HAGSHAW ENERGY CLUSTER
WESTERN EXPANSION

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3R Energy

Hagshaw Energy Cluster – Western Expansion

Scoping Report

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Contents

Appendices

Figures

1. Introduction

1.1 Overview

1.1.1 Spirebush Ltd (hereafter referred to as "the Applicant"), a subsidiary of 3R Energy Solutions Ltd (3R Energy), intends to apply for permission to construct and operate the Hagshaw Energy Cluster-Western Expansion (hereafter referred to as the "Proposed Development"), at a site centred at British National Grid (BNG) NS 70740 325550 (refer to **Figure 1.1**).

1.1.2 The Proposed Development is a mixed renewable energy development principally comprising:

- up to 72 wind turbines (c.500 megawatts (MW)),
- solar photovoltaic (PV) panels (c.50 MW),
- on-site energy storage (c.100 MW), and
- a Green Hydrogen Production Facility (c.40 MW).

1.1.3 Its total generating capacity is anticipated to be up to approximately 0.65 gigawatts (GW). The associated infrastructure will include site access, internal access tracks, crane hardstandings, underground cabling, an on-site substation and maintenance building, temporary construction compounds, concrete batching plant(s), temporary laydown areas, borrow pit search areas and a met mast(s). The Proposed Development is of strategic scale and has the capacity to produce enough clean power for the equivalent of every home in Glasgow whilst also generating *c.*£100 m of investment in local communities and *c.*£40 m of investment in the Muirkirk & North Lowther Uplands Special Protection Area (SPA) and the Muirkirk Uplands Site of Special Scientific Interest (SSSI).

1.1.4 The Green Hydrogen Production Facility (and associated infrastructure) is not classified as electricity production and therefore cannot be considered under *Section 36* of the *Electricity Act 1989.* Therefore, in line with pre-application discussions, the Applicant intends to submit an application for the Green Hydrogen component of the Proposed Development to the local planning authority (South Lanarkshire Council) under *Section 32* of the *Town and Country Planning (Scotland) Act 1997*, as amended with the remainder of the Proposed Development being considered by the Scottish Ministers via the Scottish Government Energy Consents Unit (ECU) under *Section 36* of the *Electricity Act 1989*.

1.1.5 The applications will be submitted simultaneously, and both will be supported by a single overarching Environmental Impact Assessment Report (EIA Report) as required by the *Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) (the EIA Regulations)* assessing the Proposed Development in its entirety. This document forms the EIA Scoping Report submitted to the Energy Consents Unit (ECU) in order to request an EIA Scoping Opinion, on the content of the Environmental Impact Assessment (EIA) of the Proposed Development.

1.2 The Applicant

1.2.1 The Applicant for the Proposed Development is Spirebush Ltd (named after a hill on the site), a company established by 3R Energy for the purpose of taking forward the Proposed Development. 3R Energy was established in 2009, with its head office now situated in Lanark. The company was initially established to help farms and rural businesses benefit from renewable energy, with the mainstay of the business being farm sized wind turbines, Combined Heat and Power (CHP) systems and biomass boilers. More recently, 3R Energy has diversified into larger-scale renewable energy projects and has developed over 330 MWs of onshore wind projects within the Hagshaw Energy Cluster (including a further 80 MWs of energy storage) which together will make a substantial contribution to the local area and to national renewable energy and climate change targets.

1.2.2 3R Energy is part of a family group of companies which also includes: Mitchell Energy Ltd, Mitchell Farming Partnerships and William Mitchell & Sons (WMS) Ltd, based at Newtonhead Farm Rigside and Hazelside Farm Douglas respectively, which manage the farming assets of the Group. Together the Group:

- owns and manages 3,500 acres of land in the Douglas Valley
- has farmed the land for over 120 years
- generates a combined annual turnover of c. £6 m
- employs 15 people as a direct result of its renewable energy and farming operations within the Hagshaw Cluster

1.2.3 As a local company, 3R Energy is committed to working with the communities closest to the Hagshaw Energy Cluster for the long term to develop and deliver successful projects which create significant and tangible benefits for the local area.

1.3 The Purpose of the Scoping Report

1.3.1 The purpose of this EIA Scoping Report is to request that the Scottish Minsters adopt a Scoping Opinion as per *Regulation 12 (1)* of the *Electricity Works (Environmental Impact Assessment) Regulations 2017* ("the EIA Regulations") as to the scope and level of detail of information to be provided in the EIA Report. The Scoping Opinion will be adopted following consultation with the consultation bodies and other interested public bodies.

1.3.2 The Applicant recognises the value of the scoping approach, and the purpose of this report is to ensure that information is provided in accordance with the EIA Regulations*, Regulation 12 (2).*

1.3.3 This EIA Scoping Report:

- describes the existing site and its context with reference to supporting plans;
- describes the nature and purpose of the Proposed Development;
- identifies key organisations to be consulted in the EIA process;
- establishes the format of the EIA Report;
- provides baseline information;
- describes potential significant effects and the proposed assessment methodologies for various technical assessments to be covered in the EIA Report; and
- Seeks confirmation that all likely significant effects have been correctly identified and 'scoped in' for assessment and 'scoped out' as appropriate.

1.3.4 Each technical section concludes with questions for consultees regarding the information provided in this Scoping Report, for which it would be useful to receive feedback. Not all questions will be relevant to all consultees, therefore we request that consultees provide feedback only on those questions appropriate to them. The questions should not be considered an exhaustive list, and consequently consultees are welcome to provide feedback on any issue they consider relevant to the Proposed Development. If consultees elect not to respond, the Applicant will assume that consultees are satisfied with the approach adopted/proposed.

1.4 Environmental Impact Assessment

1.4.1 The EIA Regulations require that before consent is granted for EIA development, an EIA must be undertaken. The EIA Regulations set out the types of development which must always be subject to an EIA (Schedule 1 development) and other types of development (Schedule 2 development) which require EIA if the development is likely to have significant effects on the environment by virtue of factors such as its nature, size or location.

1.4.2 The Proposed Development falls within Schedule 2 of the EIA Regulations and has the potential to have some significant environmental effects. It is the opinion of the Applicant that the Proposed Development qualifies as "EIA Development" and therefore the Applicant has not requested an EIA Screening Opinion and will instead voluntarily submit an EIA Report, as part of the Section 36 application and the associated Town and Country Planning application for the hydrogen component of the Proposed Development.

1.4.3 EIA is an iterative process, which identifies the potential environmental effects that in turn inform the eventual design of the proposals. It seeks to avoid, reduce, offset and minimise any adverse environmental effects through mitigation. The EIA report considers the effects arising during the construction, operation and decommissioning phases. Consultation is an important part of the EIA report preparation process and assists in the identification of potential effects and mitigation measures.

1.4.4 The structure of the EIA Report will follow the requirements of the EIA Regulations (Schedule 4) and other relevant good practice guidance. The EIA Report will comprise five volumes:

- Volume 1 – Written Statement;
- Volumes 2 & 3 – Figures (separate volume for visualisations / photomontages);
- Volume 4 – Technical Appendices; and
- Volume 5 – Confidential Appendices (if required).

1.4.5 A Non-Technical Summary (NTS) will also be provided, tailored to each of the permissions sought.

1.4.6 Chapters 1 to 5 of Volume 1 will comprise:

- An introduction;
- A description of the site selection and design iteration process (including consideration of alternatives);
- A description of the site and its context;
- A description of the Proposed Development;
- Information on the approach to EIA and determination of significance of effects; and
- A summary of the relevant planning and energy policy considerations.

1.4.7 The remainder of Volume 1 will present a description of effects in respect of a range of environmental topics. Each of the topics will be reported as a chapter of Volume 1 and highlight the significant effects specific to each consenting regime. The EIA Report will reference figures and technical studies, which will correspond to Volumes 2 to 5. The following topics will be considered:

- Chapter 6: Landscape and Visual;
- Chapter 7: Geology, Peat, Hydrology & Hydrogeology;
- Chapter 8: Ecology;
- Chapter 9: Forestry;
- Chapter 10: Ornithology;
- Chapter 11: Cultural Heritage;
- Chapter 12: Noise and Vibration;
- Chapter 13: Access, Traffic and Transport;
- Chapter 14: Socio-economics, Recreation and Tourism;
- Chapter 15: Aviation and Radar; and

- Chapter 16: Other Issues (Carbon balance, shadow flicker, glint and glare, telecoms etc.).

1.4.8 The EIA Report will also include a schedule of mitigation measures and a summary of residual effects.

1.4.9 A standalone **Planning Statement** assessing the Proposed Development against all relevant planning and energy policy, along with a **Pre-Application Consultation** (PAC) Report explaining the consultation carried out with the local communities about the Proposed Development will also accompany the applications.

1.5 Consultation

1.5.1 Early consultation is key in the development process, and throughout the Applicant will ensure that local communities and stakeholders are given the opportunity to engage in the process, provide feedback and are kept informed of project progress.

1.5.2 The Applicant is committed to undertaking meaningful consultation with the local community and is currently consulting the communities closest to the Proposed Development on the best locations to hold Public Consultation Events into the Proposed Development later this year. The proposed locations and format of Public Consultation Events will be agreed with the ECU and Local Authorities in advance of them being advertised in local newspapers, online and with mail drops to the closest residents. The purpose of the Public Consultation Events will be to inform the local community of the emerging proposals and to provide an opportunity for the local community to provide initial feedback and help shape the final design of the Proposed Development.

1.5.3 To date, the Applicant has begun initial consultation on the proposals with the following individuals and organisations:

- Scottish Ministers
- Energy Consents Unit
- East Ayrshire Council
- South Lanarkshire Council
- NatureScot
- Royal Society for the Protection of Birds (RSPB)
- South Strathclyde Raptor Study Group
- Muirkirk Community Association
- Landowners
- Neighbouring residents
- Muirkirk Community Council
- Sandford & Upper Avondale Community Council
- Coalburn Community Council
- Lesmahagow Community Council
- Douglas Community Council
- Muirkirk Enterprise Group

1.5.4 The Applicant has also facilitated site visits to the Proposed Development site for representatives of South Lanarkshire Council, East Ayrshire Council and NatureScot.

1.5.5 The Applicant will establish a dedicated project website which will house information about the Proposed Development and details of how comments can be submitted to the Applicant or how to set up a meeting or call/videocall with the project team to discuss any specific points. An indicative project programme is set out below.

1.5.6 A list of organisations and interested stakeholders consulted as part of the scoping process is included in **Appendix 1.1**.

Graphic 1.1 Indicative project programme

2. Site Context and Surroundings

2.1 Local Context

2.1.1 The site is bounded to the north and east by a number of operational and consented wind farms as shown on **Figure 2.1**. A group of wind farms around Kype Muir and Bankend Rig lie to the north of the site and a further group of wind farms, which together comprise the Hagshaw Energy Cluster, lie to the east.

2.1.2 The Applicant has developed a detailed understanding of the area, being locally based and having worked with local stakeholders and regulators to successfully develop over 330 MW of renewable generation within the existing Hagshaw Energy Cluster to date which will deliver:

- A saving of over 430,000 tonnes of CO2 entering the atmosphere each year.
- Green electricity for over 240,000 average households in Scotland;
- £1.6 m to local communities every year – which is £4,383 every day or £48 m (indexed) over 30 years; and
- Over 1,800 job years of employment in Scotland through the construction and development phases.

2.1.3 The existing Hagshaw Energy Cluster to the east is made up of the following wind energy developments as shown on **Figure 2.1**:

- Hagshaw Hill Wind Farm (Repowering scheme consented - developed by 3R Energy) and Extension;
- Douglas West Wind Farm (developed by 3R Energy);
- Douglas West Extension (developed by 3R Energy);
- Cumberhead West (developed by 3R Energy).
- Galawhistle Wind Farm;
- Nutberry Wind Farm;
- Dalquhandy Wind Farm;
- Cumberhead Wind Farm; and
- Hare Craig Wind Farm.

2.1.4 The Kype and Bankend Energy Cluster to the north is made up of the following wind energy developments as shown on **Figure 2.1**:

- Kype Muir Wind Farm;
- Kype Muir Extension;
- Auchrobert Wind Farm;
- Dungavel Wind Farm;
- Bankend Rig Wind Farm;
- Bankend Rig II Wind Farm (variation in planning);
- Bankend Rig III Wind Farm (in scoping);
- Mill Rig Wind Farm (consented).

2.1.5 The former Spireslack and Ponesk Opencast Coal Sites (under final restoration, for forestry) and the former Tardoes Opencast Coal Site (restored to farmland) adjoin the site to the south. The village

of Muirkirk lies some 2.45 km further south of the Proposed Development turbines at their closest point (distance to nearest proposed turbine) (refer to **Figure 2.1**).

2.1.6 Work commissioned by NatureScot and with contributions from 3R Energy and other developers as part of the Hagshaw Energy Cluster Development Framework process has drawn together substantial long-term protected species, habitat and ornithological data and insights covering the Hagshaw Energy Cluster area. These data provide useful context on the natural heritage interests of the area and inform opportunities for future restoration and biodiversity enhancement.

2.1.7 A number of scattered farmhouses and other residential properties lie within, and in proximity to, the site boundary. See **Section 3.1** below for further details. Further afield, lie the settlements of Gilmourton (c5.2 km), Drumclog (c.5.3 km), Sandford (c7.2 km), Coalburn (c.7.5 km), Glespin (c.8.3 km), Strathaven (c.8.3 km), Lesmahagow (c.9.0 km), Sorn (c.9.9 km), and Douglas (c.10.1 km), distances to the nearest proposed turbine location (noting that Douglas and Coalburn lie closer to the Green Hydrogen Facility). All occupied residential properties in close proximity to the site will be taken into account in the assessment of impacts from the Proposed Development and suitable stand-off distances and mitigation measures will be implemented as identified in each assessment.

2.2 Site Context in Relation to Designated Sites

2.2.1 Importantly, it is acknowledged that part of the site overlaps with the north-eastern extent of the Muirkirk and North Lowther Uplands SPA. This SPA covers a total area of approximately 26,832 ha within Dumfries and Galloway, East Ayrshire and South Lanarkshire. The SPA was designated for its breeding and non-breeding hen harrier as well as breeding populations of short-eared owl, merlin, peregrine and golden plover. It also overlaps with commensurate area of the Muirkirk Uplands SSSI, designated for its breeding bird assemblage, as well as breeding and non-breeding hen harrier and breeding short-eared owl. Through its programme of site condition monitoring, NatureScot have identified that the SPA in general is in unfavourable condition for most of its qualifying features, and a range of data conclude that it supports a fraction of the qualifying species for which it was designated[1]. Nonetheless, recognising the SPA's original purpose, of the part of the site which lies within the SPA boundary, design iterations have reduced the Proposed Development infrastructure footprint to approximately 42 ha. This amounts to 0.16% of the total SPA land area (albeit recognising the ecological and ornithological effects of the Proposed Development may extend beyond this immediate footprint and so will therefore also be considered). Where appropriate, the remainder of the site area which lies within the SPA boundary will be utilised for habitat restoration and management works, alongside a new SPA & SSSI Recovery and Management Fund (see **Chapter 7**), targeted at supporting recovery of the wider SPA to favourable condition.

2.2.2 The site also lies partly within Muirkirk Uplands SSSI which underpins the SPA. The SSSI is designated for upland habitats including blanket bog. NatureScot monitoring has identified that habitats across the site are degraded, with much of the blanket bog heavily drained, over grazed, and in poor condition[2]. In light of the potential effects of the Proposed Development on habitats and species for which the SPA and SSSIs are designated, a package of habitat and other conservation measures would be undertaken, developed in close liaison with statutory and non-statutory nature conservation bodies as part of the Proposed Development. This is discussed further below in **Chapters 6** and **7.**

2.2.3 RSPB Scotland has recently prepared a Conservation Action Plan (CAP) for the SPA. This document includes analysis of the potential causes of the population declines in the SPA's qualifying species, including historical land use changes as well as current regional patterns affecting recruitment. Consideration of this information, together with site specific survey data, peer-reviewed published and other data will be used in the assessment of the predicted potential effects of the Proposed Development on the designated sites and their associated habitats and protected species. Whilst

[1] For example, see NatureScot sitelink - Muirkirk and North Lowther Uplands SPA https://sitelink.nature.scot/site/8616. Hen Harrier, breeding – unfavourable declining.
[2] NatureScot sitelink - Muirkirk Uplands SSSI https://sitelink.nature.scot/site/8166. Blanket bog – unfavourable no change.

the Proposed Development will include mitigation of direct and indirect effects on key habitats and species as standard, importantly the proposal will also include significant additional funding to improve the condition of the wider SPA, in the form of a SPA & SSSI Recovery and Management Fund.

2.2.4 The Proposed Development therefore presents a significant opportunity for private investment in nature to support recovery of the SPA towards achieving favourable conservation status, and the delivery of a number of the aims and objectives of the CAP, helping key wildlife, delivering wider environmental benefits and delivering a transformational level of investment in nearby communities. The Applicant has been exploring potential partnerships with local education providers to deliver rural skills training in the local area to ensure local people are well placed to deliver the additional conservation management and restoration work required to support recovery of the SPA.

2.2.5 This part of south-west Scotland has struggled to create new opportunities following the demise of the coal industry which was once the beating heart of this area. Against that backdrop and in the context of the Climate and Biodiversity Emergencies, together these factors create a significant opportunity to develop an environmentally and economically stronger future for this part of the Muirkirk Valley which would see this large area of hill ground to the north of Muirkirk delivering more for nature, more for climate and more for people.

2.2.6 3R Energy propose to work in partnership with local landowners, and in close collaboration with nature conservation interests, the local community and other stakeholders to develop the project. The project will seek to build on the collaborative working approach at the Hagshaw Energy Cluster and expand the environmental, educational and economic benefits being delivered at that Cluster westwards to Muirkirk and northwards to the Sandford and Lesmahagow areas.

2.2.7 The strategic scale of the project will deliver a transformational level of investment in the natural environment to support the recovery of an SPA in long term decline, as well as a transformational level of investment in the local economy to reinvigorate former coalfield communities. The Applicant therefore views the Western Expansion of the Hagshaw Energy Cluster as an important opportunity to lead the way in Scotland's Just Transition to a fairer, greener Scotland.

3. The Proposed Development

3.1 Site Description

3.1.1 The Proposed Development site adjoins an established cluster of wind farms around Hagshaw Hill (known as the 'Hagshaw Cluster') and Dungavel Hill in rural South Lanarkshire and extends westwards towards the village of Muirkirk in East Ayrshire, (refer to **Figure 2.1**). The Proposed Development turbines are located approximately 2.45 km to the north of Muirkirk at their closest point (distance to the nearest proposed wind turbine).

3.1.2 Access to the main body of the site is proposed to be taken from junction 11 of the M74 motorway along existing ex-opencast and commercial forestry tracks (plus a very short stretch of new track – circa 200 m). The proposed access track from the M74 is approximately 17.5 km long in total and enters the main body of the site to the south-west of Nutberry Hill.

3.1.3 The main site area extends to approximately 4,151 ha, comprising principally of open moorland across the central and southern extents and commercial coniferous plantation and existing forestry tracks within the northern extent of the site (**Figure 1.1**).

3.1.4 The site comprises a series of summits which include Priesthill Height which rises 493 m Above Ordnance Datum (AOD) at the entrance to the main site area. Spirebush Hill (469 m AOD) and Starpet Rig (451 m AOD) in the centre of the site, Middlefield Law (466 m AOD), Meanlour Hill and Bibblon Hill (431 m AOD) within the south of the site and Auchengilloch (462 m AOD) and Goodbush Hill (475 m AOD) to the west and north of the site.

3.1.5 There are a number of watercourses that traverse the site. The southern extent of the site is drained by the Polkebock Burn, Polbeith Burn, Slot Burn, Back Burn, Harwood Burn, Dippal Burn, Patrick Burn, and Ponesk Burn which form the Head of the Greenock Water at the centre of the site before flowing south and then west along the Greenock Water, located to the outside of the southern boundary of the site. The north eastern extent of the site is drained by the Blaeberry and Kip Burns into the Logan Reservoir and into the Logan Water. The Powbrone Burn drains the forested area to the north-west of the site, flowing into the Glengavel Reservoir, located outside the site boundary.

3.1.6 **Figure 3.1** shows environmental designations within 5 km of the Proposed Development site boundary.

3.1.7 In terms of heritage interests, as well as the wildlife protected by the Muirkirk and North Lowther Uplands SPA and Muirkirk Uplands SSSI (as noted in **Section 2** above), the SSSI is also designated for its localised exposures of fossiliferous rock.

3.1.8 The Blood Moss and Slot Burn SSSI is also located in the south-west of the site, to the west of the B743 (**Figure 3.1**). It is an area of around 162 ha designated for its fossil-bearing rocks (yielding fossil fish and water scorpions) alongside the Slot Burn, and blanket bog which lies outwith the Indicative Development Areas. The Airds Moss Special Area of Conservation (SAC) is designated for its blanket bog habitat and located approximately 2.1 km to the southwest of the site boundary.

3.1.9 There are five areas within the site listed on the Geological Conservation Review, Dippal Burn (Ref 3139, 4 areas) and Slot Burn (Ref 392 & 2084) part of a network of Silurian sites in the Midland Valley of Scotland that yields important fossil-bearing rocks (see Figure 3.1). Four are located along the Dippal Burn and one along the Slot Burn, all lie outwith the Indicative Development Areas.

3.1.10 A small stand of woodland noted on the Ancient Woodland Inventory of semi-natural origin is located along the southern boundary of the site around Middlefield.

3.1.11 In terms of cultural heritage, there is one scheduled monument which lies outside the site to the north-west atop Dungavel Hill, cairn (SM2848) and two listed structures within the site boundary: the Auchengilloch Monument (LB1279) category B listed structure is located in the north of the site,

and the category C listed Covenanter's Monument (LB14395)(Martyrs Grave) at Priesthill in the south-east of the site.

3.1.12 Nine residential properties lie within the site boundary which are all in the ownership of the principal landowner partners for the Proposed Development:

- Logan Farm, Lesmahagow, Lanark, ML11 0HW
- Dippal Lodge, Muirkirk, Cumnock, KA18 3NL
- Priesthill Farm, Muirkirk, Cumnock, KA18 3NL
- Waterhead House, Muirkirk, Cumnock, KA18 3NL
- Linburn Farm, Muirkirk, Cumnock, KA18 3NL
- The Forkings, Muirkirk, Cumnock, KA18 3NL
- Netherwood Bungalow, Muirkirk, Cumnock, KA18 3NL
- Middlefield Farm, Muirkirk, Cumnock, KA18 3NL
- Middlefield Cottage, Muirkirk, Cumnock, KA18 3NL

3.1.13 As shown in **Figure 2.1** the surrounding landscape includes a number of wind farm developments including operational, consented and in planning/scoping sites.

3.2 Proposed Development Description

3.2.1 The Proposed Development is planned to comprise up to approximately 650 MW of renewable energy generation and energy storage output capacity, consisting of approximately 500 MW wind energy, 50 MW solar energy, and 100 MW battery energy storage system. The Proposed Development also includes a 40 MW electrolyser plant for the production of green hydrogen fuel.

3.2.2 The Applicant has a grid connection agreement to connect the project to the national grid in July 2028 (with potential to advance to 2027), meaning that, importantly, the Proposed Development could be grid connected and contributing to climate change and biodiversity imperatives pre-2030.

3.2.3 The project is currently proposed to comprise of the following main components:

Wind Turbines

3.2.4 Approximately 72 stand-alone, three bladed horizontal axis, wind turbines. Indicative turbine locations are shown on **Figure 3.2** and noted in **Table A1** of **Appendix 3.1**. 41 of the Proposed Development turbines lie within the jurisdiction of East Ayrshire Council, with the remaining 31 turbines lying within South Lanarkshire Council's administrative area.

3.2.5 Although the final specification of the turbines is not known at this time, they are likely to be up to 230 m maximum tip height, each with a generating capacity of up to approximately 7 MW. The design and consultation process to date has identified 19 turbines, those closest to Muirkirk, that are being considered for a reduced tip height (as shown on Figure 3.2). This will be confirmed through further consultation, both with stakeholders and the local community, and further design iteration.

3.2.6 Infrastructure associated with the wind turbine component of the Proposed Development will include:

- turbine foundations;
- crane hardstandings; on-site access tracks between turbines and from the point of access to the turbines;
- temporary construction compound(s), laydown area(s), and concrete batching plant(s);

- underground cabling between the wind turbines and the on-site substation, energy storage compound and Green Hydrogen Facility;
- borrow pits for stone; and
- meteorological mast(s).

3.2.7 The site possesses a strong wind resource as evidenced by the number of operational and consented wind energy developments in the local area. Approximately 500 MW of installed capacity could result in over 1.1 gigawatt (GW) hours of energy per year produced by the wind turbines on site.

Solar Array

3.2.8 A search area for solar photovoltaic (PV) development has been identified on the south facing slopes within the south-western extent of the site boundary, on land outside the boundary of the Muirkirk and North Lowther Uplands SPA and Muirkirk Uplands SSSI. It is anticipated that the solar PV development will generate around 50 MW and comprise solar panel arrays each with heights up to 3 m (highest point of mounting frame). The solar search area is identified on Figure 3.2.

3.2.9 Infrastructure associated with the solar component of the Proposed Development will include:

- Photovoltaic panels and mounting frames;
- access tracks;
- temporary construction compound(s) and laydown area(s);
- perimeter fencing (deer stock);
- CCTV cameras;
- inverters and transformers;
- underground cabling between the photovoltaic panels and the on-site substation and energy storage compound.

Battery Energy Storage System and Substation

3.2.10 It is proposed that a c.100 MW battery energy storage system (BESS) is located adjacent to the Proposed Development substation location, which is currently proposed within the south of the site, to the west of the A743 at Linburn (as shown on **Figure 3.2**). This location is also adjacent to the proposed solar development search areas and lies outwith the SPA/SSSI. The final location of the substation and BESS is subject to change as part of the ongoing design iteration work.

3.2.11 The BESS will comprise two steel-portal framed buildings (agricultural style sheds) approximately 60 m by 40 m each. The BESS buildings will be located alongside the on-site substation compound which will contain a control building and external electrical equipment. The compound shall be approximately 100 m by 70 m surrounded by a security fence up to 3m in height. The control building shall be a single-storey building with rendered walls and a pitched-tiled roof, with dimensions of 25 m by 15 m by up to 7 m in height. To facilitate construction of the on-site substation, BESS and solar development, a temporary compound of 50 m x 50 m is proposed. Located close to the on-site substation shall be the Transmission Network Operator (TNO) substation compound which shall be approximately 70 m x 50 m surrounded by a security fence up to 3 m in height. The TNO compound shall contain a control building and external electrical equipment. There is also a requirement for the TNO compound to have an associated temporary construction compound which would measure 100 m x 50 m. It is currently proposed that the TNO substation shall connect to the transmission network via twin overhead lines, which shall be the subject of a separate consent.

Green Hydrogen Production Facility

3.2.12 It is proposed that the green hydrogen production facility comprising a c. 40 MW electrolyser is located on land at Conexus West, consented industrial land, at Junction 11 of the M74 motorway,

close to the main site entrance. The Green Hydrogen Facility would produce up to 20,000 kg per day of green hydrogen for use as a fuel to decarbonise industry and heavy freight. The electrolyser will make use of surplus electrical generation from the wind turbines at times of low demand to split water into oxygen and hydrogen which can be used as a fuel for decarbonising heavy freight transport and industrial processes.

3.2.13 At present, the layout of the green hydrogen production facility has yet to be finalised, however based on its initial layout the facility could consist of:

- temporary construction compound and laydown areas;
- battery energy storage system (c.20MW);
- multiple buildings with a number of vertical standing pressure vessels up to 15m in height. To include:
  - a hydrogen electrolyser facility;
  - a hydrogen purification unit;
  - site office;
  - transformers;
  - infrastructure associated with water supply;
  - various H2 and O2 processing plant
- Internal access roads;
- foundations and hardstanding; and
- perimeter security fencing.

3.2.14 The green hydrogen production facility will have a predicted capacity for supply of up to 20,000 kg of green hydrogen per day based on a c.40 MW power demand. The anticipated water demand for the facility is up to c.960,000 litres per day and is currently anticipated to be supplied by the existing mains water supply at Conexus West.

Layout

3.2.15 An indicative Proposed Development layout is provided in **Figure 3.2**. **Figure 2.1** also provides a breakdown of the five indicative Development Areas within the layout:

- **Area A** located to the north of the site, comprising an area of around 622 ha and containing 29 of the 72 proposed turbines.
- **Area B** located on the east of the site, comprising an area of around 810 ha and containing 31 of the 72 proposed turbines.
- **Area C** located on the south of the site, comprising an area of around 258 ha and containing 12 of the 72 proposed turbines.
- **Area D** also located on the south of the site, comprising an area of around 155 ha of Solar PV search areas, the proposed substation, and BESS.
- **Area E** located along the access route to the site, the location for the Green Hydrogen Production Facility and comprises an area of around 20 ha

Access

3.2.16 Access by abnormal loads and construction HGVs to the Proposed Development site is proposed to be taken from junction 11 of the M74 motorway, via an existing private haul road through the operational Douglas West Wind Farm site, then into the Cumberhead Forest via the consented Douglas West Wind Farm Extension site using existing access tracks. On leaving the Douglas West

Extension site area existing forest tracks will be utilised through the consented Cumberhead Wind Farm site, operational Nutberry Wind Farm site and consented Cumberhead West Wind Farm site. Entry to the main body of the Proposed Development site is proposed to be taken in the north-eastern corner of the main site, to the south-west of Nutberry Hill.

3.2.17 It is proposed that lighter goods vehicles and personnel vehicles will also be able to access the Proposed Development site from the existing entrance into Dungavel Forest on the B743, and the existing entrances (one to Linburn Farm, one to Priesthill Farm) that cross the B743 at Linburn Farm. This point is also proposed to be upgraded as a temporary crossing point for HGVs coming from the M74 during construction of the Proposed Development to avoid any HGV traffic needing to pass through Muirkirk or Strathaven to access Development Areas C and D.

3.2.18 The Applicant is in the process of identifying suitable borrow pit search areas within the site and intends on including such areas within the application for consent. Should suitable borrow pit search areas not be identified within the site, the Applicant will need to make provision for the import of aggregate from a suitable off-site source.

3.2.19 It is proposed that post-construction, operational accesses will be formed off the B743 at (or near) the existing entrances to Linburn Farm, Priesthill Farm and Dungavel Forest to service the Proposed Development. Any occasional abnormal load requirements during the operational period (for activities such as blade swaps, if required) would continue to use the M74 access which would also be used for decommissioning. See **Chapter 11** for more details.

EIA Parameters

3.2.20 The parameters of the EIA will be such that an appropriate level of assessment is undertaken for a given hub height and rotor diameter, within the envelope of a maximum tip height of the wind turbines. The locations of the various infrastructure components will further evolve in response to the ongoing community consultation and detailed assessment work, taking consideration of environmental effects, terrain, current land use, technical and health and safety issues. The parameters of the Proposed Development will be explicitly identified in the EIA Report. The final locations of the turbines and infrastructure components will be 'frozen' at an appropriate time in order to enable the EIA Report to describe fully the Proposed Development for which Section 36 and planning consent is sought.

3.2.21 At present, consent will be sought for an operational life of 40 years from the date of commissioning the wind turbines.

3.3 Key Project Benefits

- SPA & SSSI Recovery and Management Fund of c. £40 million (£1 m p.a. indexed) over 40 years[3] (see **Appendix 7.2**);
  - resulting 40 year enhanced conservation management to benefit SPA qualifying species, and SSSI features;
- Community Investment Fund of c. £100 million (£2.5 m p.a. indexed) over 40 years[4];
  - Local Energy Discount Scheme option for closest communities;
  - Local training and employability programme;
  - Strategic Investment Plan to maximise Community Wealth Building opportunity over 40 year period;

[3] Based on a project including 500 MWs of wind generating capacity, an SPA & SSSI Recovery and Management Fund contribution of £2,000/MW, and an operational life of 40 years.

[4] Based on a project including 500 MWs of wind generating capacity, a community benefit contribution of £5,000/MW, and an operational life of 40 years.

- Community Ownership opportunity;
- Green energy to supply around 330,000 homes;
- Approximately 525,000 tonnes of CO_2 saved every year;
- Employment Catalyst of New Green Hydrogen Hub on M74;
- New access and recreation routes which link Muirkirk with existing Hagshaw Energy Cluster (subject to avoiding disturbance of sensitive species and habitats); and
- Potential for using a proportion of the community and conservation management funds to deliver local training and business support for conservation management (notably peatland restoration), and a new Nature Education Centre with local wildlife rangers (subject to a separate planning application).

3.4 Cumulative Developments

3.4.1 *Schedule 4, paragraph 5 (e)* of the EIA Regulations states that cumulative effects should be considered as a part of the EIA. It will therefore be important to consider the cumulative effects of the Proposed Development in combination with other developments in the local area, including those that are currently operational, consented and in planning. The cumulative assessment will also consider the cumulative effects of different elements of the Proposed Development on environmental media and sensitive receptors, and in particular the cumulative effects upon individual and groups of receptors.

3.4.2 In addition, *Article 6(3)* of the Habitats Directive requires that plans or projects likely to have a significant effect on one or more Natura 2000 site, either individually or in combination with other plans or projects, shall be subject to an 'appropriate assessment' of its implications for the site in view of the site's conservation objectives. The requirements of the Directive have been transposed into domestic legislation by the *Conservation (Natural Habitats, & c.) Regulations 1994*, as amended and the *Conservation of Habitats and Species Regulations 2017*. A Report to Inform the Appropriate Assessment (RIAA) will therefore be produced to accompany the application, to assess 'in combination' effects of relevant plans and projects on the SPA.

3.4.3 There are a number of operational and consented wind farm developments, as well as those in planning, that are in the vicinity of the Proposed Development site. Those of relevance will be considered in the cumulative assessment, with the main neighbouring projects shown in **Figures 2.1**. The methodology to be adopted for assessing the cumulative effects of wind energy developments will be in accordance with the NatureScot (NS,2021) Guidance '*Assessing Cumulative Impacts of Onshore Wind Energy Developments'*. The scope of the cumulative and 'in combination' assessments will be agreed through consultation with ECU, South Lanarkshire Council (SLC), East Ayrshire Council (EAC) and NatureScot (NS).

3.4.4 Other operational and consented wind farms as well as those at the application stage, within 35 km of the Proposed Development, are illustrated and listed on **Figure 5.3** (see **Chapter 5**, Landscape and Visual, below).

3.4.5 It should be noted that this record will be updated throughout the EIA process, up to an agreed point prior to submission of the application. We welcome any further information from stakeholders on additional proposed wind farm developments that should be considered.

4. Planning and Policy Context

4.1 Introduction

4.1.1 This section presents a summary of relevant policy and guidance documents that will be taken into consideration to help inform the design of the Proposed Development.

4.1.2 The EIA Report will set out the relevant policies that have been considered as part of the assessments undertaken throughout the EIA. A separate Planning Statement will provide a detailed appraisal of the Proposed Development against the relevant Development Plan policies, national planning and energy policy and other material considerations.

4.1.3 The EIA Report will also concisely reference climate change policy and the contribution of Proposed Development to the UK and Scottish Government's climate change goals and policy targets.

4.2 National Planning Policy and Guidance

National Planning Framework for Scotland (2014)

4.2.1 The National Planning Framework 3 (NPF3) is a long-term strategy for Scotland and is the current spatial expression of the Government Economic Strategy and plans for development and investment in infrastructure. The NPF identifies national developments and other strategically important development opportunities in Scotland and is accompanied by an Action Programme. All planning policies on these topics contained in SPP will therefore be taken into account.

4.2.2 It is important to note that the latest version of NPF, *i.e*. NPF4, is currently being prepared by the Scottish Government. The draft NPF4 was published in November 2021 and this provides a clear 'direction of travel' for new national level planning policy. It is anticipated that a final NPF4 will be published later in 2022. The draft NPF4 is referenced below.

Scottish Planning Policy (2014)

4.2.3 Scottish Planning Policy (SPP) sets out national planning policies which reflect the Scottish Ministers' priorities for operation of the planning system and for land use and development. It aims to promote a sustainable place; supporting economic growth, regeneration and appropriately designed development.

4.2.4 The SPP principal policies include a presumption in favour of development that contributes to sustainable development, consideration of renewable energy, sustainable economic development, rural development, historic environment, landscape and natural heritage, transport, flooding and drainage and waste management. All planning policies on these topics contained in SPP will therefore be taken into account.

Draft National Planning Framework 4 (2021)

4.2.5 The draft NPF4 was published in November 2021. Once approved, it will become part of the statutory Development Plan. Now that the draft document has been published, it is a material consideration, setting out draft policy and is not simply an indication of direction of travel.

4.2.6 The draft NPF4 (*Part 2, page 44*) continues the planning policy approach from the current NPF3 of identifying 'national development' which refers to specific land use allocations and also applies national development status to certain classes of development. The draft NPF4 states that "*national developments are significant developments of national importance that will help to deliver our spatial strategy*".

4.2.7 In the draft NPF4 18 national developments are proposed to support the delivery of the Spatial Strategy and it has set out that "*this designation means that the principle of the development does*

not need to be agreed in later consenting processes, providing more certainty for communities, business and investors".

4.2.8 There are three categories of national development proposed namely 'liveable places, productive places and distinctive places'. Within the 'productive places' category is proposed national development 12 entitled '*strategic renewable electricity generation and transmission infrastructure'*.

4.2.9 A statement for this national development is provided as follows (*page 59*):

"*This national development supports renewable electricity generation, repowering, and expansion of the electricity grid*.

A large increase in electricity generation from renewable sources will be essential for Scotland to meet its net zero emissions targets. Certain types of renewable electricity generation will also be required, alongside developments and increases in storage technology and capacity, to provide the vital services, including flexible response, that a zero-carbon network will require. Generation is for consumption domestically as well as for export to the UK and beyond, with new capacity helping to decarbonise heat, transport and industrial energy demand. This has the potential to support jobs and business investment, with wider economic benefits."

4.2.10 A statement of 'need' is also provided as follows:

"*Additional electricity generation from renewables and electricity transmission capacity of scale is fundamental to achieving a net zero economy and supports improved network resilience in rural and island areas*".

4.2.11 In terms of designation and classes of development, it is set out that a development within one or more of the classes of development set out in the draft NPF4 and that is of a scale or type that would otherwise have been classified as 'major' by the *Town and Country Planning (Hierarchy of Development) (Scotland) Regulations 2009* is designated as a national development - these include (*page 59*):

"*Electricity generation, including electricity storage, from renewables of or exceeding 50 megawatts capacity*".

4.2.12 The Proposed Development would be well over the national development threshold. The Proposed Development would make a valuable contribution in supporting the transition to a net zero economy.

4.2.13 There is a clear recognition that the planning system must be "rebalanced" so that climate change is a primary guiding principle for all plans and decisions. This is an express statement that significant change in the status quo is needed and must be reflected in consenting decisions.

4.2.14 The draft NPF4 contains various policies of relevance however given it is in draft form, these may be subject to change. It is expected however that the NPF4 will come into force later in 2022 and will therefore be a key policy consideration for the determination of the Proposed Development.

4.3 The Development Plan

4.3.1 The planning policy context applicable to the site will be taken into account in the iterative EIA design process. The relevant planning policy framework will also be described in the EIA Report.

4.3.2 The statutory Development Plan for the site comprises:

- The Glasgow and the Clyde Valley Strategic Development Plan ("Clydeplan") (Approved with modification July 2017);
- The South Lanarkshire Local Development Plan 2 (the "SLLDP2") (adopted 9th April 2021);
- The East Ayrshire Local Development Plan ("EALDP") (adopted 3 April 2017);

- The South Lanarkshire Supplementary Guidance 10: Renewable Energy (2015); and
- The East Ayrshire Supplementary Guidance 'Planning for Wind Energy' (2017).

ClydePlan

4.3.3 *Section 7* of Clydeplan is entitled '*City Region as a low carbon place'* – it sets out that delivering a low carbon future in support of the Scottish Government's ambition to achieve at least an 80% reduction in greenhouse gas emissions by 2050 is central to the vision and development strategy of the plan (paragraph 7.3).

4.3.4 *Policy 10* of Clydeplan states that "*in support of the transition to a low carbon economy and realisation of the Vision and Spatial Development Strategy, support should be given, where appropriate to alternative, renewable technologies and associated infrastructure*".

South Lanarkshire Local Development Plan 2 (SLLDP2)

4.3.5 The SLLDP2 documentation includes two Volumes as follows:

- *LDP2 Volume 1*: which contains a Vision and Strategy and development management policies; and
- *LDP2 Volume 2*: which contains additional policies and furthermore detailed criteria against which development proposals are to be considered.

4.3.6 The policies from the SLLDP relevant to the consideration of the Proposed Development and for the purposes of a comprehensive policy assessment are set out below in **Table 4.1**.

Table 4.1: Relevant SLLDP2 Volume 1 Policies

Policy	Policy Summary
Policy 1: Spatial Strategy	The spatial strategy seeks to encourage sustainable economic growth and regeneration and move towards a low carbon economy, protect the natural and historic environment and mitigate against the impacts of climate change. To do this the Council will inter alia protect and enhance the natural and historic environment and support renewable energy developments in appropriate locations.
Policy 2: Climate Change	New development must seek to minimise and mitigate against the effects of climate change. The policy contains various considerations including the need for sustainable locations, avoiding flood risk, ensuring no unacceptable effects on the environment and avoiding or minimising disturbance of carbon rich soils and, where appropriate, include provision for restoration of damaged peatlands.
Policy 14: Natural & Historic Environment	All development proposals will be assessed in terms of their impact on the natural and historic environment, including biodiversity, geodiversity, landscape and townscape. The policy sets out that the Council will seek to protect natural and historic designations from adverse impacts.
Policy 15: Travel & Transport	New development proposals must consider and mitigate the resulting impacts from traffic growth, particularly development related traffic, and have regard to the need to reduce the effects of greenhouse gas emissions.
Policy 16: Water Environment & Flooding	Any development proposals which will have a significant adverse impact on the water environment will not be permitted. Sites where flood risk may be an issue shall be the subject of a local flood risk management assessment.

Policy	Policy Summary
Policy 18: Renewable Energy	Supports applications for renewable energy developments subject to assessment against the principles set out in SPP, and the relevant criteria in the Assessment Checklist in Volume 2 of the LDP.

4.3.7 The key SLLDP2 policy is *Policy RE1 'Renewable Energy'*. *Appendix 1* of LDP2 contains a Renewable Energy 'Checklist'.

4.3.8 In terms of 'additional guidance', *Appendix 1 of Volume 1* of the LDP lists this as:

- SLC Supporting Planning Guidance 'Renewable Energy';
- Landscape Capacity Study for Wind Energy (2016) and its Addendum (2017);
- Tall Wind Turbines Landscape Capacity, Siting and Design Guidance (2019);
- South Lanarkshire Landscape Character Assessment (2010); and
- South Lanarkshire Validating Local Landscape Designations (2010).

4.3.9 *LDP2 Volume 2* contains additional policies and detailed criteria against which development proposals are to be considered. These are summarised in **Table 4.2** below.

Table 4.2: Relevant SLLDP2 Volume 2 Policies

Policy	Policy Summary
DM1 - New Development Design	New development will be required to ensure there is no conflict with adjacent land uses and no adverse impact on existing or proposed properties in terms of noise or disturbance.
Policy SDCC2 - Flood Risk	The Council will seek to prevent increases in the level of flood risk and refuse development where e it would be at risk from flooding.
Policy NHE2 – Archaeological Sites and Monuments	Seeks to preserve scheduled and non-scheduled monuments in situ and in an appropriate setting. Developments which have an adverse effect on scheduled monuments, or the integrity of their setting will not be permitted unless there are exceptional circumstances.
Policy NHE3 – Listed Buildings	Development affecting a Listed Building, or its setting shall, as a first principle, seek to preserve the building and its setting, and any features of special architectural interest which it has.
Policy NHE4 – Gardens and Designed Landscapes	Development affecting sites listed in the Inventory of Gardens and Designed Landscapes shall protect, preserve and, where appropriate, enhance such places and shall not significantly impact adversely upon their character, upon important views to, from and within them, or upon the site or setting of component features which contribute to their value.
Policy NHE6 – Conservation Areas	Development and demolition within a Conservation Area or affecting its setting shall preserve or enhance its character and be consistent with any relevant Conservation Area appraisal or management plan that may have been prepared for the area.
Policy NHE7 – Natura 2000 Sites	All development which would have a likely significant effect on Natura 2000 sites will be subject of an appropriate assessment. The requirements of the policy apply to all proposed or designated Natura sites which could be affected by the proposals, including those which are located out with the boundary of South Lanarkshire Council.

Policy	Policy Summary
Policy NHE8 – National Nature Reserves and Sites of Special Scientific Interest	Seeks to protect SSSI/National Nature Reserves. Development which affects either designation will be expected to demonstrate that the overall integrity will not be compromised or any significant adverse effect on the qualities of the area are clearly outweighed by social, environmental or economic benefits of national importance.
Policy NHE9 – Protected Species	Development that would impact on a European Protected Species will be resisted unless there is demonstratable evidence that the development is required, there is no satisfactory alternative, or the development would not be detrimental to the maintenance of the population of the species.
Policy NHE11 – Peatland and Carbon Rich Soils	The Council shall seek to protect peatland and carbon rich soils from adverse impacts resulting from development. Where peat and other carbon rich soils are present, applicants should assess the likely effects of development on carbon dioxide (CO2) emissions. Where peatland is drained or otherwise disturbed, there is likely to be a release of CO2 to the atmosphere. Developments should aim to minimise this release.
Policy NHE12 – Water Environment and Biodiversity	Development proposals should protect and where possible enhance the water environment in accordance with the Water Framework Directive. Development proposals which will have a significant adverse impact on the water environment will not be permitted. Consideration will be given to water levels, flows, quality, features, flood risk and biodiversity within the water environment.
Policy NHE13 – Forestry and Woodland	Development proposals should seek to manage, protect and enhance existing ancient semi-natural woodland (ASNW), other woodlands, hedgerows and individual trees. In all cases involving the proposed removal of existing woodland, the acceptability of woodland removal and the requirement for compensatory planting will be assessed against the criteria set out in the Scottish Government's Policy on Control of Woodland Removal.
Policy NHE16 – Landscape	Sets out criteria for the assessment of development proposals within Special Landscape Areas (SLAs) and seeks to protect and enhance the wider landscapes of SLC through the maintenance and enhancement of landscape character.
Policy NHE18 – Walking, Cycling and Riding Routes	Walking, cycling, riding routes core water routes and water access/egress points will be safeguarded. Development proposals adjacent to or on the line of any route will require to take account of the route in the design and layout.
Policy NHE20 – Biodiversity	Development should demonstrate that they have no significant adverse impact on biodiversity. Where proposals are likely to lead to significant loss of biodiversity, they will only be supported if adequate mitigation and offsetting measures can be agreed with the council. Developments should consider opportunities to contribute positively to biodiversity conservation and enhancement.
Policy RE1 - Renewable Energy	Sets out that applications for renewable energy development will be acceptable if they accord with the Volume 2 Checklist for proposals, the supporting Planning Guidance on Renewable Energy, the Landscape Capacity Study for Wind Energy and other relevant policies in LDP2.

4.3.10 It should be noted that a Planning Statement will be provided with both the S.36 consent application and the separate planning application for the hydrogen component (but separate from the EIA Report) which will contain an assessment of the accordance of the Proposed Development with the LDP2 and relevant material considerations referred to above.

Local Development Plan for East Ayrshire

4.3.11 Relevant policies from the East Ayrshire Local Development Pan (EALDP) are set out in **Table 4.3** below.

Table 4.3: Relevant EALDP Policies

Policy	Policy Summary
Policy OP1	All development proposals require to meet criteria insofar as they are relevant, or demonstrate why a proposal would outweigh any lack of consistency with relevant criteria. Relevant criteria relate to Supplementary Guidance, compatibility with surrounding established uses and no unacceptable impact on environmental quality of the area, protection and enhancement of natural and built heritage designations and the need to ensure that there are no unacceptable impacts in relation to landscape character and the tourism offer of the area.
Policy RE3: Wind Energy Proposals over 50m in height	Wind energy proposals will be assessed using the Spatial Framework and all relevant renewable energy and other LDP policies.
Policy T4: Protection of Core Paths and Natural Routes	Proposals will not be supported which disrupt or adversely impact on any existing or potential core path, right of way, bridlepath or footpath.
Policy ENV2: Scheduled Monuments and Archaeological Resources	Development which would have an adverse effect on Scheduled Monuments or on their settings will not be supported unless there are exceptional overriding circumstances.
Policy ENV6: Nature Conservation	The importance of nature conservation and biodiversity will be fully recognised in the assessment of proposals. The policy makes reference to Natura 2000 sites, Sites of Special Scientific Interest and Areas of Local Importance for Nature Conservation.
Policy ENV7: Wild Land and Sensitive Landscape Areas	The policy of references the SPP approach to the protection of Wild Land. It states any development deemed to have an unacceptable impact on Wild Land or a Special Landscape Area will not be supported.
Policy ENV8: Protecting and Enhancing the Landscape	Reference is made to the East Ayrshire Landscape Character Assessment which will be a key consideration in assessing proposals. The policy requires proposals to be sited and designed to respect the nature and landscape character of the area and to minimise visual impact.
Policy ENV9: Trees, Woodland and Forestry	Support is given to the retention of trees, hedgerows and woodland. Any removal of woodland requires to be consistent with Scottish Government Control of Woodland policy.
Policy ENV10: Carbon Rich Soils	Seeks to minimise adverse impacts from development on carbon rich soils and promotes the restoration of peatland habitats. Reference is made to development for renewable energy which may be permitted on carbon rich soils where it can be demonstrated that the balance of advantage in terms of climate change mitigation lies with the energy generation proposal and any significant effects on such areas can be substantially overcome by siting, design or other mitigation.

Policy	Policy Summary
Policy ENV11: Flood Prevention	A precautionary approach is taken to flood risk and development is directed away from functional flood plains and undeveloped areas of medium to high flood risk.
Policy ENV12: Water, air, light and noise pollution	Priority is given to maintaining and improving the quality of all water bodies and groundwater. There is a presumption against development that would have an adverse impact on the water environment in terms of pollution levels and the ecological value of water habitat. In terms of noise, the policy requires a noise impact assessment to be provided together with any necessary mitigation measures.
Policy RES11: Residential Amenity	The policy seeks to protect, preserve and enhance residential character and amenity of existing residential areas.

4.3.12 The key EALDP policy is *Policy RE3 'Wind Energy Proposals'*.

4.3.13 There is also related non-statutory planning guidance in the form of the *Ayrshire Landscape Wind Capacity Study* (2013).

4.3.14 It should be noted that a Planning Statement will be provided with the S.36 consent application (but separate from the EIA Report) which will contain an assessment of the accordance of the Proposed Development with the EALDP and relevant material considerations referred to above.

4.4 The Hagshaw Development Framework

4.4.1 Account will be taken of the Development Framework for the Hagshaw Energy Cluster 'Planning for Net Zero' which is currently in draft form.

4.4.2 In 2020 NatureScot brought together a group of wind farm developers and operators with East Ayrshire Council and South Lanarkshire Council to discuss how there could be collaborative work on the future of renewable energy development in the context of planning for and delivering Net Zero in Scotland. The initiative is focused on the existing cluster of wind farms near Hagshaw Hill and located between the communities of Coalburn, Douglas and Muirkirk.

4.4.3 Other stakeholders were engaged in initial discussions, including the Scottish Government, Historic Environment Scotland (HES), Scottish Environment Protection Agency (SEPA), Scottish Forestry, Forestry and Land Scotland (FLS) and the Royal Society for the Protection of Birds (RSPB), along with a range of consultants involved in renewable energy developments within the existing cluster, to scope out the topics where there may be opportunities to collaborate and coordinate.

4.4.4 A project steering group has been formed and has worked together to prepare the draft Development Framework aimed at shaping a more strategic approach to renewable energy development and related opportunities.

4.4.5 East Ayrshire Council and South Lanarkshire Council will use the Development Framework as a basis for working with developers, communities and other stakeholders to promote and adopt a coordinated approach to future renewable energy development across the cluster. The Development Framework will inform, shape and support the delivery work. The Framework is expected to have non statutory status and will be a material consideration.

4.5 Climate Change and Energy Policy

4.5.1 The burning of fossil fuels to produce electricity is a major contributor to climate change through the release of atmospheric carbon dioxide (CO_2) and other harmful gases known collectively as greenhouse gases.

4.5.2 The Proposed Development relates to the generation of electricity from renewable energy sources and comes as a direct response to national planning and energy policy objectives. The clear objectives of the UK and Scottish Governments will be summarised, in relation to encouraging increased deployment and application of renewable energy technologies, consistent with sustainable development policy principles and national and international obligations on climate change.

4.5.3 The *Scottish Government's Energy Strategy* (2017) set a target for the equivalent of 50% of the energy for Scotland's heat, transport and electricity consumption to be supplied from renewable sources. As heat and transport become decarbonised, demand for electricity from renewable sources can be expected to increase.

4.5.4 Further deployment of renewable energy generating technology will be required throughout the 2020s in order to meet targets. As a mature technology onshore wind, and associated solar, development has a continuing and important role to play, as confirmed by national planning and energy policy and most recently in the draft NPF4.

4.5.5 The *Scottish Government's Energy Strategy* and *Onshore Wind Policy Statement* (2017) set out *inter alia* that onshore wind is to play a vital role in Scotland's future – helping to substantively decarbonise electricity supplies and the technology is expected to play material role in growing the economy.

4.5.6 Scotland's overarching statutory target is to achieve a 100% reduction in greenhouse gas emissions to net-zero by 2045, with interim targets of 75% by 2030 and 90% by 2040, now provided for in the *Climate Change (Scotland) Act 2009* as amended by the *Climate Change (Emissions Reductions Targets) (Scotland) Act 2019* ("2009 Act") which came into force in March 2020.

4.5.7 The Scottish Government declared a climate emergency on 14 May 2019. The declaration of an "emergency" is a reflection of both the seriousness of climate change and its potential effects and the need for urgent action to cut carbon dioxide emissions. The declaration is a material consideration which will be referenced.

4.5.8 The draft OWPS was published in 2021 and Key points which can be drawn from it include:

- The central requirement for a rapid transition to net zero and the crucial role of further onshore wind development in achieving legally-binding targets, especially through the 2020s.
- Unequivocal Scottish Government policy support for the future role of onshore wind.
- The urgency of the Climate Emergency and the scale of the necessary ambition – there is express recognition in the draft OWPS of the need for "meaningful action over the next 12 months", "further and faster" delivery and that a "consistently higher rate of onshore wind, and other renewables capacity, will be required year-on-year". The scale of deployment required to be operational before 2030 is very considerable and way beyond what has happened in the past.
- The draft OWPS is clear (*paragraph 4.4.2*) that the "*most cherished landscapes*" must be afforded the necessary protections, but climate change and net-zero require decisive action and this will inevitably change how Scotland looks. Combatting climate change requires modern and efficient turbines (which *paragraph 2.2.3* of the draft OWPS confirms means taller turbines).

4.5.9 A large increase in the deployment of this renewable energy technology is supported through a number of UK level policy documents including the latest *UK Energy White Paper* (2020) and *Net Zero Strategy* (2021). Scottish Government policy commitments are also clear – most recently expressed in the draft OWPS and in the draft NPF4 which will be material to the energy and national planning policy positions to be considered for the determination of the application.

4.6 Hydrogen Policy

4.6.1 The Scottish Government's Hydrogen Policy Statement (HPS) (2020) states that it is becoming increasingly clear that hydrogen will play a major role globally in the transition to net zero, and Scotland's assets, natural, human and physical mean that Scotland can be a major player in this emerging global hydrogen market.

4.6.2 The UK Government published the Hydrogen Strategy in August 2021 which sets a target of 5GW of low-carbon hydrogen by 2030 for use across the economy. This means there needs to be a considerable ramping up of hydrogen over the coming decade.

4.6.3 The Scottish Government has set out in the HPS that producing clean hydrogen and showing that it can be used to meet challenging energy demands (e.g. for heat, transport and industry) will be part of the next stage of the Scotland energy transition pathway. It adds that it is clear that hydrogen is not just an energy and emissions reduction opportunity; it could also have an important role in generating new economic opportunities in Scotland.

4.6.4 The development of the hydrogen economy and supply chain will play an important role in the energy transition to net zero and are key components of the green economic recovery.

4.6.5 In the HPS the Scottish Government:

- Confirms Scottish Government support for the strategic growth of a strong hydrogen economy in Scotland, focusing efforts on supporting the development of Scotland's hydrogen production capability to meet an ambition of at least 5GW of renewable and low-carbon hydrogen by 2030 and at least 25GW by 2045.
- Commits £100 million funding towards the development of the hydrogen economy over the next five years as implemented through our Hydrogen Action Plan (2021).
- Confirms that both renewable and low-carbon hydrogen will play an increasingly important role in the energy transition to net zero in 2045 and the importance of establishing low-carbon hydrogen production at scale by the mid-2020s.
- The need for pace – the need to start now and grow quickly to capitalise on opportunities within the domestic and global hydrogen market.

4.7 Conclusion

4.7.1 The Proposed Development will clearly make a contribution to the attainment of renewable energy and electricity targets and emissions reduction at both the Scottish and UK levels and the quantification of this contribution would be described. In addition, the hydrogen production element of the Proposed Development would make an important contribution to the Scottish Government's vision for Scotland to become a leading hydrogen nation in the production of reliable, competitive, sustainable hydrogen.

4.7.2 The EIA Report will summarise the renewable energy policy framework, but the detail will be provided in a supporting Planning Statement, one to accompany the S.36 consent application and a separate one to accompany the planning application for the hydrogen component, both of which will also make reference to key policy documents (as relevant) such as the *Scottish Energy Strategy* (2017), the forthcoming NPF4, Scottish Government Hydrogen Policy Statement and Hydrogen Action Plan, and the *Onshore Wind Policy Statement* (2017) and its Refresh which was consulted on in late 2021 / early 2022 and which proposes an onshore wind target of an additional 8-12GW of additional onshore wind capacity to be delivered by 2030.

5. Landscape and Visual

5.1 Introduction

5.1.1 It is acknowledged from the outset that, in common with almost all commercial-scale wind and energy developments, some landscape and visual effects would occur as a result of the proposals, including potentially some significant effects.

5.1.2 A key principle of the European Landscape Convention is that all landscapes matter and should be managed appropriately. It is also acknowledged that landscapes provide the surroundings for people's daily lives and often contribute positively to the quality of life and economic performance of an area.

5.1.3 It is therefore proposed that a Landscape and Visual Impact Assessment (LVIA) is undertaken as part of the EIA and an LVIA Chapter be included in the EIA Report. The LVIA will be undertaken by Chartered Landscape Architects, who are experienced in the assessment of large scale, onshore wind and solar energy projects and are fully familiar with the landscape in and around this part of East Ayrshire and South Lanarkshire, having previously delivered the LVIAs for other nearby consented 3R projects at Hagshaw Hill, Douglas West (including Extension), and Cumberhead West.

5.1.4 It is proposed that the LVIA will consider the potential effects of the Proposed Development upon:

- Individual landscape features and elements;
- Landscape character; and
- Visual amenity and the people who view the landscape.

5.2 Baseline Description

5.2.1 The Proposed Development site adjoins an established cluster of wind farms around Hagshaw Hill (known as the 'Hagshaw Cluster') and Dungavel Hill in rural South Lanarkshire and extends westwards towards the village of Muirkirk in East Ayrshire. The Proposed Development is located approximately 2.45 km to the north of Muirkirk at its closest point to the nearest proposed wind turbine. The surrounding landscape comprises open moorland interspersed with large blocks of coniferous plantation. Beyond the site boundary farmland extends through the lower-lying Ayr valley to the south and in the lower-lying areas to the north of the Proposed Development.

Landscape Character

5.2.2 The Proposed Development straddles the border between South Lanarkshire and East Ayrshire. Area A is largely sited within South Lanarkshire, although its south-eastern corner crosses into East Ayrshire. Area B overlaps both authority areas, Areas C and D are located entirely within East Ayrshire and Area E is located entirely within South Lanarkshire. **Figure 2.1** illustrates the different Development Areas.

National Landscape Character

5.2.3 In March 2019, NatureScot published an updated set of Landscape Character Type boundaries and descriptions, which includes mapping and descriptions which supersede earlier documents.

National Landscape Character Types covering the Site

5.2.4 The Proposed Development is predominantly located in the Plateau Moorland – Ayrshire Landscape Character Type (LCT 78) and the Plateau Moorlands – Glasgow & Clyde Valley Landscape Character Type (LCT 213). A very small section of the proposed access that follows the existing wind farm access road to the M74 crosses into the Upland River Valley – Glasgow & Clyde Valley Landscape Character Type (LCT 207) at its northern end near Poniel.

5.2.5 The key characteristics of the Plateau Moorland – Ayrshire Landscape Character Type (LCT 78) are defined as:

- Topography is comparatively level with extensive plateaux rising to soft contoured ridges;
- Underlain by basalts to the east and greywackes to the south-west;
- Covered by blanket bog, heather and grass moorland, with extensive mosses and peatland forming an important component of this landscape type;
- Frequent extensive areas of coniferous forest of uniform age which, in places, have significantly modified the original character of these areas in terms of colour, texture and views;
- Largely undeveloped with a sparse network of roads;
- Wind farm development on the north-eastern margins;
- Open, exposed and rather remote landscape, wild in character, although this is lessened in places by the presence of wind turbines and associated infrastructure; and
- Views are open and medium to longer distance depending on undulations in the local topography.

5.2.6 The key characteristics of the Plateau Moorlands – Glasgow & Clyde Valley Landscape Character Type (LCT 213) are defined as:

- Large scale landform;
- Undulating hills and sloping ridges in the western areas; a more even plateau landform in the east;
- Distinctive upland character created by the combination of elevation, exposure, smooth plateau landform, moorland vegetation;
- Predominant lack of modern development;
- Extensive wind turbine development, including one of the largest wind farms in Scotland, Black Law; and
- Sense of apparent naturalness and remoteness which contrasts with the farmed and settled lowlands, although this has been reduced in places by wind energy development.

5.2.7 At the regional level, the southern part of the Proposed Development is located within LCT 18a Plateau Moorland, as defined in the East Ayrshire Landscape Wind Capacity Study (EALWCS) 2018. The study identifies a High-medium sensitivity to very large wind turbines (>130m).

5.2.8 The northern part of the Proposed Development (the majority of Area A and the northern part of Area B) are located within the Rolling Moorland Landscape Character Type, as defined in the *South Lanarkshire Landscape Capacity Study for Wind Energy* (SLLCSWE) 2016 and within the Haghsaw/Dungavel (North of Douglas Water) primary landscape unit. The study identifies a medium landscape character and visual sensitivity to wind energy development.

5.2.9 The addendum to the SLLCSWE, the Tall Wind Turbines: Landscape Capacity, Siting and Design Guidance (2019 update) provides further guidance in relation to the siting of turbines of between 150 m and 250 m height. In relation to the Rolling Moorland LCT it notes that "*Most of the areas in which the turbines could be most comfortably located either already host substantial wind energy developments, or have similar developments consented. Turbines vary between 55m and 149.9m height. The addition of larger turbines could therefore often be, or at least perceived as, an extension to an operational or consented wind farm, or would be a repowering exercise, replacing existing turbines at the end of their commercial or consented life.*"

5.2.10 It goes on to note that *"To avoid potential domination of neighbouring smaller scale landscapes, larger turbines should be located towards the centre of Rolling Moorland areas. There they will be more remote from scale indicators in the surrounding valleys, seen at a greater distance behind*

existing smaller turbines and/or partly screened by rolling landforms. Peripheral Rolling Moorland areas are therefore shown with a lower or no capacity in Figure 6.1f. Siting larger turbines between sensitive landscape and visual receptors and existing smaller turbines should be avoided where possible, as this will lead to an increased perception of the larger turbine size through exaggerated perspective."

5.2.11 With reference to *Figure 6.1f* of the SLLCSWE addendum, the part of the Proposed Development overlapping with the Rolling Moorland LCT is identified as having a medium capacity for turbines of between 150 m and 250 m in height.

5.2.12 Regarding aviation lighting, the addendum notes that within the Hagshaw/Dungavel (North of Douglas Water) area, effects are likely to be less adverse due to the closer proximity to settlements and densely populated farmland and valleys where artificial light sources are more readily encountered during the hours of darkness.

Landscape Designations

5.2.13 The Proposed Development is not located within or adjacent to a nationally designated landscape. The part of the Proposed Development within East Ayrshire overlaps with a Sensitive Landscape Area. Landscape designations in the vicinity of the site are illustrated at **Figure 5.2**.

5.3 Relevant Guidance and Legislation

5.3.1 The LVIA will be undertaken in accordance with the principles of best practice, as outlined in published guidance documents, notably the third edition of the *Guidelines for Landscape and Visual Assessment* (GLVIA3), (Landscape Institute and the Institute for Environmental Management and Assessment, 2013).

5.3.2 The methodology and assessment criteria proposed for the assessment has been developed in accordance with the principles established in this best practice document. It should be acknowledged that GLVIA3 establishes guidelines, not a specific methodology. The preface to GLVIA3 states:

"This edition concentrates on principles and processes. It does not provide a detailed or formulaic 'recipe' that can be followed in every situation – it remains the responsibility of the professional to ensure that the approach and methodology adopted are appropriate to the task in hand."

5.3.3 The approach has therefore been developed specifically for this assessment to ensure that the methodology is fit for purpose.

5.3.4 As part of the development of the proposed methodology, consideration has also been given to the following documents:

- General pre-application and scoping advice for onshore wind farms. Guidance. NatureScot (September 2020);
- Guidelines for Landscape Character Assessment, Countryside Agency and SNH (2002);
- Assessing the Cumulative Landscape and Visual Impact of Onshore Wind Energy Developments (NatureScot, March 2021);
- Siting and Design of Wind farms in the Landscape, Version 3a (SNH, August 2017);
- Visual Representation of Wind farms – Version 2.2 (SNH, February 2017);
- Landscape Institute (LI) Technical Guidance Note 06/19 Visual representation of development proposals (Landscape Institute, September 2017); and
- LI Technical Guidance Note 02/19 Residential Visual Amenity Assessment (RVAA), (Landscape Institute, March 2019).

5.4 Proposed Scope of Survey and Assessment

5.4.1 It is proposed that the main objectives of the LVIA will be as follows:

- to identify, evaluate and describe the current landscape character of the site and its surroundings, and also any notable individual or groups of landscape features within the site;
- to determine the sensitivity of the landscape to the type of development proposed;
- to identify potential visual receptors (i.e. people that would be able to see the Proposed Development) and evaluate their sensitivity to the type of changes proposed;
- to identify and describe any impacts of the Proposed Development in so far as they affect the landscape and/or views of it and evaluate the magnitude of change due to these impacts;
- to identify and describe any mitigation measures (including mitigation which is inherent in the design and layout of the Proposed Development) that have been adopted to avoid, reduce and compensate for landscape and visual effects;
- to identify and assess any cumulative landscape and visual effects;
- to evaluate the level of residual landscape and visual effects; and
- to make a professional judgement about which effects, if any, are significant.

Distinction between Landscape and Visual Effects

5.4.2 In accordance with the published guidance, landscape and visual effects shall be assessed separately, although the procedure for assessing each of these is closely linked. A clear distinction has been drawn between landscape and visual effects as described below:

- Landscape effects relate to the effects of the Development on the physical and perceptual characteristics of the landscape and its resulting character and quality; and
- Visual effects relate to the effects on specific views experienced by visual receptors and on visual amenity more generally.

Study Areas

5.4.3 In order to assist with defining the study area, a digital Zone of Theoretical Visibility (ZTV) model has been produced as a starting point to illustrate the geographical area within which views of development on the site are theoretically possible. This was based on a 'bare-earth' scenario, whereby the screening effect of areas of existing vegetation or built features in the landscape are not taken into account. The ZTV was modelled to blade tip height using the currently proposed maximum turbine height of 230 m and is presented at **Figure 5.1**.

5.4.4 The ZTV is a useful tool used to provide a focus on the area and receptors that are most likely to be affected by a Proposed Development but should always be subject to verification in the field. In this regard, site visits shall always form the primary basis in understanding the actual likely visibility of development at the site.

5.4.5 Having reviewed the ZTV and with regard to best practice guidance, it is proposed that the LVIA will consider an initial 35 km radius study area. Detailed assessment will then be provided for a 20 km section of this study area, which it is considered represents a proportionate extent of the study area and the limit within which any potential significant effects might occur.

5.4.6 For the cumulative assessment, consideration was initially given to a 60 km radius from the site, as recommended by NatureScot best practice guidance. Following this review, it is proposed that a 20 km study area be adopted to consider cumulative effects, which is considered represents a proportionate extent of the study area and the limit within which any potential significant cumulative effects might occur.

Visual Receptors

5.4.7 A detailed consideration of the potential for effects to the visual amenity of receptors in the landscape surrounding the site will be set out in the LVIA. This visual assessment will be informed by a selection of representative assessment viewpoints, which are listed below, each of which will be illustrated with visualisations prepared in line with NatureScot best practice guidance.

5.4.8 The LVIA will focus on the potential effects of the Proposed Development on different receptor groups, comprising settlements, footpath users, recognised tourist routes, long distance walking routes, cycle routes and centres for tourism.

5.4.9 It is also proposed to carry out a separate Residential Visual Amenity Assessment (RVAA) covering properties located within 2 km of all proposed turbines. Properties lying within a 2 km radius of the design freeze layout will be identified and the list further refined by reference to both the bare earth zone of theoretical visibility and a screened zone of theoretical visibility that allows for localised screening provided by woodland and other buildings.

5.4.10 This additional assessment will be presented in an appendix to the LVIA Chapter and would complement the assessment of visual receptors within the LVIA, providing further detail in relation to the effect on the views and amenity from different parts of each property and its curtilage.

5.4.11 In addition to the assessment of residential visual amenity, it is proposed to include a separate Townscape Visual Assessment of Muirkirk, focussing on the general visual amenity experienced within the settlement. The assessment will establish the baseline visual amenity through desk top analysis and local site knowledge and assess the likely change in visual amenity experienced within the different parts of the settlement.

5.4.12 The assessment will include an overall judgement of the likely effects upon visual amenity experienced from the settlement. The proposed LVIA methodology will form the basis for the judgements set out in the Townscape Visual Assessment. The assessment will be supported by up to 5 additional photowires; locations to be agreed with East Ayrshire Council.

Proposed LVIA Viewpoint Locations

5.4.13 It is proposed that the 15 locations set out in **Table 5.1** are included as viewpoints in the LVIA. The locations which are illustrated on **Figure 5.1** represent visual receptors and character types at a range of distances and directions from the site.

5.4.14 It is acknowledged that the Proposed Development is located adjacent to a number of other consented and operational developments within the Hagshaw Cluster. The LVIA viewpoints from some of these other schemes have influenced the choice of proposed viewpoint locations set out in **Table 5.1** below.

Table 5.1 Proposed LVIA Viewpoints

Viewpoint Number	Location	OS Grid Reference
1	A70, eastern edge of Muirkirk by Wee Torhill	270608, 627896
2	Victory Park, Muirkirk	269388, 627320
3	River Ayr Way, Muirkirk	269859, 626671
4	Cairn Table	272410, 624235
5	A70, Nether Wellwood	264483, 625095
6	B743 (east of Nethershield))	258726, 626946
7	B705 (Auchlinleck)	255098, 622594
8	Loudoun Hill	260869, 637928

Viewpoint Number	Location	OS Grid Reference
9	A71, bridge crossing Calder Water	266379, 641900
10	Strathaven War Memorial	270448, 644635
11	Minor road south-west of Lesmahagow	279097, 638710
12	Black Hill	283198, 643552
13	A70 Rigside	287708, 635192
14	Tinto Hill	295316, 634372
15	Auchensaugh hill	285330, 627198

5.4.15 The proposed viewpoint locations are located at a range of distances and directions from the Proposed Development, are at varying elevations and cover a variety of different character areas and types. Some of the viewpoints are intended to be representative of the visual experience in a general location whereas other viewpoints illustrate the view from a specific or important vantage point.

5.4.16 Each of the representative viewpoints will be visited to evaluate the sensitivity of views. In addition, the study area will also be extensively visited to consider the visibility of the Proposed Development as receptors move through the landscape.

5.4.17 The viewpoints will be used as the basis for determining the effects on visual receptors within the Study Area. The level of effect experienced by different visual receptor groups will be determined by considering in tandem the sensitivity and view with the magnitude of impact.

Visualisations

5.4.18 For each of the above viewpoints, daytime visualisations will be prepared in line with the *Visual Representation of Wind farms – Version 2.2* (SNH, February 2017).

5.4.19 A digital model will be generated to enable the production of wirelines of the Proposed Development from locations throughout the study area to help identify the scale, arrangement and visibility of the proposed turbines. These images will be reviewed on site to assess how natural and built screening would affect visibility of the Proposed Development.

5.4.20 Each of the wireframe models for the viewpoints within 20 km of the site will then be developed further into photomontages to help illustrate the predicted impact of the Proposed Development.

5.4.21 It is proposed that surrounding consented, but not yet constructed schemes will be digitally added to photomontages of baseline photographs, in order to illustrate the predicted baseline situation that will be in place when the wind farms are fully constructed.

5.4.22 In addition to the proposed wind turbines, the other project components (i.e. solar photovoltaic panels, green hydrogen facility, BESS, permanent anemometer mast, access tracks and the substation will be shown in photomontages for viewpoints within 5 km when they would be visible. Beyond 5 km it is considered unlikely that the ancillary elements would form more than a limited element of the entire Proposed Development when compared to the turbines.

Assessment of Turbine Lighting

5.4.23 The Proposed Development will incorporate turbines greater than 150 m, some of which under Civil Aviation Authority (CAA) Regulations will required to be lit with visible aviation lighting.

5.4.24 It is recognised that in some circumstances, it may be possible for turbine lighting to result in a significant effect on the character of the surrounding landscape. For example, if the proposed wind energy development is located within or in close proximity to a designated dark sky area, or is

remote from existing sources of visible lighting, such as residential areas, commercial or industrial sites, or major roads.

5.4.25 For wind energy developments which are not located in such areas, it is considered that there would be no potential for significant effects on landscape character to arise from visible turbine lighting of the type proposed. This is because in these areas the character of the landscape during low natural light levels is already in part characterised by the presence of artificial lighting. Therefore, the addition of visible turbine lighting would not have the potential to bring about a fundamental change to the characteristics of the landscape.

5.4.26 The surrounding landscape context around the Proposed Development contains some existing sources of artificial light, particularly within surrounding settlements, industrial developments and along highways, and when considering surrounding wind farms already consented with visible aviation lighting. Therefore, the assessment of turbine lighting will focus solely on the additional visual effects introduced by the lights.

5.4.27 In accordance with "*General pre-application and scoping advice for onshore wind farms*" (NatureScot September 2020), the LVIA will assess the additional visual effects of the aviation lighting in the main body of the LVIA chapter. The additional change introduced by the aviation lighting will form a component of the magnitude of change.

5.4.28 This consideration will be informed by a ZTV of the lit turbines and night-time visualisations from a selection of viewpoints, illustrating the proposed lighting effects. In line with NatureScot Visualisation Guidance, the viewpoints selected represent locations from where people are most likely to experience the wind farm at night.

5.4.29 It is proposed that the following night-time visualisations will be produced:

- VP 2 – Victory Park, Muirkirk; and
- VP 5 – A70, Nether Wellwood.

5.4.30 The viewpoints will be used to inform consideration of the potential visual effects on key visual receptors in settlements (e.g. Muirkirk), and users of the A70.

5.4.31 Photographic examples of existing aviation lighting in similar light conditions will be presented in a separate appendix as a 'control mechanism'.

Cumulative Effects

5.4.32 The LVIA will also consider the potential for any cumulative effects to arise. The requirement for consideration of cumulative effects under the *Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017* is set out in *Schedule 4, paragraph 5*, as follows:

"A description of the likely significant effects of the development on the environment resulting from, inter alia: (e) the cumulation of effects with other existing and/or approved development, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources".

5.4.33 Current best practice guidance for cumulative impact assessment (Assessing the Cumulative Impact of Onshore Wind Energy Developments, (NatureScot, 2021)) refers to a consideration of proposals which are '*awaiting determination within the planning process with design information in the public domain*' and states that '*The decision as to which proposals in the planning / consenting system should be included in an assessment is the responsibility of the determining authority*.'

5.4.34 As such, it is proposed in this LVIA to consider cumulative effects caused by the development of the site in conjunction with other sites which are either operational, under construction, consented or the subject of a full planning application. The NatureScot best practice guidelines identify two principal types of cumulative visual impact:

- Combined visibility – where the observer is able to see two or more developments from one viewpoint; and

- Sequential visibility – where two or more sites are not visible at one location but would be seen as the observer moves along a linear route, for example, a road or public right of way.

5.4.35 The guidelines state that 'combined visibility' may either be 'in combination' (where two or more sites are visible from a fixed viewpoint in the same arc of view) or 'in succession' (where two or more sites are visible from a fixed viewpoint, but the observer is required to turn to see the different sites). Each of the above types of cumulative effect will be considered in the LVIA.

5.4.36 The assessment will also consider the potential cumulative effects of wind turbine aviation lighting, with reference to other wind farms that are either operational, under construction, consented or the subject of a full planning application.

5.4.37 In order that the cumulative assessment remains focussed on other schemes that have the greatest potential to give rise to significant cumulative effects it is necessary at the outset to decide which schemes realistically need to be considered in detail, as to consider all schemes within 35 km of the Proposed Development would simply detract attention from the key issues relating to the application. As there are several large wind farms (either operational, consented, in planning, or in Scoping) in the immediate vicinity of the Proposed Development, it is recognised that in this context, wind farms over 20 km away are highly unlikely to give rise to significant cumulative effects which would not occur in any case with the existing distribution of immediately surrounding wind farms (i.e. in the absence of the Proposed Development). It is also considered appropriate and proportionate to scope out turbines under 50 m within 10 km of the site, and under 80 m over 10 km distance from the site. The cumulative impact assessment will therefore focus primarily on those schemes within approximately 20 km of the Proposed Development.

5.4.38 The wind farms identified within **Table 5.2** are therefore the schemes on which the discussion of the cumulative landscape and visual impact effects will be primarily focussed.

5.4.39 For the purposes of clarification, it should also be noted that other wind farms within 35 km of the Proposed Development will be shown on the supporting visualisations where relevant.

Consultation

5.4.40 The Applicant has held initial pre-application discussions about the Proposed Development with the ECU, NatureScot, East Ayrshire and South Lanarkshire Councils but consultation with statutory authorities has not yet been undertaken on the detail of the scope of the LVIA. However, the methodology and scope presented in this section has been guided by previous experience of working on numerous similar scale schemes in the general locality.

Table 5.2 – Cumulative sites within 20km

Site	Blade tip height of turbines	Number of turbines
Operational		
Andershaw	125 m	14
Auchrobert	132 m	12
Bankend Rig	76 m	11
Birkhill (Harbro)	99.5 m	1
Blantyre Muir	115 m	3
Blantyre Muir Extension	115 m	3
Calder Water	145 m	13
Douglas West	149.9 m	13
Dungavel	101.2 + 121.2 m	14
Galawhistle	4 at 121.2 m and 18 at 110.2 m	22
Hagshaw Hill	55 m	26

Site	Blade tip height of turbines	Number of turbines
Hagshaw Hill Extension	80 m	20
Nutberry	125 m	6
Hare Hill	63.5 m	20
Hare Hill Extension	70 m, 81 m and 91 m	35
Hazelside Farm	74 m	1 operational, 1 to be constructed
High Waterhead Farm	67 m	1
JJ Farm Turbine	102 m	1
Kype Muir	132 m	26
Ladehead Farm	74 m	3
Letham Farm	51 m	1
Lochhead	100 m	5
Low Whiteside Farm	54 m	1
Middle Muir	8 at 136 m and 7 at 152 m	15
North Brackenridge	76 m	1
Nutberry	125 m	6
Sanquhar	130 m	9
West Browncastle	129.9 m	12
Whitelee	110 m	140
Whitelee Phase 1 and 2 Extension	69 at 140 m and 6 at 110 m	75
Yonderton Farm	51 m	1
Consented/ Under Construction		
Bankend Rig II	126.5 m (Resubmission 200 – 250 m)	3
Broken Cross (Wind Farm)	149 m	10
Broken Cross Small Wind Cluster	55.7 m	2
Cumberhead Revised Scheme	12x 149.9 m and 2 x 180 m	14
Cumberhead West	200 m	21
Dalquhandy	11 x 149.9 m +and 4 x 131 m	15
Douglas West Extension	200 m	13
Enoch Hill Wind Farm	130 m	16 (note variation to increase tip height of all 16 turbines to 149.9 m)
Glenmuckloch	133. 5m	8
Hagshaw Hill Repowering	200 m	14
Hare Craig	Up to 230 m	8
Kennoxhead	145 m	19
Kype Muir Extension (Variation Application)	132 m + 152 m 156 m, 176 m, 200 m + 220 m	6 + 12 4, 3, 4 + 4
Lethans	5 at 176 m, 1 at 152 m, 9 at 149.9 m and 7 at 136 m	22

Site	Blade tip height of turbines	Number of turbines
Muirhouse Farm	51 m	1
M74 Eco-Park	98.2 m	2
North Kyle	149.9 m	54
South Priorhill Farm	130 m	1
Sunnyside	62 m	2
Mill Rig	250	6
In Planning		
Kennoxhead Extension	180 m	8
Kennoxhead II Extension (Penbreck)	7 at 220 m and 1 at 200 m	8 (note application to increase tip height of 6 of the consented turbines)
Lethans Extension	251 m	10
Sanquhar II	42 at 200 m and 2 at 149 m	44
At Scoping (adjacent to site)		
Bankend III	250 m	11

5.5 Potential Mitigation

5.5.1 Best practice guidance for EIA states that mitigation measures may include:

- avoidance of effects;
- reduction in magnitude of effects; and
- compensation for effects (which may include enhancements to offset any adverse effects).

5.5.2 The primary mitigation to be adopted in relation to the Proposed Development will be embedded within the design of the Proposed Development and will relate to the consideration that will be given to avoiding and minimising landscape and visual effects during the evolution of the Proposed Development layout. This is sometimes referred to as 'mitigation by design'.

5.5.3 To date, the layout of the Proposed Development has taken into consideration views and opinions of stakeholders through initial conversations and informal consultation. The current turbine and solar layout has evolved through the preliminary assessment of the infrastructure from a number of viewpoints closer to the site and comments received on the initial layouts. As a result, 19 of the turbines closest to Muirkirk are being considered for a reduction in tip height and an overall reduction in the solar search areas. Later iterations will be informed by further consultation with consultees and the local community taking into account any environmental constraints identified through further studies.

5.6 Potential Effects

5.6.1 The LVIA will consider the potential effects of the Proposed Development upon:

- individual landscape features and elements;
- landscape character;
- visual amenity and the people who view the landscape; and
- Landscape designations as appropriate.

5.6.2 The LVIA will considers the effects at three different stages in the lifetime of the Proposed Development:

- during construction of the Proposed Development;
- during the operational lifetime of the Proposed Development; and
- during decommissioning of the Proposed Development.

5.6.3 Effects during the first and third of these phases are considered to be temporary and would have a short duration. Effects associated with the operational phase of the Proposed Development are considered to be long term, reversible effects.

5.6.4 Following the judgement of the sensitivity of the landscape or visual receptor, the LVIA will provide a judgement as to the magnitude of change and the level of the effect experienced by each receptor, along with a statement to clarify whether the effect resulting from the Proposed Development is significant or not.

Assessment	Scoped In/ Out	Comment
Designated sites	✓	
Visual	✓	15 viewpoints will be used as the basis for determining the effects on visual receptors within the Study Area. Associated project infrastucture will be shown in photomontages for viewpoints within 5 km
RVAA	✓ ✓	Properties located within 2 km of all proposed turbines Include a separate Townscape Visual Assessment of Muirkirk
Turbine lighting	✓ x	Visual receptors (2 Virepoints selected) Landscape character
Cumulative	✓	20 km study area Scope out turbines under 50 m within 10 km of the site, and under 80 m over 10 km distance from the site

5.7 Scoping Questions for Consultees

- Do you agree with the proposed Study Areas?
- Do you agree with the proposed viewpoint locations? Do they cover all elements of the Proposed Development?
- Do you agree with the matters to be scoped out?
- Do you agree that the proposed scope of the assessment is appropriate?
- Are there any other wind farms you are aware of within the 20 km study area to be included the cumulative assessment?

6. Ecology and Nature Conservation

6.1 Introduction

6.1.1 The non-avian Ecological Impact Assessment (EcIA) will assess the potential for likely significant effects on Important Ecological Features (IEFs) (i.e. features above a certain conservation value) during the construction, operational and decommissioning phases of the Proposed Development. The EcIA will be presented within the Ecology and Nature Conservation chapter of the EIA Report.

6.1.2 The assessment of the avian baseline and potential impacts will be presented in a separate ornithological chapter (see **Chapter 7**).

6.2 Baseline Description

Habitats

6.2.1 The site comprises a main area of approximately 4,151 ha comprising principally of open moorland across the central and southern extents and commercial coniferous plantation within the northern extent of the site (**Figure 3.3**). It comprises a series of summits, including Priesthill Height which rises 493 m Above Ordnance Datum (AOD) at the entrance to the main site area, Spirebush Hill (469 m AOD) and Starpet Rig (451 m AOD) in the centre of the site, Middlefield Law (466 m AOD), Meanlour Hill and Bibblon Hill (431 m AOD) within the south of the site, and Auchengilloch (462 m AOD) and Goodbush Hill (475 m AOD) to the west and north of the site.

6.2.2 A number of watercourses traverse the site: The southern extent of the site is drained by the Polkebock Burn, Polbeith Burn, Slot Burn, Back Burn, Harwood Burn, Dippal Burn, Patrick Burn and Ponesk Burn, which form the Head of the Greenock Water at the centre of the site before flowing south and then west along the Greenock Water, located to the outside of the southern boundary of the site. The north-eastern extent of the site is drained by the Blaeberry and Kip Burns into the Logan Reservoir and into the Logan Water. The Powbrone Burn drains the forested area to the northwest of the site, flowing into the Glengavel Reservoir outside the site boundary. Area E for the hydrogen production facility is located by Alder Burn near the access road, east of the main development area.

Nature Conservation Designations

6.2.3 Parts of the Proposed Development areas (see **Figure 3.1**) overlap with the Muirkirk and North Lowther Uplands SPA, which is described in Chapter 7, and the Muirkirk Uplands SSSI, which in addition to bird interests (see **Chapter 7**) and earth science interests (see **Chapter 10**) is designated for blanket bog and its upland habitat assemblage. The Proposed Development site boundary also overlaps the Blood Moss and Slot Burn SSSI. Other statutory nature conservation designations are also present within 5 km of the site, as listed in **Table 6.1**.

Table 6.1 – Statutory nature conservation designations with non-avian ecological interests

Name	Distance from site	Size	Ecological Features	Condition (Date of Assessment)
Muirkirk Uplands SSSI	Overlaps with site	19,154 ha	Blanket bog	Unfavourable No change (October 2005)
			Upland assemblage – upland habitat	Favourable Maintained (October 2005)
Blood Moss and Slot Burn SSSI	Overlaps with site	162.49 ha	Blanket bog	Unfavourable No change (August 2014)

Name	Distance from site	Size	Ecological Features	Condition (Date of Assessment)
Airds Moss Conservation SAC	2.1 km southwest	1,360.22 ha	Blanket bog	Unfavourable No change (August 2016)
Coalburn Moss SAC	6 km east	223.65 ha	Active raised bog	Favourable Maintained (August 2012)
			Degraded raised bog	Unfavourable Recovering (August 2012)
Coalburn Moss SSSI	6 km east	224.35 ha	Raised bog	Unfavourable Recovering (October 2009)
North Lowther Uplands SSSI	8.7 km south	7,833.3 ha	Upland assemblage – upland habitat	Unfavourable Recovering (May 2015)
Miller's Wood SSSI	9 km east	12.92 ha	Upland birch woodland	Unfavourable Declining (May 2005)

6.2.4 In terms of non-statutory nature conservation designations, a small stand of woodland noted on the Ancient Woodland Inventory of semi-natural origin is located along the southern boundary of the site, around Middlefield.

6.3 Relevant Guidance and Legislation

6.3.1 The legislation and policies which are directly relevant to the assessment of ornithological and non-avian ecological effects have been summarised below. Refer to Chapter 4 (Planning and Policy Context), for planning policies relevant to the Proposed Development.

6.3.2 The assessment will be undertaken in line with the following legislation and guidance:

- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora ("the Habitats Directive") as transposed into Scottish law through The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- Conservation of Habitats and Species Regulations 2017;
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Wildlife and Natural Environment (Scotland) (WANE) Act, 2011 (as amended);
- The Protection of Badgers Act 1992, as amended by the Wildlife and Natural Environment (Scotland) Act 2011.
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- European Commission (2010) Natura 2000 Guidance Document 'Wind Energy Developments and Natura 2000'. European Commission, Brussels.
- Policy Advice Note PAN 1/2013 – Environmental Impact Assessment (Scottish Government 2013).
- National Planning Framework 3 (Scottish Government, 2014a);
- Scottish Planning Policy (SPP; Scottish Government, 2014b);
- The East Ayrshire Biodiversity Delivery Plan 2018-2020 (unless a more recent document will be published);

- The South Lanarkshire Biodiversity Strategy 2018-2022;
- The Scottish Biodiversity List (https://www.nature.scot/scotlands-biodiversity/scottish-biodiversity-strategy/scottish-biodiversity-list); and
- Relevant authority and local structure plans.

6.3.3 The following technical guidance and reference documents will also be considered as part of the assessment:

- Chanin P (2003). Monitoring the Otter Lutra lutra. Conserving Natura 2000 Rivers Monitoring Series No.10, English Nature, Peterborough;
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland, version 1.1 updated September 2019. Chartered Institute of Ecology and Environmental Management;
- Collins J (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London;
- Gurnell J, Lurz PWW, McDonald R and Pepper H (2009). Practical techniques for surveying and monitoring squirrels. Forestry Commission Practice Note FCPN011. Forestry Commission, Edinburgh;
- Hendry, K. & Cragg-Hine, D. (1997). Restoration of Riverine salmon habitats. Fisheries Technical Manual 4, Environment Agency, Bristol;
- JNCC (2010). Handbook for Phase 1 habitat survey - a technique for environmental audit. Revised re-print. Joint Nature Conservation Committee, Peterborough;
- Marine Scotland Science (MSS) (2021). Freshwater and diadromous fish and fisheries associated with onshore wind farm and transmission line developments: generic scoping guidelines;
- NatureScot, Natural England, Natural Resources Wales, RenewableUK, Scottish Power Renewables, Ecotricity Ltd, the University of Exeter and the Bat Conservation Trust (BCT) (2021). Bats and Onshore Wind Turbines – Survey, Assessment & Mitigation. Version: August 2021. NatureScot, Battleby;
- Scottish Renewables and others (2019). Good Practice during Wind Farm Construction. Version 4. A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science and the Association for Environmental and Ecological Clerks of Works;
- SERAD (2000). Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds ('the Habitats and Birds Directives'). Revised Guidance Updating Scottish Office Circular No 6/1995. Scottish Executive Rural Affairs Department;
- SNH (2016). Planning for development: What to consider and include in deer assessments and management at development sites, Version 2.
- SNH (2018a). Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland, Version 5. Scottish Natural Heritage;
- Oldham RS, Keeble J, Swan MJS & Jeffcote M (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal 10(4), 143-155;
- Rodwell JS (2006). National Vegetation Classification: Users' Handbook. Joint Nature Conservation Committee, Peterborough;
- Rodwell JS (ed) (1991 et seq.). British Plant Communities Volumes 1 – 5. Cambridge University Press;

- Scottish Badgers (2018). Surveying for Badgers: Good Practice Guidelines; and
- Scottish Environment Protection Agency (SEPA) (2010). Guidance for applicants on supporting information requirements for hydropower applications;
- Scottish Fisheries Coordination Centre protocol (2014). Scottish Fisheries Co-ordination Centre Electrofishing Team Leader Training manual. Inverness College. June 2007;
- Strachan R, Moorhouse T and Gelling M (2011). Water Vole Conservation Handbook 3rd edition. Wild CRU, Oxford.
- Summers, D., Giles, N. & Willis, D.J. 1996. Restoration of Riverine Trout Habitats: A Guidance Manual. Fisheries Technical Manual 1, R&D Technical Report W118, Environment Agency, Bristol.

6.4 Proposed Scope of Survey and Assessment

Consultation

6.4.1 NatureScot were consulted in April 2022 on the proposed ecology survey methodology and timings of ecological surveys at the Proposed Development. The consultation response received in May 2022 outlined a broad approval from NatureScot in terms of the scope, timing and number of surveys and all surveys proposed below took cognisance of the NatureScot response.

Study Area

6.4.2 The EIA Report will consider the following study areas[5]:

- **Nature conservation designations**: 10 km from potential works areas for SAC animal interests and SSSI bat interests, 5 km for other SACs and SSSIs, 2 km for local designations.
- **Habitats**: A minimum 250 m from potential deep (>1 m) excavations, such as turbine excavations and borrow pits for potential groundwater-dependent terrestrial ecosystems (GWDTE). 100 m from potential works areas for other habitats.
- **Bats**: A minimum 200 m plus rotor radius around potential turbine locations for roosting bats (NatureScot, 2021), 30 m from other potential works areas. 100 m around potential turbine locations for foraging and/or commuting bats.
- **Other protected mammals**: 300 m from potential works areas for otter (Chanin, 2003), but reduced to 150 m for other species, such as badger (Scottish Badgers, 2018), pine marten (Vincent Wildlife Trust, 2017) and water vole (Strachan *et al*., 2011). Study areas included an additional 50 m in addition to the outlined guidance to allow for micro siting of infrastructure (See **Figure 6.1**).
- **Amphibians:** 500 m from potential works areas for great crested newt (Oldham *et al*., 2000).
- **Reptiles**: *Ad hoc* records made during other survey work within 50 m of potential works areas.
- **Fish**: Potentially impacted streams, extending 100 m upstream and 500 m downstream of crossing locations, but for the hydrogen production facility this will extend from the proposed intake to the first major downstream confluence.

Studies

6.4.3 A comprehensive desk study will be carried out to confirm all nature conservation designations with non-avian ecological features. In addition, existing records of protected and otherwise notable species will also be identified within a 2 km radius. This work will be carried out using online sources, such as the National Biodiversity Network Gateway, the Scottish Biodiversity List (SBL) and the Local Biodiversity Action Plans (BAPs) as well as relevant schemes in the public domain, such as habitat

[5] It should be noted that 'survey area' is defined as the area covered by each survey type at the time of survey, whereas 'study area' is defined as the spatial extent of the consideration of effects on each species at the time of assessment.

and species data contained within the Environmental Statements for other schemes in the vicinity. In addition (but subject to scheme confidentiality restrictions) we will contact a range of relevant organisations for records, such as the South West Scotland Environmental Information Centre (SWEIC) which covers East Ayrshire, Glasgow Museums Biological Records Centre which covers South Lanarkshire, and the Scottish Wildlife Trust.

6.4.4 The following surveys are underway or scheduled:

- **Extended National Vegetation Classification (NVC) survey** in 2022: Although historical National Vegetation Classification (NVC) data available from Scotland's environment web[6] covers much of the site, this will be ground truthed and vegetation boundaries and/or community types updated, as appropriate, and the mapping extended to include all areas within the planning boundary, with the exception of areas of commercial forestry. The vegetation mapping will be done to the standard NVC methods in line with Rodwell (2006) with plant communities identified from representative quadrat samples with reference to the standard descriptions and constancy tables in Rodwell (1991 *et seq.*). The historic data to be updated includes the majority of the semi-natural habitats, whereas areas of conifer plantation or agricultural grasslands in the survey area will be mapped to the standard Joint Nature Conservation Committee (JNCC) *Phase 1 methodology* (JNCC, 2010). Target notes may also be produced to describe features with the potential to support protected or otherwise notable species that may require further survey or consideration in relation to the Proposed Development (other than those described below. To help inform the impact assessment (and to help inform peatland restoration proposals), Site Condition Monitoring of the SSSI blanket bog within the Proposed Development will also be carried out, using JNCC Common Standards Monitoring for Blanket Bog. This method is consistent with NatureScot methodology and will allow for useful supplementary up-to-date monitoring data for the assessment. This survey will be based on a total of 100 sample points distributed across mapped areas of upland blanket bog habitat (NVC communities M15, M16, M17, M18, M19, M20 and M25).Baseline habitat surveys will also consider areas of peatland restoration already undertaken in parts of the site.
- **Bat surveys**: The work will be undertaken in accordance with the NatureScot *et al* (2021) guidance. A bat desk study will be undertaken to collate any relevant bat information for an area extending to 10 km from the site boundary. An assessment of likely species assemblages will be undertaken based on the location of the site and known species ranges, with particular attention paid to edge-of-range species. An initial site walkover survey will subsequently be carried out across the survey area (site and a 250 m buffer) with the aim of identifying key areas or structures that may support roosting bats, e.g. buildings, bridges or trees, and require subsequent investigation. If potential roost sites are identified, then it may be necessary for additional emergence/re-entry surveys to be undertaken. In addition, areas that may provide suitable foraging or commuting areas will also be identified and used to inform the activity surveys. The emphasis of the NatureScot *et al* (2021) guidance is on a robust approach to static monitoring, using detectors deployed across the survey area. Surveys will capture a sufficient number of nights with appropriate weather conditions for bat activity (ideally above 8°C at dusk), low wind speeds and no or very light rain. Static detectors will be set to commence monitoring half an hour before sunset and finish half an hour after sunrise to ensure all bat activity is captured. The recommended minimum level of survey will be followed and includes the deployment of static detectors for a period of 10 nights in each of the seasons (Spring – April/May; Summer – June/July, and Autumn – August/September) backed up by further days if weather dictates. In line with the recent guidance survey effort will be focused on proposed turbine locations. Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites up to a maximum of 40 detectors for the largest developments, this will apply to the 72 turbine scoping layout for the Proposed Development.

[6] https://www.environment.gov.scot/

- **Protected mammal surveys**: A survey investigating for signs of protected mammals, such as otter, water vole, badger, pine marten and red squirrel, will be carried out with cognisance of standard methods (e.g., Chanin, 2003; Strachan *et al*., 2011; Scottish Badgers, 2018; O'Mahony *et al*., & 2006 Vincent Wildlife Trust, 2017; Gurnell *et al*., 2009). It will involve searching for field evidence, such as feeding signs, latrines and individual droppings, burrows, nests, footprints and obvious runways in vegetation and sightings of the animals themselves. Depending on the evidence recorded, further targeted survey could be required in line with the respective survey guidance.
- **Fisheries surveys**: This work will include a walkover survey of fish habitats to assess the productive potential of streams around proposed turbines, solar panel arrays and infrastructure, with an electrofishing survey to determine fish species present and their distribution within and around the Proposed Development. The habitat survey will be based on Environment Agency methods (Summers *et al*., 1996; Hendry & Cragg-Hine, 1997). For the electrofishing, the majority of sites will be surveyed semi-quantitatively according to the Scottish Fisheries Coordination Centre protocol (SFCC, 2014), with sites on Hall's Burn, Patrick Burn (Glengavel catchment), Powbrone Burn and tributaries, Back Burn (Auchingilloch), Kip Burn and Logan Water, Dippal Burn/Leaze Burn, Ponesk and Patrick Burns and Blackside Burn. A minimum of two sites will be fished fully quantitatively in order to provide a measure of survey efficiency. For the hydrogen production facility, survey methods will be similar to those required for abstractions for hydroelectric generation, as set out by SEPA (2010) and therefore also comprise an initial quantitative habitat survey to identify the extent and quality of fish habitats in the potentially abstracted reaches, followed by an electric fishing survey to determine the distribution and abundance of fish present. Due to their commercial and conservation value, the surveys will focus largely on salmonid species, but assessment of lamprey habitats and the presence of lamprey larvae are included in the scope. Noting that it is proposed that the hydrogen production facility will be supplied by the existing mains water supply at Conexus West.
- **Amphibian Surveys**: Habitat Suitability Index (HSI) (Oldham *et al*., 2000) assessments will be carried out to assess the habitat quality and quantity of any waterbody within 500 m of any Proposed Development infrastructure. The HSI incorporates ten suitability indices, all of which are known to affect the species. The suitability indices are derived from field scores, some of which are categorical and some numerical. For those waterbodies with a high score/category will then further surveyed or sampled using eDNA to try and identify presence or absence of Great Crested Newts (*Triturus cristatus*).

6.4.5 The assessment method will follow the process set out in the relevant provisions of *The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017* and guidance on implementation of the Habitats Directive (SERAD, 2000; SNH, 2018a).

6.4.6 In accordance with the CIEEM (2018) guidelines, the Ecology and Nature Conservation chapter for the Proposed Development will summarise the non-avian ecology baseline, with the findings of the survey work detailed in technical reports, which will be appended to the EIA Report. Features then will be evaluated using the CIEEM (2018) criteria, and features of local or higher value, denoted Important Ecological Features (IEFs), that may be susceptible to development at the site will be brought forward for an assessment of impacts during the construction, operational and decommissioning phases, assuming the presence of standard mitigation measures. Additional mitigation may then be identified where any significant impacts are predicted. The potential for cumulative ecological effects will also be assessed, which we consider will include other wind farm schemes within 10 km of the application boundary. Any significant (beneficial or adverse) residual effects will be clearly presented and discussed appropriately.

6.4.7 In terms of Habitats Regulation Assessment (HRA) the nearest Natura site designated for ecological considerations is Airds Moss SAC which is located 2.1 km from the site boundary. It is considered that the potential for significant effects on the qualifying features (i.e. blanket bog) is not likely because the blanket mire is not vulnerable to any hydrological impacts this far away. We therefore do not consider that a HRA will be required for this Natura 2000 site.

6.4.8 It is acknowledged that the Proposed Development will result in the direct loss of approximately 42 ha (figure includes 25% to account for indirect loss) of habitat from the total 26,832 ha of the SPA (around 0.16%). The Proposed Development will, in return, deliver a substantial SPA & SSSI Recovery and Management Fund capable of funding a number of habitat management measures to help reverse the decline of the SPA qualifying species, and support wider habitat and environmental benefits (notably through peatland restoration). These measures will also improve the condition of designated habitat features within the Muirkirk Uplands SSSI and the Blood Moss and Slot Burn SSSI.

6.4.9 Detailed proposals will also be outlined for habitat management to be implemented within the Proposed Development site itself during the 40 year operational phase of the Proposed Development. These will mainly focus on recovering the habitats of the SSSI which support SPA bird species in particular. There is also scope to commence habitat work in advance of construction (post-consent), and this opportunity will be explored further with stakeholders.

6.4.10 To help inform habitat mitigation and enhancement planning, a Peatland Restoration Feasibility Assessment (PRFA) will be undertaken to determine priority peatland restoration areas within the SPA which could be funded by the Proposed Development. As noted above, a Site Condition Monitoring (SCM) assessment of peatland habitats will also be undertaken across the Proposed Development site. These investigations, together with desk studies and consultation with landowners and managers will all contribute to formulating habitat mitigation and enhancement measures, designed to support the return of favourable conservation status for SPA and SSSI interests.

6.4.11 In addition, the Applicant will seek synergies where possible with the habitat management and enhancement works being implemented through wind farm and other developments in proximity, by helping ensure consistent delivery and integration of other habitat management obligations (for example, with the Dungavel and Kype wind farms). This has the potential to further build the scale of targeted conservation funding and action aimed at recovering the conservation status of the SPA and its underlying SSSIs.

Cumulative Effects

6.4.12 An assessment of cumulative effects will be undertaken following published guidance (SNH, 2018b). Cumulative effects on each feature relevant to this Proposed Development will be assessed in relation to other projects and activities subject to the EIA process within a relevant search area, and their effects on a relevant reference population; for example, at a Natural Heritage Zone (NHZ) level.

6.4.13 As it is anticipated that there will be no likely significant effects on SACs from the Proposed Development, it is not considered necessary to undertake an HRA 'in combination' assessment for any SACs.

6.5 Potential Impacts

6.5.1 The key ecology and nature conservation issues to be considered with respect to the Proposed Development are likely to include the following:

- habitat loss through land-take;
- fragmentation of existing habitats;
- direct mortality of fauna during construction, operation and decommissioning;
- behavioural changes of fauna during operation;
- disturbance to protected non-avian species during construction and decommissioning; and
- pollution via road drainage and runoff during all development phases.

6.5.2 Additionally, for species relying on aquatic resources potentially affected by watercourse crossing and surface water runoff, the following potential significant effects are also considered:

- point source and diffuse pollution;
- increased sediment loading;
- decreased habitat complexity;
- habitat fragmentation; and
- changes to discharge regime.

6.6 Mitigation

6.6.1 The potential mitigation requirements in relation to habitats have already been highlighted above at paras **6.4.9 to 6.4.11**. If it is considered that mitigation will be necessary to reduce any other adverse ecological effects, then an integrated mitigation and enhancement package will be proposed which will address ecological effects and which reflects local objectives in terms of biodiversity and achieving overall environmental gain through the Proposed Development. Mitigation will comprise embedded mitigation, fully integrated into standard design and construction measures, as well as additional targeted mitigation.

Mitigation Design

6.6.2 During the Proposed Development design and EIA process, mitigation measures will follow the recognised hierarchy of avoidance, reduction, enhancement, and compensation.

6.6.3 The layout of the Proposed Development has and will continue to evolve in order to avoid or limit direct or indirect effects on habitats of the highest ecological importance and sensitivity wherever practical.

6.6.4 Impacts on bats and proximity to bat habitat features of interest will be minimised by avoiding siting turbines so that blade tips do not come within 50 m of linear features (watercourses, woodland edges, hedges, etc) wherever possible.

During Construction

6.6.5 The NVC survey and species surveys that are currently ongoing and the subsequent assessment will identify and set out mitigation required in relation to habitats and protected or otherwise notable species. This will be done as part of a Species Protection Plan.

6.6.6 An outline Construction Environmental Management Plan (CEMP) will be developed to include protection and mitigation measures, as well as monitoring programmes, for all predicted and potential environmental impacts identified. The CEMP will be audited by a suitably qualified Ecological Clerk of Works (ECoW).

6.6.7 The risk of pollution from surface runoff to watercourses and aquatic habitats will be prevented by ensuring that runoff control measures, such as appropriate buffers as determined within the CEMP, interceptor drains and silt traps to assist in maintaining water quality, are in place.

During Operation

6.6.8 Areas of temporary infrastructure required during construction will be reinstated during construction and operation to allow the natural recolonisation of habitats. These areas will be assessed in terms of impacts within the EIA as temporary habitat loss resulting from the construction phase of the Proposed Development.

6.6.9 The results of the bat surveys will determine the mitigation requirements for the operational stage.

Habitat Condition and Future Management

6.6.10 As described in **Chapter 7**, the Muirkirk and North Lowther Uplands SPA comprises almost 27,000 ha of upland landscape, mostly within East Ayrshire but also covering parts of Dumfries and Galloway and South Lanarkshire. The SPA was originally designated in 2003, with a subsequent expansion in

2018 to cover a slightly larger area. It is designated for breeding and non-breeding hen harrier as well as breeding populations of short-eared owl, merlin, peregrine and golden plover. The current condition of the SPA is classified by NatureScot as being unfavourable for each of the qualifying species, with the exception of short-eared owl which has not been assessed since 1998. The poor condition is considered to reflect unsympathetic management on parcels of land adjoining the SPA, notably some pre-existing conifer plantations, wider factors affecting the qualifying bird species, but also more directly the absence of any sustained and co-ordinated purposeful conservation management across the SPA itself.

6.6.11 RSPB Scotland recently published a Conservation Action Plan (CAP) for the SPA. This describes the various negative pressures experienced by the SPA and suggests a range of management activities to counter them over time. For example, peatland restoration and sustainable grazing with predator control to establish a connected landscape of habitat mosaics suitable for upland bird species. It provides a long-term vision of how the SPA could be managed to better reflect the potential recognised by its original designation. However, it is understood that there is currently no long-term funding in place to deliver the CAP.

6.6.12 It is acknowledged that the Proposed Development will result in a loss of circa 42 ha of habitat from the total 26,832 ha of the SPA area (around 0.16%). It is considered that this loss would not have a measurable effect on the SPA qualifying species, given its poor condition (which is unlikely to improve under the status quo). The Proposed Development will, in return, deliver a substantial SPA & SSSI Recovery and Management Fund capable of funding a number of the management measures set out in the CAP to help reverse the decline of the SPA/SSSI. This will be enabled by using a proportion of the energy revenues. Although the precise fund administration and governance details will need further consideration, indicative estimates for the level of funding (in today's money) are c.£40 m for conservation management within the SPA/SSSI. This funding will be additional to rentals paid to landowners and to funding for site-specific mitigation measures (on-site Species and Habitat Management Plan) relating to direct habitat loss from infrastructure installation (e.g. access roads, hard standings etc.) within the Red Line Boundary of the Proposed Development. Some front-loading of funding of early capital investments will also be possible, rather than only ongoing operational activities (e.g. for habitat / peatland restoration). To inform peatland/habitat restoration potential across the SPA, a Peatland Restoration Feasibility Assessment (PRFA) will be undertaken to determine priority peatland restoration areas within the SPA which could be funded by the SPA & SSSI Recovery and Management Fund. The PRFA will therefore help ensure habitat restoration measures are well targeted and best able to deliver tangible ecological (and carbon) benefits. Some other illustrative suggestions of possible uses for the environmental funding arising from the Proposed Development have been set out in a separate discussion paper in **Appendix 7.2**.

6.6.13 Detailed proposals will also be outlined for habitat management to be implemented within the Proposed Development site itself during its 40 year operational phase, focussing on recovering the habitats for the benefit of the SPA's qualifying species (see **Chapter 7**). This management work will also benefit the designated habitat features and wildlife of Blood Moss and Slot Burn and Muirkirk Uplands SSSI's. To inform detailed Habitat Management Proposals for the Proposed Development site, a Site Condition Monitoring (SCM) assessment of Priority HMP areas will also be undertaken across the Proposed Development site as noted above. This piece of work will provide a detailed understanding of habitat condition across areas of notified blanket bog within the Red Line Boundary, including insights into key negative pressures on habitats. This information will be used to inform the assessment and habitat management recommendations for future recovery.

6.6.14 Lastly, it should be noted that the layout of the Proposed Development overlaps with one separate area of proposed habitat management for the operational Dungavel Wind Farm. The goal for this area was to clear fell conifer plantation within proximity to the Muirkirk and North Lowther Uplands SPA and provide additional habitat for foraging raptors, notably hen harriers. However, it is understood that the Dungavel HMP areas within the site boundary of that wind farm have not been implemented, and it is also understood that Dungavel Wind Farm are now in discussions with RSPB Scotland about delivering off-site works instead. It is therefore proposed to supersede this historic

Dungavel HMP area with a comprehensive new HMP for restoring and managing the habitats within the Proposed Development site and potentially more widely.

6.7 Potential Effects

IEFs Scoped Out of the Assessment

6.7.1 On the basis of experience from relevant studies and policy guidance or standards (e.g. SNH 2018a), the following IEFs are proposed to be 'scoped out' since significant effects are unlikely:

- Likely significant effects on any SACs;
- Habitats over 250 m from works areas;
- Common and/or low conservation species which are not recognised in statute as requiring special conservation measures; and
- Common and/or low conservation species not included in non-statutory lists, i.e. species that are not priority species on the Scottish Biodiversity List or local Biodiversity Action Plans.

Scoped In Potential Construction Effects

6.7.2 The following potential effects will be assessed:

- direct and indirect loss of habitats within the Muirkirk and North Lowther Uplands SPA, and Blood Moss and Slot Burn and Muirkirk Uplands SSSIs;
- direct and indirect loss of habitats, important plant species and potential groundwater-dependent terrestrial ecosystems (SEPA, 2017);
- habitat fragmentation and disturbance/displacement of faunal species;
- pollution events and sedimentation events; and
- death and injury, destruction/removal of habitat and/ or disturbance to protected and notable species including, but not limited to, bats, badger, otter, pine marten and water vole.

Scoped In Potential Operation Effects

6.7.3 The following potential effects will be assessed:

- Disturbance/displacement of non-avian protected species once turbines are in operation;
- Pollution events and sedimentation which may be caused as a result of site maintenance; and
- Injury or death to bat species due to turbine collision and/or barotrauma.

Potential Decommissioning Effects

6.7.4 Decommissioning is considered to result in similar potential significant effects to construction, although the magnitude of the impact is likely to be lower. This is based on the access tracks and hardstandings remaining in situ so there will be no impacts associated with their removal (such as sedimentation, further disruption to habitats etc). Decommissioning is therefore scoped out of the assessment.

6.8 Receptors and Impacts Scoped in or out of Assessment

6.8.1 **Table 7.2** below summarises the potential impacts proposed to be scoped in and out of the EIAR.

Table 7.2 - Receptors and Impacts Scoped In and Out

Receptor	Construction	Operation	Potential Impact
Designated Sites			
Blood Moss and Slot Burn SSSI	✓	✓	Loss / degradation / drying of habitats
Muirkirk Uplands SSSI	✓	✓	Loss / degradation / drying of habitats
Airds Moss SAC	X	X	No impact due to distance
Coalburn Moss SAC	X	X	No impact due to distance
Coalburn Moss SSSI	X	X	No impact due to distance
North Lowther Uplands SSSI	X	X	No impact due to distance
Miller's Wood SSSI	X	X	No impact due to distance
Ecological Feature			
Bats	✓	✓	Collision risk and habitat loss
Pine Marten	✓	✓	Displacement and habitat loss
Badger	✓	✓	Displacement and habitat loss
Otter	✓	✓	Displacement and habitat loss
Fish	✓	✓	Pollution / spills etc / Displacement and habitat loss

6.9 Scoping Questions to Consultees

- Is the scope of the proposed assessment, including proposed study areas, and approach to mitigation appropriate?
- Are there any other receptors that should be included in the assessment?
- Are there any other bodies or organisations who should be consulted with on the scope of assessments?
- Do the consultees wish to confirm the specific sites they want to be included in terms of cumulative impacts?
- Are you content that decommissioning effects are scoped out based on the assumptions outlined above?

7. Ornithology

7.1 Introduction

7.1.1 This section sets out the proposed approach to the assessment of potential effects on bird interests, specifically Important Ornithological Features (IOFs), during construction, operation and decommissioning of the Proposed Development.

7.1.2 The assessment of the non-avian baseline and potential impacts will be presented in a separate ecology chapter (see **Chapter 6**).

7.2 Baseline Description

Habitats

7.2.1 As described in **Chapter 6**, the main area of the Proposed Development site boundary covers approximately 4,151 ha, with the main habitat being open moorland, incised by a number of small burns, and with commercial conifer plantation in the northern part of the site. Detailed National Vegetation Classification (NVC) coverage is available for the whole site (excluding areas of commercial forestry)[7], and there are on-going surveys to validate and up-date this baseline habitat data. As described in **Chapter 6**, information is also being supplemented by Site Condition Monitoring surveys of peatland habitats on site. Further insights into the moorland and its management are being gained through consultation with the relevant farmers and land managers, with the aim of understanding long-term trends in sward structure and species composition that might influence breeding bird populations. The presence of several small burns on site has resulted in incised topography, with moorland slopes of different aspects and steepness present throughout. The site's altitude is lowest along the southern boundary of the site, where it borders the Greenock Water, rising to 493 m Above Ordnance Datum (AOD) at the entrance to the main site area from Cumberhead Forest.

Nature Conservation Designations

7.2.2 Parts of the Proposed Development site overlap with the north-eastern extent of the Muirkirk and North Lowther Uplands Special Protection Area (SPA) (see **Figure 3.1**), which is designated to protect breeding and non-breeding hen harrier and breeding short-eared owl, merlin, peregrine and golden plover. It also overlaps with part of the underlying area of the Muirkirk Uplands Site of Special Scientific Interest (SSSI), designated for its breeding bird assemblage, as well as breeding and non-breeding hen harrier and breeding short-eared owl, blanket bog and upland habitat assemblage. It is acknowledged that the Proposed Development will result in the combined direct and indirect loss of approximately 42 ha of habitat from the total 26,832 ha of the SPA (around 0.16%) but in return would yield around £40m of funding to invest in restoring the SPA towards favourable condition (see **Appendix 7.2**).

7.2.3 The statutory nature conservation designations with ornithological features present within 20 km of the site are listed in **Table 7.1**.

7 https://map.environment.gov.scot/sewebmap/?layers=eunisLandCoverScotland,natWoodSurvey,habmosNVCToAnnexIAndEUNIS,HabVegSurvey1,saltmarshSurvey1,habmos-OtherLanduse,coastalVegShingle1&extent=-245528,573191,665472,1169192

Table 7.1 – Nature conservation designations with ornithological interests[5]

Name	Distance from site	Size	Ornithological Features	Condition (Date of Assessment)
Muirkirk and North Lowther Uplands SPA	Overlaps with site	26,832.47 ha	Hen harrier (*Circus cyaneus*), non-breeding	Unfavourable Declining (December 2004)
			Hen harrier, breeding	Unfavourable Declining (July 2008)
			Short-eared owl (*Asio flammeus*), breeding	Favourable Maintained (July 1998 – has not been re-assessed since before designation)
			Merlin (*Falco columbarius*), breeding	Unfavourable No Change (July 2009)
			Peregrine (*Falco peregrinus*), breeding	Unfavourable No Change (August 2004)
			Golden plover (*Pluvialis apricaria*), breeding	Unfavourable Declining (June 2015)
Muirkirk Uplands SSSI	Overlaps with site	19,154 ha	Breeding bird assemblage	Favourable Maintained (August 2008)
			Hen harrier, breeding	Favourable Maintained (July 2008)
			Hen harrier, non-breeding	Unfavourable Declining (December 2004)
			Short-eared owl, breeding	Favourable Maintained (August 2002)
North Lowther Uplands SSSI	8.7 km south	7,833.3 ha	Breeding bird assemblage	Unfavourable No change (May 2015)
			Hen harrier, breeding	Unfavourable No Change (July 2008)

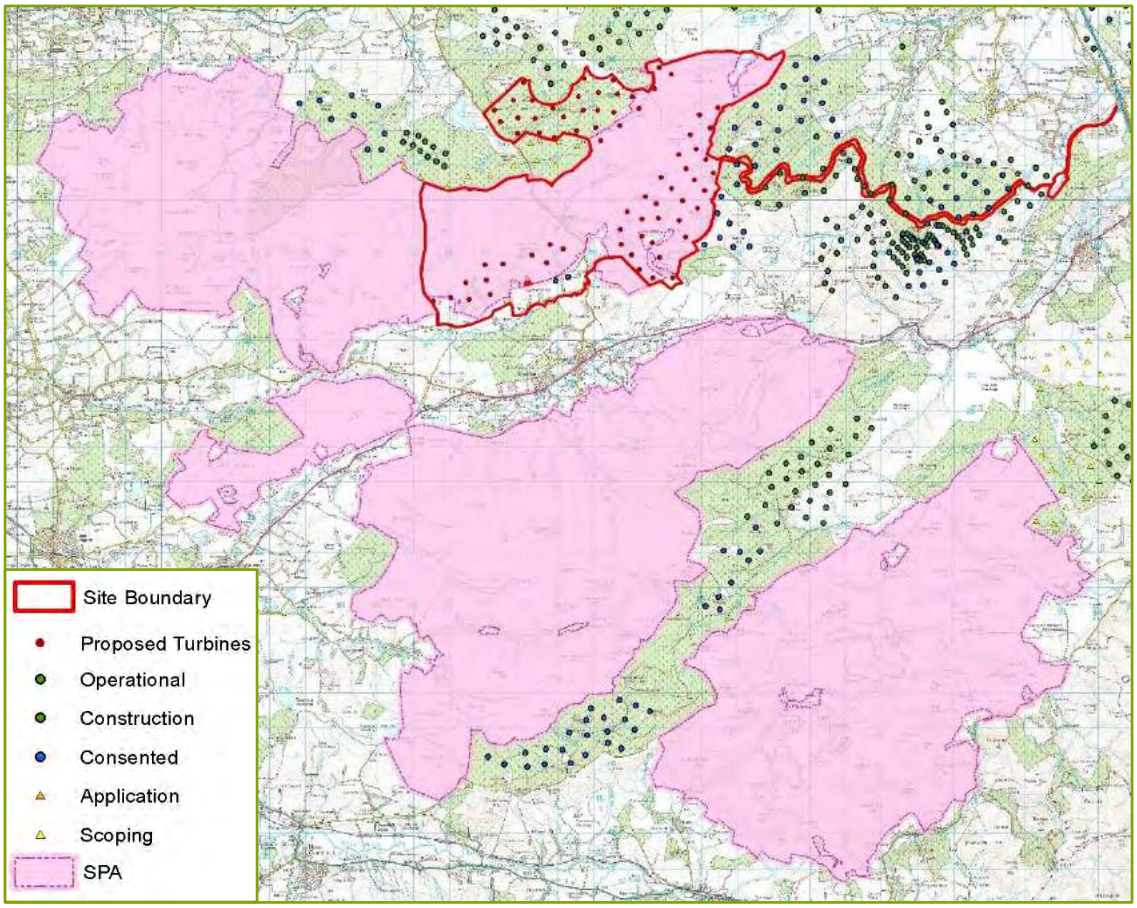
7.2.4 The condition of the SPA is classified by NatureScot as being unfavourable for each of the qualifying species, with the exception of short-eared owl which has not been assessed since 1998 as noted above. Negative pressures cited by NatureScot as being potentially responsible for the SPA's unfavourable condition include[8]:

- Climate change;
- Agricultural operations;
- Burning;
- Game/Fisheries management;
- Over grazing;
- Under grazing; and
- Forestry operations.

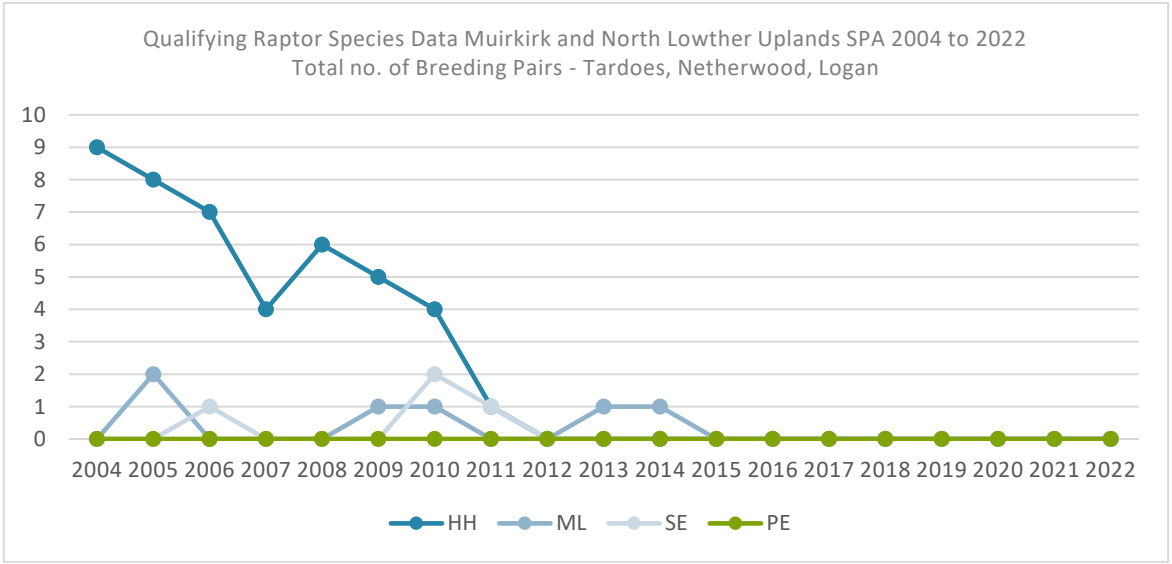
7.2.5 Survey and desk study data spanning almost two decades show that the baseline condition of the SPA, in terms of the breeding populations of qualifying species (and non-breeding in the case of hen harrier) has declined markedly since designation 20+ years ago. Evidence demonstrates that the number of breeding pairs of qualifying raptor species within the SPA in particular has dropped significantly since the year of designation.

[8] https://sitelink.nature.scot/site/8616

7.2.6 Notably, breeding pairs of hen harrier with the SPA have dropped from 21 breeding pairs in 2004 to 0 from 2016 onwards. The last known breeding attempt by hen harriers recorded within the entire 26,832 ha of the SPA (shown in the map below) was in 2016.



7.2.7 By way of example, the data below show the breeding activity of the qualifying raptor species within the north-easternmost part of the SPA comprising the landholdings of Tardoes, Netherwood and Logan (to the north-east of the village of Muirkirk) which form the parts of the SPA within the Proposed Development site boundary shown in the map above.



Source: South Strathclyde Raptor Study Group

7.2.8 According to data collected by the South Strathclyde Raptor Study Group, and further informed by desk study reviews of survey results from wind farm and other developments, hen harrier has not bred within the Proposed Development site boundary, or within 2 km of the site boundary, for over 10 years.

7.2.9 As the Proposed Development is partly located within the north-eastern extent of the Muirkirk and North Lowther Uplands SPA, it will need to undergo a Habitats Regulations Assessment (HRA) in line with the Habitats Directive, as transposed into domestic legislation by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) and the Conservation of Habitats and Species Regulations 2017, as they apply to applications under the Electricity Act 1989.

7.2.10 It has historically been common practice in HRAs to assess impacts on the populations of qualifying species as they were at the time of designation, whether they remain in that condition or not. The rationale being that site management aims to return SPA populations to historical abundances and therefore to favourable status at some point in time. However, in the case of the Muirkirk and North Lowther Uplands SPA, and in particular its north-eastern extent, this approach to defining the HRA baseline is not considered to be supported by evidence.

7.2.11 With the potential exception of short-eared owl, which has not been assessed since 1998, all SPA populations have been unfavourable for most of the 19 years since designation owing to a range of factors including habitat and land management changes. Analysis within a Conservation Action Plan (CAP) recently prepared by RSPB Scotland for the SPA considers these potential contributing factors, and also identifies that adjacent and regional land use patterns have also influenced the SPA bird populations. There also remain considerable issues regarding the threats to hen harrier populations at the regional, Scottish and UK scale which also need to be considered. There is no evidence of a recovery happening in SPA populations and therefore due to this combination of influences within this part of the SPA since designation (and more widely within and adjacent to the SPA), the baseline conditions at the time of designation of the SPA (data from late 1990s/early 2000s) do not represent a realistic or attainable target for this part of the SPA over the operational lifetime of the Proposed Development. A range of reasons for long term decline in the condition of a designated site are explored in a separate discussion paper which identifies potential funding solutions specific to this SPA (see **Appendix 7.1**).

7.2.12 The ornithological impact assessment, consideration of Likely Significant Effects, and the Habitats Regulations Assessment of the effects of the Proposed Development on the integrity of the Muirkirk and North Lowther Uplands SPA will therefore be based on a robust contemporary ornithological baseline, comprising such evidence combined with two years of ornithological surveys (2021 and 2022), completed in accordance with relevant NatureScot and other guidance[9] [10].

Muirkirk and North Lowther Uplands SPA Baseline – The 'Do-Nothing' Scenario

7.2.13 It is considered that the unfavourable condition of the SPA largely reflects the absence of funding for coordinated, cohesive and long-term conservation management. Funding for such management could in principle arise from a variety of sources. Extension of the neighbouring Hagshaw Energy Cluster into a small part of the SPA (0.16%) to advance key national priorities of climate change and energy security, whilst delivering substantial investment in nature conservation and local communities, offers a credible route to funding recovery of the wider SPA. By contrast, past experience shows that historic levels of public funding alone are inadequate and often too short-term. Similarly, competition with more iconic sites across (and beyond) Scotland makes this SPA relatively unattractive to private funders lacking personal connections to the area. Consequently, the likely trajectory of the SPA under the 'do nothing' scenario is one of continued underfunding and continued decline (see **Appendix 7.1** for further discussion on this point).

[9] SNH (2017). Recommended bird survey methods to Inform Impact Assessment of Onshore Wind Farms, Version 2. Scottish Natural Heritage

[10] European Commission (2020) Guidance Document on Wind Energy Developments and EU Nature Legislation Brussels, 18.11.2020 C(2020) 7730 Final Section 3.3

7.2.14 Whilst development on part of an environmentally designated site is not an insignificant matter, if the site otherwise evidently has ceased to retain populations of its qualifying species, and therefore the scientific basis for, and purpose of its designation, finding a solution to generate sufficient funding to reverse this failure is essential or the future of the designation (or parts of it) must surely be reviewed (i.e. designations and designation boundaries are not immutable over time).

7.3 Relevant Guidance and Legislation

7.3.1 The legislation and policies which are directly relevant to the assessment of ornithological and non-avian ecological effects have been summarised below. Refer to **Chapter 4** (Planning and Policy Context), for planning policies relevant to the Proposed Development.

7.3.2 The assessment will be undertaken in line with the following legislation and guidance:

- Directive 2009/147/EC on the Conservation of Wild Birds ("the Birds Directive") as transposed into Scottish law through The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
- The Conservation of Habitats and Species Regulations 2017;
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Nature Conservation (Scotland) Act 2004 (as amended);
- The Wildlife and Natural Environment (Scotland) (WANE) Act, 2011 (as amended);
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017;
- European Commission (2010) Natura 2000 Guidance Document 'Wind Energy Developments and Natura 2000'. European Commission, Brussels.
- European Commission (2020) Guidance Document on Wind Energy Developments and EU Nature Legislation Brussels, 18.11.2020 C(2020) 7730 Final
- Policy Advice Note PAN 1/2013 – Environmental Impact Assessment (Scottish Government 2013).
- National Planning Framework 3 (Scottish Government, 2014a);
- Scottish Planning Policy (SPP; Scottish Government, 2014b);
- The East Ayrshire Biodiversity Delivery Plan 2018-2020 (unless a more recent document will be published);
- The South Lanarkshire Biodiversity Strategy 2018-2022;
- The Scottish Biodiversity List (https://www.nature.scot/scotlands-biodiversity/scottish-biodiversity-strategy/scottish-biodiversity-list); and
- Relevant authority and local structure plans.

7.3.3 The following technical guidance and reference documents will also be considered as part of the assessment:

- Brown A & Shepherd K (1993). A method for censusing upland breeding waders, Bird Study, 40:3, 189-195.
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester;
- Gilbert G, Gibbons DW and Evans J (2011). Bird Monitoring Methods. RSPB, Sandy;
- Hardey J, Crick H, Wernham C, Riley H, Etheridge B and Thompson D (2013). Raptors: a field guide for surveys and monitoring (3rd edition). The Stationery Office, Edinburgh;

- JNCC (2004). Common standards monitoring guidance for birds, version August 2004. Joint Nature Conservation Committee;
- Scottish Natural Heritage (2010). Natura Casework Guidance: How to consider plans and projects affecting Special Areas of Conservation (SACs) and Special Protection Areas (SPAs), Version 9.0. February 2014. Scottish Natural Heritage (now NatureScot);
- Scottish Renewables and others (2019). Good Practice during Wind Farm Construction. Version 4. A joint publication by Scottish Renewables, Scottish Natural Heritage, Scottish Environment Protection Agency, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science and the Association for Environmental and Ecological Clerks of Works.
- SERAD (2000). Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds ('the Habitats and Birds Directives'). Revised Guidance Updating Scottish Office Circular No 6/1995. Scottish Executive Rural Affairs Department;
- SNH (2018a). Environmental Impact Assessment Handbook: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland, Version 5. Scottish Natural Heritage;
- SNH (2018b). Assessing the cumulative impacts of onshore wind farms on birds. Scottish Natural Heritage Guidance Note;
- SNH (2017). Recommended bird survey methods to Inform Impact Assessment of Onshore Wind Farms, Version 2. Scottish Natural Heritage;
- SNH (2016a). Assessing connectivity with Special Protection Areas. Scottish Natural Heritage;
- SNH (2016b). Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees, Version 2;
- SNH (2000). Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action. Scottish Natural Heritage;
- Stanbury A, Eaton M, Aebischer N, Balmer D, Brown A, Douse A, Lindley P, McCulloch N, Noble D, and Win I (2021). The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114: 723-747;

7.4 Proposed Scope of Survey and Assessment

7.4.1 As noted above, all SPA qualifying species (with the potential exception of short-eared owl) have been unfavourable for most of the 19 years since designation, and there have been significant land management changes within the SPA over that period, therefore the baseline conditions upon which the SPA was designated (data from late 1990s/early 2000s) are not considered to represent a realistic target for the SPA to return to in the lifetime of the Proposed Development. As described in **paragraph 7.2.4**, the cause of the decline may be a result of a range of negative pressures, specifically including changes in land management and farming practices within the SPA associated with the removal of grouse moor management from significant parts of the Proposed Development site and wider SPA between the time of designation and present. In the absence of significant and long-term external funding to artificially recreate previous management regimes which are no longer sustainable, it is not considered realistic that land management or farming practices, nor populations of qualifying species, will return to levels at the time of designation within the 40 year operational lifetime of the Proposed Development.

7.4.2 The ornithological impact assessment, consideration of Likely Significant Effects and the Habitats Regulations Appraisal of the effects of the Proposed Development on the integrity of the Muirkirk and North Lowther Uplands SPA will therefore be based on the robust contemporary ornithological baseline comprising desk study evidence combined with two years of ornithological surveys (2021

and 2022), completed in accordance with relevant NatureScot and other guidance[11] [12]. The evidence base used will include data from long-term raptor monitoring data carried out by the South Strathclyde Raptor Study Group, as well as assessment of habitat condition for the qualifying SPA species and their prey.

Consultation

7.4.3 NatureScot were consulted in April 2022 on the proposed ornithology survey methodology and timings for the full two years of surveys at the Proposed Development. The consultation response received in May 2022 outlined a broad approval from NatureScot in terms of the scope, timing and number of surveys and all surveys proposed below took cognisance of the NatureScot response.

Study Area

7.4.4 The EIA Report will consider the following study areas[13]:

- Nature conservation designations: 20 km from potential works areas for SPAs (there is just the Muirkirk and North Lowther SPA within this distance), Ramsar Wetlands and SSSIs, 2 km for local designations such as Local Nature Reserves (LNR's) and Local Wildlife Sites (LWS);
- Collision risk modelling: The results of the flight activity surveys will be used to inform collision risk modelling. A Collision Risk Analysis Area (CRAA) will be created from the turbine points using GIS Delunay triangulation[14] or similar process to create an 'at risk' area which will then be buffered by 500 m (as per SNH, 2017);
- Breeding raptors (including barn owl): 2 km from potential works areas (SNH, 2017);
- Black grouse: 1.5 km from potential works areas (SNH, 2017);
- Breeding upland waders and wintering waders, raptors, owls and wildfowl: 500 m from potential works areas (SNH, 2017);
- Cumulative assessment: As per SNH (2018b), the Natural Heritage Zone (NHZ) level is considered practical and appropriate for breeding species of wider countryside interest; and
- In-combination assessment (required as part of the HRA process): The SNH (2016a) guidance on SPA connectivity will be consulted to identify an appropriate study area on the basis of the SPA species scoped into the assessment.

Desk Study

7.4.5 A comprehensive desk study will be carried out to confirm all nature conservation designations with ornithological features. In addition, existing records of protected and otherwise notable bird species will also be identified within a 2 km radius. This work will be carried out using online sources, such as the National Biodiversity Network Gateway, the Scottish Biodiversity List (SBL) and the Local Biodiversity Action Plans (BAPs) as well as relevant schemes in the public domain, such as bird data contained within the Environmental Statements for other schemes in the vicinity. In addition (but subject to scheme confidentiality restrictions) contact will be made with a range of relevant organisations for records, such as the South West Scotland Environmental Information Centre (SWEIC) which covers East Ayrshire, Glasgow Museums Biological Records Centre which covers South Lanarkshire, and the Scottish Wildlife Trust.

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[11] SNH (2017). Recommended bird survey methods to Inform Impact Assessment of Onshore Wind Farms, Version 2. Scottish Natural Heritage

[12] European Commission (2020) Guidance Document on Wind Energy Developments and EU Nature Legislation Brussels, 18.11.2020 C(2020) 7730 Final, Section 3.3

[13] It should be noted that 'survey area' is defined as the area covered by each survey type at the time of survey, whereas 'study area' is defined as the spatial extent of the consideration of effects on each species at the time of assessment.

[14] Delaunay triangulation is a form of mathematical/computational geometry where a given set of points (in this case the turbine locations) are all joined to create discrete triangles. Further information is available here: https://uk.mathworks.com/help/matlab/math/delaunay-triangulation.html

7.4.6 In addition, and as part of the HRA process outlined above, a detailed desk study has been completed in consultation with the South Strathclyde Raptor Study Group (SSRSG) to compile historic breeding records of SPA qualifying species: hen harrier, merlin, short-eared owl and peregrine. The results of the desk study showed a clear pattern of nesting activity (principally by hen harrier) when that species did nest within this part of the SPA – last nest record in 2011. The vast majority of historic hen harrier nest records occurred along the central river valleys of the Dippal Burn, the Slot Burn, the Polbeith Burn and the Polkebeck Burn. This historic raptor nest data was mapped and used to create a 1.5 km buffer of the above watercourses as can be seen on **Confidential Figure 7.3**. Whilst no hen harrier breeding activity has taken place within the site, or 2 km of the site, within the last 10 years, the previously favoured locations have nonetheless been protected in the indicative layout of the Proposed Development. Consideration will be given to conservation management within those areas, as well as wider measures to re-establish and increase breeding populations of hen harrier in particular, within the SPA and more widely across the SPA network (refer to **paragraphs 6.6.10** to **6.6.14** and **Appendix 7.2**).

Field Studies

7.4.7 Site surveys began in April 2021 and will continue through to March 2023. The following studies, which are underway or scheduled, are being undertaken in line with the recommended guidance, in particular that issued by NatureScot (SNH, 2017) and the proposed methodologies approved by NatureScot in their initial consultation response in May 2022 (see **paragraph7.4.3**). Study areas for each of the surveys are shown in **Figure 7.1**.

Vantage Point (VP) surveys

7.4.8 Vantage Point (VP) surveys that will be completed include the 2021 and 2022 breeding seasons and the 2021-22 and 2022-23 non-breeding seasons. The work involves a minimum of 36 hours of survey per VP per season. Initially eight VPs were used to cover the application boundary which has been increased to eleven in April 2022 to include an additional area of forestry to the north-west of the site (see Figure 7.2). Winter VP surveys between September 2022 and March 2023 will comprise a minimum of three dawn and three dusk surveys at each VP with dusk surveys finishing 30 minutes after sunset in order to identify any roosting hen harrier within the viewsheds. All surveys are being completed by experienced and competent ornithologists including members of the SSRSG.

7.4.9 These surveys aim to identify the presence of species listed on the Birds Directive Annex 1, Wildlife and Countryside Act Schedule 1 or other notable species actively using the site and wider area, and involve recording flight heights and mapping flight lines.

7.4.10 As of the end of May 2022, a total of 13 target species had been recorded. Of the five Muirkirk and North Lowther Uplands SPA qualifying species (See **Table 7.1**) four have been recorded to date, with 14 registrations of peregrine, 13 registrations of hen harrier, 13 registrations of golden plover and six registrations of merlin. Given the size of the study area and the number of hours completed to date these results are considered to indicate a low usage of the site by the SPA species.

7.4.11 The most frequently recorded target species to date is curlew (90 registrations) with the only other three species with over 10 registrations being lapwing (12), snipe (12) and greylag goose (10). A further five species all recorded infrequently were black grouse (1), goshawk (2), osprey (2), pink-footed goose (98) and red kite (3).

Breeding raptor surveys

7.4.12 Surveys for raptors (including barn owl) were undertaken by SSRSG with cognisance of the methods described in Hardey *et al*. (2013) with four surveys undertaken each year in 2021 and 2022, throughout April, May, June and July.

7.4.13 The 2021 surveys concentrated on the areas within the Red Line Boundary (as per April 2021) while 2022 surveys covered the Proposed Development boundary and a 2 km survey buffer (**Figure 7.2**).

7.4.14 The results of the two years of raptor surveys did not identify the presence of any of the Muirkirk and North Lowther Uplands SPA qualifying raptor species breeding within the Proposed

Development boundary. A single record of breeding peregrine was confirmed within the 2 km survey buffer (outside the SPA boundary). Of other non-SPA raptor species, a possible goshawk breeding attempt was recorded within the Proposed Development and a red kite breeding attempt was recorded over 1.5 km from the Proposed Development boundary.

Breeding bird surveys

7.4.15 Breeding bird surveys, including the 2021 and 2022 breeding seasons followed a modified Brown and Shepherd (1993) survey method, designed for moorland/upland habitats, and involved four visits between mid-April to July, with a minimum of two weeks between survey visits, as per SNH (2017). The 2021 surveys covered the proposed turbine areas and a 500 m survey buffer (As of layout in April 2021), while survey in 2022 covered the Proposed Development boundary, extending beyond the boundary where access was available to cover all areas within 500 m of the proposed turbines. A walked transect was followed, visiting all the areas of suitable habitat within the site boundary and aiming to survey birds within 100 m of all parts of the study area. As per the NatureScot guidance the breeding bird survey has not covered areas of plantation forestry in the north of the site.

7.4.16 The breeding bird survey identified five breeding species of waders (common sandpiper, curlew, lapwing, oystercatcher and snipe). In the majority of the open moorland areas of the Proposed Development only two species (meadow pipit and skylark) were commonly recorded, a typical farmland, lowland and woodland assemblage were recorded in the remainder of the Proposed Development.

Wintering birds survey

Field Study

7.4.17 The wintering bird survey will comprise a combination of walkover and targeted "mini" VP surveys and will be completed between October 2022 and March 2023 in order to identify any winter roosting and/or foraging target species of raptor. The walkover portion of the survey will cover open areas of the site within 500 m of site infrastructure. The second section of the survey will comprise dusk VP surveys from targeted locations and aim to identify roosting hen harrier within areas of suitable habitat. The winter survey will comprise six survey visits spread throughout the winter season.

7.4.18 The VP section of the wintering bird survey comprises two hour duration dusk surveys that aim to finish 30 minutes after sunset, depending on the date of survey (as per Gilbert *et al*., 2012). Each mini VP will allow for views into areas located outside the viewsheds of the standard 11 VPs, and target habitat that is considered to be suitable for roosting hen harrier (i.e. rank grassland, deep heather and marshy grassland) that are within 2km of the site infrastructure. As mentioned above, the second winter season VP surveys are to be timed to capture hen harrier flights around any potential roost sites. The standard VPs provide good coverage to survey for potential roosting hen harrier within the viewshed areas (i.e. within the core survey area of the site). The wintering bird survey mini VPs will be used to cover any areas of suitable roosting habitat outside the viewsheds of the standard VPs within 2 km of proposed infrastructure. The winter walkover survey method will follow those recommended by Gilbert *et al.* (2012), as noted.

7.4.19 Additional winter roost surveys for any roosting SPA species will be completed dependant on the results of ongoing VP surveys. No known roosts are located in this area of the SPA, but given there is the possibility of small satellite roosts being present and should hen harrier, merlin or short-eared owl be recorded on site close to sunrise or sunset on either dawn or dusk surveys, then additional roost monitoring surveys will be carried out to identify and assess usage of any roost locations.

Desk Study

7.4.20 An initial desk study was completed to identify any historic hen harrier roosts within 2 km of the site works using publicly available information from nearby wind farm applications as well as any relevant data held by SSRSG and RSPB. The desk study will be updated with any additional publicly available data from these or other relevant bodies.

Black grouse surveys

7.4.21 Black grouse surveys were completed in suitable habitat between March and May 2022. Surveys were undertaken according to the method as detailed in Gilbert *et al.* (2011) as well as SNH (2017).

7.4.22 No evidence of black grouse leks were recorded during surveys.

Site condition monitoring

7.4.23 Assessment of habitat quality for qualifying SPA species and their prey are based on standard site Condition Monitoring protocols (JNCC, 2004). This assessment will be augmented by an analysis of broad vegetation change over time, notably the relative cover of heather and grassland dominated vegetation, obtained through air photo interpretation of historic aerial imagery available between the time of designation and present day, with any changes quantified using GIS. To help inform this analysis, reference will also be made to the NVC data for the SPA[15], compared to the up-dated NVC surveys being completed (see **paragraph 6.4.4**).

Key Sensitivities

7.4.24 On the basis of the surveys undertaken at the site to date, hen harrier, merlin, peregrine and golden plover are most likely to be considered in the EIA Report as Important Ornithological Features (IOFs, see below). Additional target species may be included depending on collision risk modelling results (which will be undertaken post design freeze).

7.4.25 In addition, there is obvious connectivity between the scheme and Muirkirk and North Lowther Uplands SPA and consequently the effects upon site integrity will be considered through the HRA process, as already noted.

7.4.26 Cumulative (and in the context of the HRA process, in-combination) effects will also be considered where relevant for all of the effects detailed below.

Methodology for Assessing Ornithological Features

7.4.27 The assessment method will follow the process set out in the relevant provisions of *The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017* and guidance on implementation of the *Birds and Habitats Directive* (SERAD, 2000; SNH, 2018a).

7.4.28 The EIA Report will include a chapter containing an Ornithological Impact Assessment (OIA). This will consider the potential direct, indirect and cumulative effects that the construction and operation of the Proposed Development could have on IOFs. This will include potential effects on statutory designated sites, excluding Muirkirk and North Lowther Uplands SPA (see below). The OIA will be supported by a technical appendix that will include all outputs from any collision risk modelling. Effects on IOFs will be assessed in relation to the species' conservation status, range and distribution. The assessment of potential effects will follow guidelines published by CIEEM (2018) and SNH (2017).

7.4.29 The assessment involves the following process:

- Identifying the potential effects of the Proposed Development;
- Considering the likelihood of occurrence of potential effects, where appropriate;
- Defining the Nature Conservation Importance (NCI) and conservation status of the bird populations present to determine overall sensitivity;
- Establishing the magnitude of the likely effect (both spatial and temporal);
- Assessing whether or not the identified effect is significant with respect to the EIA Regulation based on the above information;

[15] https://map.environment.gov.scot/sewebmap/?layers=habmosNVCToAnnexIAndEUNIS&extent=-298028,475191,719972,1268192

- Proposing measures to mitigate any potential effect determined to be significant;
- Proposing opportunities for habitat enhancement, where appropriate; and
- Reporting the residual effects after mitigation has been taken into account.

7.4.30 NCI is defined on the basis of the geographic scale (e.g. NHZ), and it is necessary to consider alongside each feature's conservation status, its distribution and its population trend based on available historic records, to provide an overall level of sensitivity. The importance of the site for the species (whether local, regional or national), based on the baseline data, will also be considered.

7.4.31 The significance of any potential effects will then be determined by integrating the sensitivity and magnitude, and the site's importance for the IOF.

7.4.32 A set of pre-defined significance criteria will be used in assessing the potential effects of the Proposed Development. It is necessary to establish whether there will be any effects which will be sufficient to adversely affect the feature to the extent that its conservation status deteriorates above and beyond that which would be expected should baseline conditions remain (i.e. the 'do nothing' scenario). Furthermore, these predictions will be given with a level of confidence relative to the effect being assessed where required (in line with CIEEM, 2018).

Methodology for Assessing Likely Significant Effects on Muirkirk and North Lowther Uplands SPA

7.4.33 The method for assessing the significance of a likely adverse effect on Muirkirk and North Lowther Uplands SPA is different from that employed for wider-countryside ornithological interests (detailed above).

7.4.34 The framework for the assessment is set through the Habitats Directive, as transposed into domestic legislation by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) and the Conservation of Habitats and Species Regulations 2017 which apply in relation to Energy Act applications. Guidance on HRA will be followed, including the latest European Commission (2020) on wind energy developments and EU nature legislation.

7.4.35 The Muirkirk and North Lowther Uplands SPA is failing to achieve a positive outcome for its qualifying species and there is no evidence (such as up-ward trends in nesting numbers) to suggest that qualifying bird populations will recover to the numbers that were present at the time of designation under a 'do-nothing' scenario, notably over the 40 year operational timespan of the Proposed Development (refer to **Appendix 7.1**). As set out in **paragraph 7.4.2**, it is therefore proposed that the baseline for the HRA is the current condition of this part of the SPA (as evidenced by the site-specific survey and desk-study data), and further evidence on the wider SPA as a whole.

7.4.36 It should be noted, however, that despite the absence of contemporary nesting, notably of hen harrier, within the site or within 2 km of it, as a precaution, as highlighted in **paragraph 7.4.6**, the proposed turbine layout and wind farm infrastructure has been designed to minimise the risk of disturbance and collision to hen harriers, should birds attempt to, or successfully nest in areas where nesting primarily took place historically. This combined approach of careful layout design, taking account of historically sensitive areas, and assessing the predicted effects of the Proposed Development against a comprehensive contemporary ornithological baseline that uses recent data (in accordance with NatureScot and other guidance) is therefore considered a reasonable, appropriate and robust approach, taking account of the best scientific evidence available at the time.

7.4.37 The assessment of effect of the Proposed Development on the integrity of the SPA will be set out in a Report to Inform an Appropriate Assessment (RIAA), which will be appended to the ornithology chapter of the EIA Report.

Cumulative/In Combination Effects

7.4.38 An assessment of cumulative effects will be undertaken following published guidance (SNH, 2018b). Cumulative effects on each feature relevant to this Proposed Development will be assessed in

relation to other projects and activities subject to the EIA process within a relevant search area, and their effects on a relevant reference population; for example, at an NHZ level for breeding species.

7.4.39 'In combination' effects on the SPA of relevant plans and projects will be assessed in the RIAA, taking account of all plans and projects with the potential to have a likely significant effect on the SPA.

7.5 Potential Impacts

7.5.1 The ways in which birds may be affected (directly or indirectly) by the construction, operation and decommissioning of the Proposed Development are:

- Direct habitat loss and subsequent displacement of ground nesting species through construction of the Proposed Development (e.g. turbine bases, tracks etc.);
- Indirect habitat loss due to birds avoiding the Proposed Development and its surrounding area. This may occur as a result of disturbance during construction and decommissioning, and maintenance and possible increased visitor disturbance during operation;
- Habitat modification due to associated changes in land cover (e.g. effects on hydrology leading to altered suitability for foraging, breeding, etc.);
- Barrier effects in which birds avoid the Proposed Development and are therefore forced to take alternative routes to feeding or roosting grounds;
- Death or injury to ground nesting birds through impacts during construction of the Proposed Development;
- Death or injury through collision with turbine blades, overhead wires (if any), met masts, or fences (if any) associated with the Proposed Development; and
- Any of the above effects acting cumulatively with those from other wind farm plans and projects (i.e. operational or consented developments and those currently in the planning process).

7.6 Mitigation

Design Mitigation

7.6.1 Potentially significant effects upon birds will be avoided or minimised where possible within the design process, through embedded mitigation, and through implementation of good practice during construction and operation of the Proposed Development.

7.6.2 The layout of the Proposed Development will avoid or limit removal of habitats used by SPA qualifying species to any significant degree, and will seek to enhance and restore priority habitats for these species within significant parts of the site, not utilised by the Proposed Development. The same principles also apply to the features of interest of the underlying SSSIs.

7.6.3 Where unmitigated likely significant effects on IOFs are identified, measures to prevent, reduce and where applicable mitigate these adverse effects will be proposed.

During Construction

7.6.4 Standard good practice (SNH, 2019) measures will be applied to minimise any potential effects on breeding birds during construction of the Proposed Development. Targeted mitigation (supported by appropriate monitoring to track its effectiveness) will also be put in place, in consultation with NatureScot. This would include (but is not limited to):

- checks for breeding raptors and golden plover by a suitably qualified ornithologist prior to works undertaken between February and July;
- appropriate buffers applied to any breeding attempts located; and

- additional mitigation measures dependent on the outcomes of a risk assessment and site-specific conditions e.g. reduced speed limits and personnel to remain in vehicles along identified sections of tracks.

7.6.5 A Breeding Bird Protection Plan (BBPP), will be produced to ensure that all reasonable precautions are taken to ensure the relevant wildlife legislation is adhered to.

7.6.6 Measures will also be put in place to monitor for any winter hen harrier roosts within potential disturbance distance, to ensure there are no potential effects on this species over this period.

During Operation

7.6.7 As highlighted above, it is acknowledged that the Proposed Development will have direct and indirect effects on habitat extent within the SPA. Mitigating the effects of this habitat loss on the SPA's qualifying bird species will therefore be a key objective of the mitigation measures included in the Proposed Development. To facilitate this, as also highlighted, the Proposed Development will generate significant long-term (40 year) funding of conservation measures to help bring about improvement in the conservation status of qualifying species of the SPA, and more widely potentially, in support of the wider SPA network for these qualifying species (see **Appendix 7.2**).

7.6.8 These measures, which will be formulated based on detailed habitat and other data, will be the subject of consultation with statutory and non-statutory conservation stakeholders, with input from relevant local landowners and farmers so delivery can be ensured.

7.6.9 These mitigation measures will be subject to a Species and Habitat Management Plan which will form part of the Proposed Development, to mitigate potential significant negative effects of the Proposed Development on IOFs, including the SPA itself and ornithological features of underlying SSSIs.

7.6.10 As well as the mitigation works, there will also be a wider range of environmental enhancement measures put in place, aimed at restoring peatlands for habitat and carbon storage purposes, improving riparian habitats, and developing local conservation management training and employment opportunities.

7.6.11 Although not specifically mitigation itself, the implementation of the Species and Habitat Management Plan will be supported and evaluated through sustained targeted monitoring of birds, avian prey abundance and habitat condition. Again, training and employment opportunities will be sought in delivering this work, with an active role proposed for the South Strathclyde Raptor Study Group in particular.

7.6.12 The financing of the wider SPA habitat management and monitoring will be through a SPA & SSSI Recovery and Management Fund, the regulation and operation of which will be governed as agreed by stakeholders, specifically South Lanarkshire and East Ayrshire Councils, NatureScot and RSPB Scotland (see **Appendix 7.2**). The planning and reporting of conservation works will operate on an annual cycle, with proposed measures and budget for the year ahead agreed each December of the Proposed Development's operational life. Once work is underway, following the first year of operation, the status of works completed, monitoring results and financial accounts will also be reported each December as well.

7.6.13 Improving the conservation status of the SPA's qualifying species is clearly a complex process and will require much greater investment and a much more targeted approach to conservation management than has been the case through current mechanisms. For example, whereas habitat management needs to be sustained over the long-term to achieve environmental improvements, conditionality requirements can change over time and land can fall in-and-out of short-term agri-environment schemes (with land managers able to pick and choose which schemes they do or do not enter), meaning that gains in one period can subsequently be lost.

7.6.14 Similarly, effective conservation action often needs to operate at a landscape scale (e.g., for habitat mosaics and connectivity), yet as described in the RSPB Scotland CAP document, agri-environment scheme membership and conditionality requirements tend to be at the individual farm-level rather

than being co-ordinated across neighbouring farms. Equally, conditionalities and scheme prescriptions are often relatively inflexible rather than being adaptable to local circumstances (including year-on-year variation) and are not always well targeted to achieve meaningful results. In light of these factors, and sustained public-sector budgetary constraints, there is presently limited realistic prospect of adequate long-term funding to restore the SPA condition to favourable status, or for action to support the wider SPA network for these qualifying species under the 'do nothing' scenario.

7.6.15 The Proposed Development therefore presents a significant opportunity through long-term landowner commitment and private investment in targeted sustained conservation management and wider environmental enhancement to underpin delivery of a number of the aims and objectives of the CAP, along with other measures, to help restore the SPA and create a positive new future for the designated area, whilst also delivering a transformative level of investment in the regeneration of neighbouring coalfield communities.

7.6.16 This part of south-west Scotland has struggled to create new opportunities following the demise of the coal industry which was once the beating heart of this area. Against that backdrop and in the context of the failed outcome of the SPA designation, and the Climate and Biodiversity Emergencies (and the Energy Crisis), together these circumstances create a compelling opportunity to explore an expansion of the neighbouring Hagshaw Energy Cluster to fund improvement of the SPA's conservation status in tandem with securing other environmental, social and economic benefits to the wider Muirkirk Valley and the Sandford/Lesmahagow areas.

7.6.17 As highlighted, the Applicant proposes to work in partnership with local farmers, landowners, and in close collaboration with nature conservation bodies, the local community and other stakeholders to further develop the Proposed Development. It will seek to build on the collaborative working approach at the Hagshaw Energy Cluster to date and expand the environmental and economic benefits being delivered at that Cluster westwards to Muirkirk and northwards to Sandford and Lesmahagow areas.

7.6.18 This innovative Proposed Development will ensure that this large area of hill ground to the north of Muirkirk is delivering more for nature, more for climate, and more for people. The strategic scale of the project will deliver a transformational level of investment in the natural environment to support the recovery of an SPA in long term decline, as well as a transformational level of investment in the local economy to regenerate coalfield communities. The Western Expansion of the Hagshaw Energy Cluster therefore embodies the aims and objectives of Scotland's Just Transition to a fairer, greener Scotland by helping to deliver:

- More investment in nature recovery, peatland restoration and designated sites;
- More renewable energy; and
- More vibrant rural communities.

7.7 Potential Effects

Construction Effects

7.7.1 Based on the available information to date from baseline surveys and the preliminary results from the desk-based study, the following construction effects are likely to be assessed:

- Direct and indirect habitat loss, habitat alteration and habitat fragmentation associated with the Proposed Development, including loss of nesting habitat for target species (SPA qualifying species); and
- disturbance to SPA qualifying species and other breeding birds from construction and decommissioning activities and, in the case of hen harrier, any winter roosting activity as well.

Operational Effects

7.7.2 Based on the available information to date from baseline surveys and the preliminary results from the desk-based study, the following operational effects are likely to be assessed:

- displacement of target species (SPA qualifying species) around operational turbines; and
- potential collision risks associated with operational turbines for IOFs (notably Schedule 1, Annex 1 and other breeding waders).

Species Scoped Out of the Assessment

7.7.3 On the basis of experience from relevant studies and policy guidance or standards, the following species are likely to be 'scoped out' because significant effects are unlikely:

- Common and/or low conservation species not recognised in statute as requiring special conservation measures, i.e. they are not listed in Annex 1 of the Birds Directive or Schedule 1 of the Wildlife & Countryside Act 1981 (as amended);
- Common and/or low conservation species not included in non-statutory lists of birds whose populations are at some risk either generally or in parts of their range, i.e. they are not Red or Amber-listed Birds of Conservation Concern species (Stanbury *et al*., 2021); and
- Passerine species, not generally considered to be at risk from wind farm developments (SNH 2017), unless being particularly rare or vulnerable at a national level.

7.7.4 Decommissioning is considered to result in similar potential significant effects to construction, although the magnitude of the impact is likely to be lower. This is based on the access tracks and hardstandings remaining in situ so there will be no impacts associated with their removal (such as further disruption to habitats etc). Decommissioning is therefore scoped out of the assessment.

7.8 Receptors and Impacts Scoped in or out of Assessment

7.8.1 **Table 7.2** below summarises the potential impacts proposed to be scoped in and out of the EIAR.

Table 7.2 - Receptors and Impacts Scoped In and Out

Receptor	Construction	Operation	Potential Impact
Designated Site			
Muirkirk and North Lowther Uplands SPA	✓	✓	Impact on qualifying species/loss of habitat
Muirkirk Uplands SSSI	✓	✓	Impact on qualifying species/loss of habitat
North Lowther Uplands SSSI	✓	✓	Impact on qualifying species.
Ornithological Feature			
Hen Harrier	✓	✓	Collision and disturbance/ displacement
Peregrine	✓	✓	Collision and disturbance/ displacement
Merlin	✓	✓	Collision and disturbance/ displacement
Short-eared owl	✓	✓	Disturbance/ displacement
Golden Plover	✓	✓	Collision and disturbance/ displacement

Receptor	Construction	Operation	Potential Impact
Breeding waders (common sandpiper, curlew, lapwing, oystercatcher, snipe)	✓	✓	Collision and disturbance/ displacement
Black grouse	X	X	Not considered to be breeding in the Proposed Development
Breeding bird assemblage	✓	✓	Disturbance/ displacement
Geese	X	X	Occasional presence and over 20 km from any goose SPA.
Other non-target species -Gulls/ Common Raptors/ Raven/ducks etc	X	X	Only present at the site in low numbers.

7.9 Scoping Questions to Consultees

- Is the scope of the proposed assessment, including proposed study areas, and approach to mitigation appropriate?
- Do you agree with the scope of species being included in the assessment and the associated surveys?
- Are there any other bodies or organisations who should be consulted with on the scope of assessments?
- Do the consultees wish to confirm the specific sites they want to be included in terms of cumulative impacts?
- Are you content that decommissioning effects are scoped out based on the assumptions outlined above?
- Do you have any suggestions relating to the scope and objectives for the Proposed Development's mitigation and enhancement, including the Species and Habitats Management Plan and the SPA & SSSI Recovery and Management Fund.

8. Noise and Vibration

8.1 Introduction

8.1.1 This chapter considers the potentially significant effects of noise during the site preparation and construction, operation, and decommissioning phases of the Proposed Development which will require further consideration within the EIA Report.

8.1.2 This Scoping chapter sets out the key issues identified and proposes a method and standards for assessment of noise in the EIA Report.

8.1.3 Consultation with East Ayrshire Council (EAC) and South Lanarkshire Council (SLC) Environmental Health Officers (EHOs) will continue throughout the assessment process to agree the following:

- the status of identified potential Noise Sensitive Receptors (NSRs);
- noise monitoring positions for the baseline survey;
- identification of potentially cumulative developments and a detailed method for the consideration of potential cumulative effects; and
- the derivation of appropriate ETSU noise limits, with apportionment for cumulative developments if appropriate.

8.1.4 We assume that SLC and EAC EHOs will work together during the consultation process to avoid duplication of communications.

8.2 Baseline Description

8.2.1 A review of maps and aerial images has identified that the site and surroundings comprise a mixture of farmland, forestry and moorland. The surrounding area has been subject to extensive wind farm development, with consented and operational developments noted to the north, east and south.

8.2.2 Based on our review of the available information and knowledge of the area we anticipate that the baseline noise environment will be dominated by the wind, wildlife and livestock, with wind turbine noise a significant contributor close to existing wind farms. The 'future baseline' will include noise from wind turbines which have been consented but not yet built.

8.2.3 Road traffic and other anthropogenic sources are likely to be a greater contributor to background noise levels around Muirkirk and Glenbuck, to the south of the site.

8.3 Guidance and Legislation

8.3.1 The following documents will be referenced in the EIA Report chapter:

- The Control of Pollution Act (CoPA) 1974;
- Planning Advice Note (PAN) 1/2011: Planning and Noise;
- Scottish Government Onshore Wind Turbines: Planning Advice;
- The Working Group on Noise from Wind Turbines: The Assessment & Rating of Noise from Wind Farms (ETSU-R-97) (1996);
- Institute of Acoustics (IoA) Bulletin Article Volume 34 No. 2, March / April 2009;
- Institute of Acoustics (IoA) (2013) A good practice guide to the application of ETSU-R-97 for wind turbine noise assessment (IoA GPG) and associated Supplementary Guidance Notes (SGS);
- British Standard BS5228 (2009) Part 1: Noise + A1 (2014) Code of practice for noise and vibration control on construction and open sites;

- British Standard BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound;
- Design Manual for Roads and Bridges (DMRB); and
- Calculation of Road Traffic Noise (CRTN).

8.3.2 Where EAC and SLC have their own noise-related requirements, these will also be considered in the EIA Report chapter. We request that any such requirements should be highlighted in the Scoping response.

8.4 Study Area

8.4.1 The Study Area has been informed by preliminary modelling of the wind turbines of the Proposed Development. The 35 dBL_{A90} noise contour is shown in **Figure 8.1**, for operation in isolation. A selection of representative NSRs is shown, but the final list of NSRs will be agreed with the EHOs following a review of maps of the area, cumulative noise predictions and a site visit. **Figure 8.1** also shows the 32 dBL_{A90} contour, representing the 35 dBL_{A90} contour, plus a worst-case correction for concave topography (see **paragraph 8.5.10**).

8.4.2 Wind turbines are likely to be the noisiest component of the Proposed Development, however, we note that noise from the solar, energy storage and hydrogen fuel components of the project, including associated road traffic movements, will also require assessment. The overall study area has therefore been defined based on the 35 dBL_{A90} noise contour from the wind turbines, and localised study areas will be identified for the consideration of these other aspects.

8.5 Assessment Method

Construction

8.5.1 Potential impacts from construction noise and, where appropriate, vibration, will be assessed at the closest identified NSRs. Predictions of noise will be based on the likely site preparation and construction methods and programme. Where appropriate, the assessment of construction noise will also consider off-site activities such as construction traffic and deliveries, where the necessary information is available. Construction noise can be effectively controlled by employing appropriate best-practice methods and limiting hours of work at sites close to Noise Sensitive Receptors (NSRs).

Operation

8.5.2 We will consult directly with the EAC and SLC EHOs to agree the detailed method of assessment for each aspect of the project, however the general approach is outlined below.

Wind turbine noise

8.5.3 The identity of the closest NSRs will be agreed and any financial involvement established. Any relevant wind energy schemes that should be included in the cumulative assessment, whether in planning, consented or operational, will also be identified and agreed. Potentially cumulative wind turbine developments will be excluded on the basis of a 10 dB difference in noise emissions at relevant NSRs, where this can be demonstrated through prediction.

8.5.4 A baseline noise survey will be undertaken in accordance with the IoA GPG for NSRs where the baseline noise environment does not include wind turbine noise. Wind speed measurements will be collected, likely by a remote-sensing SoDAR or LiDAR device, and standardised to 10 m in accordance with the method provided in the IoA GPG. Micro-siting of the baseline survey locations will seek to exclude influence from non-representative noise sources such as plant, boiler flues, heat pumps, vegetation and any existing wind turbines. A record of the installation of monitoring locations will be provided to the EHOs for review following the commissioning visit.

8.5.5 Daytime and night-time operational overall noise limits will be derived from measured background noise levels at the closest identified NSRs across the range of critical wind speeds (typically 4 – 12 m/s) in accordance with ETSU-R-97 and any specific requirements of EAC and SLC. Records of the baseline data analysis will be provided to the EHOs, identifying periods of rainfall excluded from the analysis and any other treatments of the data.

8.5.6 Given the extensive wind farm development to the north and east of the site, we anticipate that it will not be possible to measure background noise levels in the absence of wind turbine noise at NSRs in these areas. Background noise levels at such NSRs will therefore be agreed through consultation with EHOs. The basis for such agreement will be reported background noise levels measured during baseline measurement campaigns for cumulative developments.

8.5.7 Analysis of predicted noise levels at NSRs affected by cumulative developments will be undertaken to identify controlling properties, in accordance with the methods provided in the IoA GPG. Apportionment of overall noise limits will be undertaken to determine residual noise limits specific to the Proposed Development, taking account of available headroom. This process will be agreed through consultation with EHOs at each stage.

8.5.8 Derived noise limits will be applied at NSRs using monitoring locations as proxies. The approach to allocating proxy data to NSRs will be agreed with the EHOs.

8.5.9 A candidate turbine will be selected for the Proposed Development, the verified noise emission details of which will be reproduced in the EIA Report chapter (A-weighted and octave band data) for critical wind speeds.

8.5.10 Noise levels will be predicted within CadnaA noise modelling software, in accordance with the ISO9613 method and the IoA GPG requirements. Corrections for concave topography and topographic screening corrections line-of-sight visibility will be applied to predicted noise levels in accordance with the IoA GPG, where applicable. The two corrections will be assumed not to apply simultaneously, i.e. where topographic screening occurs, it will be assumed that concave topography corrections will not also apply.

8.5.11 Corrections for directivity may be applied within the cumulative assessment in accordance with the guidance set out in the IoA GPG, where appropriate, e.g. where NSRs lie between two developments and where simultaneous down-wind predictions are therefore overly conservative.

8.5.12 Predicted levels will be evaluated against agreed noise limits and the magnitude of impact and significance of effect determined accordingly. All residential NSRs will be assumed to be of high sensitivity. The sensitivity of any other types of receptors identified will be agreed with the EHOs.

Other noise sources

8.5.13 Noise from solar, energy storage and hydrogen production facilities will be evaluated in accordance with BS4142. Background noise levels will be characterised using data collected during the wind farm baseline monitoring campaign, supplemented by additional attended measurements where appropriate.

8.5.14 Road traffic noise, in particular that arising from Heavy Goods Vehicles (HGVs) accessing the hydrogen plant, will be evaluated in accordance with CRTN and DMRB criteria. CRTN measurements will be undertaken to characterise the source level of roads where changes in traffic flows are projected to exceed DMRB criteria.

8.6 Proposed Mitigation

8.6.1 We anticipate that key controls for construction noise such as core hours of works would be exerted through the requirements of the EHOs and that such controls would constitute effective mitigation measures.

8.6.2 Site-specific mitigation measures will be outlined to reflect the principles of Best Practicable Means, as set out in the Control of Pollution Act (CoPA) 1974. The purpose of these measures will be to reduce construction noise and, where relevant, vibration impacts insofar as is reasonably practicable.

8.6.3 Mitigation of operational noise from the solar, energy storage and hydrogen production facilities may include the careful selection of plant and equipment and/or the provision of noise barriers/acoustic enclosures.

8.6.4 Where predicted operational noise levels exceed the proposed noise limits at any wind speed, outline mitigation strategies will be proposed. Mitigation of operational noise, if required, may include an alternative selection of turbine, operating certain turbines in low noise modes under certain meteorological conditions, such as specific wind speeds and directions.

8.7 Potential Impacts

8.7.1 The Proposed Development will introduce new noise sources into the area, both during the construction and operational phases. Significant adverse impacts can be prevented by restricting noise levels from the Proposed Development to within noise limits determined in accordance with appropriate guidance, as detailed above.

8.8 Receptors and Impacts Scoped In or Out of Assessment

8.8.1 No NSRs have yet been scoped out of the assessment, however, the status of potential NSRs will be confirmed during site visits and through consultation with the EHOs. Where properties are determined to be derelict and uninhabitable, they may be scoped out of further assessment.

8.8.2 Should any blasting be required for borrow pits, it is unlikely that the charge parameters will be known at the time of the assessment. We therefore propose to scope out detailed assessment of potential vibration impacts, and instead commit to meeting appropriate vibration limits at NSRs should blasting be required. We anticipate that such a commitment could be agreed through an appropriate planning condition.

8.9 Scoping Questions to Consultees

- Do you accept the proposed assessment methods and study area?
- Given the size and generating capacity of the Proposed Development, we consider that the upper (40 $dBL_{A90,10min}$) fixed minimum daytime ETSU noise should apply, do you agree?; and
- Do you consider the 43 dBLA90,10min fixed minimum ETSU noise limit to be appropriate during the night-time period? If not, what fixed minimum limit would you propose?
- Are you content that decommissioning effects are scoped out based on the assumption that effects will be similar or less than during construction?

9. Cultural Heritage

9.1 Introduction

9.1.1 This section provides an overview of the Archaeology and Cultural Heritage context for the Proposed Development. It sets out the relevant legislative and policy framework and the guidance relevant to the EIA. The methodology that will be employed in the assessment is set out and an initial description of the baseline is also provided.

9.2 Baseline Description

9.2.1 A desk-based assessment, drawing on existing archive records (South Lanarkshire Historic Environment Record (HER), curated by West of Scotland Archaeology Service (WoSAS)) and designation records maintained by Historic Environment Scotland (HES) and historic maps, has been carried out to identify sites and areas that have archaeological and historic environment potential. The locations of these sites are shown on **Figure 9.1**.

Inner Study Area (see below (9.4.2) for definition)

Designated Heritage assets

9.2.2 There are two Listed Buildings that lie within the Proposed Development site: (Category B Listed Auchingilloch Monument (LB 1279) and Category C Listed Martyr's Grave, Priesthill (LB 14395)).

9.2.3 There are no other designated heritage assets within or intersecting with the Inner Study Area.

Non-designated Heritage Assets

9.2.4 The WoSAS HER contains records for 82 individual elements of 55 non-designated heritage assets within the Proposed Development site. Eight of these are classed as NSR sites (potentially of national importance) and include a limestone quarry (12141) of post-medieval date, a burnt mound (9686), of prehistoric date, and two nearby pairs of enclosures (9684 and 9687) of medieval date, at least one of which (9684) has been found to contain evidence of earlier (bronze Age) settlement.

9.2.5 Other heritage assets recorded within the Inner Study Area include a possible house platform and six cairns (potentially of prehistoric date), along with a grouping of flint artefact find-spots of prehistoric date along the Powbrone Burn, recorded in around 1980-1. Other sites recorded include farmsteads and field systems of medieval or post-medieval date along with sheepfolds and stock enclosures, rig and furrow cultivation plots, and field systems enclosed within banks, recorded during surveys by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) in the early 1990s. Probable shieling huts and two possible shepherds' cairns have also been recorded.

9.2.6 The main concentrations of recorded heritage assets are in Area C and along the Powbrone Burn in Area A.

9.2.7 Preliminary assessment of Ordnance Survey 1st maps (1860-4) shows the Proposed Development Area as being predominantly unenclosed moorland/rough pasture. Eight farmsteads are marked along with 26 sheepfolds. Four further sheepfolds are shown on the 2nd edition maps (1898-9). The historic map evidence shows that the Proposed Development Area has historically been largely used for sheep grazing, with farmsteads located along the lower lying ground close to the Greenock Water.

Outer Study Area (see below (9.4.2) for definition)

9.2.8 Preliminary assessment of the HES designations database shows that, there are 13 other Scheduled Monuments within 10 km of the Proposed Development (outermost scoping turbine layout). These

include six Bronze Age funerary monuments, a motte and two Castles, a Chapel, and three industrial sites.

9.2.9 In addition to the two Listed Buildings within the Inner Study Area (see above), there are 132 other Listed Buildings within 10 km of the Proposed Development (72 of Category B and 60 of Category C). There are no Category A Listed Buildings within 10 km of the Proposed Development. Most of the Listed Buildings are located in built-up areas in urban settings (Strathaven (50), Lesmahagow (11), and Sandford (5)) and have settings that are characterised by their townscapes.

9.2.10 There are two Historic Battlefields (Battle of Drumclog and Battle of Loudon Hill) and four Conservation Areas (Lugar, Lesmahagow, Sandford and Strathaven) within 10 km of the Proposed Development.

9.2.11 There are no Inventory Gardens and Designed Landscapes (GDL) within 10 km of the Proposed Development. Dumfries House GDL lies 12.5 km to the southwest of the Proposed Development and there are six others that lie within 20 km.

9.2.12 The New Lanark World Heritage site (also a Conservation Area and an Inventory Garden and Designed Landscape) lies 15 km to the northeast of the Proposed Development.

9.2.13 In addition to the designated heritage assets described above there are 49 heritage assets, recorded in the Council HER as non-statutory register (NSR) sites, 11 of which have multiple parts, that lie outwith the Inner Study Area, but are within 10 km of the outermost turbines of the scoping layout. These recorded NSRs include two chambered cairns, seven other cairns, a standing stone, and a fort, all of probable prehistoric date. There is also a possible Roman Temporary Camp, a motte and bailey castle, two tower houses, a Priory (Lesmahagow), and a chapel and burial ground with possible medieval origins. Other NSR sites include medieval or post-medieval farmsteads and mining related remains.

9.2.14 The locations of these designated heritage assets and NSR site are shown on **Figure 9.2**.

9.3 Relevant Guidance and Legislation

9.3.1 The assessment will be prepared following the advice and guidance in the following documents:

Legislation

- Ancient Monuments and Archaeological Areas Act 1979
- Planning (Listed Buildings and Conservation Areas (Scotland) Act 1997 (as amended by Historic Environment (Amendment) (Scotland) Act 2011)
- Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013
- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017

Planning Policies

- National Planning Framework (NPF 3)
- Scottish Planning Policy (SPP) (2014)
- Historic Environment Policy for Scotland (HEPS) (2019) (HES, 2019)

Guidance

- Environmental Impact Assessment Handbook (SNH and HES, 2018)
- Standard and Guidance for Historic Environment Desk-Based Assessment (CIfA, 2014, updated 2020)
- Principles of Cultural Heritage Impact Assessment in the UK (IEMA, IHBC & CIfA, 2021)

- Designation Policy and Selection Guidance (HES, 2019)
- Managing Change in the Historic Environment: Setting (HES, 2016)
- Planning Advice Note 2/2011: Planning and Archaeology (PAN 2/2011)

9.4 Proposed Scope of Survey and Assessment

9.4.1 The EIA Report will include a chapter that will present an assessment of the Proposed Development's potential effects upon archaeology and cultural heritage assets. The assessment will consider the potential for direct (i.e. physical) effects on the cultural heritage within the Proposed Development site, arising from construction activities, and effects upon the settings of heritage assets with statutory and non-statutory designations in the wider landscape surrounding the Proposed Development.

Study Areas

9.4.2 Two study areas will be used for the assessment:

- The Inner Study Area: the Proposed Development site, defined by the red line boundary, within which turbines and associated infrastructure are proposed, will form the study area for the identification of heritage assets that could receive direct effects arising from the construction of the Proposed Development.
- The Outer Study Area: a wider study area, extending 10 km from the outermost finalised proposed turbine locations, will be used for the identification of cultural heritage assets whose settings may be affected by the Proposed Development (including cumulative effects). Views towards any assets identified as having settings sensitive to change will also be considered, even where no visibility is predicted from the asset. The wider ZTV will also be assessed to identify any designated assets beyond 10 km that have settings that may be especially sensitive to the Proposed Development.

Post-scoping Consultation

9.4.3 Following receipts of scoping opinions, consultation will be carried out where necessary to clarify and resolve any points raised through the scoping process, and to agree locations for (and types of) any requested visualisations. Potential receptors for visualisations (photomontages or wirelines) will be identified by the heritage consultants through analysis of the blade and tip height ZTVs and presented to HES and WoSAS for their agreement.

Desk-based Assessment

9.4.4 An enhanced scope of desk-based assessment will be carried out, drawing on up to date archive records and other available sources, to identify sites and areas that have archaeological and historic environment potential and to inform the field survey. The following sources will be consulted to ensure that the baseline data is up to date:

- Historic Environment Scotland (HES) Spatial Data Warehouse: for up-to-date data on the locations and extents of Scheduled Monuments, Listed Buildings, Conservation Areas, Inventory status Garden and Designed Landscapes, and Inventory status Historic Battlefields;
- WoSAS Historic Environment Record (HER): for a digital database extract in GIS for all assets within 10 km of the Proposed Development site boundary;
- The National Record for the Historic Environment (NRHE) database (Canmore): for any information additional to that contained in the HER;
- Bibliographic references (e.g. Statistical Accounts of Scotland; any references in HER or NHRE entries): to provide background and historic information where relevant to the Proposed Development site;

- Map Library of the National Library of Scotland: for Ordnance Survey maps and other historical map resources;
- Modern aerial photographic imagery (Google Earth, Bing Maps, ESRI World Imagery);
- National Collection of Aerial Photography (NCAP): for historic aerial photographic imagery;
- Scottish Remote Sensing Portal: for Lidar imagery covering the Proposed Development site; and
- Historic Land-Use Assessment Data for Scotland (HLAMap): for information on the historic land use character of the Proposed Development site and the surrounding area.

Field Surveys

9.4.5 A walk-over reconnaissance field survey within the Inner Study Area will be carried out once an initial infrastructure layout has been developed. The field survey will focus on the heritage assets that may be affected by the Proposed Development; in particular, those in proximity to components of the infrastructure. The survey will be undertaken in order to:

- locate and record the baseline character and condition of heritage assets identified through the desk-based assessment;
- identify any others not revealed through the desk-based study;
- identify any area of archaeological potential; and
- assess the heritage value of the heritage assets identified through the desk-based assessment and field survey.

9.4.6 Field survey in areas covered by commercial forestry will be limited to targeting the locations of known heritage assets identified through desk-based assessment, as far as access is possible, in order to establish their continuing presence or absence and to record their baseline condition where remains do survive.

9.4.7 Field survey of the proposed site access route from Junction 11 on the M74 will be excluded, as this route utilises an existing access track network serving other operational and consent wind farms and has been subject to previous survey.

9.4.8 Site visits to heritage assets in the Outer Study Area will be undertaken to assess, with the aid of wireline visualisations, the predicted impact of the Proposed Development on their settings. Site visits will include any assets specifically identified by consultees as requiring assessment and those identified through analysis of the blade tip height ZTV where it is considered, on the basis of professional judgement, that the impact on their settings could be significant.

Assessment Methodology

9.4.9 The effects of the Proposed Development on heritage assets will be assessed on the basis of their type (direct effects, impacts on setting and cumulative impacts) and nature (adverse or beneficial). The assessment will take into account the value/sensitivity of the heritage asset and its setting and the magnitude of the predicted impact, following the approach advised in the SNH/HES (2018) EIA Guidance.

- Adverse effects are those that detract from or reduce cultural significance or special interest of heritage assets.
- Beneficial effects are those that preserve, enhance, or better reveal the cultural significance or special interest of heritage assets.

9.4.10 The assessment of significance of effects will be undertaken using two key criteria: the sensitivity of the cultural heritage asset (**Table 9.1**) and the magnitude of the predicted impact (**Table 9.2**), which measures the degree of change to the baseline condition of an asset resulting from the Proposed Development.

Assigning Sensitivity to Heritage Assets

9.4.11 Cultural heritage assets are given weight through the designation process. Designation ensures that sites and places are recognised by law through the planning system and other regulatory processes. The level of protection and how a site or place is managed varies depending on the type of designation and its laws and policies (HES, 2019).

9.4.12 **Table 9.1** summarises the relative sensitivity of key cultural heritage assets (and their settings) relevant to the Proposed Development (excluding, in this instance, Marine Resources).

Table 9.1: Sensitivity of Heritage Assets

Sensitivity of Heritage Asset	Definition/Criteria
High	Assets valued at an international or national level, including: World Heritage sites Scheduled Monuments Category A Listed Buildings (Buildings of special architectural or historic interest which are outstanding examples of a particular period, style or building type) Inventory Gardens and Designed Landscapes Inventory Historic Battlefields Non-designated assets that meet the relevant criteria for designation (including sites listed in the HER as being non-statutory register (NSR) sites deemed to be of potential national importance)
Medium	Assets valued at a regional level, including: Archaeological sites and areas that have regional value (contributing to the aims of regional research frameworks) Non-Inventory Designed Landscapes (NIDL) (where these are identified in Local Authority records) Category B Listed Buildings (Buildings of special architectural or historic interest which are major examples of a particular period, style or building type) Conservation Areas
Low	Assets valued at a local level, including: Archaeological sites that have local heritage value Category C listed buildings (Buildings of special architectural or historic interest which are representative examples of a period, style or building type) Unlisted historic buildings and townscapes with local (vernacular) characteristics
Negligible	Assets of little or no intrinsic heritage value, including: Artefact find-spots (where the artefacts are no longer in situ and where their provenance is uncertain) Poorly preserved examples of particular types of features (e.g. quarries and gravel pits, dilapidated sheepfolds, etc)

Criteria for Assessing the Magnitude of Impact

9.4.13 The magnitude of impact (adverse or beneficial) will be assessed in the categories, high, medium, low, and negligible and described in **Table 9.2**.

Table 9.2: Magnitude of Impact

Magnitude of Impact	Criteria	
	Adverse	Beneficial
High	Changes to the fabric or setting of a heritage asset resulting in the complete or near complete loss of the asset's cultural significance. Changes that substantially detract from how a heritage asset is understood, appreciated, and experienced	Preservation of a heritage asset in situ where it would otherwise be completely or almost completely lost. Changes that appreciably enhance the cultural significance of a heritage asset and how it is understood, appreciated, and experienced.

Magnitude of Impact	Criteria	
	Adverse	Beneficial
Medium	Changes to those elements of the fabric or setting of a heritage asset that contribute to its cultural significance such that this quality is appreciably altered. Changes that appreciably detract from how a heritage asset is understood, appreciated, and experienced.	Changes to important elements of a heritage asset's fabric or setting, resulting in its cultural significance being preserved (where this would otherwise be lost) or restored. Changes that improve the way in which the heritage asset is understood, appreciated, and experienced.
Low	Changes to those elements of the fabric or setting of a heritage asset that contribute to its cultural significance such that this quality is slightly altered. Changes that slightly detract from how a heritage asset is understood, appreciated, and experienced.	Changes that result in elements of a heritage asset's fabric or setting detracting from its cultural significance being removed. Changes that result in a slight improvement in the way a heritage asset is understood, appreciated, and experienced.
Negligible	Changes to fabric or setting of a heritage asset that leave its cultural significance unchanged and do not affect how it is understood, appreciated, and experienced.	

Assessment of Effects on Setting

9.4.14 The SNH/HES EIA Handbook (2018) Appendix 1, paragraph 42 advises that:

"In the context of cultural heritage impact assessment, the receptors are the heritage assets and impacts will be considered in terms of the change in their cultural significance".

9.4.15 Historic Environment Scotland's guidance document, 'Managing Change in the Historic Environment: Setting' (HES 2016), notes that:

"Setting can be important to the way in which historic structures or places are understood, appreciated and experienced. It can often be integral to a historic asset's cultural significance."

"Setting often extends beyond the property boundary or 'curtilage' of an individual historic asset into a broader landscape context".

9.4.16 The guidance also advises that:

"If proposed development is likely to affect the setting of a key historic asset, an objective written assessment should be prepared by the applicant to inform the decision-making process. The conclusions should take into account the significance of the asset and its setting and attempt to quantify the extent of any impact. The methodology and level of information should be tailored to the circumstances of each case".

9.4.17 The guidance recommends that there are three stages in assessing the impact of a development on the setting of a historic asset or place:

- Stage 1: identify the historic assets that might be affected by the Proposed Development;
- Stage 2: define and analyse the setting by establishing how the surroundings contribute to the ways in which the historic asset or place is understood, appreciated, and experienced; and
- Stage 3: evaluate the potential impact of the proposed changes on the setting, and the extent to which any negative impacts can be mitigated.

9.4.18 The SNH/HES EIA Handbook (2018) Appendix 1, paragraph 43 advises that:

"When considering setting impacts, visual change should not be equated directly with adverse impact. Rather the impact should be assessed with reference to the degree that the proposal affects those aspects of setting that contribute to the asset's cultural significance".

9.4.19 Following these recommendations, the turbine blade tip and hub height ZTVs for the Proposed Development will be used to identify those heritage assets from which there would be theoretical visibility of one or more of the proposed wind turbines, and the degree of theoretical visibility:

- World Heritage Sites, Scheduled Monuments, Category A and B Listed Buildings, Conservation Areas, Inventory Gardens and Designed Landscapes and Inventory Historic Battlefields, where present within the blade tip height ZTV and within 10 km of the outermost turbines, will be included in the assessment.
- Category C Listed buildings within the blade tip height ZTV and within 5 km of the outermost turbines will be included in the assessment.
- Consideration will also be given to designated heritage assets beyond 10 km where long-distance views and intervisibility are considered to be an important aspect of their settings.
- Consideration will also be given to designated heritage assets where there is no predicted visibility from the asset but where views of or across the asset are important factors contributing to its cultural significance. In such cases, consideration will be given to whether the Proposed Development could appear in the background to those views.

Assessing the Significance of Effects

9.4.20 The sensitivity of the asset (**Table 9.1**) and the magnitude of the predicted impact (**Table 9.2**) will be used to inform an assessment of the level of the effect (direct effect or effect on setting), summarised using the formula set out in the matrix in **Table 9.3**. The matrix employs a graduated scale (from Negligible to Major effects) and where two outcomes are possible through application of the matrix, professional judgement supported by reasoned justification, will be used to determine the level of effect.

Table 9.3: Significance of Effect

Magnitude of Impact	Sensitivity of Asset			
	High	Medium	Low	Negligible
High	Major	Major / Moderate	Moderate / Minor	Minor / Negligible
Medium	Major / Moderate	Moderate	Moderate / Minor	Minor / Negligible
Low	Moderate / Minor	Moderate / Minor	Minor	Negligible
Negligible	Minor / Negligible	Minor / Negligible	Negligible	Negligible

9.4.21 Major and moderate effects are considered to be 'significant' in the context of The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (EIA Regulations). Minor and negligible effects are considered to be 'not significant'.

9.5 Potential Impacts

Direct Impacts

9.5.1 The Proposed Development could potentially directly impact upon one or more of the designated or non-designated heritage assets recorded within the Inner Study Area.

9.5.2 It is possible that there could be other, unknown, and buried remains of archaeological interest within the site and any such remains could be directly affected by construction of the Proposed Development.

Setting Impacts

9.5.3 The Proposed Development could give rise to potentially adverse impacts on the settings of Designated Heritage Assets within the Outer Study Area (as defined above).

Scoped In

9.5.4 It is proposed that the assessment will include consideration of potential impacts of the Proposed Development on the settings of:

- Scheduled Monuments, Category A and B Listed Buildings, Conservation Areas, Inventory Gardens and Designed Landscapes, Inventory Historic Battlefields, and NSR sites where present within 10 km of the outermost turbines.
- Category C Listed buildings and Non-Inventory Designed Landscapes (NIDLs) within 5 km of the outermost turbines.

9.5.5 Consideration will be given to designated heritage assets beyond 10 km where long-distance views and intervisibility are considered to be an important aspect of their settings. Assets currently identified as justifying inclusion are:

- New Lanark WHS, Conservation Area and Inventory Garden and Designed Landscape.
- Dumfries House (LB 14413) and it associated Inventory Garden and Designed Landscape.

9.5.6 Consideration will also be given to designated heritage assets where there is no predicted visibility from the asset but where views of or across the asset are important factors contributing to its cultural significance. In such cases, consideration will be given to whether the Proposed Development could appear in the background to those views.

9.5.7 Those assets that are most likely to be affected are those where wide-ranging views, or prominence in the landscape, are important aspects of their settings. Initial appraisal has identified Dungavel Hill, cairn (SM 2848) as having a setting on a hilltop where such characteristics are important aspects of its setting. In the wider landscape, Cairn Table, two cairns (SM 4631) also occupies a prominent location on a notable hilltop and has wide ranging views as an important aspect of its setting. Intervisibility between Cairn Table and Dungavel Hill cairns is also an important aspect of their shared setting.

9.5.8 Two Listed Buildings, Auchingilloch Monument (LB 1279) and Martyr's Grave, Priesthill (LB 14395), lie within the Inner Study Area and will also require detailed assessment of their settings.

9.5.9 The turbine blade tip and hub height ZTVs for the Proposed Development will be used to identify those heritage assets from which there would be theoretical visibility of one or more of the proposed turbines and to assess the degree of potential visibility.

Scoped Out

9.5.10 It is proposed that the assessment will scope out consideration of potential impacts of the Proposed Development in the following circumstances:

- Impacts on the settings of listed buildings that lie within urban settings can be scoped out of the assessment on the basis that their settings are constrained to, and defined by, their locations within the built environment and their relationships with surrounding buildings and the local townscape.
- Impacts on the settings of most designated heritage assets beyond 10 km of the Proposed Development can be scoped out, as most assets beyond that distance will be too far distant to have their settings significantly adversely affected by the Proposed Development. New Lanark World Heritage site, 15 km northeast of the Proposed Development, and Category A Listed Dumfries House (LB 14413) and its associated Inventory Garden and Designed Landscape, will be considered in the design stage and addressed in the assessment if required.

- Assessment of impacts on the settings of Category C Listed Buildings and non-inventory designed landscapes beyond 5 km can be scoped out as it is considered that, for these locally important designations, beyond that distance their settings will not be significantly adversely affected.
- Assessment of impacts on heritage along the proposed site access route (from M74 Junction 11) to the proposed wind farm boundary can be scoped out. This access route utilises a route already in use as existing timber haul roads and used for other wind farm developments within the Hagshaw Cluster. Therefore, no addition impacts are likely to arise in connection with the Proposed Development.
- Direct impacts on heritage assets during the operational and decommissioning phases can be scoped out as any maintenance, repair or replacement works, and decommissioning work, would utilise the as-built infrastructure.
- Impacts on the settings of heritage assets during the construction and decommissioning phases can be scoped out as any such effects would be short-term and temporary. The operational phase represents the worst-case scenario and is sufficient for assessing setting impacts overall.

9.6 Potential Mitigation

Design mitigation

- Avoidance of identified areas of constraint during the design of the turbine layout and the onsite infrastructure; and
- Avoidance, or minimisation, of visual impact on New Lanark WHS and Dumfries House.

Construction Phase mitigation

- Appointment of an Archaeological Clerk of Works (ACoW) to advise on and oversee construction phase mitigation;
- Preparation of a Written Scheme of Investigation (WSI) prepared in response to any planning condition applied to any consent and submitted for the approval of the Council;
- Fencing off/marking out areas of constraint for avoidance during the construction phase;
- Archaeological evaluations or set piece excavations where heritage assets cannot be avoided; and,
- Watching briefs/archaeological monitoring in archaeologically sensitive areas or as may be determined through planning conditions.

9.7 Potential Effects

9.7.1 **Table 9.4** below summarises the potential impacts proposed to be scoped in (✓) and out (x) of the EIAR

Table 9.4 – Receptors or Impacts Scoped In or Out of assessment

Potential Impact	Construction	Operation	Decommissioning	Comment
Direct impact on heritage assets	✓	x	x	Assessment of potential direct impacts will be limited to sites within the Inner Study Area.
Impacts on the settings of heritage assets	x	✓	x	Impacts will be considered for designated heritage assets and NSR sites as outline above.

Proposed Visualisation Viewpoints

9.7.2 **Table9.5** below identifies those designated heritage assets for which, based on the Scoping blade tip height ZTV, it is proposed that visualisations may be included in support of the assessment in the EIAR. In addition to these, reference will be made to LVIA viewpoints where these are helpful to the assessment (Cairn Table as an example).

Table 9.5 Cultural Heritage Visualisations

VP Ref	site Name & Ref No	Visualisation type (suggested) to be agreed with consultees (with reasoning)
CH 1	Dungavel Hill, cairn (SM 2848)	Photomontage (including cumulative wirelines) from location of cairn Hill top burial cairn with intervisibility with Cairn Table cairns and other cairns on nearby hill tops.
CH 2	Glenbuck Ironworks, 470m NW of Glenbuck Home Farm	Photomontage (including cumulative wirelines) from within village. Promoted mining heritage site and birthplace of Bill Shankly.
CH 3	Chapelhouse, chapel and farmstead (SM 5405)	Photomontage (including cumulative wirelines) from location of chapel. Chapel and probable ecclesiastical residential site in secluded setting.
CH 4	Blacksidend, cairn (SM 2924)	Wireline (including cumulative wirelines) from location of cairn. Hill top burial cairn with intervisibility with Dungavel Hill cairn
CH 5	Glen Garr, cairn (SM 2469)	Wireline (including cumulative wirelines) from location of cairn. Hill top burial cairn with intervisibility with Dungavel Hill cairn
CH 6	Harting Rig, cairn (HER 9121)	Wireline (including cumulative wirelines) from location of cairn. Hill top burial cairn with intervisibility with Dungavel Hill cairn
CH 7	New Lanark WHS	Photomontage or photowireline (including cumulative wirelines) from Braeside Road looking across valley.
CH 8	Dumfries House (LB 14413) & GDL	Photomontage or photowireline (including cumulative wirelines) from viewpoint southwest of House (if achievable), with House in foreground and turbines behind.

9.7.3 Post-scoping follow-up consultation will be made with consultees, once a finalised design has been arrived at, to confirm requirements for visualisations for inclusion in the EIA.

9.8 Scoping Questions to Consultees

- Do consultees agree with the proposed scope of the assessment, including the proposed Study Areas?
- Do consultees agree with the proposed assessment methodology?
- Are consultees satisfied with the mitigation measures proposed?
- Do consultees agree with the matters to be ‘scoped-in’ and 'scoped out'?
- Are there any other designated heritage assets in the surroundings of the Proposed Development that they consider could have their settings adversely affected?
- Are consultees satisfied with the locations and types of visualisations proposed?
- Are there any other locations for which consultees recommend visualisations be considered?

10. Hydrology, Hydrogeology and Geology

10.1 Introduction

10.1.1 This section considers the potential for significant effects on surface water, groundwater, the potential risk of flooding, and the drainage requirements which may result from the Proposed Development. This section also considers the potential effects on geological receptors, including peat.

10.2 Baseline Description

Land Use and Topography

10.2.1 The Proposed Development is centred at British National Grid (BNG) NS 70740 325550, located approximately 2.45 km to the north of Muirkirk (distance to the closest proposed turbine). The site is located within the East Ayrshire and South Lanarkshire Council areas.

10.2.2 The site comprises a main Development Area of approximately 4,151 ha comprising principally open moorland across the central and southern extents and commercial coniferous plantation and existing forestry tracks within the northern extent of the site. The site boundary also includes the site access track (from junction 11 of the M74 motorway along existing former opencast and forestry tracks (plus a very short stretch of new track – circa 200 m) to the eastern boundary of the main Development Area) which is approximately 17.5 km long.

10.2.3 The site comprises a series of summits which include Priesthill Height which rises 493 m Above Ordnance Datum (AOD) at the entrance to the main site area; Spirebush Hill (469 m AOD) and Starpet Rig (451 m AOD) in the centre of the site; Middlefield Law (466 m AOD), Meanlour Hill (382 m AOD)and Bibblon Hill (431 m AOD) within the south of the site; and Auchengilloch (462 m AOD) and Goodbush Hill (475 m AOD) to the west and north of the site.

Designated sites

10.2.4 The site also lies partly within the north-eastern extent of the Muirkirk Uplands Site of Special Scientific Interest (SSSI) which underpins the wider Muirkirk and North Lowther Uplands Special Protection Area (SPA). The SSSI is designated for upland habitats including blanket bog. NatureScot have found that habitats across the site are degraded, with much of the blanket bog heavily drained, over grazed, and in poor condition. That said, some extensive peatland restoration works have been undertaken in the central part of the site with the opportunity to more than double the extent of this as part of the Proposed Development.

10.2.5 The SSSI is also designated for its localised exposures of fossiliferous rock.

10.2.6 The Blood Moss and Slot Burn SSSI is located in the south of the site, to the west of the B743. It is an area of around 162 Ha designated for its fossil-bearing rocks (yielding fossil fish and water scorpions) alongside the Slot Burn, and blanket bog.

10.2.7 There are five areas within the site boundary listed on the Geological Conservation Review (**Figure 10.4**), Dippal Burn (Ref 3139, 4 areas) and Slot Burn (Ref 392 & 2084) part of a network of Silurian sites in the Midland Valley of Scotland that yields important fossil-bearing rocks.

Geology and Peat

10.2.8 British Geological Survey (BGS) mapping indicates that the superficial geology at the site is anticipated to be dominated by widespread peat deposits across large flat expanses with Glacial Till and Fluvioglacial deposits present across hillsides, with alluvium associated with local watercourses (**Figure 10.1**).

10.2.9 Review of the Carbon and Peatland 2016 mapping published by Scottish Natural Heritage (now NatureScot) indicates that areas of Class 1 peatland are present, generally corresponding with areas undergoing restoration works as part of a Peatland Action project. Limited areas of Class 3 peatland are also present with the remainder comprising Class 5 or mineral soil (**Figure 10.2**).

10.2.10 Class 1 and 2 peatland is considered nationally important priority peatland habitat. Class 3 to 5 is not considered priority peatland, though Class 3 peatland is associated with carbon-rich soils, with some potential areas of deep peat.

10.2.11 A low resolution, Phase 1 (100m grid) peat probing survey was undertaken at the Site in May – June 2022, in line with Best Practice Guidance. The recorded peat depths were used, in conjunction with historic data (gathered as part of a Peatland Action project) to produce a peat depth isopach (**Figure 10.4**). Although there are significant peat deposits across the site, they are well delineated, with several areas, particularly within Areas B and D, comprising shallow soils.

10.2.12 BGS mapping indicates that the bedrock geology at the site comprises a heavily faulted sequence of predominately Devonian to Silurian age sedimentary rocks within the main development area, with Carboniferous bedrock underlying parts of the proposed access route to the east. There are intrusive igneous rocks of varying age. Coal bearing rocks are present to the south of the site, and in the east, underlying parts of the proposed access track and hydrogen hub (**Figure 10.3**). The coal bearing bedrock corresponds with a Development High Risk Area, as characterised by the Coal Authority (**Figure 10.5**). The former Spireslack and Ponesk Opencast Coal sites and the former Tardoes Opencast Coal site adjoin the site to the south, with the former mining village of Muirkirk lying some 2.45 km further south of the site (distance to the nearest proposed turbine).

Surface Water

10.2.13 There are a number of watercourses that traverse the site (**Figure 10.6**). The southern extent of the site is drained by the Polkebock Burn, Polbeith Burn, Slot Burn, Back Burn, Harwood Burn, Dippal Burn, Patrick Bur, and Ponesk Burn which form the Head of the Greenock Water at the centre of the site before flowing south and then west along the Greenock Water, located to the outside of the southern boundary of the site. The northeastern extent of the site is drained by the Blaeberry and Kip Burns into the Logan Reservoir and into the Logan Water. The Powbrone Burn drains the forested area to the northwest of the site, flowing into the Glengavel Reservoir, located outside the site boundary.

Groundwater

10.2.14 The bedrock is classified as a low to medium productivity aquifer, with flow virtually through fractures and discontinuities, with limited groundwater in the near surface weathered zone and secondary fractures, increasing to low yields within the Carboniferous units, which may have been disturbed by mining.

10.2.15 The site is situated primarily within the North Glengavel Groundwater body, classified by SEPA as having an overall status of 'Good'. An area of the proposed access track is situated within the Douglas Coalfield North Groundwater body, with an overall status of 'Poor'.

10.2.16 Nine residential properties lie within the site boundary. Additional properties are located in close proximity to the site boundary. There is potential for these to be served by private water supplies (PWS), this will be determined during the EIA process, to establish whether there are PWS in the study area and adjacent areas which require assessment.

Flooding

10.2.17 SEPA flood maps indicate high potential for river flooding within the Dippal Burn, Greenock Water, Ponesk Burn and Powbrone Burn. Surface Water flooding is generally limited to the Logan Reservoir, though there are localised areas of medium and high potential adjacent to the existing access track from the M74.

10.3 Relevant Guidance and Legislation

10.3.1 The key sources of guidance and legislation relating to geology, peat, hydrology and hydrogeology are outlined below:

- Scottish Government (2011). The Water Environment (Controlled Activities) (Scotland) Regulations 2011;
- Scottish Government (2017). The Water Intended for Human Consumption (Private Supplies) (Scotland) Regulations 2017;
- Scottish Executive (2003). The Water Environment and Water Services (Scotland) Act 2003;
- SEPA (2009). SEPA Policy 19 Groundwater Protection Policy for Scotland. Version 3;
- SEPA (2016). SEPA Policy 41 A Planning Authority Protocol Development at Risk of Flooding: Advice and Consultation;
- CIRIA (2001). Control of Water Pollution from Construction sites - Guidance for Consultants and Contractors. CIRIA C532;
- SEPA (2006). Prevention of Pollution from Civil Engineering Contracts: Special Requirements. Version 2
- SEPA (2017). Land Use Planning System SEPA Guidance Note 31: Planning Guidance on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (GWDTE);
- European Parliament and Council (EC) (2000). EC Water Framework Directive (2000/60/EC);
- Forestry Commission (2012). Forestry and Water Guidelines;
- CIRIA (2015). The SuDS Manual. CIRIA C753;
- CIRIA (2006). Control of Water Pollution from Linear Construction Projects - Technical Guidance. CIRIA C648;
- Scottish Government, SNH, SEPA (2017). Guidance on Developments on Peatland;
- Energy Consents Unit Scottish Government (2017). Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments. Second Edition;
- Scottish Renewables, SEPA (2014). Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and the Minimisation of Waste;
- SEPA (2010). SEPA Regulatory Position Statement - Developments on Peat;
- SEPA (2017). SEPA Regulatory Position Statement - Developments on Peat and Off-site Uses of Waste Peat. WST-G-052. Version 1;
- Scottish Renewables, Scottish Natural Heritage, SEPA, Forestry Commission Scotland, Historic Environment Scotland, Marine Scotland Science, AECoW (2019). Good Practice During Wind Farm Construction. 4th Edition;
- Scottish Natural Heritage, Forestry Commission Scotland (2010). Floating Roads on Peat: A report into Good Practice in Design, Construction and Use of Floating Roads on Peat with Particular Reference to Wind Farm Developments in Scotland;
- Scottish Executive (2005). Scottish Roads Network Landslides Study Summary Report;
- Forestry Commission (2006). Guidelines for Risk Management of Peat Slips on the Construction of Low Volume/Low Cost Roads on Peat;
- Scottish Natural Heritage (2015). Constructed Tracks in the Scottish Uplands;
- SEPA, EnviroCentre (2011). Restoration Techniques Using Peat Spoil from Construction Works;

- CIRIA (1997). Ground Engineering Spoil: Good Management Practice. CIRIA report 179;
- NetRegs. Guidance for Pollution Prevention (GPP) – Various;
- CIRIA (2015). Environmental Good Practice on site. CIRIA C741;
- Institution of Civil Engineers (2001). Managing Geotechnical Risk: Improving Productivity in UK Building and Construction;
- Scottish Government (2014). Scottish Planning Policy (SPP);
- SEPA (2017). Land Use Planning System SEPA Guidance Note 4: Planning Guidance on On-shore Windfarm Developments;
- CIRIA (2002). Construction over Abandoned Mine Workings. Special Publication 32; and
- The Coal Authority (2012). Risk Based Approach to Development Management, Resources for Developers.

10.4 Proposed Scope of Survey and Assessment

10.4.1 The potential effects from the Proposed Development on geology and the water environment (hydrology and hydrogeology) will be assessed by completing a desk study and consultation, field investigation followed by an impact assessment, the process of which is detailed below.

10.4.2 The impact assessment will consider potential cumulative, or in-combination effects associated with other developments in the same hydrological or hydrogeological catchments and within 5 km of the Proposed Development.

Desk Study

10.4.3 A desk study will be undertaken to confirm the baseline characteristic by reviewing available information relating to soils, peat, geology, hydrology and hydrogeology.

10.4.4 The desk study will review previous assessments undertaken at nearby sites as much valuable and relevant information is likely to be contained in these reports and can be used to initially characterise the following:

- The depth and distribution of peat;
- The nature of the underlying geology;
- Groundwater resources;
- Licensed and unlicensed groundwater and surface water abstractions;
- Public and private water supplies;
- Surface water flows;
- Flood extents;
- Rainfall data;
- Water quality data; and
- Potentially contaminative current or historic land uses, including coal mining;

10.4.5 The baseline assessment will include review of published geological maps, OS maps, aerial photographs digital terrain models (slope plans) and geological literature.

10.4.6 The baseline assessment will include a review of the development proposals and reports from other technical studies being undertaken for the application, including ecology surveys, drainage strategy and flood risk assessments.

10.4.7 Liaison with the project ecologists and review of survey data (including NVC) to identify potential GWDTE would be included within the baseline assessment. The desk study will also include a review of peatland restoration work previously undertaken within Proposed Development Area B to inform site design and mitigation proposals.

10.4.8 The desk study will be used to develop a conceptual site model which would then be used to identify sensitive features or receptors which may potentially be affected by the Proposed Development, and which might warrant further investigation as part of the proposed field surveys.

Field Survey

10.4.9 The geological and water assessment specialists will liaise closely with each other as well as with the project ecologists and wider project team to ensure that appropriate information is gathered to allow potentially sensitive features or receptors to be adequately assessed and a comprehensive impact assessment to be completed.

10.4.10 A programme of site visits and surveys will be undertaken to:

- Verify the information collected during the desk study;
- Undertake a visual assessment of the main surface waters and identify private water supplies;
- Identify drainage patterns, areas vulnerable to erosion or sediment deposition, and any pollution risks;
- Visit any identified potential Groundwater Dependent Terrestrial Ecosystems (GWDTEs) (in consultation with project ecologists);
- Visit PWS sources that might be affected by the Proposed Development to confirm details of the location of the abstraction, its type and use;
- Contribute to preparation of a schedule of potential watercourse crossings;
- Inspect rock exposures and establish by probing an estimate overburden thickness;
- Following the design iteration resulting from the Phase 1 peat probing exercise recently undertaken (see **Figure 10.4**), Phase 2 peat depth probing data will be collected to provide more detailed information on ground conditions and peat depths around proposed infrastructure and access track routes. This information will be used within various assessments to determine how peat may influence the Proposed Development. All surveys will be undertaken in accordance with current best practice; and
- Confirm substrate beneath areas of peat based on the type of refusal of peat depth probe.

10.4.11 The desk study and field surveys will be used to identify potential development opportunities and constraints and be used to inform the site design.

10.4.12 Once the desk study and initial field surveys are completed and sensitive soil, geological and water features have been identified, an impact assessment will be undertaken.

Peat Landslide Hazard and Risk Assessment

10.4.13 Phase 2 peat depth data will be obtained following design chill to assess the proposed infrastructure and access routes, to confirm ground conditions and peat depths to inform the emerging site design and impact assessment following the recently undertaken Phase 1 peat probing exercise as required by current best practice. As part of the programme of field work the following will be undertaken:

- A geomorphological mapping exercise to link the topographical features with the underlying geology and to visit those areas of the site that may be identified as potentially 'at risk from peat slide';
- The thickness of the peat will be established by probing and the underlying sub-strata interpreted;

- Signs of historic, existing or potential instability will be recorded.

10.4.14 The Phase 2 peat depth probing will be undertaken as part of the site design in accordance with best practice and will include peat probing along the infrastructure at 50 m centres and at 10 m interval crosshair at turbine locations.

10.4.15 Output from the field surveys will comprise a record of investigation locations and summary of peat depths recorded.

10.4.16 If significant peat depths are proven a preliminary Peat Landslide Hazard and Risk Assessment (PLHRA) will be completed using the site survey data and slope analysis (using DTM data), highlighting areas that may be impacted by a peat slide so that appropriate mitigation measures can be identified and included in the site design.

Peat Management Plan

10.4.17 Should the design be unable to completely avoid areas of peat, a site-specific Stage 1 (outline) Peat Management Plan (PMP) would be prepared to assess the potential volumes of peat excavation required and identify opportunities for re-use.

Coal Mining Risk Assessment (CMRA)

10.4.18 Should a CMRA be considered necessary following review of existing information and reports, a desk-based review of geological conditions would be undertaken. This would include acquisition of a Coal Authority Report and Abandonment Plans if present to develop an understanding of the coal mining history at the site and how it impacts the Proposed Development. The assessment would identify areas of potential risk, mitigation and recommendations for further work, as appropriate.

Consultation

10.4.19 As part of the consultation phase of the project, environmental data and views on the Proposed Development may be sought from:

- SEPA;
- NatureScot;
- East Ayrshire Council;
- South Lanarkshire Council;
- The Coal Authority; and
- Ironside Farrar (Advisors to the Scottish Government with regard to Peat).

10.5 Potential Impacts

10.5.1 The potential impacts associated with construction and operation of the Proposed Development are anticipated to include:

- Pollution or siltation of local watercourse/lochs from construction-phase run-off;
- Changes to surface water drainage patterns, for example introduction of areas of hardstanding and crossings of minor field drains, and potentially drainage/effluent from the proposed hydrogen hydrolyser;
- Impacts on the quality and/or quantity of groundwater serving local PWS and GWDTE, if present;
- Impacts associated with water abstraction for the hydrogen hydrolyser and potentially other uses, for example changes to surface water flows or local groundwater level/quantity depending on proposed nature and location of abstraction;
- Excavation, localised compaction and/or dewatering of peat; and

- Impacts on environmental and human receptors from peat slide risk.

10.5.2 The above impacts will be assessed to determine potential magnitude, to establish the potential significance of effect. It is considered likely that significant effects can be avoided through standard embedded mitigation, including appropriate site design.

10.6 Potential Mitigation

10.6.1 Following the assessment of effects, required mitigation will be identified and any subsequent residual effects will be assessed. Specific reference will be made to the SEPA Guidance Note 4 'Planning guidance on wind farm developments' (LUPS-GU4) (2017) and SEPA 'Guidelines for Water Pollution Prevention from Civil Engineering Contracts: Special Requirements' (2006).

10.6.2 The Proposed Development will undergo design iterations and evolution in response to constraints identified as part of the baseline studies and field studies to avoid and/or minimise potential effects on receptors where possible.

10.6.3 This will include geological, hydrological and hydrogeological constraints which include slope stability, deep peat, watercourse locations, areas of potential flooding, private water supplies and groundwater dependent terrestrial ecosystems.

10.6.4 For example, it is expected that the following potential mitigation measures will be included in the design of the Proposed Development:

- A buffer of up to 50 m will be applied to watercourses wherever possible;
- site specific peat probing will be used to identify areas of potential deep peat and these areas will be avoided where possible;
- A site specific peat landslide hazard and risk assessment (PLHRA) will be prepared and areas of potential increased peat slide risk will be avoided or mitigated through engineering controls;
- If required, a peat management plan will be prepared to show how the integrity of peat will be safeguarded;
- Impacts on private water supply sources and areas of GWDTE will be avoided or subject to detailed assessment to demonstrate no significant effects; and
- Water abstraction and drainage/effluent for the hydrogen electrolyser will be subject to suitable siting and design, and licensing/permitting as may be required.

10.6.5 Most or all potentially significant effects are anticipated to be mitigable through standard embedded mitigation measures including suitable site design (taking the findings of the above studies and surveys into account) and appropriate construction methods to be set out in the Construction Environmental Management Plan (CEMP). Where additional site-specific mitigation is required, this will be clearly set out in the EIA Report and will be subject of ongoing consultation with relevant regulators and stakeholders.

10.7 Potential Effects

10.7.1 The construction, operation and decommissioning of the Proposed Development has the potential to result in the following high-level types of effects:

- Disturbance and loss of deposits of peat;
- Ground instability (including peat slide risk and coal mining induced collapse) and contamination;
- Loss of or damage to designated sites (bog habitat, geological heritage sites);
- Impairment of surface water and groundwater quality from pollution, fuel, oil, concrete or other hazardous substances;

- Increased flood risk to areas downstream of the site during construction through increased surface water runoff;
- Potential change of groundwater levels and flow paths and contribution to areas of peat and GWDTEs;
- Disturbance of watercourse bed and banks from construction of culverts; and
- Potential pollution impacts to public and private water supplies.

10.7.2 The purpose of the assessment will be to assess potential effects on soils, peat, geology and water environment (hydrology and hydrogeology) and specifically:

- Identify any areas susceptible to peat slide, using site specific peat thickness and Digital Terrain Modelling (DTM) data to analyse slopes;
- Assist micro-siting turbines, tracks and other proposed infrastructure in areas of no peat or shallow peat, and areas where there is little peat landslide hazard risk;
- If required show how any disturbed peat will be managed and safeguarded, by the preparation of a peat management plan;
- Determine what the likely effects of the Proposed Development are on the hydrological regime, including water quality, flow and drainage;
- Allow an assessment of potential effects on identified licensed and private water supplies; and;
- Assess potential effects on water (including groundwater) dependent habitats.

10.7.3 Where warranted, it is anticipated that the impact assessment might include the following technical appendices:

- Peat landslide hazard and risk assessment (PLHRA);
- Peat management plan (PMP);
- Coal Mining Risk Assessment (CMRA);
- Schedule of watercourse crossings;
- Private Water Supply (PWS) Assessment;
- Flood Risk Assessment (FRA);
- Groundwater Dependent Terrestrial Ecosystems Risk Assessment.

10.7.4 A qualitative risk assessment methodology will be used to assess the significance of the potential effects. Two factors will be considered: the sensitivity of the receiving environment and the potential magnitude should that potential impact occur.

10.7.5 This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the risk presented by the Proposed Development. This approach also allows effort to be focussed on reducing risk where the greatest benefit may result.

10.7.6 The sensitivity of the receiving environment (i.e. the baseline quality of the receiving environment as well as its ability to absorb effects without perceptible change) and the magnitude of impacts will each be considered through a set of pre-defined criteria.

10.7.7 The sensitivity of the receiving environment together with the magnitude of the effects defines the significance of the effect, which will be categorised into level of significance.

Table 10.1 – Receptors or Impacts Scoped In or Out of assessment

Potential Impact	Construction	Operation	Decommissioning	Comment
Designated sites	✓	x	x	The Muirkirk Uplands SSSI is designated for blanket bog habitat on site, though is assessesed as being in unfavourable condition. Potential effects on designated sites would be reduced by undertaking a peat depth assessment and peat management plan if deemed necessary following field studies. In addition, an iterative design process would avoid thick peat and sensitive geological receptors.
Surface Water	✓	x	x	Logan Reservoir and Greenock Water likely to receive site surface drainage. It is assumed that there is little or no potential for significant effects from operational drainage, taking account of embedded mitigation (appropriate drainage design, appropriate design and construction of water crossings).
Flood Risk	✓	✓	x	Flood mapping indicates that localised flooding of rivers is likely. For the wind and solar development, potential flood risk can be suitably mitigated by including a 50m buffer from watercourses within the site layout design. Crossings of minor watercourses/ field drains, if required, will be designed to appropriately convey flows. Proposed watercourse crossings would be addressed within the schedule of watercourse crossings technical appendix. However, it is considered that a Stage 1 Flood Risk Assessment should be completed for the Proposed Development elements more sensitive to flood risk, namely the substation and hydrogen hydrolyser.
PWS	✓	x	x	Potential for PWS to be present, therefore provisionally scoped in. May be scoped out in consultation with SEPA and EAC/SLC if studies identify no PWS within the site catchment area.
GWDTE	✓	x	x	Low to moderately permeable aquifers, potential for GWDTE to be present, therefore provisionally scoped in. May be scoped out in consultation with SEPA and if surveys identify no GWDTE within relevant buffer distances of proposed infrastructure.
Peat	✓	x	x	Geological mapping indicates the potential presence of peat at the site, the extent, depth and nature of which will be established during the EIA process.There is potential for at least some excavation of peat to be required, and potential for

Potential Impact	Construction	Operation	Decommissioning	Comment
				the Proposed Development to impact on peat via localised compaction and dewatering.
Receptors Sensitive to peat slide risk (watercourse/water bodies, properties, infrastructure)	✓	x	x	Data from Peatland Action indicates that peat deposits are likely to be present on site. May be scoped out in consultation with SEPA and EAC/SLC if peat surveys identify little or no peat at proposed infrastructure locations.
Bedrock Geology	✓	x	x	5 areas are listed on the Geological Conservation Review. Any impacts would be mitigated by ensuring a sufficient buffer from infrastructure.
Coal Mining	✓	✓	x	Potential for impacts from historic coal mining activity. Areas within the site are identified by the Coal Authority as Development High Risk.
Contaminated Land	x	x	x	Low likelihood of any current or historical contaminative land uses at the site; Proposed Development not a sensitive receptor to contamination.

10.8 Scoping Question to Consultees

- Do the consultees agree that, subject to further information coming to light from field surveys, consultation and desk study, the proposed assessment methodology, including proposed study areas, is appropriate?
- Do the consultees have any information not outlined in the Scoping Report that would inform the impact assessment for geology, peat, hydrology and hydrogeology?

11. Traffic and Transport

11.1 Introduction

11.1.1 The Traffic and Transport chapter will assess the effects arising from construction and operation of the Proposed Development. It will consider all vehicle movements associated with the construction and operation of the Proposed Development, including consideration of construction traffic and the source of and vehicle movements associated with the delivery (and export, if required) of material and components to the site. The decommissioning phase is too far in the future to be considered at present and will therefore not be included in the assessment.

11.2 Baseline Description

11.2.1 During construction it is proposed that all abnormal loads and HGVs will access the Proposed Development from the public road network at the western roundabout of Junction 11 of the M74. It is proposed that lighter goods vehicles and personnel vehicles will also be able to access the Proposed Development site from the existing entrance into Dungavel Forest on the B743, and the existing entrances (one to Linburn Farm, one to Priesthill Farm) that cross the B743 at Linburn Farm around 2.6 km north of the A70 in Muirkirk. This point is also proposed to be upgraded as a temporary crossing point for HGVs coming from the M74 during construction of the Proposed Development to avoid any HGV traffic needing to pass through Muirkirk or Strathaven to access Development Areas C and D. Construction access to Development Area A for HGVs is proposed to be via a new 'cross-country' track linking Area A with the existing private road network in Cumberhead Forest (from the M74) via Development Area B. Refer to **Figure 2.1** for Development Areas.

11.2.2 All abnormal loads, construction traffic and HGVs associated with the Green Hydrogen Production Facility will access the site via Junction 11 of the M74. The western roundabout at Junction 11 also provides access to two further private accesses, the B7078 to the north and the B7078 to the east. The B7078 to the north is a single carriageway road with one lane in each direction. It provides a route to the northbound M74 and the B7078 continues northwards to Lesmahagow. The B7078 to the east of the western roundabout passes underneath the M74 and forms a roundabout with a leg of the B7078 to the south and the slip road from the southbound M74.

11.2.3 The B7078 to the south of Junction 11 of the M74 is a dual carriageway which extends southwards for around 2 km to Junction 12 of the M74. It meets the A70 at this roundabout, which forms a route via Douglas and Muirkirk to Cumnock and Ayr going westbound. The A70 meets the B743 at a signalised junction in Muirkirk. The B743 links Muirkirk with Strathaven.

11.2.4 The baseline will be informed by site visits and collection of data. The transport network around the Proposed Development will be visited and any potentially sensitive receptors will be identified. Data on traffic flows and accidents will be obtained for the roads likely to experience an increase in traffic arising from the Proposed Development. It is proposed that week-long Automatic Traffic Counter (ATC) surveys are undertaken at the following four locations shown in **Table 11.1** below. These would count all vehicles by direction and classification and record vehicle speed.

Table 11.1 ATC Survey Locations

Coordinate (BNG)	Description of Location
284576, 634840	B7078 north of western roundabout
284670, 634715	B7078 between two roundabouts
284797, 634552	B7078 south of eastern roundabout
269821, 629958	B743 Linburn Farm

11.2.5 This data will be collected in 2022 and, assuming no Covid-related restrictions are in force at the time of collection, no adjustment will be made to the observed data to make it representative of pre-Covid conditions. A 'Low' traffic growth factor from the National Road Traffic Forecasts (NRTF) dataset will be applied to factor traffic flows observed on non-trunk roads to the year of construction and opening. A 'High' growth factor will be applied to traffic flows observed on trunk roads and motorways.

11.2.6 Post-construction, operational, accesses will be formed off the B743 at (or near) the existing entrances to Linburn Farm, Priesthill Farm and Dungavel Forest to service the Proposed Development. Any occasional abnormal load requirements during the operational period (for activities such as blade swaps) would continue to use the M74 access which would also be used for decommissioning.

11.3 Relevant Guidance and Legislation

11.3.1 The methodology will principally follow the 'Guidelines for the Environmental Impact of Road Traffic' prepared by the Institute of Environmental Assessment.

11.3.2 The impact of the traffic estimated to be generated by the Proposed Development on the surrounding local road network will be subject to a screening process using the following two rules outlined in the Guidelines to identify the appropriate extent of the assessment area:

- Rule 1 - include highway links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles will increase by more than 30%).
- Rule 2 - Include any other specifically sensitive areas where traffic flows have increased by 10% or more.

11.3.3 The assessment of the baseline situation will determine which sections of road should be subject to which of the above rules. Where the predicted increase in traffic flows is lower than the appropriate thresholds, the Guidelines suggest the significance of effects can be stated to be low or insignificant and further detailed assessments are not warranted.

11.4 Proposed Scope of Assessment

11.4.1 The geographical scope of the assessment will be those sections of the road network likely to experience increases in traffic arising from the Proposed Development more than the appropriate threshold from the two rules above. It is anticipated that the geographic al scope of assessment will cover the slip roads to and from the M74 at Junction 11, the section of the B7078 linking the two slip roads and the B743 to the north of Muirkirk.

11.5 Potential Impacts

11.5.1 Where the estimated increase in traffic flows is expected to be greater than the appropriate rule above, the potential impacts on the following topics will be considered in more detail:

- Severance;
- Driver delay;
- Pedestrian delay;
- Pedestrian amenity;
- Fear and intimidation; and
- Accidents.

11.5.2 The potential for cumulative effects from other relevant developments in the study area will also be considered.

11.6 Potential Mitigation

11.6.1 Potential mitigation measures will be identified once the impacts have been assessed. These measures may include, provision of a Construction Traffic Management Plan, (CTMP), restrictions on vehicles routeings and times in order to avoid or reduce impacts on sensitive receptors.

11.7 Receptors and Impacts Scoped in or out of Assessment

11.7.1 The transport assessment will not include for potential effects during decommissioning.

11.8 Scoping Questions to Consultees

- That the proposed methodology is acceptable?
- That the methods and locations proposed for obtaining traffic flow data are acceptable?
- That the use of the appropriate National Road Traffic Forecasts (NRTF) is acceptable?
- What developments should be included as committed developments within the baseline traffic flows in the assessment, noting that these should have planning consent at the time of assessment?
- Details of any upgrades or network changes that may be undertaken to the study area network within the next five years?

12. Socio Economics, Recreation and Tourism

12.1 Introduction

12.1.1 This chapter will consider the potential socio-economic, recreation and tourism effects from the Proposed Development.

12.1.2 The socio-economics, recreation and tourism assessment will include consideration of local tourism and recreation activity, employment generation and any indirect or induced effects from the Proposed Development, which, in addition to turbines, includes solar panels, BESS and a green hydrogen production facility. The chapter will also include an assessment of the socio-economic benefits from the c.£100m community benefit fund, shared ownership opportunity, local energy discount scheme proposal, local training and skills development programme, and the c.£40m SPA & SSSI Recovery and Management Fund associated with the Proposed Development.

12.2 Baseline Description

12.2.1 The baseline assessment will include a description of the current socio-economic, recreation and tourism baseline within the local area. This will include a summary of the economic performance data and a description of the relevant tourism assets that will be covered in the assessment.

12.2.2 The baseline description will cover and compare the study areas of:

- Muirkirk;
- East Ayrshire;
- South Lanarkshire; and
- Scotland.

12.2.3 The economic impacts will be quantified for East Ayrshire, South Lanarkshire and Scotland.

12.2.4 Previous work outlined the demographic profile of the local area within the context of the national demographic trends, finding that the local area has a lower share of working age adults than Scotland as a whole, particularly young adults. The area also has a higher share of the population aged 65 and over. The demographics suggest a lack of opportunities for young people in the area.

12.2.5 It was also found that the local area experiences high levels of deprivation, with two SIMD datazones in the area ranking in the 20% most deprived areas of Scotland. Deprivation is particularly notable in the domains of income and employment.

12.2.6 The study also found that the area, which has faced economic challenges as the UK transitioned away from coal, has the opportunity to benefit from the transition to renewables, creating jobs and opportunities for young people in the area, supporting the existing construction sector and addressing high levels of deprivation.

12.2.7 The baseline study included in the EIA Report will update previous work and set it in context of the regional trends as well as national. It will also cover:

- employment and economic activity in the local area within the context of regional and national economies;
- wage levels within the regional economy compared to the national level; and
- the role of the tourism sector in the local and regional economy, with consideration to assets, including accommodation providers and public paths, in the immediate vicinity of the Proposed Development (15km).

12.3 Relevant Guidance and Legislation

12.3.1 There is no specific legislation or guidance on the methods that should be used to assess the socio-economic impacts of a proposed renewable energy development. The proposed method has however been based on established best practice, including that used in the UK Government and industry reports on the sector. In particular, this assessment will draw from two studies by BiGGAR Economics on the UK onshore wind energy sector: a report published by RenewableUK and the Department for Energy and Climate Change (DECC) in 2012 on the direct and wider economic benefits of the onshore wind sector to the UK economy (BiGGAR Economics, 2012) and a subsequent update to this report published by RenewableUK in 2015 (BiGGAR Economics, 2015).

12.3.2 There is also no formal legislation or guidance on the methods that should be used to assess the effects that wind farm development may have on general tourism and recreation interests. The proposed method will consider individual attractions and tourism facilities to assess if there could be any effects from the Proposed Development.

12.3.3 For recreational assets, guidance has been provided by NRTF (NS) on how to assess effects on recreational amenity and the approach outlined will be used. This takes into consideration a number of potential effects, including direct effect on facilities, such as limitation or restrictions on access, and effects on the intrinsic quality of the resources enjoyed by people. In general, this guidance considers recreational and access impacts to potentially be significant if:

- permanent or long-term effects on the resources on which enjoyment of the natural heritage depends, in particular where facilities have been provided by SNH or others under statutory powers;
- permanent or long-term change that would affect the integrity and long-term sustainable management of facilities which were provided by NatureScot or others under statutory powers;
- where there are recreational resources for open air recreation pursuits affected by the proposal which have more than local use or importance, especially if that importance is national in significance;
- major constraints on or improvements for access or accessibility to designated natural heritage sites; and
- where mitigation and/or compensatory or alternative recreational provision is considered to be inadequate.

12.3.4 Effects will be considered based on the guidance from Guidelines for Environmental Impact Assessment and a Handbook for EIA.

12.3.5 It is also important that the socio-economic, tourism and recreation chapter takes account of the relevant local and national policy objectives.

12.3.6 Previous work accounted for various development strategies produced by local communities surrounding the Proposed Development, including:

- Windfarms in the Douglas Valley Developing a Legacy: Community Benefit Consultation Findings;
- Rigside & Douglas Water Community Action Plan 2018-2023;
- Lesmahagow, Brocketsbrae and Hawksland: A Community Led Action Plan 2019-2024;
- Coalburn, Douglas and Glespin: Community Action Plans;
- Muirkirk Community Action Plan; and,
- The Hagshaw Energy Cluster Development Framework (Draft, Sep 2022).

12.3.7 The Proposed Development presents the opportunity for the local area to receive significant community benefits, which can be used to address some of the challenges outlined in these strategies. The main concerns outlined in local strategies were the:

- tired appearance of villages/towns;
- difficulty socialising with neighbours;
- poor employment prospects and lack of economic drivers;
- lack of amenities and facilities, especially for young people;
- public access and recreation; and
- poor transport options.

12.3.8 The assessment work will also include other relevant strategies such as:

- Scotland's National Performance Framework;
- Scotland's National Strategy for Economic Transformation; and
- Scotland Outlook 2030 (the national tourism strategy).

12.4 Proposed Scope of Survey and Assessment

12.4.1 It is anticipated that the contents of the assessment chapter will include:

- introduction, including scope of assessment and methodology;
- economic development and tourism strategic context;
- baseline socio-economic, tourism and recreation context;
- socio-economic assessment;
- tourism and recreation impact assessment
- proposed measures and actions to maximise local economic impacts;
- proposed measures and actions to mitigate any harmful effects (if required); and
- summary of findings and conclusions.

12.4.2 This study will be a desk-based study but may also include some consultations with local stakeholders.

12.5 Potential Impacts

12.5.1 Assessing the significance of effects will be based on assessing the sensitivity of an economy/tourism and recreation asset to change and then assessing the potential magnitude of the change associated with the Proposed Development. When sensitivity and magnitude are combined, the significance of effect will be assessed. Major and moderate effects will be considered significant in the context of EIA Regulations.

12.5.2 In order to assess the magnitude of the socio-economic impacts, the level of activity/employment supported during the construction and operation phases will be estimated.

12.5.3 Government and industry reports will be used to determine the expected capital and operational expenditure associated with the Proposed Development, as well as the breakdown of expenditure by different contracts (e.g. turbine, balance of plant). An assumption will then be made based on the share of each type of contract that can be secured regionally and nationally. This increase in turnover in each study area will then be used to estimate the economic impact associated with the Proposed Development.

12.5.4 The method used to assess the socio-economic effects will be based on industry best practice and will consider the share of contracts that can be secured in each study area, and the level of employment that can be supported as a result.

12.5.5 In order to assess effects on tourism and recreation assets, the features that make them distinctive and attractive, such as how they display local heritage, will be identified. The potential impact of the Proposed Development on those key features will then be assessed, with consideration of other chapters of the EIAR where relevant, to determine the magnitude of change.

12.6 Potential Mitigation

12.6.1 Proposed mitigation measures will depend on the findings of the assessment and potential effects identified.

12.7 Potential Effects

12.7.1 The effects that will be considered in the assessment will include the potential socio-economic, tourism and recreation effects associated with the Proposed Development.

12.7.2 BiGGAR Economics was previously commissioned by 3R Energy to calculate initial projections for the potential effects of the Proposed Development based on an estimated capital investment of around £0.5 billion, and an annual operational spend of over £10 million. This found that the Proposed Development presents substantial opportunities for the regional area and estimated that, if the regional area secured a 'typical' share of contracts related to construction, expenditure in the area could generate an economic impact of £32 million GVA and 450 years of employment.

12.7.3 It also highlighted the opportunities to increase the regional share of contracts, through engagement with the supply chain, creating incentives for lead contractors to use regional suppliers, understanding and developing the regional skills offering and ensuring that businesses in the area are prepared and able to tender. In the case that a higher regional share is enabled, it was estimated that the construction expenditure could generate £44 million GVA and 610 years of employment.

12.7.4 Initial projections also indicated that annual operational and maintenance expenditure could generate £3 million GVA and 40 jobs in the regional area.

12.7.5 An updated economic impact analysis will be undertaken considering any changes to the Proposed Development since the initial projections were estimated. This will be done using the methodology developed by BiGGAR Economics, which has been used to assess over 150 renewable energy proposals onshore wind farms across the UK. The assessment will consider the potential direct and indirect socio-economic effects of each of the elements of the Proposed Development: onshore wind, solar, battery energy storage and green hydrogen production.

12.7.6 The potential direct socio-economic effects will include:

- temporary effects on the local and national economy due to expenditure during the construction phase; and
- permanent effects on the local and national economy due to expenditure associated with the operational phase.

12.7.7 The potential indirect socio-economic effects will include:

- permanent effects as a result of any additional public expenditure that could be supported by the additional tax revenue that would be generated during the operational phase; and
- permanent effects on the local economy that could be supported by the community funding and shared ownership proposals, and the deployment of the SPA & SSSI Recovery and Management Fund during the operational phase.

12.7.8 The link between onshore wind energy developments and the tourism sector has been a subject of debate. However, the most recent research has not found a link between tourism employment, visitor numbers and onshore wind development.

12.7.9 In 2021 BiGGAR Economics published research that identified 16 wind farms with a capacity of at least 10 megawatts that became operational between 2015 and 2019. Analysis of trends in tourism employment in the locality of these wind farms (15 km radius) found that 11 of the 16 areas had experienced more growth in tourism employment than for Scotland as a whole. For 13 of the 16 wind farms, trends in tourism employment in the locality had outperformed the local authority in which they were based.

12.7.10 This study was an update of previous research undertaken by BiGGAR Economics in 2017 that considered 28 wind farms constructed between 2009 and 2015 and the trends in tourism employment in the areas local to these developments. This analysis had also found that there was no relationship between the development of onshore wind farms and tourism employment at the level of the Scottish economy, at the local authority level nor in the areas immediately surrounding wind farm developments.

12.7.11 Nevertheless, the tourism sector is an important contributor to the Scottish economy, particularly in rural economies, and so there is merit in considering whether the development will have any effect on the tourism sector. This assessment will consider the potential effects that the development could have on tourism attractions, routes, trail, and local accommodation providers. This will consider the implications of any effects identified for the tourism sector in the local area and wider region.

12.7.12 Effects will be considered based on the guidance from guidelines for Environmental Impact Assessments (IEMA, 2004) and a Handbook for EIA (Scottish Natural Heritage, 2018).

12.8 Scoping Questions to Consultees

- Consultees are asked for suggestions of any socio-economic and tourism effects that should be specifically considered in the report beyond those already covered above?

13. Aviation and Radar

13.1 Introduction

13.1.1 This section provides an indication of the potential effects of the construction and operation of the Proposed Development on aviation. Further, it provides a summary of the full assessment methodology to be adopted and the key reference documents covering legislation, policy and guidance.

13.2 Baseline Description

13.2.1 The Proposed Development lies underneath the Scottish Terminal Area, 30km from Prestwick Airport, 37km from Glasgow Airport and over 55km from Edinburgh Airport. It lies beyond the area of interest of Edinburgh Airport, with no further aerodromes having the potential for impacts.

13.2.2 NATS En-route and the MOD are also consulted as statutory consultees.

13.2.3 There are no military radars with potential to be affected by the Proposed Development. It does lie within a military Tactical training Area (denoted TTA 20T) used for military low flying training. However, impacts are highly dependent on the location and the MOD has a history of not objecting to low flying impacts in this part of the Tactical Training Area.

13.2.4 NATS operate radar in the area which will be affected, requiring mitigation.

13.2.5 Because proposed tip heights are over 150m, there is a requirement for aviation obstacle lighting.

13.3 Relevant Guidance and Legislation

13.3.1 The primary planning policy document is the Scottish Planning Policy document (the SPP, Dec 2020), which states a requirement to assess impacts on aviation, other defence matters and seismological recording.

13.3.2 Scottish Onshore Wind Policy Statement (2017) notes the potential impacts of wind developments, especially on radar, mitigation methods and suggests longer term strategic direction towards self-management of the issues by the aviation sector to reduce the financial burden on the wind energy sector.

13.3.3 Planning Circular 2/03, Safeguarding of Aerodromes, Technical sites and Military Explosives Storage Areas, contains annexes which describe the formal process by which planning authorities should take into account safeguarding, including in relation to wind energy developments. As a statutory consultee, the MOD will be consulted through the Section 36 scoping process. They publish a guidance document on www.gov.uk called 'Wind farms: MOD safeguarding', Updated 21 July 2021. They state that wind turbines can adversely affect a number of MOD operations including radars, seismological recording equipment, communications facilities, naval operations and low flying. These effects are not limited to specific geographical areas.

13.3.4 The wind energy team deals specifically with wind-related developments and processes planning applications and pre-application consultation requests for on- and offshore wind farm developments The MOD wind energy team liaises with a broad range of experts to formulate a comprehensive MOD response. Where the MOD has concerns about a development the team will work with the developer to look for ways to mitigate them.

13.3.5 Civil Aviation Authority (CAA) CAP 393, The Air Navigation Order and Regulations, specifies the statutory requirements for the lighting of onshore wind turbines over 150 m tall.

13.3.6 CAA guidance, within CAP 764 (CAA Policy and Guidance on Wind Turbines), sets out recommended consultation and assessment criteria for the impacts of wind turbines on all aspects of civil aviation.

13.3.7 The CAA involvement in the Wind Farm Pre-Planning Consultation Process has ceased; CAP 764 now states that "*developers are required to undertake their own pre- planning assessment of potential civil aviation related issues*" and that "*it is incumbent upon the developer to liaise with the appropriate aviation stakeholder to discuss – and hopefully resolve or mitigate – aviation related concerns without requiring further CAA input*."

13.4 Proposed Scope of Survey and Assessment

13.4.1 The acceptability of the Proposed Development, in terms of net effects on aviation related interests, is established through direct consultation with all relevant stakeholders within the consenting process. The initial task is to independently assess the potential effects and where significant effects may occur, to enter a dialogue with the affected stakeholders. Where impacts are of concern additional analysis may be required and where impacts are deemed unacceptable, mitigation solutions identified and explored with the goal of reducing impacts to acceptable levels. While the aim of this dialogue is to enable the approval of all stakeholders before full submission, this is not always possible. In the case of impacts, typically solutions are identified but do not reach full maturity in terms of the assessment by the stakeholders and the contracting of mitigation (where required) until formal consent applications have been submitted.

13.4.2 The initial impact assessment aims to exhaustively identify all potential issues and the associated stakeholders affected by the Proposed Development. This involves considering all military and civil aerodromes in the wider area out to circa 60 km, all radar installations out to the limit of their range, all navigational aids, air-ground-air communications stations and low flying activities. A provisional lighting design will be generated to inform the LVI assessment. This will need to be finalised post consent, through agreement with the CAA before construction which can be secured via an appropriately worded condition.

13.5 Consultation

13.5.1 The scoping submission will generate an initial view from Glasgow Airport, Prestwick Airport, the MoD and NATS.

13.5.2 The other key consultees relate to the design and approval of an aviation obstacle lighting scheme. This will require consultation with local airspace users such as Police Scotland and the Scottish Air Ambulance Service, with responses supporting a scheme to be provided to the CAA for their assessment and approval.

13.6 Potential Impacts

13.6.1 The Proposed Development is predicted to have impacts on the airport primary radars at Glasgow and Prestwick, requiring mitigation to allow the normal operation of the airports.

13.6.2 The Proposed Development is also expected to have impacts on the NATS En-route radars at Lowther Hill and Cumbernauld, requiring mitigation to allow normal operation.

13.6.3 It is proposed to scope out assessment of effects during the construction and decommission of the Proposed Development during which it is assumed the turbine blades will not be turning.

13.7 Potential Mitigation

13.7.1 Mitigation is available to address the predicted radar impacts.

13.7.2 Glasgow Airport mitigates operational wind farms using the on-site Terma radar, specifically installed for this purpose. The radar has a built-in capability to remove the impacts of wind turbines. This solution is expected to be effective in mitigating the impacts of the Proposed Development.

13.7.3 NATS En-route mitigates operational wind farms in this cluster through the implementation of a radar mosaic solution, using data imported from Glasgow Airport Terma radar. The solution is expected to be effective in mitigating the impacts of the Proposed Development.

13.7.4 Prestwick Airport, like Glasgow, has installed a Terma radar with built-in mitigation capabilities. This should also provide effective mitigation.

13.8 Potential Effects

13.8.1 With the implementation of the mitigation described above, no residual radar impacts are anticipated.

13.8.2 Every effort will be made to reduce lighting impacts, by minimising the number of turbines lit, their intensity and the hours of operation. The potential for an Aircraft Detection Lighting Scheme will be examined in detail. ADLS can greatly reduce periods of lighting at night by triggering the lights only when an aircraft is in the vicinity at low altitude.

13.9 Scoping Questions to Consultees

- Are there any further considerations in relation to aviation and radar that need to be taken into account?

14. Forestry

14.1 Introduction

14.1.1 The majority of the Proposed Development is located in open ground, with the notable exception of part of Dungavel Forest (Development Area A – see **Figure 2.1**) an extensive commercial forest extending to approximately 1,340 ha, predominantly planted with Sitka spruce, with minor components of other commercial species including Lodgepole pine and Japanese larch.

14.1.2 Parts of the wider Dungavel Forest have been harvested for the development of the adjacent Dungavel Hill Windfarm, with areas outwith the wind farm managed as commercial forest.

14.2 Baseline Description

Dungavel Forest

14.2.1 Dungavel forest is held in a single ownership with areas outwith existing wind farm development managed as commercial forest. The forest is in the process of producing a Long-Term Forest Plan setting out harvesting and replanting proposals, with the focus on commercial timber production and reflecting modern forestry practices through the introduction of greater areas of designed open ground, with more diversity of conifer and native woodland species.

14.2.2 The Proposed Development includes 730 ha of Dungavel Forest with 23 turbines proposed to be keyholed into the southern section of the forest. This area is characterised by compartments of productive Sitka spruce with average and above average growth rates in central Dungavel with crop quality dropping off to the south and east, where growth rates are average to below average.

14.3 Relevant Guidance and Legislation

14.3.1 All forestry proposals will be subject to the UK Forestry Standard and an associated suite of best practice guidance, with the following policies and guidance being referred to as part of the forestry assessment:

- Scottish Forestry Strategy (SFS), 2019;
- Scottish Land Use Strategy (SLUS), 2021;
- Forestry and Land Management (Scotland) Act, 2018;
- The Forestry (Environmental Impact Assessment) (Scotland) Regulation 2017;
- Scottish Planning Policy 2020 (SPP);
- National Planning Framework for Scotland 3 (NPF3), 2014;
- Control of Woodland Removal (CoWR) and associated implementation guidance, 2019;
- Supplementary Guidance to support the FC Forests and Peatland Habitat Guidance Note (2000);
- Management of Forestry Waste, 2017;
- Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Position Statement and Guidance, 2014;
- Glasgow and the Clyde Valley Strategic Development Plan 2017;
- South Lanarkshire Local Development Plan 2 2021;
- East Ayrshire Local Development Plan 2017 & subsequent Local Development Plan 2, when published;

- Forestry and Woodland Strategy for Glasgow City Region 2020;
- Ayrshire and Arran Forestry and Woodland Strategy 2013.

14.3.2 In line with these policies and guidance, the overarching objective will be to minimise the scale of impact on the forest environment, consulting with Scottish Forestry, and other consultees as necessary, to ensure appropriate forestry proposals, and that opportunities for targeted habitat and environmental enhancement are incorporated into the Long Term Forest Plan.

14.4 Proposed Scope of Survey and Assessment

14.4.1 The assessment methodology set out in the Scottish Government's policy on control of woodland removal: implementation guidance will form the basis of the approach to be adopted, while drawing on the principles set out in *The Forestry (Environmental Impact Assessment) (Scotland) Regulation 2017* in assessing the overall significance of environmental effects.

14.4.2 This will involve a detailed approach to forestry and wind farm planning being undertaken to assess the impacts of the Proposed Development, through an iterative design process in consultation with Scottish Forestry. This process will require the production of specific forestry proposals detailing areas to be harvested, timber production and replanting plans associated with the Proposed Development. These wind farm forestry plans will then be compared to any existing, approved Forest Plans as a benchmark against which the impacts of the Proposed Development can be quantitatively assessed and the area of woodland removal and environmental enhancement quantified.

14.4.3 In-line with established best practice, the assessment will seek to minimise the area of forestry included in the application, constraining the application to those areas of forestry directly required for the application, and retaining the wider forestry resource under the authority of Scottish Forestry. This approach not only helps to minimise woodland impacts but also the production of non-forestry residues, which will also be considered as part of the assessment.

14.4.4 Areas of woodland removal and environmental enhancement arising as a result of the Proposed Development will be identified, quantified and detailed as part of this assessment along with details of how any arising compensatory planting will be addressed.

14.5 Potential Impacts

14.5.1 Potential impacts include changes to the forest design through premature harvesting of timber, with associated impacts on age structure, coupe design and timber production. Woodland removal will arise as a result of essential infrastructure footprints and associated tree free buffer zones located on forest ground.

14.6 Potential Mitigation

14.6.1 Mitigation will include the development of revised forestry proposals in consultation with Scottish Forestry which will form part of the final submission. These plans would seek to minimise the impacts of the Proposed Development on the forest ensuring those impacts extend only to those areas essential to the Proposed Development, with the wider forest management remaining under the authority of Scottish Forestry. Areas of forestry used for essential infrastructure footprints and associated tree free buffer zones, and for environmental enhancement, will be subject to full Compensatory Planting Obligations, which will be included in the final submission along with a full Compensatory Planting Plan detailing how this obligation will be secured and delivered.

14.7 Potential Effects

14.7.1 The Proposed Development will likely result in changes to the forest felling phases, with earlier felling programmes, resulting in reduced first rotation productivity due to premature harvesting. Earlier harvesting intervention will see implementation of UKFS compliant forest design sooner,

especially in areas of low economic and biodiversity value forest. Where there are areas of crops with very low growth rates or that are unproductive the development of a wind farm will expedite or bring about the removal of areas of crops that would otherwise be uneconomic to harvest. It will also bring forward opportunities for environmental enhancement. Plantation removal will be an unavoidable consequence of the Proposed Development however these areas will be minimised through keyholing of infrastructure, with any losses replaced through compensatory planting on a like-for-like basis in terms of areas and species and will be agreed in consultation with Scottish Forestry.

14.7.2 It is proposed that effects on forestry during decommissioning be scoped out of further assessment.

14.8 Scoping Questions to Consultees

- Are there any further considerations in relation to forestry that need to be taken into account?

15. Shadow Flicker

15.1 Introduction

15.1.1 This chapter considers shadow flicker, which is an effect caused by the rotation of the turbine blades when the sun is shining, which can create a flickering or strobe like effect. It can be distracting and disturbing for people who are affected. Effects occur usually when the frequency of the flicker is less than 1.5 Hz.

15.2 Baseline

15.2.1 There are a number of operational wind turbines surrounding the Proposed Development. Potential residential receptors are principally located along the high road to Netherwood which runs adjected to the proposed solar areas and some additional residential receptors located along the Muirkirk to Strathaven road (B743).

15.3 Guidance and Legislation

15.3.1 There is no standard for the assessment of shadow flicker. The specific advice sheet from Scottish Government, Onshore Wind Turbines, a web-based guide (Scottish Government, 2014) sets out the potential geographic area which may fall under assessment: *"Where this [*shadow flicker*] could be a problem, developers should provide calculations to quantify effect. In most cases however, where separation is provided between turbines and nearby dwellings (as a general rule ten rotor diameters), 'shadow flicker' should not be a problem."*

15.3.2 Published research by the Department of Energy and Climate Change (DECC), Update of UK Shadow Flicker Evidence Base (DECC, 2011), evaluates the current international understanding of shadow flicker and confirms an acceptable study area for assessment is ten rotor diameters from each turbine and within 130 degrees either side of north.

15.3.3 There are at present no formal guidelines available on what exposure would be acceptable in relation to shadow flicker.

15.4 Assessment Scope and Methodology

15.4.1 Based on an indicative candidate turbine model (maximum tip height 230 m), which has a rotor diameter of maximum 155 m, the minimum distance from the turbine at which residential property must lie in order to be outwith consideration for shadow flicker effects, is 1,550 m (10 times the rotor diameter). Potential for shadow flicker impacts will be assessed at all residential and or regularly occupied receptors within this shadow flicker study area.

15.4.2 Based on a review of OS mapping, around 23 potential receptors have been identified within 1,550 m of the proposed turbine locations.

15.4.3 The shadow flicker assessment will be undertaken using WindPRO computer modelling software and will be run for both a worst case scenario (accounting for 365 sunshine days per year and 100 % turbine operation) and a realistic scenario (using, where possible, measured meteorological data and 85 % turbine operation) on the potential shadow flicker occurrence for a 1 m x 1 m ground floor window at each identified sensitive receptor location, assumed to be facing directly towards the Proposed Development. Where a number of properties are in close proximity a single receptor location will be identified as representative of the grouping.

15.4.4 The sensitivity of the receptors will be considered to be high unless there are particular reasons for reduced sensitivity. A significant effect will be noted where a receptor is identified as experiencing greater than 30 hours of flicker a year or more than 30 minutes per day on the worst affected day, whichever is the greater (DECC, 2011).

15.4.5 The assessment will present clear findings on the estimated number of hours of shadow flicker impact anticipated for each receptor, for both scenarios. Where required, potential mitigation measures will be discussed.

15.4.6 No impacts are anticipated during construction or decommissioning.

15.5 Potential Significant Effects

15.5.1 There is the potential for significant shadow flicker impacts to occur during the operational phase of the Proposed Development when the turbine blades are moving. It is proposed to scope out assessment of effects during the construction and decommission of the Proposed Development during which it is assumed the turbine blades will not be turning.

15.6 Approach to Mitigation

15.6.1 Should potential significant effects be identified on local receptors, the Applicant will further consult with South Lanarkshire and East Ayrshire Council and could consider implementation of a shadow flicker protocol to mitigate shadow flicker impacts.

15.7 Consultation Proposals

15.7.1 It is proposed to directly consult with the Environmental Health Officers at both councils throughout the assessment stages as required to inform them of any changes to the layout and assessment as required and confirm any potential mitigation measures should these be required.

15.8 Scoping Questions to Consultees

- Do consultees agree to the above study area and assessment methodology?
- Do consultees have any comments regarding the receptors which may be subject to significant effects from the Proposed Development?

16. Glint and Glare

16.1 Introduction

16.1.1 A glint and glare assessment will be undertaken to assess the likely impact of solar reflection on receptors within the Proposed Development's surrounding environment.

16.1.2 Glint and glare in this context is the effect of reflected sunlight causing harm or discomfort to a sensitive receptor. A glint can be defined as the momentary receipt of a bright light and a glare can be defined as the receipt of a bright light over an extended or continuous period of time[16].

16.2 Baseline

16.2.1 There are no other solar PV modules in the local area currently, and therefore no glint or glare effects associated with them. Other reflection effects occur from windows, glasshouses, car windscreens and waterbodies.

16.3 Guidelines and Legislation

16.3.1 Glint and glare assessments are sometimes required to accompany planning applications for solar developments, depending on the determining authority's judgement of their need. There are no guidelines setting out a particular methodological approach, but the receptors of interest are specified in the NPPF as well as guidance issued by the Department for Communities and Local Government (DCLG)[17] which states:

'Particular factors a local planning authority will need to consider include… the effect on landscape of glint and glare and on neighbouring uses and aircraft safety.'

16.3.2 Accordingly, sensitive receptors are considered to be aviation receptors, such as control towers and aircraft, residential receptors and ground based transport receptors, such as drivers and passengers in cars and trains.

16.4 Assessment Scope and Methodology

16.4.1 A glint and glare assessment will be undertaken to identify the potential for solar reflections to impact on sensitive receptors. The assessment is proposed to be limited to ground based receptors and will exclude aviation receptors. The nearest airport is Prestwick Airport, approximately 30 km to away; at this distance significant glint and glare impacts are extremely unlikely.

16.4.2 There is no formal guidance with regard to the maximum distance at which glint and glare should be assessed. There is no maximum distance for potential reflections. The significance of a reflection decreases with distance because the proportion of an observer's field of vision that is taken up by the reflecting area diminishes. Screening from terrain and vegetation is also more likely to reduce glint and glare impacts at longer distances. These reasons and industry standards indicate that a 1km buffer from the proposed panel area is appropriate for glint and glare effects on ground-based receptors.

16.4.3 Assessment is not recommended for local roads, where traffic volumes and/or speeds are likely to be relatively low. All roads within the 1 km buffer zone are local, therefore it is proposed to scope out impacts on road users.

16.4.4 The methodology for the glint and glare assessment is as follows:

[16] BRE (2015) Planning Guidance for the Development of Large Scale Ground mounted Solar PV Systems. Available at: http://www.bre.co.uk/filelibrary/pdf/other_pdfs/KN5524_Planning_Guidance_reduced.pdf [Accessed 21/04/2022]

- Identify sensitive receptors in the area surrounding the solar development. Currently 15 residential receptors have been identified within 1km of the solar area.
- Assess the direct solar reflections from the solar panels towards the identified receptors by undertaking geometric calculations.
- Consider the visibility of the panels from the receptor's location. If the panels are not visible from the receptor then no reflection can occur.
- Based on the results of the calculations, determine whether a reflection can occur, if so, consider the location of the solar reflection with respect to the location of the sun in the sky, its angle above the horizontal and the time of day at which a reflection could occur.
- Consider both the solar reflection from the proposed solar farm and the location of the direct sun light with respect to the receptor's position.
- Consider the solar reflection with respect to the published studies and guidance.
- Determine whether the solar reflection is likely to be a significant nuisance or a hazard to safety.
- Propose mitigation in the event that a significant impact is identified.

16.5 Potential Significant Effects

16.5.1 There is the potential for significant glint and glare impacts to occur during the operational phase of the Proposed Development when solar panels are installed. It is proposed to scope out assessment of effects during the construction and decommissioning of the Proposed Development during which it is assumed the panels will not cause any glint or glare. It is proposed to scope out assessment of impacts on road users and aviation.

16.6 Approach to Mitigation

16.6.1 Should potential significant effects be identified on local receptors, the Applicant will further consult with South Lanarkshire and East Ayrshire Council about additional screening options for the solar array.

16.7 Scoping Questions to Consultees

- Do consultees agree to the above study area and assessment methodology?
- Do consultees have any comments regarding the receptors which may be subject to significant effects from the Proposed Development?

17. Telecommunication

17.1 Introduction

17.1.1 This section considers potential issues associated with telecommunications as a result of the Proposed Development during construction, operation and decommissioning phases.

17.2 Legislation, Policy and Guidance

17.2.1 The following legislation, policy and guidance will be used to inform the telecommunication assessment.

- Wireless Telegraphy Act (UK Government, 2006);
- Planning Advice Note: PAN 62 Radio Telecommunications (Scottish Government, 2001b); and
- Tall structures and their impact on broadcast and other wireless services (Ofcom, 2009).

17.3 Proposed Scope of Assessment

Telecommunications

17.3.1 Any potential effects on communication links will be sought through formal consultation with Spectrum Licensing (previously known as Ofcom) and all relevant link operators. Where possible and applicable, the turbines will be designed to take into account the minimum separation distance from identified communication link(s). An assessment will be made as to the significance of potential operational effects and where appropriate, suitable mitigation measures will be discussed.

Television

17.3.2 The closest television transmitter is the Muirkirk transmitter, located approximately 2km south of the site boundary. This transmitter has switched to digital transmission only. Currently there is no widely accepted method of determining the potential effects of wind turbines on digital television reception, however digital television signals are better at coping with signal reflections, and do not suffer from ghosting that may occur with analogue signals.

17.3.3 To date, there are very few cases of wind turbine interference with digital television reception post-digital switchover. Given the strength of the digital signal in the area and the inherently resilient nature of digital television reception, there is considered to be a low risk of any interference from a wind energy development at this location on domestic television reception.

17.3.4 Due to the low risk of interference with television reception, the requirement to address any reception issues once the Proposed Development is operational could be conditioned in any consent granted. For the above reasons, it is not proposed to carry out a detailed assessment of potential effects on television reception and this topic therefore will be scoped out of further assessment.

17.4 Assessment Methodology and Potential Impacts

17.4.1 No assessment is proposed at this stage; should the need to assess potential impacts arise following consultation with relevant stakeholders, the studies will be commissioned as necessary.

17.4.2 There is potential for the operational Proposed Development to impact telecommunications links, if turbines are not sited outside prescribed buffer zones.

17.5 Potential Mitigation

17.5.1 Should they be required, the mitigation measures will be agreed through direct dialogue between the Applicant and relevant stakeholders.

17.6 Receptors and Impacts Scoped in or out of Assessment

17.6.1 A desk based study has not identified any telecommunication or television links on site but this will be confirmed through consultation with the operators.

17.6.2 No impacts are anticipated during construction or decommissioning.

17.7 Scoping Questions to Consultees

- Do consultees agree to the decision to scope out of telecommunications and television following consultation with operators?

18. Carbon Calculator

18.1 Introduction

18.1.1 This section of the document sets out the proposed approach to the assessment of potential effects of the Proposed Development on carbon balance as a result of the construction and operation of the Proposed Development.

18.1.2 Calculation of the carbon footprint will be based on best practice guidelines including the Scottish Government Carbon Calculator Tool.

18.2 Proposed Scope of Assessment

18.2.1 A wind farm and solar development has the potential to displace electricity generated from fossil fuels during its operational lifespan and consequently prevent carbon dioxide (CO_2) from being released. The EIA will provide an estimate of the potential amount of CO_2 savings that can be made will be based on assessing the electricity generation mix that the Proposed Development is displacing at any given time and the carbon released due to the construction of the Proposed Development.

18.3 Assessment Methodology

18.3.1 A wind farm constructed on peatland habitat has the potential to generate CO_2 emissions as a result of the excavation and/or degradation of peat. The current best practice guidance available on the Scottish Government website provides a method to calculate carbon emission savings associated with wind farm developments on Scottish peatlands using a full life cycle analysis approach using a web-based application. The tool was originally published in 2008 and the latest version published in December 2018 (Scottish Government, 2018b). The tool compares the carbon costs of wind farm developments with the carbon emissions savings attributable to the wind farm. The calculation is summarised as the length of the time (in years) it will take the carbon savings to amount to the carbon costs also referred as the “payback period”. An assessment of effect of significance will not be undertaken but the volumes of CO_2 savings and emissions will be provided in the Chapter.

18.4 Potential Mitigation

18.4.1 During the design process, the turbines will be sited to avoid areas of deep peat as far as possible and measures to minimise peat disturbance especially during excavation will be taken into consideration. Best practice measures will also be considered to minimise peat disturbance during construction and decommissioning that will be provided as a part of the Construction Environment Management Plan.

18.5 Scoping Questions to Consultees

- Do you agree with the above methodology for assessing carbon emissions and savings as a result of the Proposed Development?

19. Air Quality

19.1.1 The air quality of the site is expected to be good due to the rural location, with few pollution sources.

19.1.2 During the construction of the Proposed Development, the movement of vehicles and the on-site plant would generate exhaust emissions. Given the short-term nature of the construction period and the limited area to be developed, effects on air quality are likely to be negligible.

19.1.3 Operational wind turbines and solar panels produce no notable atmospheric emissions. The operation of the wind turbines and solar panels would therefore have no discernible adverse effects on local or national air quality. Additionally, during operation the Proposed Development will provide a beneficial effect on local and global air quality, by avoiding emissions which would otherwise be achieved by other technologies by the burning fossil fuels.

19.1.4 Furthermore, in respect of the green hydrogen production facility, the electrolysis process splits water by electrical energy to obtain hydrogen plus oxygen. As the hydrogen is stored and transported offsite, the primary outputs are oxygen and water with the oxygen output serving to improve local air quality.

19.1.5 Construction activities also have the potential to generate dust during dry spells, which may adversely affect local air quality. Relevant mitigation measures for air quality, dust and pollution control will be captured within the site-specific Construction Environmental Management Plan (CEMP).

19.1.6 It is therefore proposed that an assessment of air quality is scoped out of the EIA.

20. Major Accidents and Disasters

20.1.1 Given the nature of the Proposed Development, the risk of a major accident or disaster is considered to be extremely low, and given its remote location, it is not likely to the be susceptible to natural disasters or extreme weather.

20.1.2 The Principal Designer would need to ensure a Design Risk Assessment process is followed during the design phase to ensure designers fully assess risks and mitigate to a level deemed as low as reasonably practicable during the design stage as part of the requirements of *the Construction (Design and Management) Regulations* (2015).

20.1.3 The Proposed Development will be constructed and operated in accordance with relevant health and safety legislation including the Health and Safety at Work Act 1974 and the Control of Major Accident Hazard Regulations 2015 (COMAH).

20.1.4 During the operational phase of the Proposed Development, routine maintenance inspections would be completed in order to ensure the safe and compliant operation of all built infrastructure.

20.1.5 It is therefore proposed that an assessment of the risk of major accidents and disasters is scoped out of the EIA.

21. Summary

21.1.1 This EIA Scoping Report outlines the proposed technical and environmental assessment that will be included within the EIA Report for the Proposed Development. The proposed scope and methodologies for each assessment have been provided and the guidance to be followed set out. Should any further information be required in order that a full EIA Scoping Opinion can be provided we would be happy to provide further information and/or discuss any further requirements.

Appendices

Appendix 1.1 – Scoping Consultee List

Table A1: List of consultees and interested stakeholders consulted as part of the Scoping process.

Organisation	Organisation
Association of Salmon Fishery Boards	Mountaineering Council of Scotland
BAA (Glasgow Airport)	Muirkirk Community Association
BAA Edinburgh Airport	Muirkirk Community Council
British Horse Society	Muirkirk Enterprise Group
BT	NATS Safeguarding
Civil Aviation Authority - Airspace	NatureScot
The Coal Authority	RSPB Scotland
Coalburn Community Council	Sanford Upper Avondale Community Council
The Crown Estate	Scottish Forestry
Defence Infrastructure Organisation	Scottish Government - Hydrogen Policy
District Salmon Fisheries Board	Scottish Government - Natural Resources Division
Douglas Community Council	Scottsh Raptor Study Group (South Strathclyde)
East Ayrshire Council	Scottish Water
Fisheries Management Scotland	ScotWays
Galloway and Southern Ayrshire Biosphere	Scottish Wildlife Trust
Glasgow Prestwick Airport	SEPA
Health and Safety Executive	South Lanarkshire Council
Historic Environment Scotland	Transport Scotland
Joint Radio Company	Visit Scotland
Lesmahagow Community Council	

Appendix 3.1 – Turbine Coordinates

Table B1: Scoping Layout Turbine Coordinates (72) - Tip height as noted below and rotor diameter up to 76m.

Turbine No.	X Coordinate	Y Coordinate	Tip Height (m)	Turbine No.	X Coordinate	Y Coordinate	Tip Height (m)
01	265555	629121	<230	37	273129	633146	230
02	266045	629221	<230	38	272366	633292	230
03	266557	629172	<230	39	272849	633443	230
04	266464	629651	<230	40	272693	633856	230
05	267135	629310	<230	41	273249	634044	230
06	267027	629725	<230	42	272945	634423	230
07	266985	630158	<230	43	273459	634627	230
08	267490	630185	<230	44	272157	635577	230
09	268292	630434	<230	45	271832	635761	230
10	268698	630217	<230	46	271697	635169	230
11	268795	630741	<230	47	271263	634600	230
12	269164	630609	<230	48	271087	634944	230
13	271646	629786	<230	49	270544	635402	230
14	271273	630019	<230	50	270667	635013	230
15	271065	630440	<230	51	270560	634494	230
16	270764	630735	<230	52	270732	634118	230
17	270742	631167	<230	53	270200	633688	230
18	270946	631678	230	54	270064	634058	230
19	271345	631456	230	55	270118	634553	230
20	271345	630972	230	56	270124	635056	230
21	271641	630785	230	57	269751	635442	230
22	271841	630374	<230	58	269583	634946	230
23	272209	629780	<230	59	269720	634550	230
24	272562	630950	230	60	269528	633961	230
25	272379	631410	230	61	269179	634361	230
26	271809	631479	230	62	268909	633783	230
27	271745	631895	230	63	268500	633898	230
28	271435	632094	230	64	268870	634614	230
29	271877	632635	230	65	268368	634310	230
30	272167	632336	230	66	267903	633890	230
31	272482	631976	230	67	267915	634342	230
32	272888	631770	230	68	268296	634838	230
33	273088	632279	230	69	267417	634234	230
34	272804	632571	230	70	267249	634553	230
35	272576	632905	230	71	267782	634837	230
36	273328	632770	230	72	268059	635339	230

Appendix 7.1 –

Enhancing the Muirkirk and North Lowther Uplands Special Protection Area: A Discussion Paper on Financing Nature Conservation & Community Regeneration in the Muirkirk Valley

Version 2.0

Enhancing the Muirkirk and North Lowther Uplands Special Protection Area:

A Discussion Paper on

Financing Nature Conservation & Community Regeneration in the Muirkirk Valley

by

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for

3REnergy

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Introduction

1. This discussion paper briefly reviews the policy challenge of securing delivery of 'public goods' from rural land management in Scotland, and the relevance of environmental designations for this purpose.

2. Against this general context, the paper then considers the case of the Muirkirk and North Lowther Uplands Special Protection Area (MNLU SPA) and the prospects of attracting sufficient funding to ensure appropriate land management to correct the site's current unfavourable and declining status and to counter socio-economic deprivation in local communities.

3. Specifically, the option of using long-term sponsorship funding generated from a renewable energy development on part of the MNLU SPA is presented. Allowing renewable energy generation on part of an environmental designation to leverage funding for appropriate management across the rest of it is perhaps controversial.

4. However, it needs to be considered against the likelihood of continued under-funding leading to further gradual deterioration of the whole SPA. That is, environmental designation alone is insufficient to protect and enhance public goods because they require the presence of appropriate management not just the absence of inappropriate management. In turn, this requires funding that has often not been available historically, leading to this and other designated sites being in poor condition.

5. As a case-study, the MNLU SPA illustrates the mismatch between land use policy objectives and funding allocations. It also highlights the existence of messy trade-offs and compromises involved in addressing the challenges of the twin climate and biodiversity emergencies and achieving a 'Just Transition' towards Net Zero.

6. Hence this paper aims to stimulate discussion relevant to not only the specifics of financing nature conservation & community regeneration in the Muirkirk valley but also to wider contemporary debates about land use priorities, policy measures and funding models.

Context

7. Land can be used for different purposes. For example, for housing, for forestry, for agriculture. In many cases, a given parcel of land can have multiple functions. For example, within limits, land can be used for both agriculture and recreation.

8. Contemporary debates on land use frame this multi-functionality in terms of ecosystem services.[1] Hence, whilst food, fibre and energy provision from land have traditionally been emphasised, recognition is now increasingly given to other services. For example, climate and water regulation, habitat space for biodiversity, and landscape aesthetics.

[1] See https://www.nature.scot/scotlands-biodiversity/scottish-biodiversity-strategy-and-cop15/ecosystem-approach/ecosystem-services-natures-benefits

9. This broader perspective is reflected in current Scottish Government policy commitments to address environmental degradation, alongside continued references to food production and cultural heritage. However, although ecosystem services can often be generated together to some extent, prioritising the delivery of specific services can mean reducing the delivery of others.

10. For example, land used for forestry offers carbon sequestration for climate regulation and provisioning of timber for construction or energy but displaces provisioning of food and changes the types of habitats and biodiversity relative to those associated with farming. Equally, management style also affects the level and mix of ecosystem services delivered. For example, intensive farming prioritises provisioning of food over climate and water regulation or habitat spaces.

11. Although government policies may seek complementarities (i.e., win-win options) between different ecosystem services, substitutions and trade-offs can be unavoidable. For example, there is a limit to how far innovation and best practice can simultaneously improve food production and biodiversity at a specific site before one or other has to be compromised.

12. Moreover, variation in site-specific characteristics (e.g., soil, topography, climate) means that not all parcels of land can generate the same mix of ecosystem services and hence trade-offs can also have a geographical dimension. For example, some habitats and biodiversity will only ever occur at high altitude in Scotland, maximum carbon content is lower in mineral soils than organic ones, and land in the east is intrinsically more agriculturally productive.

13. Trade-offs and the implications for land managers and rural communities of changing ecosystem service priorities are widely acknowledged. For example, as reported by the various Farmer Led Groups[2] commissioned by the Scottish Government to identify future agricultural land use options, or the commitment to a 'Just transition' to accompany achieving Net Zero by 2045 and help individuals and communities to adjust.[3]

14. However, required adjustments are unlikely to be distributed evenly and the process by which land is to be allocated to different uses remains uncertain. For example, it is not clear exactly how trade-offs between agriculture, forestry, renewable energy and conservation management are to be decided at either the national or local level – although the pilot Rural Land Use Partnerships (RLUPs) are an attempt to offer a mechanism for this at the local level, following principles of the Land Use Strategy in defining options and priorities.[4]

Environmental Designations

15. Environmental designations offer one policy approach to controlling types of land use at specific locations. For example, Scotland has over 1400 Sites of Special Scientific Interest (SSSI), designated to

[2] See https://www.gov.scot/policies/agriculture-and-the-environment/farmer-led-climate-change-groups/
[3] See https://www.gov.scot/groups/just-transition-commission/
[4] See https://blogs.gov.scot/rural-environment/2021/02/05/working-together-to-maximise-the-potential-of-our-land/ and https://www.gov.scot/publications/scotlands-third-land-use-strategy-2021-2026-getting-best-land/

protect nationally important flora, fauna, geology, and/or geomorphology features from damaging land management.[5]

16. Some of these sites are stacked with further environmental designations denoting their international importance. For example, 243 Special Areas of Conservation (SACs) and 162 Special Protection Areas (SPAs). Other overlapping designations include woodland parks, National Parks and National Nature Reserves.

17. Collectively, existing environmental designations cover c.18% of Scotland's land. The Scottish Government commitment to placing at least 30% of Scotland's land under nature protection by 2030 ('30x30') is interpreted as expanding the area of environmental designations. This may either be via existing mechanisms and or 'Other Effective area-based Conservation Measures'.[6]

18. However, whilst an environmental designation may protect against specific environmentally damaging activities it is generally insufficient on its own to maintain or enhance environmental features against degradation from background trends and/or neglect. That is, in the absence of appropriately planned and funded management, there remains a risk of environmental deterioration.

19. Indeed, around 20% of designated features across Scottish SSSIs are in unfavourable condition.[7] This reflects a wider policy challenge in securing ecosystem services from land management.

The land use policy challenge

20. Some ecosystem services derived from rural land management are valued through market prices via the interaction of private supply and demand. For example, the provision of food and timber.

21. Others, however, are not and take the form of public goods.[8] For example, landscape aesthetics, climate regulation and habitat space all have value to society but are not priced correctly through markets. This market failure leads to their under-provision.

22. Under provision of public goods arises for a variety of reasons, but primarily because suppliers are unable to recover their costs through charging service users. This matters since, in most cases, ecosystem services do not arise spontaneously from rural land but rather require active management.

23. More specifically, land's natural capital (e.g., soils, biodiversity) often needs to be combined with human capital (e.g., skills, knowledge) and financial capital (e.g., equipment, inputs), and this incurs effort and expense.

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[5] See https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/national-designations

[6] See https://www.gov.scot/publications/scottish-biodiversity-strategy-post-2020-statement-intent/pages/7/

[7] See https://www.nature.scot/sites/default/files/2019-05/Official%20Statistics%20-%20Protected%20sites%20-%20proportion%20in%20favourable%20condition%202019.pdf

[8] This is a narrow economic concept, easily confused with the broader political concept of public interest (i.e., what is presumed to be good for the public). Strictly, public goods are items for which one person's use does not reduce its availability to another person and for which use cannot be restricted to only those explicitly paying for it. These conditions are termed 'non-rivalry' and 'non-excludability'. For example, a landscape view is a public good, a leg of lamb is not (food is not a public good, even though food security is in the public interest).

24. If private costs cannot be recouped to leave an acceptable profit margin, private suppliers have little incentive to incur them, and public goods remain under-provided.[9] Policy remedies for this problem include regulatory obligations and direct provision by Government.

25. For example, land managers can be obliged to refrain from certain activities (e.g., drainage, field operations during bird breeding season), with penalties (e.g., fines) imposed if they breach such regulatory obligations.

26. This approach (sometimes referred to as the 'polluter pays principle') is generally deployed to avoid inappropriate land management activities rather than appropriate positive ones. Moreover, regulation is often criticised as stifling innovation and efficiency through inflexibility and incurring additional administrative costs for monitoring and enforcement.

27. As an alternative, government or its agencies can acquire and/or manage land directly itself. For example, as with some nature reserves and forestry estates in Scotland. This avoids reliance on private land managers and the accompanying need for monitoring and enforcement of rules. However, it incurs public costs for land acquisition and management and may crowd-out more efficient private operations.

28. Neither of the above options feature prominently in contemporary discussions about rural land management in Scotland. Instead, efforts are primarily directed towards encouraging private land managers to voluntarily provide public goods through appropriate management.

29. This involves offering information, advice and training to improve land managers' capabilities to deliver public goods, but also offering support payments to incentivise delivery. Such efforts require significant levels of funding, which may be derived from various sources.

Public funding

30. Traditionally, funding for the delivery of public goods has come from public budgets. For example, in the form of agri-environment schemes or management agreements under which land managers receive grant-aid for upfront capital works and/or recurrent payments for ongoing adherence to management prescriptions.

31. More recently, generic conditionality requirements (e.g., Good Agricultural and Environmental Condition, Greening) attached to direct support payments (e.g., the Basic Payment Scheme) have also been used and may be reinforced under future Scottish agricultural policy.

32. However, such approaches have suffered from a number of weaknesses. For example, whereas conservation management needs to be sustained over the long-term to achieve and preserve environmental improvements, conditionality requirements can change over time and land can fall in-and-out of voluntary, short-term agri-environment schemes. Hence gains in one period can subsequently be lost.

33. Similarly, effective conservation action often needs to operate at a landscape scale (e.g., for habitat mosaics and connectivity), yet agri-environment scheme membership and conditionality requirements tend to be at the individual farm-level rather than being co-ordinated across

[9] A complication here is that, within limits, many land-based public goods are produced jointly (i.e., as co or by-products) with private goods. This means that the specific costs of providing public goods can be difficult to calculate.

neighbouring farms. Equally, conditionalities and scheme prescriptions are often relatively inflexible rather than being adaptable to local circumstances (including year-on-year variation) and are not always well targeted to achieve meaningful results.

34. In addition, a further weakness has been (and remains) constraints on the overall availability of public funding and how public payment rates are calculated. For example, agri-environment schemes have been allocated a relatively small share of overall agricultural funding and payment rates have been constrained[10] to only cover 'costs incurred and income foregone', which in many cases is insufficient to incentivise widespread uptake. Moreover, the limited budget means that scheme membership is competitive and therefore not all land can be enrolled (further contributing to continuity and spatial co-ordination problems).

35. Given other demands (e.g., post-Covid recovery) on public budgets, it is not expected that public funding for land management will increase. Nor are there any indications that the share allocated explicitly to conservation management measures within the overall land management budget will rise significantly (although it is possible that conditionality for general agricultural support may be strengthened).

36. Consequently, it is widely anticipated that there will remain a public funding shortfall in relation to environmental land management. As a result, there is considerable interest in possibilities for attracting alternative private sources of funding, either to replace or (perhaps more likely) supplement public funding.

Private funding

37. Various private funding models can be envisaged, but they can be summarised as falling into two main categories of 'trading' or 'sponsorship'. Under the latter, funding is provided by cross-subsidisation from an activity not necessarily related to production of the public goods (hence echoing the use of public funding raised through taxation elsewhere in the economy). This essentially relies upon sponsors (internal or external) having philanthropic or Corporate Social Responsibility (CSR)[11] motivations.

38. By contrast funding under a trading model is sought by attempting to generate market revenues from the sale of public goods. This essentially relies upon being able to overcome market failure characteristics, which is challenging (i.e., public goods are public goods for a reason). However, it has potential to raise significant sums if it can be made to work (i.e., markets are powerful).

39. The two private funding categories are not mutually exclusive, meaning that sponsorship may run alongside trading activities. Moreover, both can co-exist with public funding (so-called 'blended finance').

Trading

40. Trading models include attempts to charge a premium price for goods and services associated with sustainable land management. For example, branding food as from wildlife friendly or low carbon

[10] Constrained by the World Trade Organisation (WTO) Agreement on Agriculture (AoA) which determines how domestic support for agriculture is viewed in terms of distorting international trade and hence how payments can be made.

[11] Now also referred to as Environment, Social, and Governance (ESG).

production systems. However, although successful examples do exist, market premiums are often small and require significant marketing effort to create and maintain.

41. Value created by land management is sometimes captured at least partially by other local businesses. For example, providers of tourism accommodation and activities. In principle, a proportion of such trading revenue could be redirected to land managers. However, in practice this is often too complex.[12]

42. An alternative trading model which is attracting increasing attention is the creation of direct markets for selected ecosystem services, either sold individually or bundled together. For example, carbon sequestration, water management and biodiversity maintenance.

43. This type of approach has various flavours and labels, including 'offsetting', 'environmental markets' and 'Payments for Ecosystem Services' (PES). In all cases, a major challenge is to provide sufficient assurances to buyers that the service being delivered is genuine. This has led to the creation of various assurance standards specifying, for example, the required form and duration of land management practices and how outcomes are to be measured and reported.

44. These standards are best developed for carbon sequestration and storage. For example, in the UK, the Woodland Carbon Code and the Peatland Code are already in operation and provide a means for land managers to generate revenue through the sale of voluntary[13] carbon credits created. In these cases, carbon credits are created by, respectively, planting trees and restoring degraded peatlands.

45. Standards for other forms of carbon sequestration (e.g., into farmland soils) and for other environmental public goods (e.g., biodiversity) do exist, but are as yet somewhat variable in their perceived credibility. Consequently, trading under them is less established.[14]

46. In some cases, food processors and retailers are exerting pressure back along their supply-chains to encourage sustainable land management, as defined either by the retailer themselves or with reference to a trading standard. In these cases, land managers may receive an additional payment for compliance with more demanding contractual obligations, but often their reward is simply being able to continue to act as a supplier.

47. Moreover, processors and retailers are often claiming any environmental credits generated by the land manager. Typically, this is to allow credits generated in the supply-chain to be presented as offsetting environmental damage reported at the processing or retail level (e.g., Scope 3 carbon emissions, biodiversity net gain). It does, however, constrain land managers' ability to use credits themselves, either to generate revenue or to set against their own emissions.

[12] Possibilities include a reliance on voluntary donations by visitors ('visitor payback'), a local 'bed tax' on overnight stays, and entry charges. The latter is difficult to reconcile with the right to roam, but membership organisations (e.g., RSPBS, National Trust for Scotland) can sometimes achieve it. Public goods delivered through membership groups are referred to as 'club goods' (which blurs into the sponsorship model described below).

[13] Two types of markets exist for ecosystem services - 'compliance' markets and 'voluntary' markets. The former is regulated by government. For example, the UK Emissions Trading Scheme (ETS) for heavy industry and aviation. Voluntary markets are unregulated.

[14] Many international examples of Payments for Ecosystem Services are actually funded by governments rather than private buyers.

48. Consequently, despite the potential gains to be made from environmental trading, navigating the complexity is not straightforward and ownership of environmental credits generated from land management is a complex and increasingly contentious topic.[15]

Sponsorship

49. The complexities and uncertainties of seeking funding under a trading model can be avoided through recourse to sponsorship. This essentially involves securing funding that is not directly dependent on generating trading revenue from the land management being funded.

50. Such cross-subsidisation can occur within a business as internal sponsorship with no requirement for external funding. For example, where a business owner can afford to carry loss-making activities because of other profitable enterprises and/or accumulated capital reserves (often unrelated to land management) and is motivated to do so by personal or altruistic objectives. This type of behaviour can occur at any scale of land-based business but is perhaps most visible in the form of various high-profile purchases of Scottish estates by wealthy individuals.

51. However, most land-based businesses in Scotland lack the internal resources required to cross-subsidise the production of public goods from land management. Hence most require external funding.

52. External sponsorship can take the form of philanthropic donations, either through established charities or more novel crowdfunding activities. Such sponsors do not seek explicit reward (other than perhaps recognition of their support).

53. Alternatively, external sponsorship may also be driven by CSR/ESG motivations. That is, businesses operating in other sectors of the economy may wish to signal that they are committed to sustainability principles and prefer to do by directly supporting identifiable land management projects rather than simply buying environmental credits in an anonymous market place.

54. CSR sponsors may not derive any direct reward but may derive indirect rewards through how they are subsequently perceived by their own investors, staff, customers and neighbouring communities. For example, more favourable borrowing terms, greater staff retention, more customer loyalty, community goodwill.

55. However, securing external sponsorship can involve considerable effort. For example, philanthropic funding is often competitive (and hence uncertain) and bidding processes can be long and complex. Equally, securing sponsorship can involve protracted searching for potential sponsors and then protracted negotiations to agree funding deals.

56. Indeed, intermediaries (e.g., brokers) are often required to work with all parties to find appropriate matches between prospective funders and potential projects. This is particularly true where projects involve multiple land managers.

57. Moreover, notwithstanding the supposed more anonymous nature of markets, buying and selling of credits also often involves intermediaries in agreeing bilateral deals between buyers and sellers, particularly where projects involve forward selling of credits to smooth cash flows.

[15] e.g., see https://www.landcommission.gov.scot/news-events/news/chair-of-land-commission-urges-caution-in-selling-carbon-rights?p_slug=news

MNLU SPA

58. The Muirkirk and North Lowther Uplands Special Protection Area (MNLU SPA) comprises 27,000 ha of upland landscape, mostly within East Ayrshire but also covering parts of Dumfries and Galloway and South Lanarkshire (see Annex 1 for map).

59. The area is a plateau moorland, ranging in height between 180m and 593m, with land use dominated by livestock rough grazing but a history of coal and mineral extraction. The local economy was previously highly dependent on mining, the decline of which has contributed to significant social deprivation within local communities (see Annex 2 for summary socio-economic statistics).

60. The SPA was originally designated in 2003, with a subsequent expansion in 2018 to cover a slightly larger area. Designation was primarily in recognition of the presence of various rare upland bird species (e.g., hen harrier, short-eared owl, merlin, peregrine, golden plover), and underlying SSSI designations for extensive blanket bog habitats characterised by specialised upland plants assemblages (e.g., mosses, sedges, heather).[16]

61. Unfortunately, as with many other sites, official assessments report that most of the qualifying biological features used to justify the MNLU SPA designation are in unfavourable, declining condition.[16] This reflects unsympathetic management on parcels of land adjoining the SPA, notably some pre-existing conifer plantations, but also more directly the absence of any sustained and co-ordinated purposeful conservation management across the SPA.

62. RSPB Scotland recently published a Conservation Action Plan (CAP) for the SPA.[17] This describes the various negative pressures experienced by the SPA and suggests a range of management activities to counter them over time. For example, peatland restoration and sustainable grazing with predator control to establish a connected landscape of habitat mosaics suitable for upland bird species.

63. The CAP provides a welcome long-term vision of how the SPA could be managed to better reflect the potential recognised by its original designation. However, management incurs costs and these need to be funded. Yet the history of environmental land management in Scotland (and beyond) is one of persistent under-funding due to short-termism and competing demands. Consequently, implementing the CAP to deliver on the SPA's potential is a challenge.

64. Importantly, the potential contribution of SPA management to community well-being through effects on local environmental conditions and employment opportunities should not be separated from consideration of conservation management needs. Rather, where possible, funding and management should be configured to deliver in both environmental and socio-economic terms. For example, the employment and economic output multiplier effects of land management ripple through local economies, supporting activity and livelihoods beyond the SPA itself.

65. As presented, the CAP is uncosted. However, indicative costings can be estimated from current agri-environmental scheme payment rates and generic published estimates. For example, hen harrier grassland management (not currently available outwith Orkney) and habitat mosaic management are

[16] See https://sitelink.nature.scot/site/8616

[17] See RSPB (2020) Conservation Action Plan for the Muirkirk and North Lowther Uplands Special Protection Area (SPA). RSPB South & West Scotland Region Muirkirk and North Lowther Uplands Delivery Group, under the auspices of the Interreg VA-funded Cooperation Across Borders for Biodiversity (CABB) Advisory project

paid at c.£90/ha.[18] Similarly, aggregate-level average funding needs have been reported as c.£95/ha.[19] This implies funding needs for the whole MNLU SPA of perhaps £2.4m/year, less if targeted at specific parts of the SPA.

MNLU SPA funding prospects

3REnergy sponsorship

66. 3REnergy is a developer of renewable energy projects. It already operates within the Hagshaw Energy Cluster adjacent to the MNLU SPA and a proportion of the energy revenues raised from the projects it has developed are directed towards funding for local communities.

67. For example, the onshore wind projects that 3REnergy has developed within the Hagshaw Energy Cluster to date will deliver:
    - £1.6m to local communities every year, which is £48 million (indexed) over 30 years;
    - Over 1,800 job years of employment through the construction and development phases;
    - Green electricity for over 240,000 households in Scotland; and,
    - A saving of over 430,000 tonnes of CO2 each year.

68. Importantly, 3REnergy itself has roots in the local area through its founders and staff and is interested in options for extending sponsorship funding through enlargement of the Hagshaw Cluster.

69. Specifically, whether it would be possible to expand into the SPA itself, and to then use a proportion of additional energy revenues raised for sponsorship funding. Although the precise development details would need further consideration, indicative estimates for the level of funding (in today's money) are c.£40m for conservation management and c.£100m for community development over a period of 40 years.

70. This funding would be additional to rentals paid to land owners and to funding for obligatory specific mitigation measures relating to infrastructure installation (e.g., access roads, hard standings etc.). Some front-loading of funding of early capital investments rather than only ongoing operational activities would be possible (e.g., for peatland restoration).

71. Such an arrangement would offer long-term funding for the SPA, and further boost funding for local socio-economic development measures. For example, community sponsorship support could be directed towards training programmes for local residents to assist with employability, including for jobs linked to the Hagshaw Cluster and/or the wider SPA management activities. In this regard, it is noted that the Prince's Foundation is currently providing rural skills training in the area at Dumfries House, which could be used for the likes of traditional estate management skills (keepering etc).[20]

72. Equally, consideration could be given to supporting nature education and recreational opportunities, including through new facilities funded by the sponsorship to increase the offering of the local area

[18] See https://www.ruralpayments.org/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/moorland-management/
[19] See https://www.wildlifetrusts.org/sites/default/files/2019-09/Paying%20for%20public%20goods%20final%20report.pdf
[20] See https://dumfries-house.org.uk/education

and create a more vibrant rural economy. Local community engagement and enthusiasm is acknowledged as key to place-based development involving environmental land management.[21]

73. A draft development plan[22] for the Hagshaw Energy Cluster already notes that further expansion has potential benefits for nature management, outdoor recreation and inclusive sustainable growth plus local community identity and heritage with the overall aim of supporting more economically active and sustainable communities.

74. Decisions would be needed on the allocation of funding across the SPA, and neighbouring areas. For example, funding for conservation management could be shared across the entire SPA or concentrated on particular sections. Similarly, community support could be distributed uniformly or directed towards specific locations and activities.

75. However, 3REnergy would not itself expect to make decisions about how sponsorship funding should best be utilised. Rather, governance arrangements would need to be established to give voice to relevant local stakeholders better placed to identify options and priorities for funding. Such arrangements could build upon existing ones.

76. For example, in a similar manner to how community funding from the Hagshaw Cluster is currently managed, or via oversight by bodies such as the RSPB or the East Ayrshire Coalfield Environment Initiative. Equally, there may be a role for any future Rural Land Use Partnership (RLUP) established in the area.

Counterfactuals

77. The environmental and socio-economic gains from additional local funding would be significant. Yet, 'sacrificing' a portion of the SPA to generate such funding is an unconventional idea. In particular, the purpose of environmental designations is, in part, to protect sites from damaging land use and installing renewable energy infrastructure will inevitably cause some damage, even if only on a small part of the SPA.

78. However, consideration needs to be given to the counterfactual of what is likely to happen to the SPA in the absence of 3REnergy sponsorship. The Conservation Action Plan makes clear that the condition of the SPA is currently unfavourable and declining, and that this decline will continue if purposeful management is not put in place.

79. Ultimately this could lead to a situation where the SPA loses all of its qualifying features and no longer merits its status as a designated site. Avoiding this undesirable outcome requires funding, and if 3REnergy sponsorship is unacceptable then alternatives will need to be found.

80. In principle, an alternative sponsor could be found. However, the processes and resources available to seek an alternative sponsor are not clear (i.e., who would undertake the task?). Moreover, the MNLU SPA lacks the iconic species and landscapes of some other locations in (particularly Highland) Scotland or elsewhere and is unlikely to attract the attention of non-local philanthropic or CSR sponsors, nor to guarantee long-term commitment.

[21] For example, see https://pure.sruc.ac.uk/files/45492919/February_2022_Policy_Spotlight_Scotland_s_Protected_Areas_FINAL.pdf

[22] Overseen by a steering group including representatives of NatureScot and East Ayrshire and South Lanarkshire councils, plus various energy companies. See https://www.thehagshawenergycluster.co.uk/

81. Yet, the local economy generally lacks large businesses or wealthy individuals capable of generating the level of funding required, rendering the likelihood of finding other sponsors low. Furthermore, even if an alternative sponsor could be found for aspects of environmental enhancement, this scenario would not necessarily provide any investment in the regeneration of surrounding coalfield communities such as Muirkirk.

82. Securing funding through environmental trading might be possible. However, although markets for carbon credits are reasonably well established, the revenues currently available under the Woodland Carbon Code and the Peatland Code are relatively modest and insufficient to fund woodland creation and peatland restoration (let alone cross-subsidise other land management activities) without additional funding (e.g., from public grants or timber sales).

83. For example, voluntary carbon prices under both codes currently range up to about £20/t CO_2e. Restoring a moderately degraded peatland may avoid 2t CO_2e per ha per year, implying annual revenues of £40/ha.[23] However, this is before deductions for assurance processes[24] which can account for a third of gross revenues, implying annual net revenues of less than £30t/ha. Similarly, a new woodland may sequester 6t CO_2e per ha per year and generate perhaps £80/ha of annual net revenue.[25]

84. Whilst these illustrative levels of net funding may be sufficient to cover ongoing management, they are not sufficient to also cover upfront capital costs (e.g., blocking drains, planting trees). Higher gross revenues may be achievable from more degraded peatlands (e.g., bare peat) and different, types of woodland (e.g., faster growing or more densely planted trees), but capital costs also tend to rise. Moreover, trading revenues are not generally generated from all parcels of land within a site. Hence funding derived from carbon trading is best regarded as supplementary to rather than a substitute for other funding sources (e.g., public or sponsorship).

85. This situation could perhaps change if voluntary carbon market prices were to rise significantly. Various forecasts do suggest that this is a possibility, but also that it is subject to considerable uncertainty. For example, a global glut of carbon credits is depressing international prices below £5/t CO_2e, which limits how high UK prices are likely to rise.

86. Moreover, buyer confidence is fragile and international efforts to agree credible minimum standards have yet to resolve a number of issues. For example, in relation to verification processes and definitions of permanence and additionality. The same problems also afflict other environmental markets, including for biodiversity and water regulation. Consequently, trading revenues are unlikely to be a reliable source of sole funding for conservation management in the SPA. Moreover, again, this scenario would not provide any investment in the regeneration of surrounding coalfield communities like Muirkirk.

87. The final source of funding is public expenditure. Land managers within the MNLU SPA currently receive public funding in the form of Pillar I and Pillar II support payments under the (now legacy) Common Agricultural Policy. Pillar I payments comprise the Basic Payment Scheme (BPS), Greening and voluntary coupled schemes. Pillar II payments include agri-environmental schemes and the Less

[23] Although in practice carbon credits are not sold annually but at five-yearly intervals, meaning that revenue streams are not continuous/smooth.

[24] See https://www.woodlandcarboncode.org.uk/ and https://www.iucn-uk-peatlandprogramme.org/sites/default/files/header-images/PeatlandCode_v1.1_FINAL.pdf

[25] It is also worth noting that widespread woodland creation does not feature in the Conservation Action Plan, and hence woodland carbon revenues are of less relevance than (more modest) peatland carbon revenues.

Favoured Area Support Scheme (LFASS). In addition, some specific public funding is supporting peatland restoration under NatureScot's Peatland Action programme.

88. However, as noted in the Conservation Action Plan, past and current public funding has been insufficient to support the types of management actions needed to revive the SPA. Detailed information on public funding is not readily available, but the type of land use in the SPA will place it within either Region 2 or Region 3 for Pillar I support (attracting annual payments of c.£40/ha and £12/ha respectively). Less Favoured Area Support Scheme funding may add a further c.£10/ha to this.

89. This suggests that current annual agricultural support funding across the SPA will be in the range of c.£0.6m to c.£1.3m, although probably towards the lower end of this range given that most land is likely to be classified as in Region 3.[26] Pillar II support is unlikely to apply across the entire SPA, but may perhaps contribute a further c.£0.2m. In addition, at least some sites within the SPA are receiving specific support for peatland restoration under NatureScot's Peatland Action programme.

90. The Scottish Government is currently in the process of formulating future policy for supporting land management. Whilst the direction of travel is towards greater emphasis on environmental performance, it seems unlikely that additional public funding will become available given the range of other pressures on the public purse.

91. Moreover, at least in the first instance, budget allocations to poorer agricultural land (e.g., Region 3) and agri-environment scheme payment rates seem unlikely to increase. Indeed, in the specific case of peatland restoration, it has already been acknowledged that meeting ambitious policy targets will require private funding to supplement available public funding.[27]

92. If 3REnergy sponsorship was added to current public funding, it could at least double total annual support for the SPA to c.£1.9m to c.£2.7m. Alternatively, it could substitute for some elements of public support, most obviously scarce Peatland Action funding which could then be deployed elsewhere. Additional trading income could further supplement overall funding within the SPA.

93. Importantly, the 3REnergy sponsorship scenario would provide an additional £2.5m of annual funding for investment in local coalfield community regeneration, which could also include an element of community-led SPA management.

<u>Conclusions and points for further discussion</u>

94. Preservation and enhancement of the MNLU SPA requires purposeful conservation management. In turn, this requires access to longer-term and more generous funding than is currently available. In principle, such funding might be sought from various sources. In practice, the likelihood of securing sufficient funding is low.

95. Consequently, an offer of significant sponsorship funding over a 40-year period needs to be taken seriously. The fact that it involves a trade-off, 'sacrificing' a part of the SPA (around 0.2% of its total

[26] Land managers may receive higher total payments if they also have land outside of the SPA boundary.
[27] See https://www.nature.scot/sites/default/files/2021-02/Board%20meeting%20-%2003%20February%202021%20-%20Restoring%20Scotlands%20peatlands%20-%20our%20ambition%20and%20role.pdf Ambitions for public funding in England are more explicit, at £500m/yr by 2027 and £1bn/yr by 2030. https://consult.defra.gov.uk/natural-environment-policy/consultation-on-environmental-targets/consultation/subpage.2022-03-15.6135362752/

land area) for development in order to release funds to enhance the rest of the SPA, is a complication but not a reason to summarily dismiss the idea.

96. Rather, careful consideration needs to be given to the counterfactual situation of what is likely to happen if the offer is rejected. Unless there is a credible strategy for securing sufficient funding from other sources, the inferred outcome is one of continued deterioration in the condition of the whole SPA and ultimately the loss of its designated status and a missed opportunity for local communities.

97. This perspective has relevance beyond the specific case of the MNLU SPA, reflecting tensions at the national level between stated policy ambitions and the level of funding available. In particular, without adequate funding for meaningful management on-the-ground, the laudable aim of increasing the area of land under nature protection to at least 30% by 2030 risks being somewhat hollow. Specifically, without long-term funding for appropriate management, designations may be in name only and make no practical difference to environmental conditions.

98. In the specific case of the MNLU and the wider Muirkirk Valley, the 3REnergy sponsorship proposal appears to offer one solution to help deliver some key Scottish Government objectives:

- More investment in nature, peatland restoration and protected sites.
- More renewable energy.
- More vibrant rural communities.

99. It is hoped that this paper will stimulate genuine strategic discussions of how rural land management in the MNLU SPA could be funded differently going forward to secure delivery of desired ecosystem services, and to aid this the following questions are suggested for further discussion:

a) is it certain that the condition of the MNLU SPA will continue to decline without additional funding and purposeful conservation management?

b) given background pressures (e.g., climate change), will additional funding and conservation management prevent further declines in the condition of the MNLU SPA over the long-term?

c) what are indicative costings for conservation management sufficient to return the whole MNLU SPA to a favourable condition?

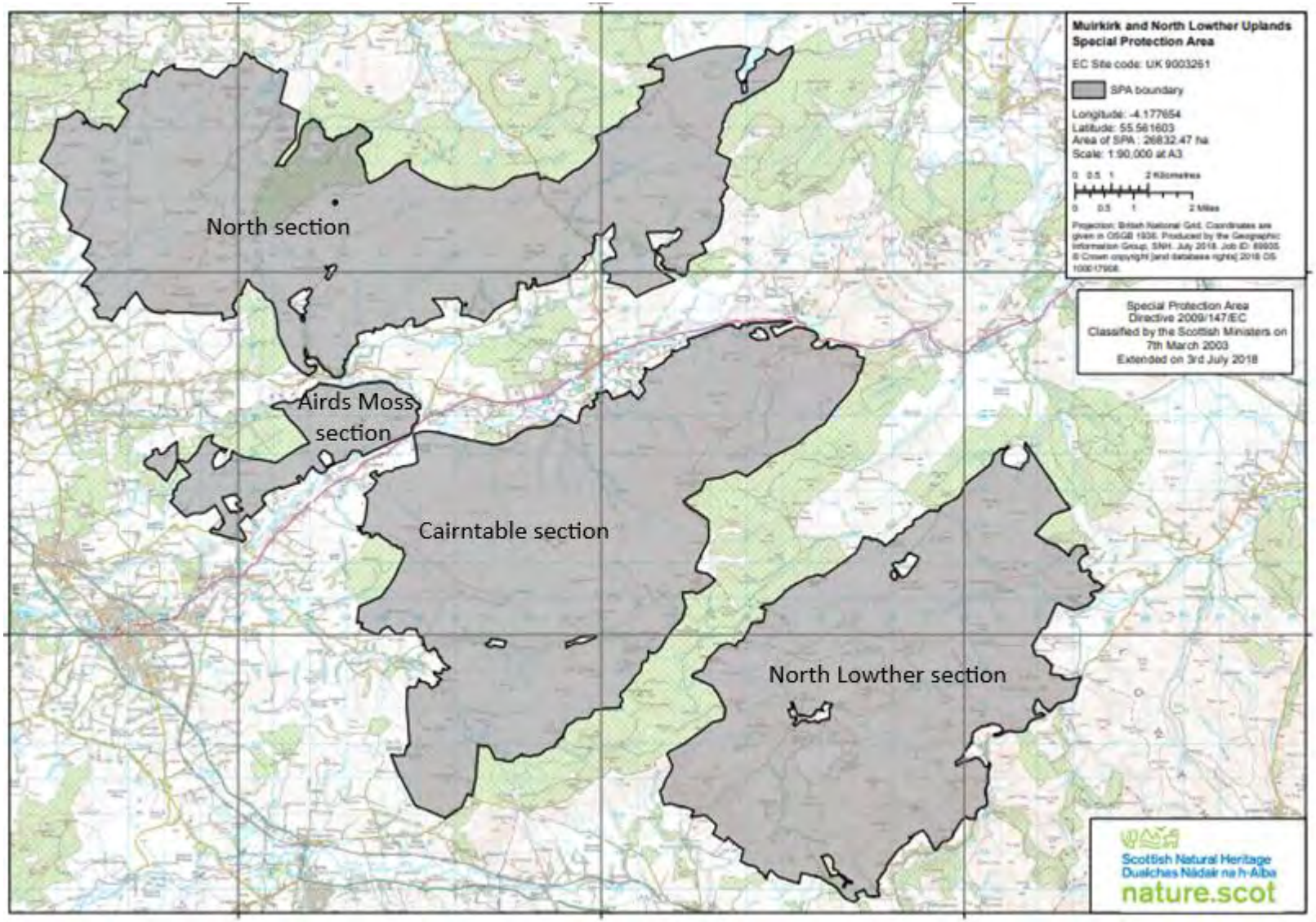
d) what are indicative costings for conservation management sufficient to return selected parts of the MNLU SPA to favourable condition?

e) what is the likelihood of attracting sufficient long-term public funding to support the necessary long-term conservation management of the MNLU SPA?

f) what is the likelihood of generating sufficient long-term private trading funding to support the necessary long-term conservation management of the MNLU SPA?

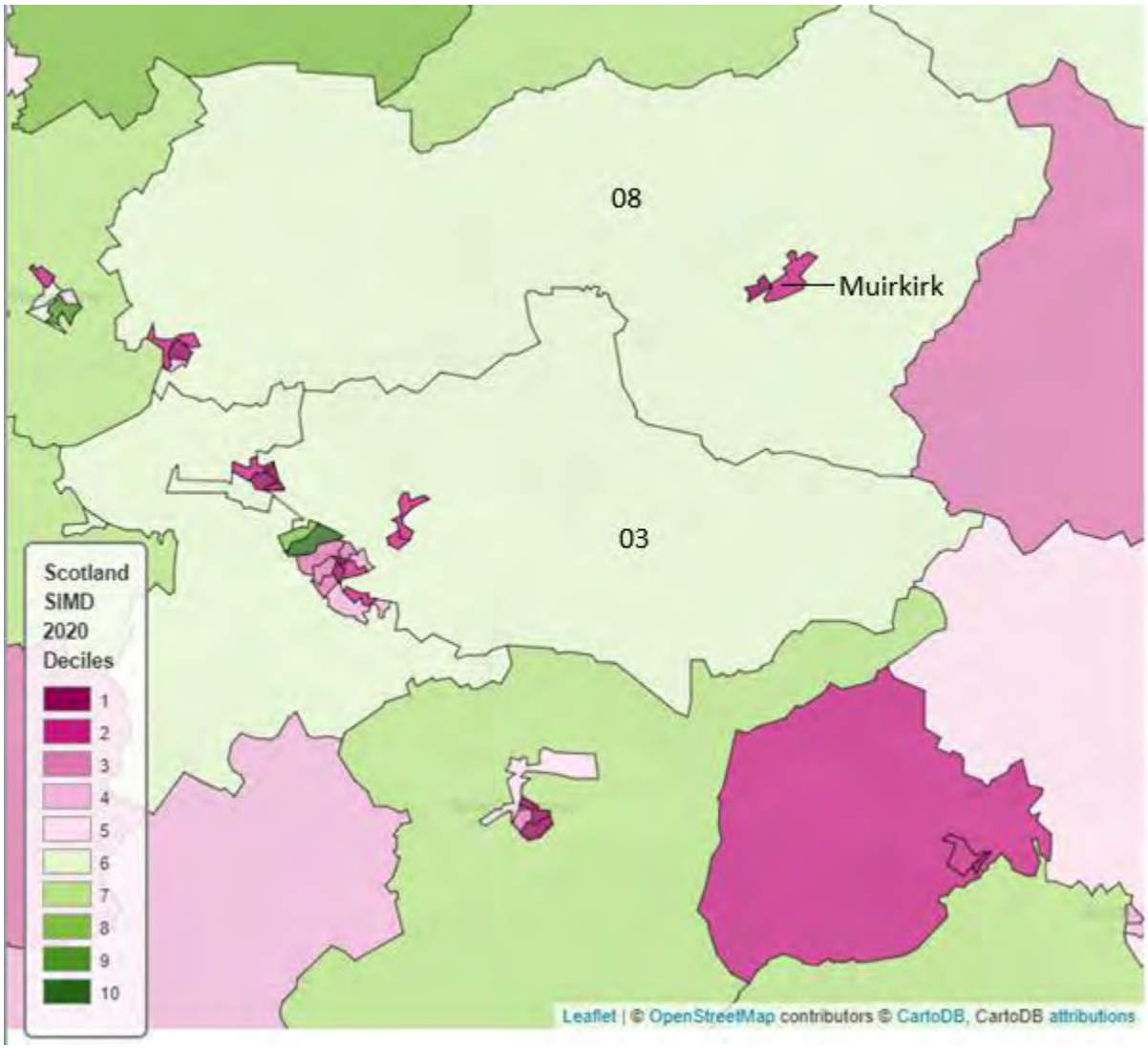
g) what is the likelihood of attracting sufficient long-term private sponsorship funding from sources other than within-site development to support the necessary long-term conservation management of the MNLU SPA?

Annex 1: Map of MNLU SPA (source: derived from https://apps.snh.gov.uk/sitelink-api/v1/sites/8616/documents/45)



Annex 2: Summary socio-economic statistics

The MNLU SPA itself falls within several data zones (the smallest spatial statistical unit for which data are published in Scotland). It is mostly within the Cumnock Rural 03 and 08 zones, which are light green on the map below – indicating middle ranking on the Scottish Index of Multiple Deprivation. However, the SPA also spills into and/or is adjacent to other zones shaded in dark pink which are in the top 10% or 20% of most deprived zones in Scotland. These include Muirkirk (Cumnock Rural 06 and 07 zones).



Source: https://datamap-scotland.co.uk/scotland-deprivation-zones-on-a-map/simd2020-overall-deprivation-map/

In terms of actual numbers, the rankings (out of 6976, with a ranking of 1 being most deprived) for four selected data zones relevant to the SPA are reported below (same source as Map).

Data Zone (with approximate local description)	Overall	Income	Employment
Cumnock Rural 03 (SPA, Cairntable & North Lowther)	3941	4237	4174.5
Cumnock Rural 06 (Muirkirk West)	291	370	283
Cumnock Rural 07 (Muirkirk East)	1239	1677.5	596
Cumnock Rural 08 (SPA, North and Airds Moss)	3803	4518.5	3866

Appendix 7.2 –

Illustrative suggestions of how Hagshaw Energy Cluster environmental funding could be used - SPA and SSSI Recovery and Management Fund Concept

Illustrative suggestions of how Hagshaw Energy Cluster environmental funding could be used-

SPA and SSSI Recovery and Management Fund Concept

Introduction

1. A local renewable energy developer, 3R Energy, is exploring the potential of expanding the Hagshaw Energy Cluster in South Lanarkshire westwards towards Muirkirk in East Ayrshire. As currently designed, the proposal would affect around 0.16% of habitat within the north eastern extent of the Muirkirk and North Lowther Uplands Special Protection Area (MNLU SPA) (albeit the ecological and ornithological effects of the Proposed Development may extend beyond this immediate footprint and so will therefore also be considered).

2. In return, the proposed development would generate conservation funding in the region of c.£40m to be used towards restoring the MNLU SPA to favourable condition. A separate fund of c.£100m would also be generated by the Proposed Development to be invested in the regeneration of local communities (potentially supporting development of conservation management business opportunities, energy efficiency measures, environmental education and other activities that would also contribute to environmental benefits as envisaged in the Just Transition).

3. It is not for 3R Energy to prescribe how the environmental funding generated by renewable energy production on a small part of the MNLU SPA could be used. Rather, that would be a matter for relevant stakeholders to agree through appropriate local governance.

4. Nonetheless, some illustrative suggestions of possible uses for the funding may be helpful in stimulating debate. The following examples are offered in that spirit, but others could be considered too.

Possible funding categories

5. The three broad categories of Nature, People, and Place perhaps suggest some obvious funding possibilities. First and foremost, as recognised by RSPB Scotland's Conservation Action Plan (CAP) for the MNLU SPA, there is an urgent need to address the unfavourable conservation status of the SPA's qualifying species. Based on data over the last 20 years, this status now appears to be persistent and long-term. Implementing the CAP to help address this requires a mix of upfront and on-going conservation activities, all of which need long-term funding.

6. Second, upfront and on-going activities to enhance the SPA could create and maintain local employment opportunities. However, local communities do not necessarily possess the relevant green job skills at present and consequently there is a need for funding of local training.

7. Third, the designated status and cultural heritage of the area could be harnessed for educational and recreational purposes, to improve community engagement with its surroundings and to potentially generate additional tourism employment opportunities. Yet, again, local communities may need funding for investment in skills and facilities to take advantage of such opportunities.

8. Each of these three categories are presented in turn below, including examples of specific investment ideas and their indicative funding requirements.

Implementing the CAP

9. The SPA's qualifying species are primarily in unfavourable, declining condition. This reflects a range of complex influences but includes the absence of any sustained and co-ordinated purposeful conservation management across the SPA, which in turn reflects the absence of any long-term and co-ordinated funding for such management.

10. The CAP sets-out in some detail the types of management needed to return the SPA to favourable condition. These include a variety of monitoring activities to better understand baseline and future conditions, but also substantive changes to land use to meet the requirements of specific species.

11. In particular, areas of degraded peatland need to be restored and vegetation managed to provide a mix of sward types and lengths to create suitable habitat mosaics for (especially) target bird species. This will incur upfront capital costs but also on-going cash and income-forgone costs. In addition, suppression of predation by (e.g.) foxes and crows is required, implying further ground-keeping costs.

12. The MNLU CAP is, to our knowledge, as-yet uncosted. However, current relevant agri-environment scheme payment rates and published headline data suggest that c.£90/ha is an appropriate benchmark for on-going annual habitat management.[1] Applied uniformly across all 27k ha of the SPA, this implies an aggregate annual funding need of c.£2.4m. Restricting funding to (e.g.) only the Northern and Airds Moss sections of the SPA would reduce this to c.£1m per annum. More granular data on the extent, condition and feasibility of enhancement for individual habitat types would refine these high-level estimates.

13. Upfront capital costs would be additional to this, most notably for extensive peatland restoration but also potentially for equipment and field shelters for equipment/staff.[2] Reported median peatland restoration costs are c.£1000/ha,[3] implying perhaps a funding requirement of c.£13.5m across the whole SPA. Restricting funding to the Northern and Airds Moss sections of the SPA would perhaps reduce the total to c.£6m, and funding is also available under Peatland Action and the Peatland Code. Again, more granular natural capital data would refine these estimates.

14. It is recognised that conservation measures need to be targeted at the MNLU SPA specifically, and this will be prioritised therefore in the Species and Habitat Management Plan for the Proposed Development. However, reflecting UK-wide pressures on several of the target bird species, funding could also support conservation activities beyond the site itself at landscape but also SPA network level.

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[1] See https://www.ruralpayments.org/topics/all-schemes/agri-environment-climate-scheme/management-options-and-capital-items/moorland-management/ and https://www.wildlifetrusts.org/sites/default/files/2019-09/Paying%20for%20public%20goods%20final%20report.pdf

[2] Equipping gamekeepers for the Langholm Project cost c.£16/ha. http://www.langholmproject.com/PDF%20downloads/Langholm%20Moor%20Demonstration%20Project%20Final%20Report.pdf although existing SPA landowners may have actual costs in MNLU SPA.

[3] See https://www.researchgate.net/publication/350726033_The_costs_of_peatland_restoration_-_March_2021_update_on_database_based_on_the_Peatland_Action_Programme_in_Scotland although it should also be noted that inflation is already increasing costs and, moreover, past restoration has typically been on easier (and therefore cheaper) sites – future costs per ha are expected to be higher.

15. For example, given the scale of raptor movements revealed by ringing and satellite tagging, there are potential benefits to widen conservation efforts to a larger scale through the establishment of a South Scotland Harrier Conservation Project (along similar lines to the South Scotland Golden Eagle Project). This would be a conservation-led initiative to target conservation measures including anti-persecution and habitat enhancement work. Depending on the scope, such an initiative could be funded through a contribution of £1.5 to £2.5 million per five years of its operation, Research into factors influencing hen harrier dispersal and re-colonisation could also be investigated, potentially through a PhD research programme, or working with the British Trust for Ornithology. A PhD student costs a minimum of c.£20/k per year,[4] although other costs would also be incurred.

Skills development

16. In order for Scottish Government aspirations for a Just Transition to a Net Zero, circular economy to be realised there will be significant growth in green employment. This will stem from adjustments in the specific requirements of existing jobs but also the creation of entirely new jobs. In both cases there will be an on-going need for skills development and increasing capacity to deliver conservation management.

17. Restoration and on-going management of the SPA itself represents one source of green jobs. Construction and maintenance of the renewable energy facilities in and around the SPA represents another. Both represent potential employment opportunities for local residents, and bespoke advice and training for traditional estate management type skills could be funded from the Proposed Development to equip the local community with additional environmental skills.

18. Importantly, green growth offers an opportunity to address some of the local economic and social deprivation issues prevalent in the local area. In particular, green jobs represent a tangible benefit from harnessing aspects of the natural environment in a more sustainable manner than has occurred previously, resulting in this large area of hill ground north of Muirkirk doing more for nature, more for climate and more for people.

19. Perhaps most obviously, training courses could be co-designed with existing local providers. Initial talks have already been held with the Prince's Foundation based at Dumfries House regarding such a possibility. Equally, renewable energy operators themselves could offer training or support for sub-contractors to do so in relation to specific activities.

20. The funding needs for skills development are difficult to specify in abstract since they depend on the duration, intensity and type of training offered as well as the number of students. For example, a one-day classroom-based lesson will be less expensive than a one-day practical session on-the-ground.

21. However, funding is likely to be needed to cover preparation of new training (e.g., course design, assembling materials), acquisition of new equipment (e.g., widetrack excavators) and delivery (e.g., trainer time). Although the majority of such funding would be in cash, some could potentially be in-kind (e.g., sharing of equipment and staff time) and could be per activity or per student, and either covering all costs or just a proportion.

[4] See https://www.ukri.org/what-we-offer/developing-people-and-skills/find-studentships-and-doctoral-training/get-a-studentship-to-fund-your-doctorate/#:~:text=The%20levels%20given%20here%20are,(PGR)%20programme%20of%20work.

22. Vocational training related to rural land management and wildlife monitoring is already available from various providers, both within and outwith Scotland. Modes of delivery vary (e.g., on-line, in-field, one-to-one, group), as do duration and intensity (e.g., one day, one week, one day a week for a year etc.). Hence funding costs for training related to the SPA development will depend upon how many trainees are envisaged but also what form the training will take.

23. Indicative costs for potentially relevant in-field short courses include:£250-£300 for chainsaw operation and maintenance (2 days); £220 for hedge cutting (1 day); £125 for dry stone walling (per day, 1 – 5 days; £250 for ATV operation (1 day); £200 for 360° degree excavator operation (per day, 3 – 10 days); £525 for rough terrain truck operation (3 days); £210 for Phase 1 habitat surveying (1 day); £210 for ecological appraisal (1 day).[5]

24. One trainee attending all of these courses would require c.£2.0k of funding. A cohort of ten trainees would cost c.£20k per year (although not all trainees would necessarily do all courses and other courses might be added too).

Education and Recreation

25. Access to green space and outdoor recreation opportunities contribute to healthy living, directly benefiting residents but potentially also visitors to the area. The latter may generate local income and employment opportunities.

26. Even once restored to favourable condition, the fragile nature of the SPA makes most of it unsuitable for high-volume recreational access. Nonetheless, it may be possible for selected parts of the SPA to accommodate modest recreational/educational usage and/or for recreational/educational facilities to be provided on land adjoining the SPA or within Muirkirk itself.

27. Recreational pastimes span a range of activities and levels of exertion, appealing to different people and with different infrastructure requirements and different implications for environmental pressures. For example, dog walking, wildlife watching, hiking, mountain biking, not all of which would be environmentally appropriate everywhere. Similarly, educational activities can be indoors and/or outdoors.

28. Facilities could include, for example, all-ability access paths, picnic areas and bird hides, all with appropriate educational interpretation signage. Depending on design and materials, paths cost £16 - £60/m^2, (wetland boardwalks are more expensive), recycled plastic picnic tables cost c.£600 each, bird hides can cost £5000 each, depending on size and design.[6]

29. More ambitiously, a visitor centre could be established to house more extensive and interactive interpretation material and/or educational courses for local people. For example, about the SPA and the natural environment but also local cultural heritage and the contribution of the local area to the country's energy needs over the years (from coal to renewables). Design and utilisation ideas could

[5] See www.lowe-maintenance.co.uk, www.rau.ac.uk, www.sruc.ac.uk, www.nationalgamekeepers.org.uk, www.kaneecology.co.uk/services/training/ecological-survey-methods/

[6] See https://www.pathsforall.org.uk/mediaLibrary/other/english/surfacing-guide-for-path-projects-94731.pdf https://www.thewilddeckcompany.co.uk/raised-boardwalk-wetland-boardwalk-design/ https://www.thewilddeckcompany.co.uk/product-portfolio/bird-hides/

be borrowed from existing visitor centres, such as at the Whitelee Wind Farm at Eaglesham or the Scottish Sea Bird Centre at North Berwick.

30. Siting such a centre outwith the SPA itself might be more environmentally appropriate, particularly if it acted as a base for active walkers and cyclists. However, remote cameras and digital technologies could be used to provide real-time information to enliven interpretation material and connect visitors to the SPA at least virtually.

31. Construction of a visitor centre would entail significant upfront construction costs and on-going running costs (although the latter might be offset through visitor revenues). Construction would offer further local employment opportunities, as would staffing of visitor centre activities.

32. Visitor centres vary significantly in terms of construction materials, size and facilities. Unsurprisingly, this leads to significant variation in construction, both totals and per square-metre. For example, publicly available cases studies suggest total costs of c.£0.4m to c.£9.5m, implying average costs of c.£1k to £4k per square-metre.[7]

33. Current published industry standards suggest construction costs of £2k to £3k per square-metre.[8] The Whitelee visitor centre is approximately 625 square-metres,[9] suggesting that replicating it near Muirkirk might cost c.£1.3m – c.£1.9m.

34. Running costs would be additional, and again would vary with construction, size and facilities. For example, energy efficiency, café, exhibitions etc. Relevant cost estimates are seemingly not readily available, but using published office space costs as a comparator suggests c.£270 to c.£400 per square metre.[10] This implies c.£0.2m - £0.25m per annum (although a rural site may incur lower rates).

35. In both cases, generating more precise costings would require more specific articulation of what is being sought in terms of skills development and visitor services. Moreover, direct discussions with local suppliers would provide more accuracy than the web references cited here. Nonetheless, the ballpark figures presented above give an indication of the likely magnitude of costs arising.

36. Staffing costs would be additional to this. For example, a manager and two support staff on £30k and £25k salaries would, with on-costs, equate to c.£0.1m per year (although a proportion of such costs might be covered from café or other revenues).

37. Existing local providers of recreational and/or educational services would need to be involved in the planning and design of new facilities, to make the best use of shared infrastructure and to avoid unhelpful duplication of services already offered.

[7] See www.ajbuildingslibrary.co.uk, www.architype.co.uk, www.grosvenorconstruction.co.uk, www.woodhead-construction.co.uk, www.building.co.uk
[8] See www.building.co.uk, www.costmodelling.com/building-costs
[9] Inferred from Whitelee Windfarm Visitor Centre - Google Maps
[10] See https://racquetscourt.co.uk/the-true-cost-of-occupying-office-space/, https://www.lsh.co.uk/total-office-cost-survey/metrics

Conclusions

38. It is not for 3REnergy to prescribe how environmental funding generated by renewable energy development on a small area of the MNLU SPA should be used. However, the possibilities and indicative costings suggested above are intended to help stimulate discussion of potential opportunities.

39. More detailed consultation and co-creation with a range of stakeholders will be required to identify funding priorities in line with key objectives and to agree appropriate governance mechanisms, with the main focus of improving the conservation status of the SPA's qualifying species.

Pareto Consulting
16th September 2022

Figures

265000 270000 275000 280000 285000

640000 635000 630000 625000

N

South Lanarkshire

South Lanarkshire

East Ayshire

KEY

Site Boundary

Local Authority Boundary

0 2 4 km

Scale 1:80,000 @ A3

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

3R Energy

ITPENERGISED

Hagshaw Energy Cluster - Western Expansion
Scoping Report

Figure 1.1

Site Location Plan

Project / Drwg Number:	4188/993				
Date: 15/09/2022	Drawn by: NH	Checked by: AH	Version: V1		

265000 270000 275000 280000 285000

640000 635000 630000 625000

N

Kype Muir
Auchrobert
Kype Muir Extension
Dungavel
A
B
C
D
E
Cumberhead West
Hagshaw Energy Cluster
Nutberry
Dalquhandy
Douglas West
Douglas West Extension
Cumberhead
Hare Craig
Hagshaw Hill and Extension
Galawhistle
Hagshaw Hill Repowering
Bankend Rig II
Bankend Rig
Bankend Rig III
M74
J11
Broken Cross
Bodinglee
Glentaggart
Kennoxhead
Andershaw
West Andershaw
Kennoxhead Extension
Kennoxhead Extension II (Penbreck)

KEY

Site Boundary

Indicative Development Areas

- A - Area A - Wind Turbines
- B - Area B - Wind Turbines
- C - Area C - Wind Turbines
- D - Area D - Solar
- E - Area E - Hydrogen
- Substation & Energy Storage Compound

Cumulative Developments

- Wind Farm Operational / Under Construction
- Approved Wind Farm
- Wind Farm in Application
- Wind Farm in Scoping
- Surface Mining (historic sites)

0 1 2 3 km

Scale 1:70,000 @ A3

British National Grid Coordinate System

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

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Figure 2.1
Cumulative Developments & Indicative Development Areas

Project / Drwg Number:	4188/993			
Date: 22/09/2022	Drawn by: NH	Checked by: AH	Version: V2	

260000 265000 270000 275000 280000 285000 290000

645000 640000 635000 630000 625000 620000

N

Clyde Valley Woods SAC

Upper Nethan Valley Woods SSSI

Clyde Valley Woods SAC

Coalburn Moss SSSI & SAC

Blood Moss & Slot Burn SSSI

Muirkirk and North Lowther Uplands SPA & SSSI

Airds Moss SAC

Galloway and Southern Arshire Bioshpere Reserve

Muirkirk and North Lowther Uplands SPA & SSSI

Miller's Wood SSSI

Red Moss SSSI & SAC

Muirkirk and North Lowther Uplands SPA & SSSI

KEY

- Site Boundary
- 5km Site Buffer
- Indicative Turbine Location
- Solar Development Search Area
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility

Cumulative Wind Development

- Wind Farm Operational / Under Construction
- Approved Wind Farm
- Wind Farm in Application
- Wind Farm in Scoping
- Muirkirk & North Lowther Uplands SPA & SSSI
- Sites of Special Scientific Interest
- Geological Conservation Review
- Ancient Woodland Inventory
- Scheduled Monument
- Scottish Wildlife Trust Reserves
- Special Area of Conservation
- Conservation Areas
- Historic Battlefields
- Biosphere Reserve
- RSPB Reserves
- Gardens and Designed Landscapes

Listed Buildings/Monuments

- A
- B
- C

0 2.5 5 km

Scale 1:100,000 @ A3

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

3R Energy

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Hagshaw Energy Cluster - Western Expansion Scoping Report

Figure 3.1

Environmental Designations Within 5km

Project / Drwg Number:	4188/993			
Date: 21/09/2022	Drawn by: NH	Checked by: AH	Version: V1	

265000 270000 275000 280000 285000

640000 635000 630000 625000

N

KEY

Site Boundary

Indicative Turbine Location

Maximum Tip Height 230m

Reduced Tip Height*

Solar Development Search Area

Substation & Energy Storage Compound

Green Hydrogen Production Facility

Cumulative Wind Development

Wind Farm Operational / Under Construction

Approved Wind Farm

Wind Farm in Application

Wind Farm in Scoping

* Reduced tip heights are being considered for turbines in the south western part of the site

0 1 2 3 km

Scale 1:65,000 @ A3

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

3R Energy

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Hagshaw Energy Cluster - Western Expansion Scoping Report

Figure 3.2

Indicative Proposed Development Layout

Project / Drwg Number:	4188/993				
Date: 21/09/2022	Drawn by: NH	Checked by: AH	Version: V1		

265000 270000 275000 280000 285000

640000 635000 630000 625000

N

KEY

Site Boundary

Indicative Turbine Location

Maximum Tip Height 230m

Reduced Tip Height*

Solar Development Search Area

Substation & Energy Storage Compound

Green Hydrogen Production Facility

Cumulative Wind Development

Wind Farm Operational / Under Construction

Approved Wind Farm

Wind Farm in Application

Wind Farm in Scoping

* Reduced tip heights are being considered for turbines in the south western part of the site

0 1 2 3 km

Scale 1:65,000 @ A3

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

3R Energy

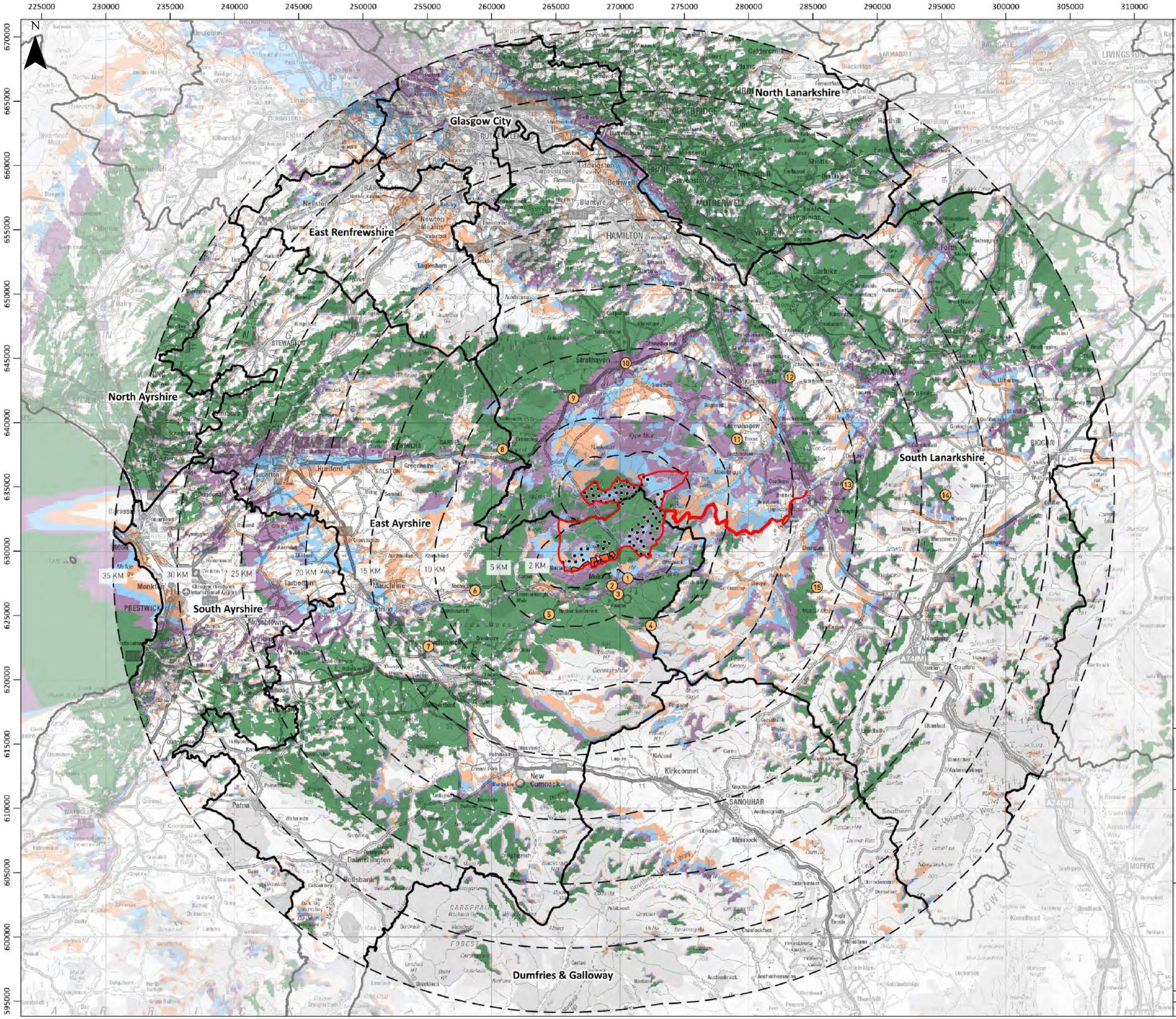
ITPENERGISED

Hagshaw Energy Cluster - Western Expansion
Scoping Report

Figure 3.3

Indicative Proposed Development Layout

Project / Drwg Number:	4188/993			
Date: 21/09/2022	Drawn by: NH	Checked by: AH	Version: V1	



KEY

- Site Boundary
- Study Area 35 km
- Proposed LVIA Viewpoints
- Proposed Turbines
- Solar Development Search Area
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility
- Local Authority Boundary

Blade Tip (230 m)
Zone of Theoretical Visibility

- 1 to 18 turbines visible
- 19 to 36 turbines visible
- 37 to 54 turbines visible
- 55 to 72 turbines visible

This ZTV has been run with all turbines at 230m to tip to illustrate a maximum visual envelope, however, as per Figure 3.2 reduced tip heights are being considered for 19 turbines in the south western part of the site.

Viewpoint	Location
1	A70, eastern edge of Muirkirk by Wee Torhill
2	Victory Park, Muirkirk
3	River Ayr Way, Muirkirk
4	Cairn Table
5	Nether Wellwood (A70)
6	B743 (east of Nethershield))
7	B705 (Auchlinleck)
8	Loudoun Hill
9	A71, bridge crossing Calder Water
10	Strathaven War Memorial
11	Minor road south-west of Lesmahagow
12	Black Hill
13	A70 Rigside
14	Tinto Hill
15	Auchensaugh hill

0 5 10 km

Scale 1:280000 @ A3

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

3R Energy

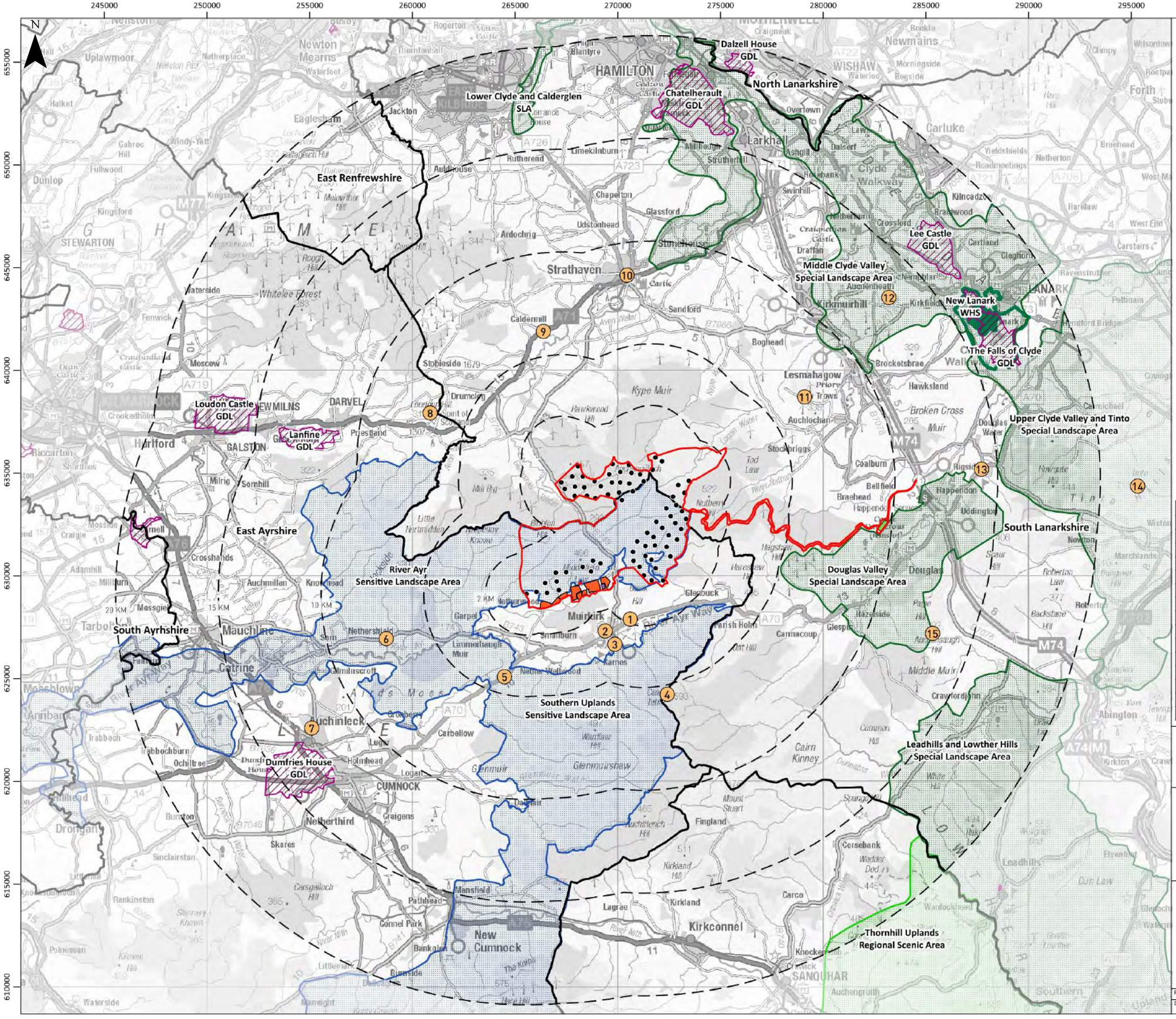
ITPENERGISED

Hagshaw Energy Cluster - Western Expansion
Scoping Report

Figure 5.1

Blade Tip Zone of Theoretical Visiblity to 35 km with Viewpoints

Project / Drwg Number:	4188/993		
Date: 16/09/2022	Drawn by: DG	Checked by: DT	Version: V6



KEY

- Site Boundary
- Study Area 20 km
- Proposed LVIA Viewpoint
- Proposed Turbines
- Solar Development Search Area
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility
- Local Authority Boundary

Landscape Designations

- East Ayrshire Sensitive Landscape Area
- South Lanarkshire Special Landscape Area
- Dumfries & Galloway Regional Scenic Area

Heritage Designations

- New Lanark World Heritage Site Boundary
- New Lanark World Heritage Site Buffer Zone
- Gardens and Designed Landscape

Viewpoint	Location
1	A70, eastern edge of Muirkirk by Wee Torhill
2	Victory Park, Muirkirk
3	River Ayr Way, Muirkirk
4	Cairn Table
5	Nether Wellwood (A70)
6	B743 (east of Nethershield))
7	B705 (Auchinleck)
8	Loudoun Hill
9	A71, bridge crossing Calder Water
10	Strathaven War Memorial
11	Minor road south-west of Lesmahagow
12	Black Hill
13	A70 Rigside
14	Tinto Hill
15	Auchensaugh hill

0 5 10 km

Scale 1:175000 @ A3

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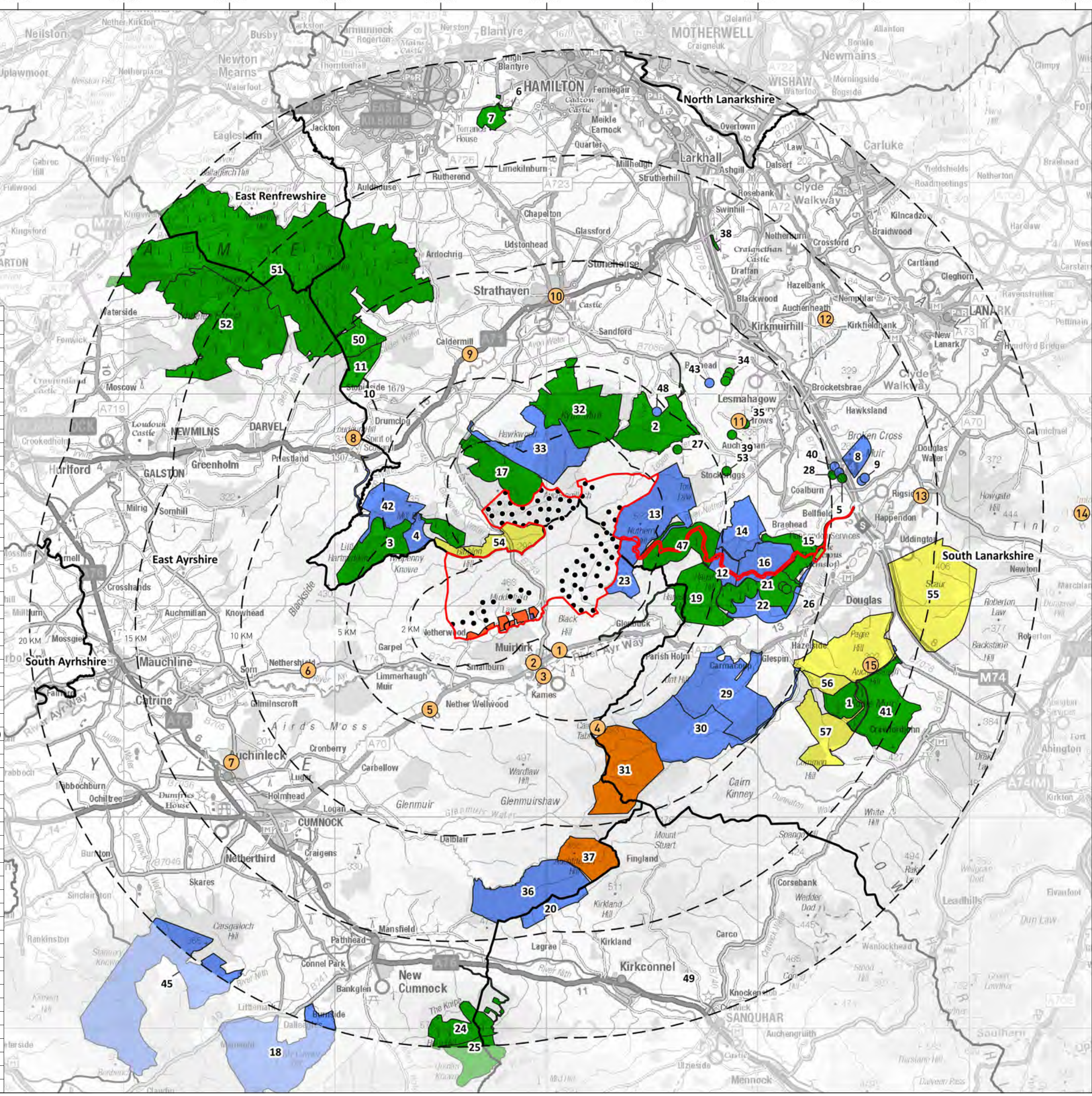
Scoping Report

Figure 5.2

Landscape Designations within 20 km with Viewpoints

Project / Drwg Number:	4188/993		
Date: 16/09/2022	Drawn by: DG	Checked by: DT	Version: V6



NO	NAME
1	Andershaw
2	Auchrobert
3	Bankend Rig
4	Bankend Rig II
5	Birkhill
6	Blantyre Muir
7	Blantyre Muir Extension
8	Broken Cross
9	Broken Cross Small Wind Cluster
10	Calder Water
11	Calder Water
12	Cumberhead Resubmission
13	Cumberhead West
14	Dalquhandy
15	Douglas West
16	Douglas West Extension
17	Dungavel
18	Enoch Hill Windfarm
19	Galawhistle
20	Glenmuckloch
21	Hagshaw Hill and Extension
22	Hagshaw Hill Repowering
23	Hare Craig
24	Hare Hill
25	Hare Hill Extension
26	Hazelside Farm
27	High Waterhead Farm
28	JJ's Farm
29	Kennoxhead
30	Kennoxhead Extension
31	Kennoxhead Extension II (Penbreck)
32	Kype Muir
33	Kype Muir Extension
34	Ladehead Farm
35	Letham Farm
36	Lethans
37	Lethans Extension
38	Lochhead
39	Low Whiteside Farm
40	M74 Eco Park
41	Middle Muir
42	Mill Rig
43	Muirhouse Farm
44	North Brackenridge
45	North Kyle
46	North Lowther Energy Initiative
47	Nutberry
48	South Priorhill Farm
49	Sunnyside
50	West Browncastle
51	Whitelee
52	Whitelee Phase 1 and 2 Extension
53	Yonderton Farm
54	Bankend Rig III
55	Bodinglee
56	Glentaggart
57	West Andershaw

KEY

- Site Boundary
- Study Area 20 km
- Proposed LVIA Viewpoint
- Proposed Turbines
- Solar Development Search Area
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility
- Local Authority Boundary

Other Wind Farms

- Operational
- Consented/Under Construction
- In Planning
- Scoping

Note:
Wind turbines less than 50m in height to blade tip have been scoped out within 10 km of the Proposed Development.
Wind turbines less than 80m in height to blade tip have been scoped out beyond 10 km of the Proposed Development.

Viewpoint	Location
1	A70, eastern edge of Muirkirk by Wee Torhill
2	Victory Park, Muirkirk
3	River Ayr Way, Muirkirk
4	Cairn Table
5	Nether Wellwood (A70)
6	B743 (east of Nethershield))
7	B705 (Auchlinleck)
8	Loudoun Hill
9	A71, bridge crossing Calder Water
10	Strathaven War Memorial
11	Minor road south-west of Lesmahagow
12	Black Hill
13	A70 Rigside
14	Tinto Hill
15	Auchensaugh hill

0 5 10 km

Scale 1:185000 @ A3

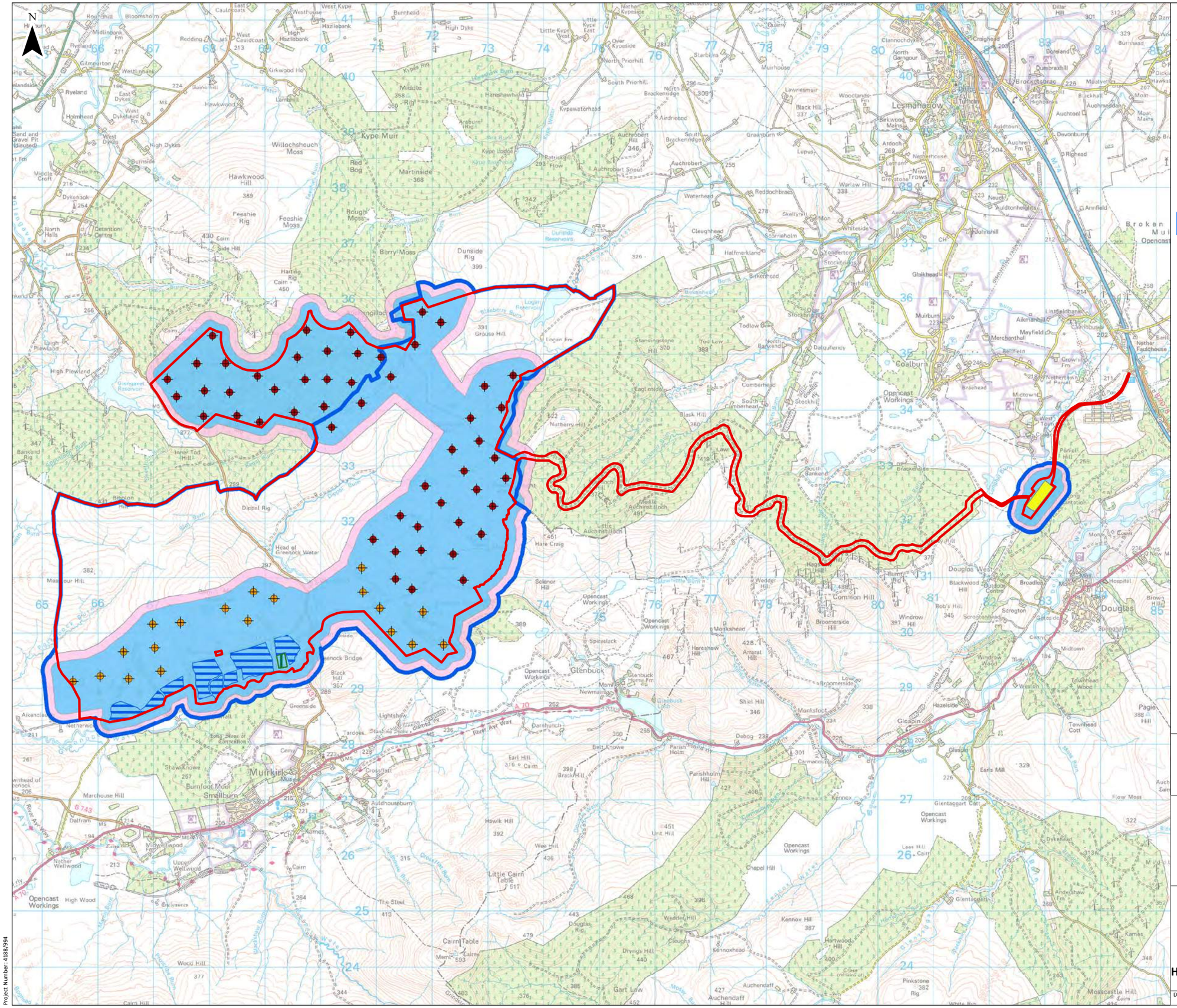
British National Grid Coordinate System

Hagshaw Energy Cluster - Western Expansion
Scoping Report

Figure 5.3

Other Wind Farms within 20 km

Project / Drwg Number: 4188/993			
Date: 21/09/2022	Drawn by: DG	Checked by: DT	Version: V7



KEY

* Reduced tip heights are being considered for turbines in the south western part of the site

0 2 4 km

Scale 1:65,000 @ A3

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Figure 6.1

Habitats and Protected Mammals Survey Areas

Date:	Drawn by:	Checked by:	Version:
15/09/2022	NH	AT	V1

Project Number: 4188/994

N

KEY

- Site Boundary

Indicative Turbine Location

- Maximum Tip Height 230m
- Reduced Tip Height*
- Breeding Bird Survey Area
- Winter Walkover Area
- Breeding Raptor Area

* Reduced tip heights are being considered for turbines in the south western part of the site

0 1 2 km

Scale 1:50,000 @ A3

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Figure 7.1

Ornithology Study Areas

Date:	Drawn by:	Checked by:	Version:
15/09/2022	AT	MF	V1

Project Number: 4186/994

N

VP1
VP2
VP3
VP4
VP5
VP6
VP7
VP8
VP9
VP10
VP11

KEY

Site Boundary

Indicative Turbine Location

Maximum Tip Height 230m

Reduced Tip Height*

VP1 and Viewshed

VP2 and Viewshed

VP3 and Viewshed

VP4 and Viewshed

VP5 and Viewshed

VP6 and Viewshed

VP7 and Viewshed

VP8 and Viewshed

VP9 and Viewshed

VP10 and Viewshed

VP11 and Viewshed

All viewsheds analysis run at 20m surface offset

* Reduced tip heights are being considered for turbines in the south western part of the site

0 1 2 km

Scale 1:40,000 @ A3

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Figure 7.2

VP Locations and Viewsheds

Date:	Drawn by:	Checked by:	Version:
15/09/2022	AT	MF	V1

Project Number: 4188/994

265000 270000 275000

635000

630000

N

KEY

Site Boundary

Indicative Turbine Location

Maximum Tip Height 230m

Reduced Tip Height*

Solar Development Search Area

Substation & Energy Storage Compound

35 dBLA90 contour including correction for concave topography

35 dBLA90 contour

Noise Sensitive Receptor

* Reduced tip heights are being considered for turbines in the south western part of the site

0 1 2 km

Scale 1:45,000 @ A3

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Scoping Report

Figure 8.1

35 dBLA90 Contour and Nosie Sensitive Receptors

Project / Drwg Number:	4188/993			
Date: 21/09/2022	Drawn by: NH	Checked by: AH	Version: V1	

265000 270000 275000 280000 285000

640000

635000

630000

625000

N

KEY

- Site Boundary
- Indicative Turbine Location
- Solar Development Search Area
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility

Cumulative Wind Development

- Wind Farm Operational / Under Construction
- Approved Wind Farm
- Wind Farm in Application
- Wind Farm in Scoping
- HER Site (point)
- HER Site (linear)

0 1.5 3 km

Scale 1:65,000 @ A3

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

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Hagshaw Energy Cluster - Western Expansion

Figure 9.1

Cultural Heritage: Inner Study Area

Project / Drwg Number:	4188/993				
Date: 14/09/2022	Drawn by: SG	Checked by: GM	Version: V2		

250000 255000 260000 265000 270000 275000 280000 285000 290000

650000 645000 640000 635000 630000 625000 620000 615000

N

Loudoun Castle
Lanfine
Battle of Drumclog
Battle of Loudoun Hill
CA395
SM2619
SM2627
SM2628
CA394
SM4298
CA269
Lee Castle
New Lanark World Heritage Site
The Falls of Clyde
CH 7
CH 6
CH 1
SM2848
CH 5
SM2469
CH 4
SM2924
SM5405
SM5537
SM6640
CH 2
SM2931
CH 3
SM4631
CA65
CH 8
SM3311
Dumfries House
Scot's Mining Company House

KEY

- Site Boundary
- Indicative Turbine Location
- Indicative Turbine Location Buffers (5km & 10km)
- Scheduled Monument
- Listed Building Category A
- Listed Building Category B
- Listed Building Category C
- Properties in Care
- World Heritage Site
- Garden and Designed Landscape
- Conservation Area
- Battlefields Inventory Boundary
- NSR Site Code C & V (point)
- View Points

Blade Tip ZTV - No. of turbines visible:

- 1-15
- 16-30
- 31-45
- 46-60
- 61-72

0 3.5 7 km

Scale 1:130,000 @ A3

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

3R Energy

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Hagshaw Energy Cluster - Western Expansion

Figure 9.2

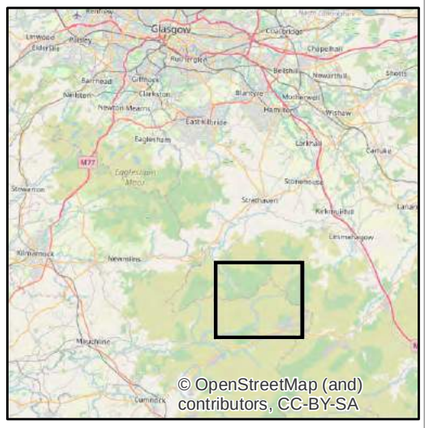
Cultural Heritage: Outer Study Area

Project / Drwg Number:	4188/993			
Date: 14/09/2022	Drawn by: SG	Checked by: GM	Version: V3	

N

KEY

- Indicative Red Line Boundary
- Indicative Turbine Location
- PV Development Search Areas
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility
- Surface Coal Resource Areas
- Development High Risk Areas
- Geological Conservation Review (GCR)



0 1.5 3 km

Scale 1:65,000 @ A3

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

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Hagshaw Energy Cluster - Western Expansion Scoping Report

Figure 10.1

Coal Development High Risk Area & GCR

Date:	Drawn by:	Checked by:	Version:
21/09/2022	AH	AH	V7

Project Number: 4188/994

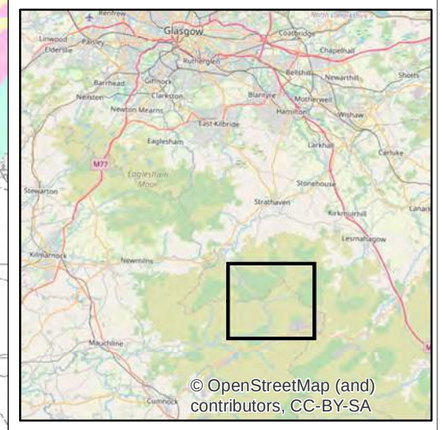
N

KEY:

- Indicative Red Line Boundary
- Indicative Turbine Location
- PV Development Search Areas
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility

Superficial Geology

- PEAT
- ALLUVIUM - CLAY, SILT, SAND & GRAVEL
- GLACIOFLUVIAL DELTAIC DEPOSITS - GRAVEL, SAND AND SILT
- SUPERFICIAL DEPOSITS - SEDIMENT
- TILL, DEVENSIAN - DIAMICTON



0 1.5 3 km

Scale 1:65,000 @ A3

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Scoping Report

Figure 10.2

Superficial Geology

Date:	Drawn by:	Checked by:	Version:
15/09/2022	AH	AH	V7

Project Number: 4188/994

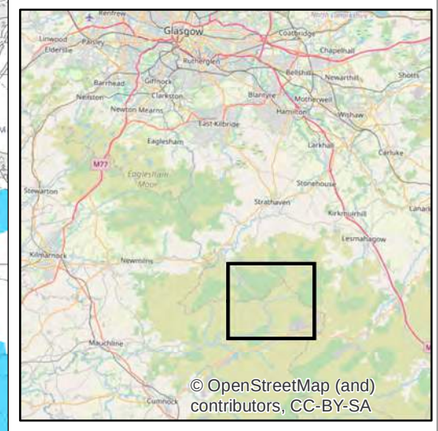
N

KEY:

- Indicative Red Line Boundary
- Indicative Turbine Location
- PV Development Search Areas
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility

Peatland Classification

- Class 1
- Class 3
- Class 4
- Class 5



0 1.5 3 km

Scale 1:65,000 @ A3

HAGSHAW ENERGY CLUSTER WESTERN EXPANSION

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Figure 10.3

Peat Classification

Date:	Drawn by:	Checked by:	Version:
15/09/2022	JC	AH	V7

Project Number: 4188/994

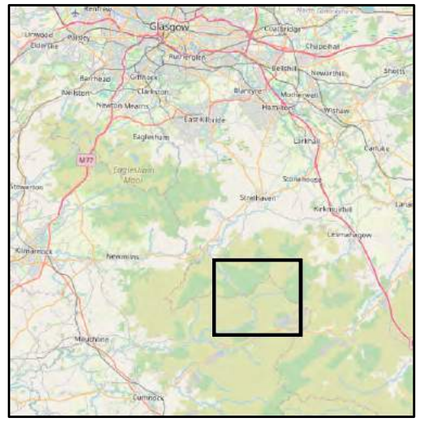
N

KEY:

- Indicative Red Line Boundary
- Indicative Turbine Location
- PV Development Search Areas
- Substation & Energy Storage Compound
- Peat Depth - Phase 1 Probing
- Peat Depth - Peatland Action

Peat Depth (m)

- 0 - 0.1
- 0.1 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4



0 0.25 0.5 1 1.5 km

Scale 1:35,000 @ A3

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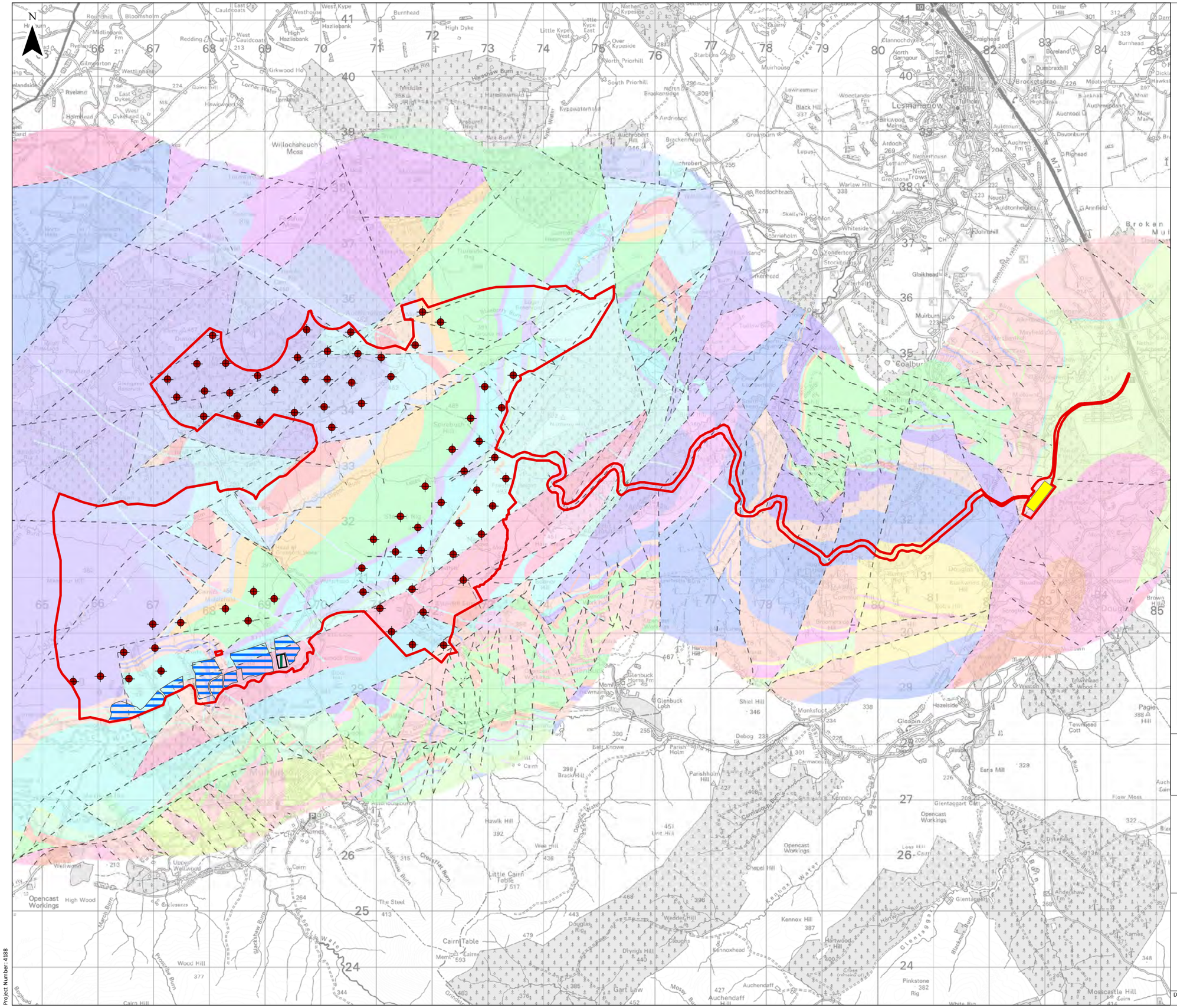
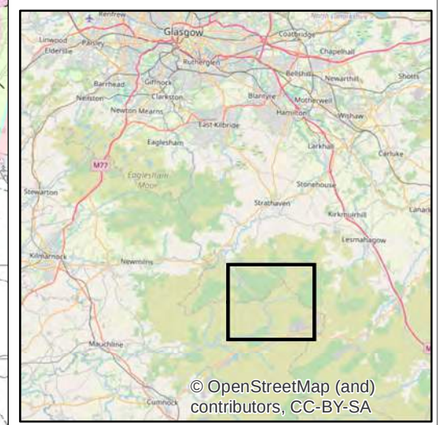
Scoping Report

Figure 10.4

Peat Depth

Date:	Drawn by:	Checked by:	Version:
15/09/2022	DN	AH	V1





0 1.5 3 km

Scale 1:65,000 @ A3

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Scoping Report

Figure 10.5a

Bedrock Geology and Faults

Date:	Drawn by:	Checked by:	Version:
15/09/2022	AH	AH	V7

Project Number: 4188

KEY:

- Indicative Red Line Boundary
- Indicative Turbine Location
- PV Development Search Areas
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility
- FAULTS

Igneous Bedrock

Carboniferous - Paleogene

- MULL DYKE-SWARM - MICROGABBRO
- MIDLAND VALLEY CARBONIFEROUS TO EARLY PERMIAN ALKALINE BASIC SILL SUITE - MICROGABBRO

Silurian - Devonian

- SOUTH OF SCOTLAND GRANITIC SUITE - FELSITE
- SOUTH OF SCOTLAND GRANITIC SUITE - MICRODIORITIC-ROCK
- SOUTH OF SCOTLAND GRANITIC SUITE - QUARTZ-PORPHYRY
- SOUTHERN MIDLAND VALLEY FELSITE SILLS - FELSITE
- UNNAMED IGNEOUS INTRUSION OF UNKNOWN AGE - AGGLOMERATE
- UNNAMED IGNEOUS INTRUSION OF UNKNOWN AGE - FELSITE
- UNNAMED IGNEOUS INTRUSION OF UNKNOWN AGE - MAFITE
- DISTINKHORN PLUTON - DIORITE

Sedimentary Bedrock

Carboniferous

- SCOTTISH LOWER COAL MEASURES FORMATION - SEDIMENTARY ROCK CYCLES, COAL MEASURE TYPE
- PASSAGE FORMATION - SEDIMENTARY ROCK CYCLES, CLACKMANNAN GROUP TYPE
- UPPER LIMESTONE FORMATION - SEDIMENTARY ROCK CYCLES, CLACKMANNAN GROUP TYPE
- LAWMUIR FORMATION - SEDIMENTARY ROCK CYCLES, STRATHCLYDE GROUP TYPE
- KINNESSWOOD FORMATION - LIMESTONE, NODULAR (CORNSTONE)
- KINNESSWOOD FORMATION - SANDSTONE
- KINNESSWOOD FORMATION - SILICATE-CONGLOMERATE, CALCITE-CEMENTED (CALCRETE)
- BALLAGAN FORMATION - ARGILLACEOUS ROCK, DOLOSTONE AND SANDSTONE

Silurian - Devonian

- SWANSHAW SANDSTONE FORMATION - SANDSTONE
- GREYWACKE CONGLOMERATE FORMATION - CONGLOMERATE

Silurian

- PLEWLAND SANDSTONE FORMATION - SANDSTONE
- MIDDLEFIELD CONGLOMERATE FORMATION - CONGLOMERATE
- GLENBUCK GROUP AND MONKS WATER GROUP (UNDIFFERENTIATED) SANDSTONE, CONGLOMERATE AND [SUBORDINATE] ARGILLACEOUS ROCKS
- WATERHEAD GROUP (CF GLENBUCK GROUP) CONGLOMERATE, SANDSTONE AND SILTSTONE
- LOGAN FORMATION - SANDSTONE, SILTSTONE AND MUDSTONE
- SLOT BURN FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- MONUMENT FORMATION - SANDSTONE
- DIPPAL BURN FORMATION - SANDSTONE, SILTSTONE AND MUDSTONE
- BIRKENHEAD SANDSTONE FORMATION - SANDSTONE
- LEAZE FORMATION - SANDSTONE
- DUNSIDE FORMATION - SANDSTONE
- BLAEBERRY FORMATION - MUDSTONE
- KIP BURN FORMATION - MUDSTONE
- CASTLE FORMATION - SILTSTONE
- PATRICK BURN FORMATION - MUDSTONE
- PATRICK BURN FORMATION - WACKE
- PONESK BURN FORMATION - WACKE

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Scoping Report

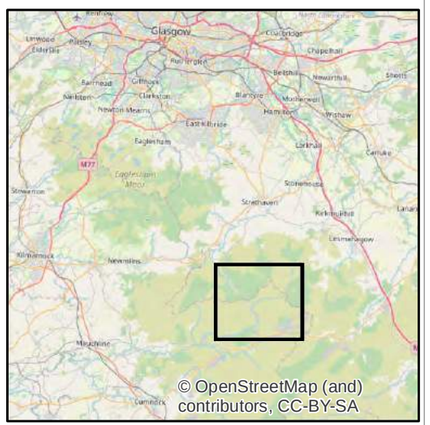
Figure 10.5b

KEY: Bedrock Geology and Faults

Date:	Drawn by:	Checked by:	Version:
12/08/2022	JC	AH	V7

KEY:

- Indicative Red Line Boundary
- Indicative Turbine Location
- PV Development Search Areas
- Substation & Energy Storage Compound
- Green Hydrogen Production Facility
- Watercourses and Waterbodies
- 50m Watercourses & Waterbodies Buffer



0 1.5 3 km

Scale 1:62,000 @ A3

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Figure 10.6

Watercourses and Waterbodies

Date:	Drawn by:	Checked by:	Version:
22/09/2022	JC	AH	V7

Project Number: 4188/994

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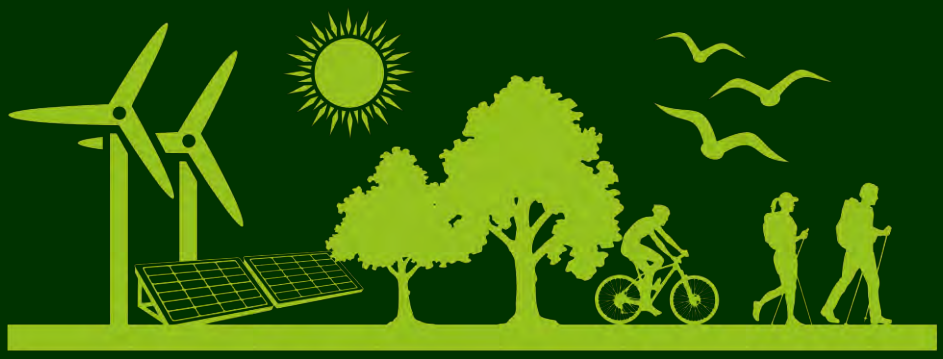

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