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# Chapter 2

## Site Selection & Design Evolution

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### Glossary

Term	Definition
The Applicant	The applicant is “RWE Renewables UK Developments Ltd”.
Proposed Development	The proposed Daer Wind Farm
Proposed Development Area	The project development area within the site boundary
Daer Land Portion	Scottish Water Land Ownership, comprising of land east and south of Daer Reservoir. Wholly within the South Lanarkshire Local Authority Area (demarcated in Diagram 2.1 for reference).

Term	Definition
Kinnelhead Land Portion	The Kinnelhead Land Portion is situated wholly within the Dumfries & Galloway Local Authority Area (demarcated in Diagram 2.1 and several EIAR Figures incl. 7.5c).
Rivox Land Portion	This Forestry and Land Scotland (formerly Forestry Commission) owned area of commercial forestry sits to the east of the Daer Land Portion. Situated wholly within the Dumfries & Galloway Local Authority Area (see Diagram 2.2 for reference). This area was originally scoped but not pursued for wind turbine development.

## List of Abbreviations

Abbreviation	Description
RWE	RWE Renewables UK Developments Ltd, the Applicant
Natural Power	Natural Power Consultants Limited
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
AA	Appropriate Assessment
MW	Mega Watt
ECU	Energy Consents Unit
SLC	South Lanarkshire Council
DGC	Dumfries & Galloway Council
LVIA	Landscape & Visual Impact Assessment
SM	Scheduled Monument
SAC	Special Area of Conservation
SNH	Scottish Natural Heritage (now NatureScot)
SSSI	Site of Special Scientific Interest

## 2.1 INTRODUCTION

2.1.1 The purpose of this Chapter is to identify the steps that have been considered in the site selection and design evolution of the proposed Daer Wind Farm (the Proposed Development). This Chapter demonstrates how the site design and the layout of the turbines evolved through the initial site selection process, identification of various constraints and site-specific factors, and highlights the key design criteria applied.

2.1.2 Planning Advice Note (PAN) 68: Design Statements explains the process of undertaking a design statement. Design and Access statements are a statutory requirement for all National and Major Developments under the terms of the Town and Country Planning (Development Management Procedures) (Scotland) Regulations 2013. Although not a statutory requirement for a Section 36 application, this Chapter nevertheless explains the design process which has been gone through in arriving at the final layout. It also fulfils the requirement of Regulation 5(2)(d) of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 to provide a description of the reasonable alternatives considered and the main reasons for the option chosen by the Applicant.

## 2.2 THE SITE SELECTION PROCESS

2.2.1 The Applicant has a portfolio of sites across Scotland that it has investigated over time for the potential for wind energy development. Some are not progressed whilst others make it all the way to application stage and constructed following consent. The area in the vicinity of Daer Reservoir has been investigated by the Applicant for over 10 years. In that time, a wind monitoring campaign has been undertaken with data collected from two temporary anemometer masts. Feasibility studies have been completed remotely and via site visits. Results indicated that this site would be a technically and environmentally appropriate location to develop a wind farm. A scoping report was originally submitted to the Scottish Government in 2011 by the Applicant (formerly known as E.ON Climate & Renewables UK Developments Ltd). At this time, it was envisaged the wind farm would comprise of approximately 22 wind turbines approximately 130.5 m in height to blade tip.

2.2.2 The Applicant did not progress the layout scoped in 2011 to application stage. Since then, there have been significant changes in policies and market conditions for onshore wind. In 2018, Natural Power was commissioned by the Applicant to investigate the new potential and suitability for a wind farm development here. A new Scoping Report was issued to the ECU and consultees in December 2018 introducing turbines at 170 m in height to blade tip and update to it made in 2019 which changed the site boundary and increased turbine tip height to 180 m. The design evolution of this Proposed Development is presented in section 2.3.

2.2.3 The overarching aim of the selection process was to have a layout that maximised the efficiency of the Proposed Development whilst limiting the potential environmental impacts. Factors influencing the suitability of the site included:

- Suitable wind speeds;
- Suitable separation distance from dwellings and settlements;
- Proximity to sensitive landscape and visual receptors;
- Reasonably close proximity to viable grid connection;
- Willing landowner(s);
- Potential to use existing infrastructure, as far as practical;
- Suitable land area to accommodate generating capacity; and
- No significant constraints preventing development.

2.2.4 Initial feasibility studies of the above factors indicated that there was an opportunity for further wind energy development east of Daer Reservoir between the operational Clyde Wind Farm to the north, and Harestanes Wind Farm to the south. Figure 1.2 of the EIAR illustrates the regional context of the Proposed Development Area against which strategic constraints have been considered.

## Policy Context

2.2.5 Scottish Planning Policy (SPP) indicates that the Proposed Development is situated predominately within a Group 3 area; one with potential for wind farm development. According to the NatureScot Carbon and Peatland Map<sup>1</sup>, some parts of the Proposed Development Area have carbon rich soils and/or deep peat which under SPP, classifies them as Group 2; areas of significant protection. The Applicant commissioned baseline survey work to establish the actual extent of peat depth in the Proposed Development Area. A full review of legislation, national and local planning policy has been provided in Chapter 4: Climate Change, Legislative and Policy Context of the EIAR, and an assessment of such material is provided in the accompanying Planning, Design and Access Statement, as well as in the individual EIAR chapters, in particular Chapter 8. The iterative design process factored in such policy context, including avoiding Group 2 areas, where practicable, for example.

## Wind Resource

- 2.2.6 Initial long-term wind resource estimates were derived from multiple sources including site measurements collected on the Proposed Development Area. Early estimates used within an initial feasibility assessment of the long-term wind speeds across the Proposed Development area are as follows:
- 2.2.7 Early indications for the Proposed Development are that the capacity factor will be good/above average at ~40% for turbines up to 180 m to blade tip.
- 2.2.8 Although these values should be taken as indicative, they imply that the wind resource at the Proposed Development has the potential to deliver an economically viable wind energy development.
- 2.2.9 Detailed assessments have been undertaken using state of the art VENTOS Computational Fluid Dynamics (CFD) modelling in order to better understand the local wind regime. This has led to an improved understanding of the specific complex flow regime, that results from the terrain and forestry surrounding the Proposed Development. The turbulence intensity, wind shear, inflow angle and veer across the site were assessed in order to inform the design process (along with all relevant physical, environmental and technical constraints). The process was undertaken iteratively in order to arrive at the appropriate number, size and location of turbines for the Proposed Development to minimise project risks (turbine performance / operational issues) and maximise project efficiency and energy yield output. An anemometry monitoring campaign has been commenced, using industry best practice monitoring techniques in order to capture detailed wind profiles and further refine the wind resource on site.

## Grid Connection

2.2.10 Securing a grid connection was another factor in delaying the progression of the EIA since original Scoping in 2011. Capacity in the network was acquired and a grid connection agreed with the network operator which led to progressing the project again with Scoping in 2018. Capacity on the electricity grid for the Proposed Development has been secured with a connection date of 2027.

## Access

2.2.11 An access study was carried out in 2020 to determine the feasibility of the proposed public access route from King George V Dock in Glasgow to the entrance of the Proposed Development Area using a Siemens Gamesa 155 wind turbine as a candidate model for the purposes of swept path analysis. The study assessed the delivery of wind turbine components and general construction traffic including a site visit by an experienced engineer from Pell Frischmann. The access study was used within the initial feasibility study of the Proposed Development and as a result deemed that the site had good access given proximity to the M74. Use of existing forestry roads and tracks built for other wind farms has also been identified and their use and upgrade proposed.

The potential effects on transport and access are fully assessed in the EIAR and the results presented in Chapter 11.

## Land Use

2.2.12 The Proposed Development is located in an area of moorland and semi-improved pasture, adjacent to Daer Reservoir. Diagram 2.1 below illustrates the landownerships where the turbine infrastructure is proposed. The green and yellow areas depict the different tenancies and combined form the Daer Land Portion, owned by Scottish Water. The blue area is the Kinnelhead Land Portion.

Source: Natural Power

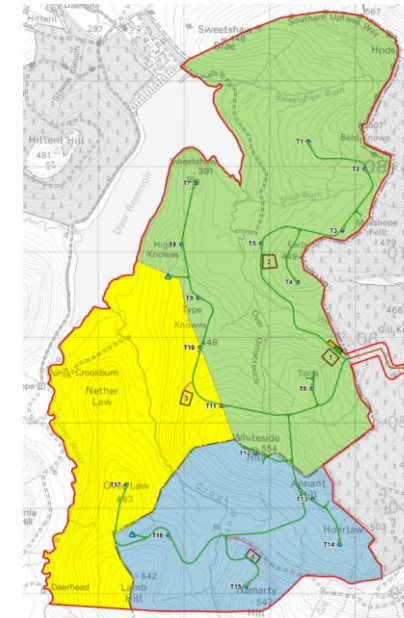


Diagram 2.1: Land Parcels

- 2.2.13 Scottish Water operates the Daer Reservoir which itself also generates some electricity to power the drinking water plant. The Proposed Development compliments the existing renewable energy developed in this remote location here. Furthermore, it is an asset which will significantly increase the renewable energy generated on Scottish Water land and therefore accords with the Scottish Water Energy Programme. Hosting private renewable energy investment is one of this utility's four-pronged approach to energy management, stating it hosts private investment in renewables on its land where it provides a good return for customers and is compatible with providing high quality services<sup>2</sup>.
- 2.2.14 The landowners, including tenant farmers have been consulted during the EIA in particular with relation to establishing appropriate areas for habitat management.
- 2.2.15 The route for the proposed private access from the public road is mostly on existing tracks on land used for commercial forestry. As a result of some new track and widening/upgrading in existing forestry an assessment of forestry has been provided in Chapter 12.

## Proximity of Dwellings

2.2.16 The Proposed Development Area is relatively remote and distant from large numbers of potential receptors. It is outwith any settlement which would otherwise class it in Group 2 as defined by SPP. Five dwellings have been identified within 3 km of the Proposed Development as shown in Table 2.1.

<sup>1</sup> Available online: [https://map.environment.gov.scot/Soil\\_maps/?layer=10](https://map.environment.gov.scot/Soil_maps/?layer=10) (last accessed 29/10/2020)

<sup>2</sup> Available online: <https://docs.google.com/viewerng/viewer?url=www.scottishwater.co.uk/-/media/ScottishWater/Document-Hub/Key-Publications/Energy-and-Sustainability/Scottish-Water-Energy-Programme.pdf> (last accessed 23 November 2020)

Table 2.1: Dwellings within 3 km of the nearest proposed turbine

Property	Direction from Proposed Development	Distance to nearest turbine (km)	Turbine no.
Sweetshaw Foot	North	1.3	7
Kirkhope Cleuch Cottage	West	1.3	8
Kirkhope	South West	1.5	17
Crookburn	South West	1.5	17
Blairmack	South East	1.5	14

Source: Appendix A5.5: Residential Visual Amenity Assessment

2.2.17 Potential noise, shadow flicker and visual amenity impacts have been given consideration during the site design iterations to ensure minimised effects on nearby residents. A detailed noise assessment is provided in Chapter 10: Noise. Shadow flicker is considered in Chapter 13. Residential visual amenity is considered fully in Chapter 5: Landscape and Visual Assessment, of the EIAR.

## Landscape and Visual

2.2.18 Landscape and visual considerations were taken considered during the early stages of the project, as these were understood to be key to the progression of the project. Several sources of information were used at the time to inform the design. These include, but are not limited to, the following:

- Guidelines for Landscape and Visual Impact Assessment, Third Edition (GLVIA3) (Landscape Institute and the Institute of Environmental Management, 2013);
- Siting and Designing Wind Farms in the Landscape, Guidance, Version 3a (SNH, 2017);
- South Lanarkshire Local Development Plan Supplementary Guidance: Renewable Energy (2015);
- South Lanarkshire Landscape Capacity Study for Wind Energy (South Lanarkshire Council, 2016);
- South Lanarkshire Landscape Character Assessment (South Lanarkshire Council, 2010);
- South Lanarkshire Tall Wind Turbines: Landscape CAPACITY, Siting and Design Guidance, Addendum to Landscape Capacity Study for Wind Energy 2016 (South Lanarkshire Council, 2019);
- Dumfries & Galloway Council Local Development Plan 2, Wind Energy Development: Development Management Considerations, Supplementary Guidance (Dumfries & Galloway Council, 2020);
- Dumfries & Galloway Council Local Development Plan 2, Part 1 Wind Energy Development: Development Management Considerations, Appendix 'C' Dumfries & Galloway Wind Farm Landscape Capacity Study (Dumfries & Galloway Council, 2020).

2.2.19 Chartered Landscape Architects have worked closely with the project team from the outset, reviewing the siting and design of the wind turbines in order to minimise, as far as practical, the potential landscape and visual and cumulative effects of the Proposed Development.

2.2.20 The relationship between the proposed turbines and existing turbines of operational wind farm sites in the area has been a key consideration for the design of the Proposed Development in landscape and visual terms. Consideration was also given to other wind farms that are consented or currently in planning and the potential for cumulative effects. Consideration of the Proposed Development in relation to other constructed, under construction, consented and submitted developments in the area is fundamental to fully assess the potential landscape and visual effects.

## Ecology and Ornithology

2.2.21 Desk based studies indicated that there were no designated ecological or ornithological constraints such as Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA) or RAMSAR, within the Proposed Development Area. Baseline survey work indicated potential suitability for wind energy development, subject to

further detailed assessment and survey data fed into the iterative design process. Potential effects upon ecology and ornithology are fully assessed in the EIA and the findings are presented in Chapter 6 and Chapter 7.

## Hydrology, Geology and Hydrogeology

2.2.22 The Proposed Development was always going to be within the catchment for Daer Reservoir but with experience held by the Applicant, Natural Power and Scottish Water of other similar projects built on drinking water catchments this was considered to be manageable through site design, best practice in construction and other mitigation measures including a Pollution Prevention Plan. As part of the hydrology assessment all mapped watercourses were marked as a hard constraint from the outset and a 50 m buffer was applied to them to protect watercourses from disturbance and potential effects on water quality during construction and operation. In cognisance of Scottish Water's guidance, a 100 m buffer was also applied during the design process and infrastructure located outwith this where possible. Desk based surveys indicated potential for carbon rich soils and deep peat. The Proposed Development area was surveyed and such areas avoided where practical through the design evolution. Ground Water Dependant Terrestrial Ecosystems (GWDTE) were also identified and avoided where possible. A detailed assessment of hydrological elements is provided in Chapter 8.

## Cultural Heritage

2.2.23 During the initial feasibility assessment, the presence of cultural heritage was investigated within and out with the Proposed Development Area and results did not reveal any significant concerns. A baseline survey was undertaken which identified cultural heritage assets in the Proposed Development Area. These were accounted for during the design evolution and direct effects thus avoided. A full cultural heritage assessment is provided in Chapter 9.

## Existing Infrastructure and Aviation

2.2.24 The presence of existing infrastructure such as service pipes and cables, TV transmission, mobile telephone networks and electromagnetic paths were considered. Geographic information systems (GIS) data used within the initial feasibility study indicated there was existing infrastructure within the Proposed Development Area to avoid in particular a high-pressure gas pipeline in the northern part of the Proposed Development Area. A micropath link was identified bisecting the Proposed Development Area and a cautious 200 m buffer applied. A study of unexploded ordnance (UXO) was undertaken which indicated a potential for UXO within the Proposed Development Area. Whilst not a hard constraint to design, UXO surveying was undertaken in advance of intrusive groundwork such as peat probing and no UXO were discovered. Full details are provided in Chapter 13.

## Public Right of Way and Core Paths

2.2.25 The Southern Upland Way passes through the Proposed Development Area in the north and was given a 'topple height' distance buffer during the design process. There were no other such rights of way that travelled through the Proposed Development Area that needed to be accounted for in design. More details are provided in Chapter 13.

## 2.3 DESIGN EVOLUTION

2.3.1 This section describes the design evolution of the Proposed Development and discusses how the site design and layout continued to evolve throughout the EIA process. The site design process was guided by the findings of the baseline surveys and by issues raised by statutory and non-statutory consultees in line with Scottish Planning Policy. The layout evolved under the guidance, requirements and considerations of RWE including Scottish Water's own guidance, contributions from Natural Power and from other contributing specialist consultants such as cultural heritage, aviation and transport advisors. Many of site constraints identified during the process and taken into account for the design evolution are illustrated in Figure 1.3.

## Scoping (2018)

In 2018 a layout incorporating the Daer Land Portion and forested Rivox Land Portions was prepared. There were 15 turbines at up to 170 m in tip height which were predominately in the Daer Land Portion with 3 located in the forested Rivox Land Portion to the east, see Diagram 2.2 below.

Source: Natural Power

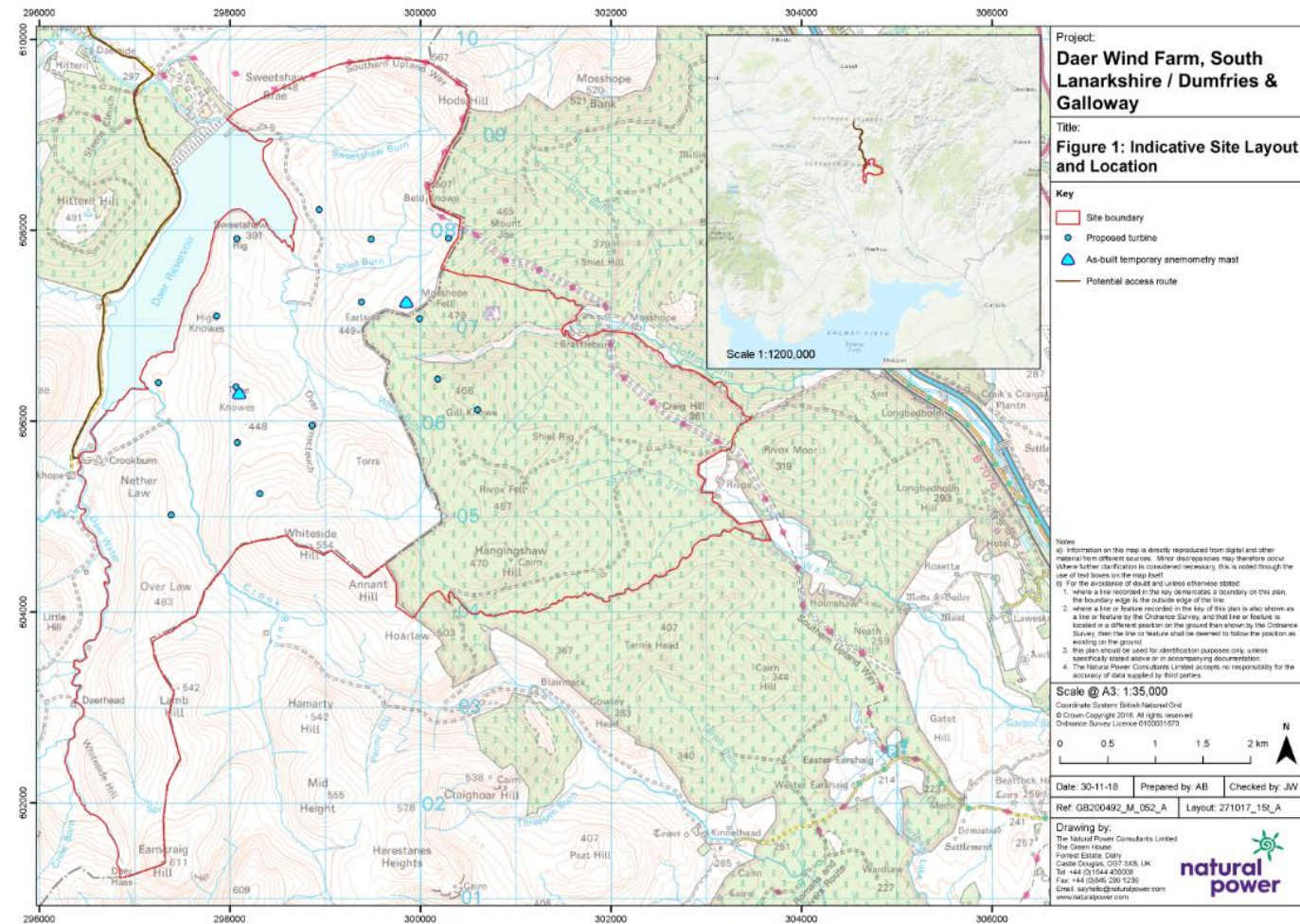


Diagram 2.2: Scoping (2018) (not to scale)

2.3.2 The layout was based predominately on desk-based reviews and baseline ecology and ornithology surveys. A Scoping Report was prepared and issued to consultees via the ECU for responses. Scoping Opinions were received by the Applicant from several consultees. This consultation helped identify and clarify key issues, promoted dialogue with both consultees and other stakeholders, and confirmed methods for survey, evaluation and assessment going forward. The consultee responses were reviewed in partnership with the specialist subconsultants in order to make sure all relevant issues identified were assessed as part of the site survey work and were subsequently included in draft copies of relevant EIA chapters.

## Scoping Update (2019)

2.3.3 In 2019, the Applicant had to alter the site boundary as a result of changes with landownership. This removed the Rivox Land Portion on the east and introduced the Kinnelhead Land Portion to the south. The maximum tip height sought would also change from 170 m to 180 m. These changes were communicated to the ECU.

## Design Workshop #1

2.3.4 A design workshop was held in November 2019 between the Applicant and consultants from relevant departments of expertise including landscape, planning, ecology, ornithology, hydrology, wind, construction design to amend the layout following the change in site boundary and collection of more site data including phase 1 peat. The resultant layout from this workshop is presented in Diagram 2.3.

Source: Natural Power

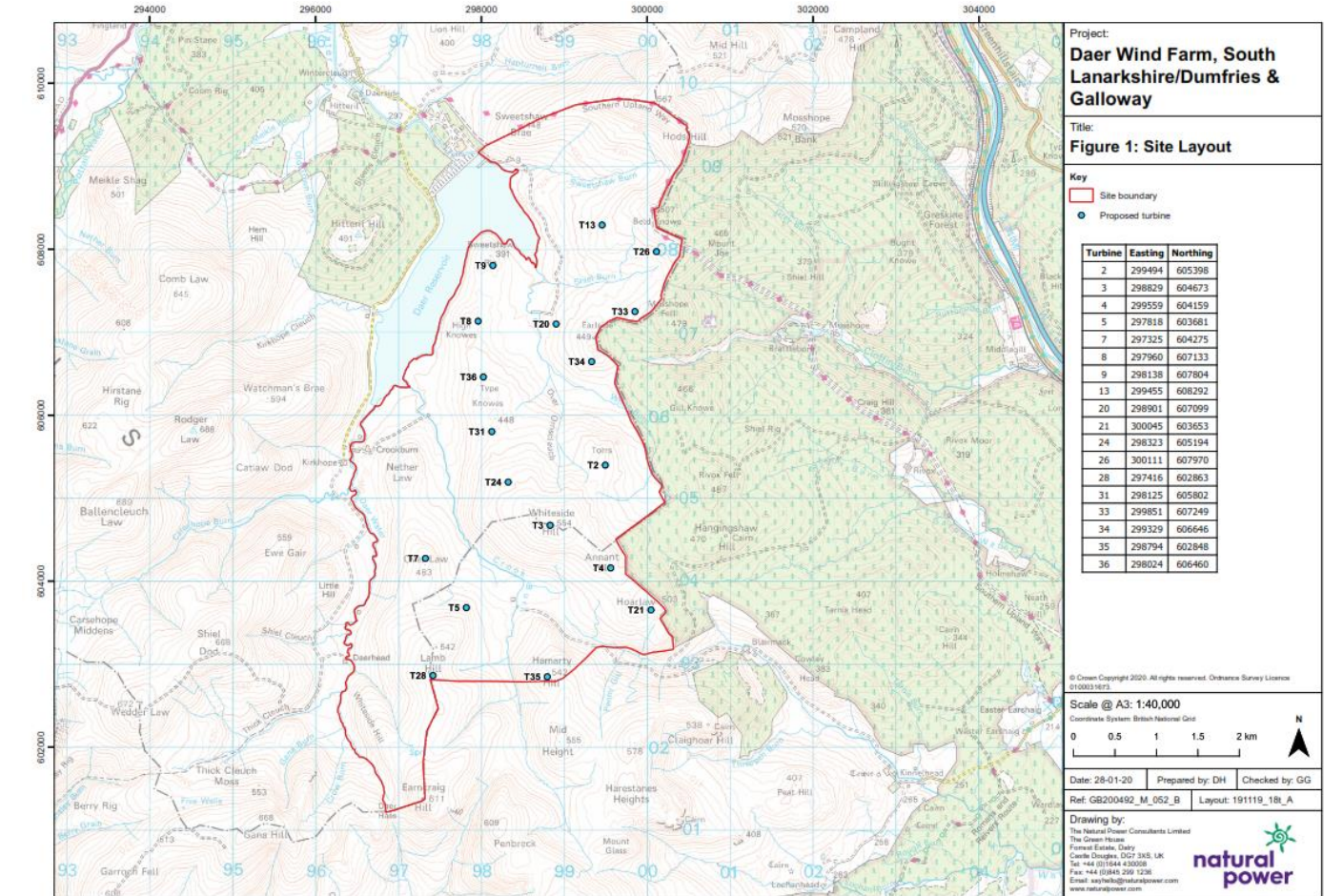


Diagram 2.3: Design Workshop #1 (not to scale)

2.3.5 The resultant layout included 18 turbines at up to 180 m in tip height. Ground conditions, ornithology, ecology, LVIA, wind yield were all residual risks to investigate further and amend the layout as required, including phase 2 peat surveys, cultural heritage baseline survey, additional ornithology survey and an Unexploded Ordnance (UXO) study.

## Design Workshop #2

2.3.6 The second design workshop was undertaken in June 2020 following completion of cultural heritage baseline surveys, noise modelling, UXO baseline survey and landscape & visual technical review. Ornithology survey work remained ongoing through the breeding season. A new proposed access route to site was introduced which was based predominately on pre-existing forestry and wind farm tracks and as a result the site boundary was altered. The resultant layout remained for 18 turbines still at up to 180 m in tip height. One turbine was identified to remain within a 200 m buffer (albeit >100 m away) from an identified micropath link. Consultation was undertaken with the stakeholder (Buccleuch Estates) to ascertain the status and appropriate buffer required (Chapter 13 assesses such infrastructure). There remained background noise monitoring to be undertaken

which was delayed due to the Coronavirus pandemic and lockdown restrictions in place across the country. Further landscape and visual analysis and phase 2 peat survey work was also required.

Source: Natural Power

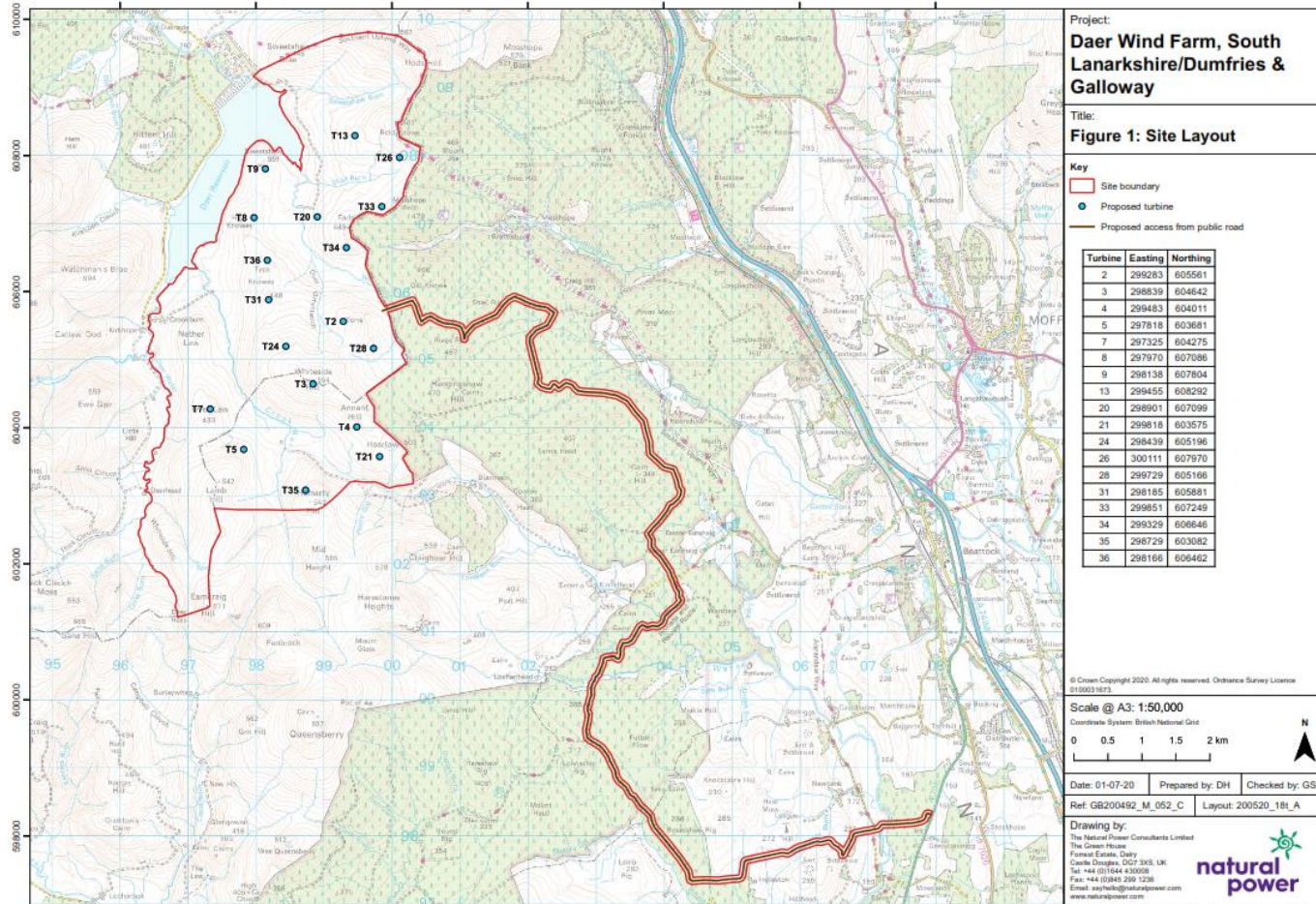


Diagram 2.4: Design Workshop #2 (not to scale)

### Design Workshop #3 – Turbine Design Freeze

2.3.7 Further refining of turbine locations was undertaken in a balancing act between competing LVIA and wind resource interests as well as ground conditions particularly peat, high value habitats identified in NVC survey and GWDTE. An indicative substation location was included, T28 removed, T2 and T4 relocated to improve turbine spacing and avoid surface site constraints. The resultant layout is shown in Diagram 2.5. This design resulted in a turbine layout used for landscape & visual impact assessment for the purposes of consultation. This layout was also consulted upon with the public and full details of pre-application consultation process are provided in the PAC Report.

Source: Natural Power

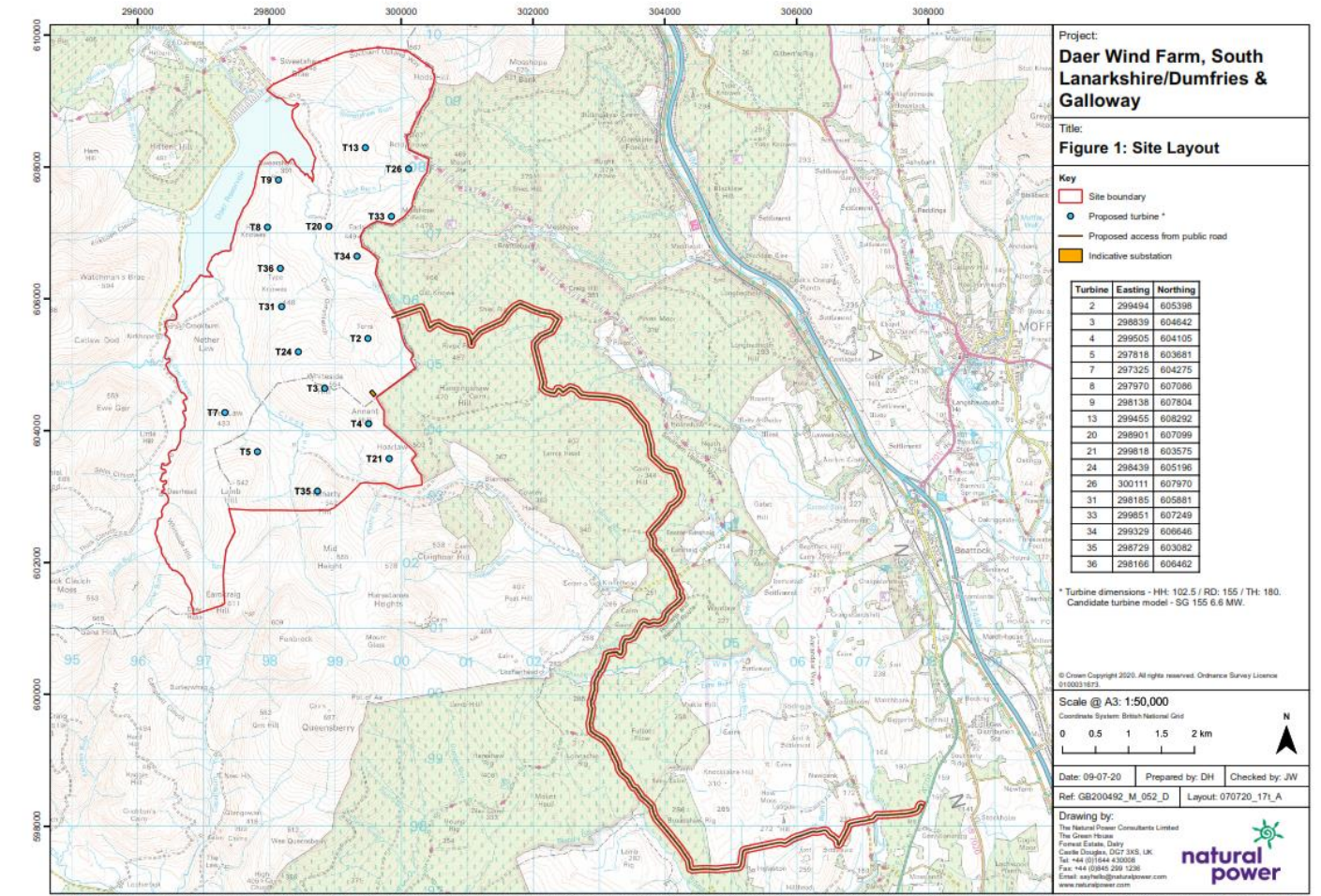


Diagram 2.5: Design Workshop #3 – Turbine Design Freeze (not to scale)

### Design Workshop #4 – Infrastructure

2.3.8 Essential infrastructure for the Proposed Development was included and refined at this stage. The Substation/Control Building was re-located due to site constraints and to align with the entrance to site from the east. The Temporary Construction Compound was also included adjacent. Site tracks included following Design Construction 2-D and 3-D design work. Proposed Borrow Pit Search Areas including temporary tracks to access them and existing Borrow Pits were included. The site boundary was also amended to remove the southwestern portion of land which would not be developed on nor provide use for habitat management. This layout design is presented in Diagram 2.6.

Source: Natural Power

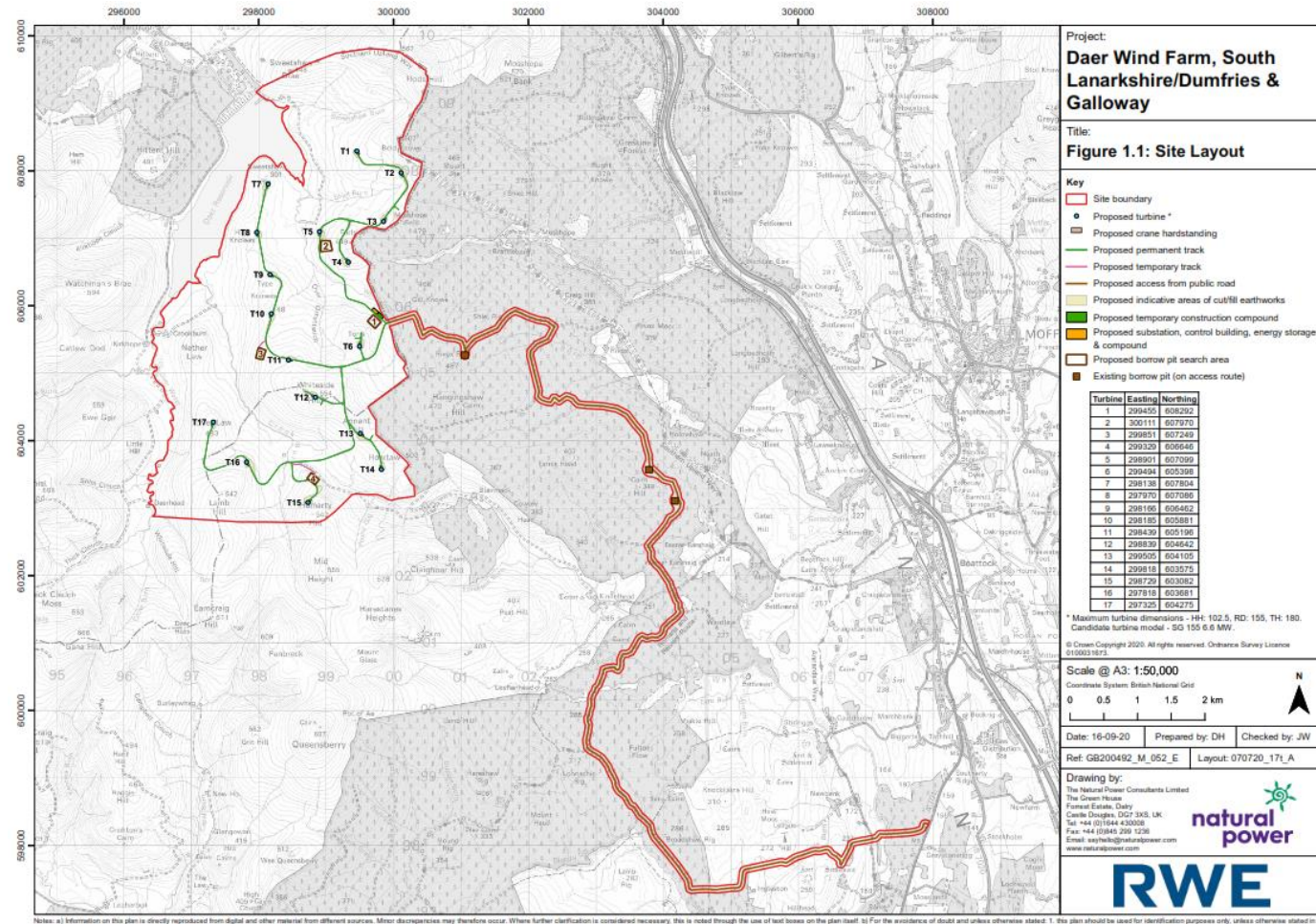


Diagram 2.6: Design Workshop #4 – Infrastructure (not to scale)

## Section 36 Application Layout

2.3.9 In order for the Applicant to continue monitor wind conditions and turbine performance, permanent anemometer masts and their tracks were added to the Proposed Development Area, taking account of the site constraints and preferential areas for recording wind data. Use of the existing borrow pits along the proposed access from the public road was not granted by the landowner and thus these were removed from inclusion. The layout for the Proposed Development is presented to scale in Figure 1.1 and shown not to scale in Diagram 2.7. It is this final layout for which the application under Section 36 of the Electricity Act 1989 has been made and EIA focussed on to determine potential effects of the Proposed Development, whilst also taking account of embedded mitigation, discussed in relevant EIAR Chapters.

Source: Natural Power

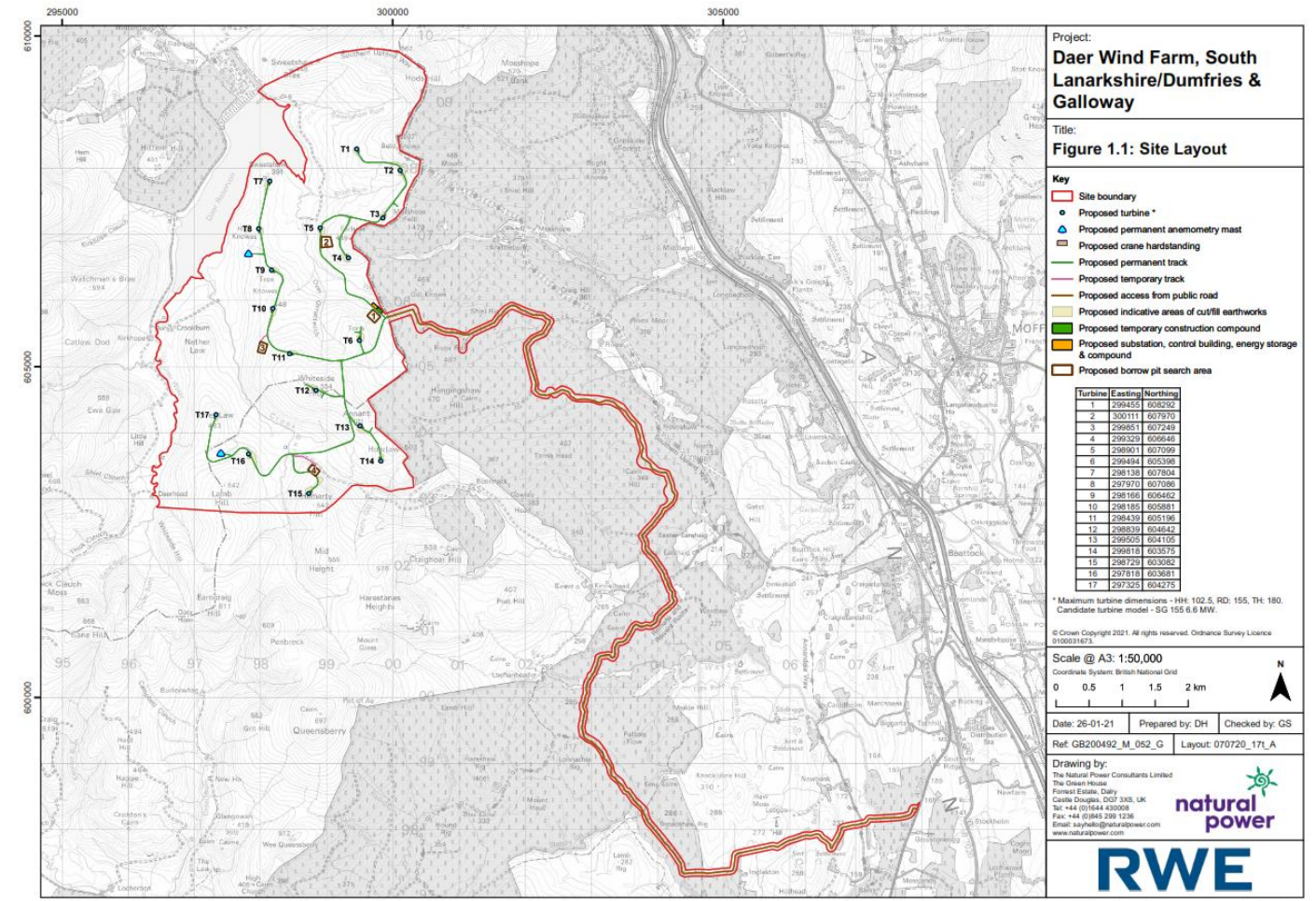


Diagram 2.7: Section 36 Application layout (not to scale)

## 2.4 SUMMARY

2.4.1 The Proposed Development has been located in a suitable area for wind farm development following a lengthy site selection and feasibility process. The rigorous design evolution has taken place over several years through much iteration which has reacted to new developments, policies, market mechanisms and consultee responses. Through balancing the various site constraints with the scale of development required to be economically viable, the Applicant believes that the Proposed Development provides optimum use of the site with respect to the potential renewable electricity generating capacity balanced against the potential environmental and other effects.

