Chapter 02

Site Selection and Design Evolution

2 Site Selection and Design Evolution

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2 Site Selection and Design Evolution

2.1 Introduction

2.1.1 The Environmental Impact Assessment (EIA) Regulations (2017) require the consideration of alternatives and an indication of the reasons for selecting the site, except where limited by constraints of commercial confidentiality. Paragraph 5(2)(d) of the EIA Regulations requires that an EIA Report includes *"a description of the reasonable alternatives studied by the developer, which are relevant to the development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the development on the environment".*

2.1.2 Part 2 of Schedule 4 of the EIA Regulations similarly notes the following requirement: "*A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects*".

2.1.3 This chapter provides information on how the Proposed Development site was identified by the Applicant as a suitable location for a hybrid wind, solar photovoltaic (PV) and long duration electricity storage (LDES) energy development, as well as the design iteration process undertaken to arrive at the final Proposed Development layout and design.

2.1.4 The EIA process provides an opportunity to integrate technical and environmental considerations into the iterative design of a development, allowing potential environmental effects to be considered and minimised so that the environment is considered within the Proposed Development design layout from the earliest stage.

2.1.5 The final design of the Proposed Development represented in this EIA Report was arrived at following iterative consideration of many alternative design configurations, including location of turbines, turbine scale, layout and design of tracks and ancillary infrastructure, as well as alterations to the solar and LDES layouts. This chapter describes the design iteration process from which the Proposed Development design was selected.

2.1.6 The final design for the Proposed Development is described in **Chapter 3** and is shown in **Figure 1.2.**

Development Context

2.1.7 Against a backdrop of emerging renewable energy and climate change policy imperatives, 3R Energy Solutions Ltd (3R Energy) established a new group company (Hagshaw Hill 3 Ltd – the Applicant) to take forward the development of the Hagshaw Hill III Energy Project. The 3R Energy Group is both a landowner and developer within the Hagshaw Energy Cluster who has to date developed over 330 MW of onshore wind, and 80 MW of energy storage projects, which are all now either in operation or under construction. Together these projects will make a substantial contribution to the local area and to national renewable energy and climate change targets.

2.1.8 3R Energy is also a founding partner of the award-winning Hagshaw Energy Cluster Development Framework project which represents an ambitious vision for the future of the Hagshaw Energy Cluster and surrounding area, identifying opportunities to enhance and invest in the local environment, communities and place.

2.2 Site Selection and Alternatives

2.2.1 As noted above, EIA legislation requires the consideration of alternatives and an indication of the reasons for selecting the site, except where limited by constraints of commercial confidentiality.

2.2.2 The Proposed Development site sits within a landscape of operational and consented wind farm developments, and is part of the Hagshaw Energy Cluster which benefits from a strong wind resource, direct access to the M74 motorway and proximity to the electricity network. It is therefore considered to be a suitable site for wind energy development, making use of some existing site

infrastructure and recognising the accepted principle of wind energy generation within the local landscape.

2.2.3 The Proposed Development site is considered an appropriate and viable location for a hybrid energy project due to:

- Good average wind speeds and generation capacity, evidenced by the surrounding operational sites;
- Predominantly south-facing slopes suitable for solar PV development;
- Being within an established wind farm landscape, where there is an opportunity to progress a coordinated layout, phasing, access, grid connection and landscape strategy throughout the Hagshaw Energy Cluster;
- Easy accessibility with direct existing access from the M74 without the requirement to pass through any communities;
- Presence of existing screening of the south-eastern areas of the site (proposed location of the substation and LDES compound and solar areas) afforded by adjacent woodland located to the south-east of the site boundary;
- Ability to re-use existing access tracks (both to and within the Proposed Development site) with minor upgrading;
- Close proximity to a viable grid connection point;
- Potential to positively contribute to regional and national renewable energy and carbon reduction targets; and
- Opportunity to provide substantial social and economic investment to surrounding communities within the South Lanarkshire Council (SLC) area.

2.3 Design Principles

2.3.1 The following principles were adopted during the design iterations made by the Applicant to ensure that the final design of the Proposed Development was the most suitable for the site:

- Create a scheme which maximises the potential of the site to generate renewable energy, while observing technical and environmental constraints.
- Siting and Designing Wind Farms in the Landscape (SNH [now NatureScot], 2017) provides a current best practice guidance and a framework for the consideration of key design issues including turbine size, layout composition, wind farm design in relation to landscape character and designing for multiple wind farms. This guidance was taken into account when considering of other physical and environmental constraints, avoiding inconsistent turbine spacing, such as relatively large gaps, outliers or excessive overlapping turbines to minimise visual confusion and ensure a balanced / compact array from key views.
- Design advice contained within the Hagshaw Energy Cluster Development Framework was also considered.
- Create a layout that fits the existing pattern of development in the surrounding landscape context.
- Minimise impacts on cultural heritage features wherever possible.
- Observe a suitable distance between the Proposed Development and uninvolved residential properties (i.e no closer than has already been established by adjacent developments) and

minimise impacts on residential amenity (visual, noise, shadow flicker, and glint and glare) wherever possible.

- Consider the location of the existing turbine within the site boundary associated with Hazelside Farm, as well as the potential for wake effects on neighbouring development turbines.
- Avoid of areas of peat and bog habitat wherever possible.
- Take cognisance of the existing Hagshaw Hill Extension Wind Farm's Habitat Management Plan (HMP) areas (see **paragraph 2.3.2** below).
- Wherever possible, maintain appropriate buffers around watercourses except where crossings are required.
- Consider the varied elevation of the site to minimise the requirement for cut and fill.
- Consider the locations of existing and proposed overhead line infrastructure present within the south eastern portion of the site.
- Utilise the existing access track directly from the M74 and the access track for the existing Hazelside Farm wind turbine located on the site.
- Position the solar array and LDES on lower-lying land to reduce visual impacts and to take advantage of existing screening afforded by adjacent woodland and topography.
- Consider potential of noise from LDES units in respect of positioning relative to residential receptors.

2.3.2 The design iteration of the Proposed Development has sought to minimise potential impacts on the operational Hagshaw Hill Extension's HMP, which includes areas within the Proposed Development site that are managed for black grouse habitat enhancement. As part of the Proposed Development, further habitat restoration and enhancement measures are proposed that would deliver beneficial effects for black grouse, including improved foraging opportunities and increased availability of natural shelter. Additional details are provided in the outline Biodiversity and Enhancement Management Plan (**Technical Appendix 7.5**).

2.4 Design Iterations

2.4.1 The layout of the Proposed Development has been an iterative process which started in late 2024, each time taking into consideration information gathered at the site or comments from consultees, as well as the professional judgement of the technical experts.

Wind Turbines, Associated Infrastructure, and Access Tracks

2.4.2 The main turbine and associated infrastructure changes are described within **Table 2.1** and shown on **Figure 2.1** to **Figure 2.5**. These iterations have taken into consideration of the identified on-site environmental and engineering constraints, reducing the impacts on residential amenity and the wider landscape, and avoiding watercourses and sensitive habitats wherever possible.

2.4.3 During design optimisation, the locations of infrastructure and track design was refined to minimise the volume of earthworks and cut and fill required to construct the Proposed Development. **Figure 2.5** shows the final layout and the on-site constraints.

Solar PV

2.4.4 The site was identified as suitable for solar PV, with predominantly south facing slopes. There have been five main iterations to the design of the solar element of the Proposed Development; these layouts are presented in **Figure 2.1** to **Figure 2.5** and the amendments made are described in **Table 2.1** below.

Substation and LDES

2.4.5 The two main iterations of the substation and LDES layout are presented in **Table 2.1** below and are shown in **Figure 2.1** to **Figure 2.5**. Further information on the final substation and LDES arrangement is presented in **Chapter 3**.

Borrow Pits

2.4.6 Borrow pits are required as a source of rock to be used in the construction of the tracks, hardstandings and foundations. Potential locations for the borrow pits were identified based upon a review of geological mapping, site reconnaissance and construction logistics. The total number and size of borrow pit search areas was selected to meet the estimated volume of rock required to construct the tracks, areas of hardstanding and foundations.

2.4.7 There are three borrow pit locations included as part of the Proposed Development. The borrow pits have been through a design iteration process along with all other infrastructure; the previously considered borrow pit locations are shown in **Figure 2.3** to **Figure 2.4**.

2.4.8 If the Proposed Development is consented, further intrusive geotechnical investigation will be carried out at the three borrow pit locations to establish more detail on the volume and quality of rock from each location (refer to Borrow Pit Assessment in **Technical Appendix 9.3**).

Construction Compounds

2.4.9 The locations of the three temporary construction compounds have also been considered through the iterative design process as shown in **Figure 2.2** to **Figure 2.5**. The construction compounds have been located for practical purposes; to control traffic entering the site, to be located close to infrastructure, and to facilitate construction of the substation and LDES facilities. On-site constraints have been avoided as well as steep areas to reduce the requirement for cut and fill.

Micrositing

2.4.10 To be able to address any localised environmental sensitivities, unexpected ground conditions or technical issues that are found during detailed intrusive site investigations and construction, it is proposed that agreement is sought for a 100 m micrositing allowance around all infrastructure. The technical assessments (presented in **Chapters 6** to **12**) have considered the potential for micrositing and it is considered that the proposed infrastructure could be micrositing without resulting in potential new effects. During construction, the need for any micrositing would be assessed and agreed with the on-site Environmental Clerk of Works (ECoW) and Archaeological Clerk of Works (ACoW).

Table 2.1 - Proposed Development Design Iteration

Date & Overall Layout Reference	Turbine Iteration	Number and Scale of Turbines	Solar Iteration	LDES Iteration	Infrastructure Iteration	Description of Iteration
July 2025 'Layout A' (**Figure 2.1**)	A (Scoping Layout)	8 (all at 200 m to tip)	B	A	N/A	Layout A was the initial design of 8 turbines at 200 m tip height. This design was based on an initial desk-based study, and existing survey data available for the site and neighbouring developments within the wider Hagshaw Energy Cluster. Initial on-site constraints identified included varied elevation (notably the potential for landscape and visual impacts and engineering challenges), watercourses, pockets of deeper peat, the locations of neighbouring development turbines, underground cables, and an existing turbine within the site boundary associated with Hazelside Farm. This included for four 'maximum parameter' solar search areas that were slightly revised pre-scoping to remove areas lying on higher ground to reduce visual impact, as well as an LDES and substation compound located in the south-east of site. The proposed LDES and substation compound location was situated to provide screening afforded by adjacent woodland, and proximity to existing tracks which can be re-used for the Proposed Development. Site access was proposed from the north-east in order to re-use an existing access track servicing other developments within the wider Hagshaw Energy Cluster.
August 2025 'Layout B' (**Figure 2.2**)	B (Design Chill)	8 (six at 200 m to tip and two at 180 m to tip)	B	A	A	Layout B was developed from the initial Layout A and introduced tracks and hardstandings to the design. Following the results of a National Vegetation Classification (NVC) survey, T1 was microsited south-east to avoid bog habitat. T3 was also microsited west and its hardstand oriented to keep out of a 50 m watercourse buffer. T5 was microsited north-west to move out of a ravine, reducing fill requirements. In consideration of further Zone of Theoretical Visibility (ZTV) analysis, the total tip heights of T2 and T4 were also reduced from 200 m to 180 m to improve views of the Proposed Development from Douglas.

Date & Overall Layout Reference	Turbine Iteration	Number and Scale of Turbines	Solar Iteration	LDES Iteration	Infrastructure Iteration	Description of Iteration
						No changes were made to the solar search areas or substation and LDES compound. A temporary construction compound (referred to as construction compound A) was added to the layout close to the site entrance.
October 2025 'Layout C' (**Figure 2.3**)	C	8 (six at 200 m to tip and two at 180 m to tip)	C	B	B	Following more detailed design work, the LDES compound was reduced in size and two additional temporary construction compounds (construction compounds B and C), turning heads, and a borrow pit search area (BP3) were added to the layout. The substation was microsited east to avoid overhead lines. T3 was microsited south to remove it further from a 50 m watercourse buffer and reduce wake loss. T5 was also moved east to reduce wake loss. Following protected species surveys, T8 was microsited north-west to respect a protected species buffer. The solar areas were also refined to avoid protected species buffers, bog habitat identified from the NVC survey, watercourse buffers, pockets of deeper peat, overhead lines and slope greater than 15 degrees. The northern solar area on higher ground was removed to reduce visual impact.
October 2025 'Layout D' (**Figure 2.4**)	C (Gatecheck 1 Layout)	8 (six at 200 m to tip and two at 180 m to tip)	D	B	C	No changes were made to the turbine locations. Following review of peat survey data, the hardstanding for T1 was reoriented anticlockwise and its access track realigned to avoid a small area of peat >1 m in depth. Based on engineering feedback and discussion with the landowner, BP3 was reduced in size and two further smaller borrow pit search areas were added to the layout closer to the proposed site access to help facilitate early construction works (BP1 and BP2). The solar areas were also further optimised and refined. The temporary construction compound at the site entrance (construction compound A) was increased in size to optimise available space. The size of construction compound C was also increased slightly to more accurately reflect the generation requirements of the Proposed Development.

Date & Overall Layout Reference	Turbine Iteration	Number and Scale of Turbines	Solar Iteration	LDES Iteration	Infrastructure Iteration	Description of Iteration
December 2025 'Layout E' (**Figure 2.5**)	C (Design Freeze)	8 (six at 200 m to tip and two at 180 m to tip)	E	B	D	No changes were made to the turbine locations. Following further consultation with SEPA, a small number of panels associated with the south-western solar area were removed to avoid an area of deeper peat. Panels were also removed from the solar area adjacent to the substation and LDES compound to allow for a greater standoff distance from an existing overhead line. Ancillary infrastructure including inverters, security fencing, Closed Circuit Television (CCTV) cameras and an access track network were also incorporated into the solar design. Minor changes were made to the access track network for the substation and LDES to reduce the requirement for cut and fill. Minor track re-alignment was also undertaken by the site entrance to better accommodate the existing access track into the site. Construction compound A and construction compound C were resized to maximise available space to allow for design flexibility, with their access points realigned to reflect this resizing.

2.5 Summary

2.5.1 The final Proposed Development layout has been informed by a robust design iteration process, taking into account potential environmental, landscape and visual impacts and their effects, physical constraints, and health and safety considerations, alongside advice from consultees. The information used to inform the design iteration process included baseline data, review of preliminary visualisations, ongoing impact assessments and energy yield optimisation.

2.5.2 The final layout has been designed to maximise renewable energy generation from the site, as well as the social, economic and environmental benefits, whilst avoiding and minimising potential adverse impacts on the environment wherever possible.

2.5.3 The EIA Report is based on the final layout selected for the Proposed Development. The final layout comprises 8 wind turbines (six up to 200 m in height and two up to 180 m in height), approximately 30 MW of solar PV, and approximately 50 MW of LDES, as well as associated infrastructure. The final layout of the Proposed Development is described in detail in **Chapter 3** and shown on **Figure 1.2**.

2.6 References

Scottish Government (2017). The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Available at: https://www.legislation.gov.uk/ssi/2017/101/contents/made

SNH (now NatureScot) (2017). Siting and Designing Wind Farms in the Landscape. Version 3a. Available at: https://www.nature.scot/siting-and-designing-wind-farms-landscape-version-3a