowly permeable seasonally wet acid loamy and clayey soils is also present in the north of the central site area.

10.1.5 Peat is present in deposits throughout the Site, with depths varying throughout but which are greater towards the north at between 10cm and 190cm. Generally, throughout the Site depths are below 1m in depth. Where areas of deep peat have been identified, these have been avoided wherever possible through modifications to the design and layout of the proposed Development.

10.1.6 The assessment as a whole addressed the potential for significant effects to designated sites, private water supplies, groundwater dependent ecosystems and peat hydrology.

10.2 Significance of Effects

10.2.1 With respect to the River Wye Special Area for Conservation (SAC), this encompasses the River Ithon which drains directly from the Site via the Blue Lins Brook, Custogian Brook and the Llaithddy Brook.

10.2.2 Potential impacts on the SAC relate to changes in water quality as result of construction activities including excavations and watercourse crossings. Embedded mitigation measures to reduce water quality effects such as the buffer distances from watercourses would reduce the potential effects on the designated Sites. However, some works within these buffers would be required for the construction of watercourse crossings. In addition, without further mitigation pollution could still enter the watercourse during periods of heavy rain from open excavations or dewatering activities. The potential impact on this high sensitivity receptor could result in a moderately adverse and therefore significant effect without suitable mitigation.

10.2.3 In-combination effects to the ecology of the SAC, including brown trout and otters, have also been identified, which are addressed in the information submitted to inform a Habitat Regulations Assessment with the application documents. This assesses the effects of the proposed mitigation measures that include a water quality monitoring programme, as series of pollution prevention measures and formulation of a surface water management plan. With the implementation of these measures, residual effects to the quality and ecology of the SAC are assessed as neutral and not significant.

10.2.4 A total of 22 properties with private water supplies lie within the draining catchments of the development, or within 250m of the Site boundary. Given the distance of the abstractions from the Site it is considered there would be a minor adverse effect, which is considered not significant.

10.2.5 The assessment identified that mostly low and some moderately dependant groundwater dependent habitats have been identified within the Site and surrounding the proposed infrastructure, for which impacts could result in moderately adverse significant effects prior to mitigation. There are potential effects in relation to the water levels within peat deposits, whereby the construction of access tracks and turbine bases through an area of peat could disturb the flow of water through the habitat. If not mitigated this could result in the raising of the water table within peat habitats upslope of the infrastructure and drying in the areas downslope. The resultant impact on peat hydrology (high sensitivity) could result in a moderate significance of effect prior to mitigation.

10.2.6 The proposed Development area is not at significant risk of fluvial or coastal flooding. Only limited areas within the Site are within NRW Flood Zones 2 and 3. There is no evidence of historic flood risk in the vicinity of the Site.

10.2.7 Sustainable Drainage Systems (SuDS) and further drainage management measures are to be adopted to reduce the impacts of the proposed Development upon the baseline environment. In addition, a private water supply risk assessment, Surface Water Management Plan and groundwater dependent terrestrial ecosystem assessment have all been developed to protect local assets. These mitigation measures are well established practices within wind farm construction projects.

10.2.8 A Water Framework Directive (WFD) Assessment for the proposed Development has been conducted, which aims to identify the relevant ground water and surface water bodies located within the vicinity of the site and to assess if the proposed Development is compliant with the objectives of the WFD which are to protect and enhance the ecological and chemical health of rivers, lakes, estuaries and coastal and groundwaters. The assessment has concluded that the

proposed Development will not be detrimental to the objectives of waterbodies in the vicinity of the Site, including the River Wye SAC.

10.2.9 A mitigation strategy to reduce the levels of effects deemed moderately adverse and greater is submitted with the application. Details will be agreed as a pre-commencement condition to development in a Construction Environmental Management Plan (CEMP), which will ensure the protection of hydrological resources and water quality to acceptable levels. Through the imposition of the provisions of the CEMP residual effects are deemed at no greater than minor adverse significance due to the proposed Development , and therefore any effects are considered not significant.

11 ARCHAEOLOGY AND CULTURAL HERITAGE

11.1 Context

11.1.1 A heritage assessment of the proposed Garn Fach Wind Farm has been conducted. The term 'cultural heritage' includes all aspects of the physical historic environment, together with intangible aspects such as associations with famous people or cultural perceptions, sacred sites and place-names, local customs and craft industries. The historic environment encompasses the complete range of man-made features that have been introduced into the landscape from the Palaeolithic, more than 250,000 years ago, up to and including the 20th century.

11.1.2 Scheduled Ancient Monuments are designated features of national importance. They are protected under the Ancient Monuments and Areas of Archaeological Importance Act, 1979, and their settings are also protected. There is one Scheduled Monument within the Site boundary, Fowler's Arm Chair Stone Circle and Round Cairns (RD039), and a further seven within 1km. The assessment has identified 81 scheduled monuments within 10km of the Site boundary.

11.1.3 Listed Buildings are protected under the Planning (Listed Buildings and Conservation Areas) Act 1990, as amended by the Historic Environment (Wales) Act 2016. All listed buildings are nationally important, but are graded in order of significance as Grade I, II* or II. Grade I and II* buildings are considered to be of equal status to Scheduled Ancient Monuments. There are 73 listed buildings within 6km of the Site boundary, of which eight are Grade II* and 65 Grade II. There is one Grade I listed building at a distance of between 6km and 10km and nine which are listed at Grade II*.

11.1.4 In addition, the baseline surveys identified:

- two registered parks and gardens within 6km of the Site boundary at Plas Dinam (5.3km west north west of the Site) and The Hall, Abbeycwmhir (4.4km SE);
- two Registered Historic Landscapes within 6km of the Site boundary at Caersws Basin (3.9km N) and Clywedog Valley (6.5km NW);
- Llandinam Conservation Area (4.8km N);
- 82 non-designated assets within the Site boundary, 27 of which were of medium value, 15 of low value, 33 of negligible value and 7 previously recorded assets which could not be identified and whose value could not therefore be determined. Of the assets of medium value, 11 were considered to be of specific importance due to their similarity in form and function with other features of the historic landscape; in determining whether they met the criteria for national importance the resulting conclusion was that they had importance on a regional, rather than national, scale.

11.1.5 At the request of the Powys County archaeological advisor, an additional geophysical survey was

undertaken in April / May 2021 in respect of zones of potential archaeological sensitivity covering 43ha divided between 13 areas within four land parcels. In summary, the results revealed few buried archaeological features despite the wealth of upstanding prehistoric monuments within the sensitive areas selected for survey. Two possible ditched enclosures were tentatively identified in the northern part of the Site near to Turbines 1 and 4, with a potential third enclosure and a trackway further to the north. A detailed investigation of these potential sub-surface archaeological features was undertaken in January 2022. No evidence of remains was identified.

11.1.6 Under LANDMAP, the all-Wales landscape resource tool, the Site occupies part of three historic landscape aspect areas. The northern part lies within the Waun Lluestowain aspect area, which is typified by enclosed marginal land and moorland. Fieldscapes are both irregular and regular, while settlement is non-nucleated. The area is considered to be of moderate value in historic landscape terms. The central part of the Site lies within the Pen Ithon aspect area, which is a high value landscape of predominantly 19th-century enclosure, with regular fieldscapes and non-nucleated settlement. To the south is the Bwlch-y-Sarnau aspect area, which is of high value, comprising largely marginal land with relict earthworks and structures comprising the remains of prehistoric, Roman, medieval and post-medieval activity.

11.2 Significance of Effects

11.2.1 The wind farm design process has sought to avoid all historic assets and this strategy has significantly reduced the potential direct effects of the proposed Development on historic assets which will be further augmented by an archaeological monitoring programme to investigate and record any remains found during groundworks.

11.2.2 In terms of direct impacts to known historic assets, there are no predictions of significant effects to the 11 undesignated assets within the Site boundary.

11.2.3 However, some residual effects remain that result from visual and cumulative impacts. The assessment has identified some large and very large potential effects to monuments based on the visual change that they would experience from development within their setting, which would adversely affect appreciation and experience of their heritage significance. One scheduled ancient monument, RD039 Fowler's Arm Chair, would be significantly affected at moderate/major, with a further 5 monuments assessed as potentially resulting in moderate/slight effects and therefore unlikely to be significant. Screening the turbines from the historic assets is not achievable; however, the application includes for the provision of a new permissive path and interpretation board to Fowler's Arm Chair, which would enhance public appreciation of this monument within its setting.

11.2.4 Cumulative impact with other wind farm schemes, particularly the nearby Llandinam Wind Farm, would result in an extension to turbines on the horizon in the line of vision from approximately seven monuments. Of these the greatest effect would be to Polyn y groes barrow located north of the Site, which is assessed as having a moderate/large effect (significant). Fowler's Arm Chair monument is assessed as experiencing a moderate slight effect (not significant), and the other five monuments a slight effect (not significant). The turbines at Garn Fach would cumulatively adversely affect the setting for these monuments, but this would be of a scale that is incremental to the already much changed setting caused by the existing and consented wind farms at Llandinam.

11.2.5 The assessment also identified 11 undesignated assets within the Site boundary, of which 4 of moderate value and for which the significance of effect will be Moderately significant in respect of three round barrows and one standing stone.

11.2.6 No listed buildings, registered parks and gardens or historic landscapes of Wales would be significantly affected by the scheme, either individually or cumulatively with other schemes.

12 AIR SAFEGUARDING AND TELECOMS

12.1 Aviation

12.1.1 Three principal air-safeguarding issues/receptors were identified following initial consultations with aviation consultees.

12.1.2 RAF Shawbury – radar line of sight calculations have been undertaken from the RAF Shawbury Primary Surveillance Radar (PSR) to assess if any of the turbines would be likely to affect the radar. Having initially expressed concern when consulted about the proposal in 2018, the Defence Infrastructure Organisation (DIO) confirmed they have no objection.

12.1.3 Military Low Flying - the proposed Development is located within Tactical Training Area (TTA)7, where military aircraft undertake tactical low flying. The DIO has confirmed that it has no concerns with the proposal subject to lighting requirements.

12.1.4 NATS (En Route) plc (NERL) - NERL has a network of overlapping radars covering this area. In this case, the closest radar is at Clee Hill and radar modelling has shown that turbines 1 to 8 will be in line of sight of the radar and turbines 9 to 17 will be screened by terrain. A Technical and Operational Assessment (TOPA), undertaken by NERL, identified that although a technical impact is anticipated, this is deemed acceptable; NERL therefore have no objection to the proposed Development.

12.1.5 Mitigation is required in relation to military low flying. The DIO has expressed a requirement for the perimeter turbines to be fitted with 25 candela omni-directional red lighting or Infrared lighting. A lighting scheme will be agreed with the DIO and made the subject of a suitably worded planning condition.

12.2 Telecommunications

12.2.1 As there are no telecommunications links within 250m of any of the proposed wind turbine locations, no effects are anticipated.

13 TRANSPORT AND ACCESS

13.1 Context

13.1.1 Access to the site of the proposed Development for the wind turbine generators will be required from the Port of Entry on the Mersey via the M53, A55, A483, A5 and Newtown Bypass. Thereafter, vehicles with abnormal loads will enter the Site via the local road south of Cwmyrhiwdre (C2025 / U2835) from the A483. All other construction vehicles would access the Site from within the locality and the region and utilise the same access routes.

13.1.2 The proposed Development is expected to increase traffic volumes on the trunk and local highway network during the construction phase. Traffic volumes would fall off considerably outside the peak period of construction.

13.2 Significance of Effects

13.2.1 The maximum traffic impact associated with construction is predicted to occur in month 7 of the construction programme. The greatest impact would be on the local road (C2025 / U2835) from the A483 south of Cwmyrhiwdre, which is also the existing access route to the Llandinam Wind Farm. During these months an average of 80 HGV movements (or 10 per hour) is predicted per day with a further 50 car and LGV movements to transport construction workers to and from the site, resulting in up to 130 journeys in this month. This increase is significant, as there will be large effects through delays and wider implications to the users of this road. The assessment of significance suggests traffic flows on the C2025 / U2835 during the peak periods of construction are considered significant effects, prior to the application of mitigation measures. No significant capacity issues are expected on any of the other roads within the study area due to the additional construction traffic movements associated with the proposed Development, as background traffic movements are low and the links are of a reasonable standard.

13.2.2 A review of the local road network was undertaken to assess the feasibility of transporting turbines to the development site and this has concluded that access for the candidate turbine is feasible, subject to the provision of mitigation works.

13.2.3 Traffic levels during the operational phase of the proposed Development would be one or two vehicles per week for maintenance purposes, which is a negligible increase in the context of current vehicle movements on the affected network. Traffic levels during the decommissioning of the proposed Development are expected to be lower than during the construction phase as some elements may be left in situ and others broken up on site.

13.2.4 To manage the impacts of the construction phase of the Development, a Construction Traffic Management Plan (CTMP) will be agreed with relevant authorities prior to commencement of the wind farm project. Details will include: methods to minimise the volume of material to be imported to site to help reduce HGV numbers; confirmation of use of on-site batching to reduce traffic numbers; a site worker transport and travel arrangement plan; methods to minimise on- and off-site sediment and dust dispersal; agreed normal site working hours; traffic management measures on the unclassified road to avoid conflict with general traffic; and provision of construction updates on the project website and/ or a newsletter to be distributed to residents within an agreed distance of the site.

13.2.5 No link capacity issues are expected on any of the roads assessed due to the additional movements associated with the proposed Development. The effects of construction traffic are temporary in nature, and with the proposed mitigation, no significant traffic effects are predicted.

14 Socio-Economics

14.1 Context

14.1.1 The proposed Development has been assessed for the potential social and economic impacts of developing the Garn Fach Wind Farm, during construction, operation and decommissioning. Both beneficial and adverse impacts have been considered for the local, Welsh and UK economies.

14.1.2 Economic impacts have been considered through the numbers of jobs safeguarded and created (Full Time Equivalent) and the contribution to Gross Value Added (GVA). Social impacts have been reviewed for the consequences the proposed Development may have on recreational uses and implications for local residents during the 18 month construction phase.

14.1.3 The potential economic and social impacts are expected to be generally beneficial, with negative residual effects considered to be of minor significance during construction. Throughout the construction phase it is expected that the wind farm will contribute positively to the local and national economy, and during operation there are expected to be some economic benefits as well as the opportunities brought about by the community fund and local ownership (if taken up).

14.2 Significance of Effects

14.2.1 A summary of the impacts generated by the development of the Garn Fach Wind Farm over the lifetime of the project is set out in the table below.

Summary impacts of the Garn Fach Wind Farm

Impact	GVA (Gross Value Added)	Employment (Full time Equivalents)	Impact	Period	Significance	Impact Area
Community Fund	£4,757,391	109.3 FTEs	Positive	Permanent During Operation	Major	Wales
	£1,549,958	50 FTEs				UK
	N/A	23 FTEs				Local
Development / Build / Operation	£38,551,164	498.7 FTEs	Positive	Permanent from build through operation	Major	Wales
	£61,429,362	1,678 FTEs				UK
	£16,022,217	349.2 FTEs				Local
Recreation	N/A	N/A	Negative	Temporary during construction	Minor	Local
			Positive	Permanent during operation	Moderate	
Skills Provision	N/A	N/A	Positive	Permanent	Minor	Local

15 Shadow Flicker

15.1 Context

15.1.1 A shadow flicker assessment has been undertaken to identify and outline potential effects of shadow flicker arising from the movement of wind turbine blades on surrounding residential properties (receptors) as a result of the operation of the Development. The study area included all properties within ten rotor diameters (plus a further 50m for turbine micro-siting) of any turbine location, equal to 1410m.

15.1.2 Thirteen properties were identified at which shadow flicker had the potential to arise. The levels of shadow flicker reported are worst case, whereby it is assumed that each property is occupied, that there are windows or doors facing the wind turbines, that there are no intervening obstructions, that the sun shines throughout daylight hours, that the wind blows constantly within the operating parameters of the wind turbines, and that the rotor is always orientated towards the receptor.

15.2 Significance of Effects

15.2.1 The results show that a number of the turbines have the potential to cause shadow flicker effects. Where the average annual UK sunshine hours are applied to the model, then the currently occupied buildings are likely to experience shadow flicker for no more than 26.47 hours per annum, with the majority likely to experience less than 20 hours per annum. None of the properties identified would experience over 30 hours per year or 30 minutes per day, and therefore based on accepted significance criteria the effects on all properties would not be significant.

16 Air Quality, Climate and Carbon Balance Assessment

16.1 Air Quality

16.1.1 Welsh Government recognises air pollution as a significant environmental contributor in the deterioration of public health, and Public Health Wales estimates that the equivalent of around 1,600 deaths are attributable to fine particulate matter (PM2.5) exposure and around 1,100 deaths to nitrogen dioxide (NO_2) exposure each year in Wales. The principal causes of air quality deterioration are widely recognised as transport, fossil power generation, industry and agriculture. Welsh Government is now in the process of developing a Clean Air Plan for Wales to establish Clean Air Zones and accelerate compliance with air quality standards.

16.1.2 Due to the temporary nature of construction activities (over a period of 18 months) and the operational nature of the proposed Scheme, effects to air quality are evaluated as negligible and not significant. Suppression measures to minimise air quality issues local to the development site are as set out in the Outline CEMP.

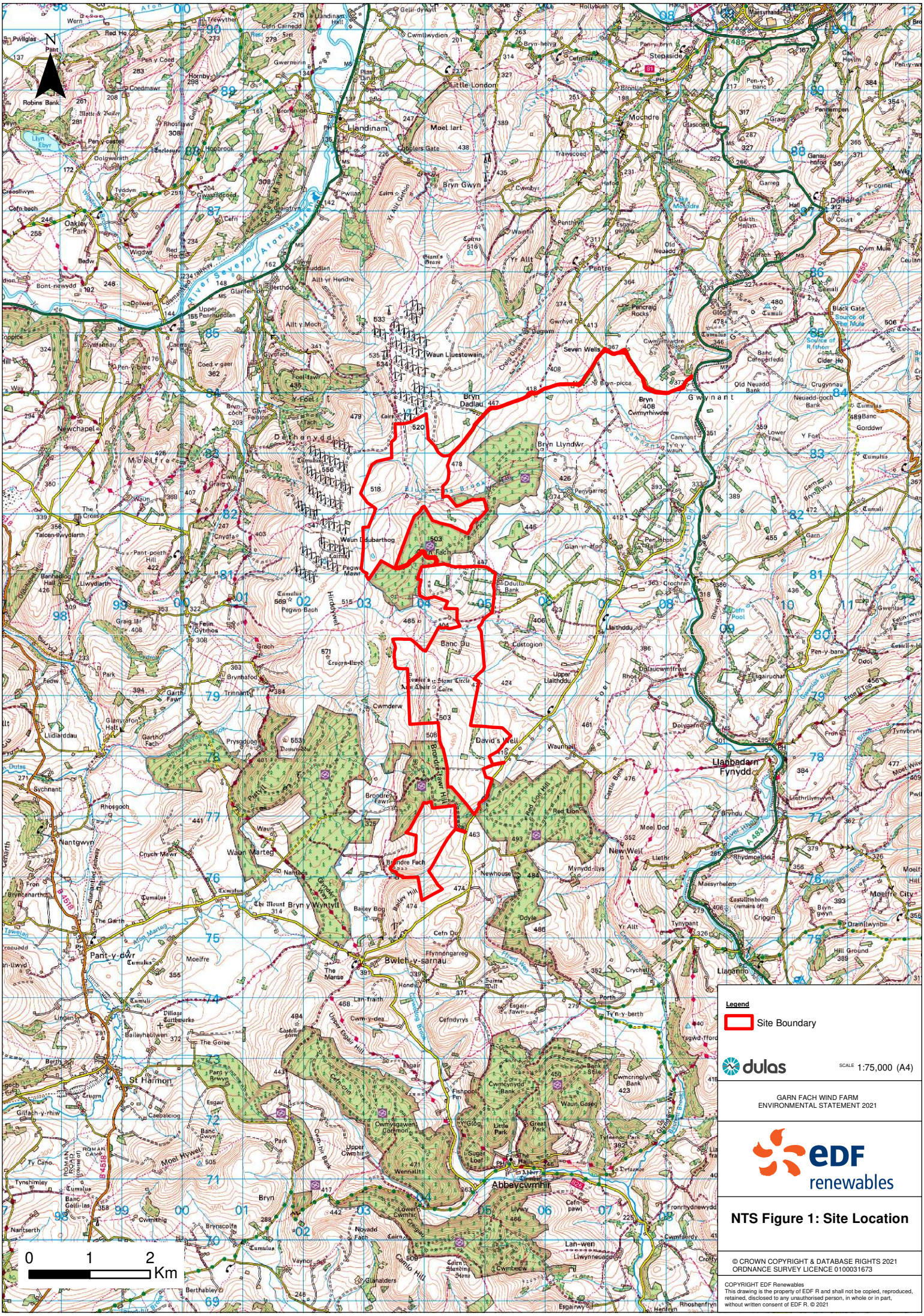
16.2 Climate and Carbon Balance

16.2.1 The Environment Act Wales 2016 established primarily legislative requirements for a 2050 Greenhouse Gas Emissions Target, and in February 2021 Welsh Government made a legal commitment to achieve net zero emissions by 2050. In this context the proposed Development will have a positive contribution on efforts to decarbonise and tackle climate change nationally and locally. Garn Fach Wind Farm is expected to deliver carbon offsetting benefits equivalent to over 3,500,000 tonnes over its 30-year lifetime and it is likely that, based on current factors, it would repay its carbon debt within the first few years of operation; the wind farm scheme would therefore be carbon positive for the mainstay of its operational lifetime.

16.2.2 On a national scale, the predicted carbon reduction benefits of this proposed Development will form part of the collaborative effects to decarbonise the power generation sector, and increasingly potentially the transport and heat sectors. As such, individual schemes such as Garn Fach will, alongside other renewable energy schemes, have a small but significant part in achieving the net zero target.

NTS FIGURE 1: SITE LOCATION

NTS FIGURE 2: SITE LAYOUT


Legend
Site Boundary
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SCALE 1:75,000 (A4)
GARN FACH WIND FARM
ENVIRONMENTAL STATEMENT 2021
edf renewables
NTS Figure 1: Site Location
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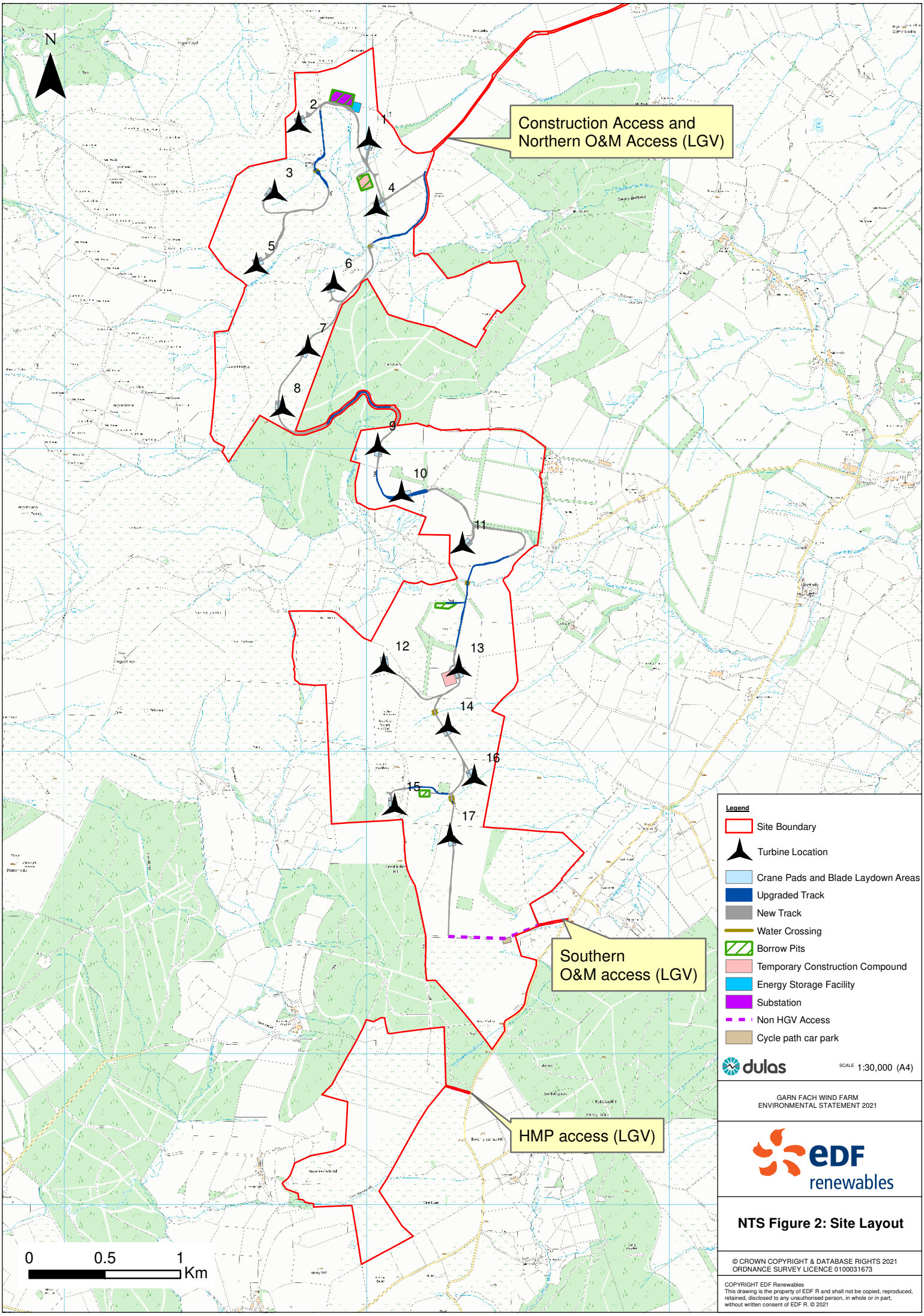

GARN FACH WIND FARM
ENVIRONMENTAL STATEMENT 2021

edf renewables

NTS Figure 2: Site Layout