Technical Appendix 5.1: LVIA Methodology and Visualisation Methodology

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Chapter 1
Introduction

LVIA Methodology

1.1 This appendix sets out the methodology used for Glenouther Wind Farm (hereafter referred to as 'the Proposed Development') Landscape and Visual Impact Assessment (LVIA) and associated cumulative assessment contained in **Chapter 5: Landscape and Visual Impact Assessment** of the EIA Report. The methodology adopted has been used to assess both the Proposed Development and the Likely Grid Connection Route which, together, are considered to comprise a 'single project' for the purposes of the EIA (see **Chapter 2: Approach to the EIA** of the EIA Report).

1.2 The methodology for the production of accompanying visualisations was based on current good practice guidance as set out by NatureScot (2017) and the Landscape Institute (2019). Detailed information about the approach to taking viewpoint photography, Zone of Theoretical Visibility (ZTV) and visualisation production is also provided below.

1.3 Landscape and visual assessments are separate, although linked, processes. LVIA therefore considers the likely effects of a proposed development on:

- landscape as a resource in its own right (caused by changes to the constituent elements of the landscape, its specific aesthetic or perceptual qualities and the character of the landscape); and
- views and visual amenity as experienced by people (caused by changes in the appearance of the landscape).

1.4 The 'primary' LVIA deals with landscape and visual effects separately against the current baseline. It is followed by an assessment of cumulative landscape and visual effects, which considers the effects against potential future baseline scenarios, where relevant.

Guidance

1.5 This methodology was developed by Chartered Landscape Architects (Chartered Members of the Landscape Institute (CMLI)) at Land Use Consultants Ltd (LUC), who have extensive experience in the assessment of landscape and visual effects arising from wind energy developments.

1.6 The methodology was developed primarily in accordance with the principles contained within the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3) (2013) and associated clarification notes (2024). NatureScot cumulative guidance (2021) also informed the approach to the assessment of cumulative landscape and visual effects in relation to onshore wind energy development. Other relevant guidance is listed in **Chapter 5** of the EIA Report.

Scope of Assessment

1.7 LVIA considers physical changes to the landscape as well as changes in landscape character. It also considers changes to areas designated for their scenic or landscape qualities, and the visual impacts of a proposed development, informed by an assessment undertaken from representative viewpoints, and as perceived by people living in and around settlements, using the landscape for recreation and seen from routes though the landscape.

1.8 All potentially significant landscape and visual effects (including cumulative effects) are examined, including those relating to construction, operation and, where relevant, decommissioning.

1.9 Where it is judged that significant effects are unlikely to occur, the assessment of likely effects on some receptors is 'scoped out'.

Assessment Methodology

Study Area

1.10 The study area for LVIA is determined by the nature and scale of the development proposal and the nature of the study area (e.g. complex topography or extensive tree cover leading to visually enclosed areas may limit the extent of likely significant effects). A 45 km radius study, in line with NatureScot guidance (2017), was defined for this assessment. Where likely significant effects are anticipated to be more localised, the assessment focusses on smaller study areas within 45 km as appropriate.

Methodological Overview

1.11 The key steps in the methodology for assessing landscape and visual effects are as follows:

- The study area is defined, and the area over which the development will potentially be visible is established through the creation of an initial ZTV plan[1].
- The landscape of the study area is analysed, and landscape receptors identified, informed by desk and field-survey.
- The visual baseline is recorded in terms of the different receptors (groups of people) who may experience views of the development (informed by the initial ZTV) and the nature of their existing views and visual amenity.
- Potential assessment viewpoints are selected, as advocated by GLVIA3, to represent a range of different receptors and views, in consultation with statutory consultees:
  - *"Representative viewpoints*, selected to represent the experience of different types of visual receptor, where larger numbers of viewpoints cannot all be included individually and where the significant effects are unlikely to differ – for example, certain points may be chosen to represent the views of users of particular public footpaths and bridleways;
  - *Specific viewpoints*, chosen because they are key and sometimes promoted viewpoints within the landscape, including, for example, specific local visitor attractions, viewpoints in areas of particularly noteworthy visual and/or recreational amenity such as landscapes with statutory landscape designations, or viewpoints with particular cultural landscape associations; and
  - *Illustrative viewpoints*, chosen specifically to demonstrate a particular effect or specific issues, which might, for example, be the restricted visibility at certain locations." (GLVIA3, Para 6.19, Page 109).
- Likely significant effects on both the landscape as a resource and visual receptors are identified.
- The level (and significance) of landscape and visual effects are judged with reference to the nature of the receptor (commonly described as the sensitivity of the receptor), which considers both susceptibility and value, and the nature of the effect (commonly described as the magnitude of change), which considers a combination of judgements including scale, geographical extent, duration and reversibility.

Direction of Effects

1.12 As required by the EIA Regulations (2017), the assessment identifies the direction of effect as either being beneficial, adverse (also referred to as positive or negative) or neutral.

1.13 The direction of landscape, visual and cumulative effects (beneficial, adverse or neutral) is determined in relation to the degree to which the proposal fits with the existing landscape character or views, and the

[1] A bare ground ZTV indicates areas from where a development is theoretically visible, but does not account for screening from vegetation and/or buildings

contribution to the landscape or views that the proposed development makes, even if it is in contrast to the existing character of the landscape or views.

1.14 With regard to wind energy development, whilst there is a broad spectrum of response from the strongly positive to the strongly negative, an assessment is required to take an objective approach. Therefore, to cover the maximum/worst case situation, likely landscape and visual effects (including cumulative effects) relating to commercial scale wind farms are generally assumed to be adverse (negative).

Assessing the Significance of Effects

1.15 An assessment of landscape and visual effects requires consideration of the nature of the receptor (sensitivity of receptor) and the nature of the effect on the receptor (magnitude of change). GLVIA3 states that the nature of receptors, commonly referred to as their sensitivity, should be judged by their susceptibility to the type of change proposed, and the value attached to the receptor. The nature of the effect on each landscape and visual receptor, commonly referred to as its magnitude, should be assessed in terms of size and scale of effect, duration and reversibility. These aspects have been considered together, to form a judgement regarding the overall significance of effects (GLVIA3, Figure 3.5, page 39), guided by the principles set out in Figure A5.1.1 below. The geographical extent of the landscape or visual change is described separately i.e. the area over which the landscape or visual effect will arise.

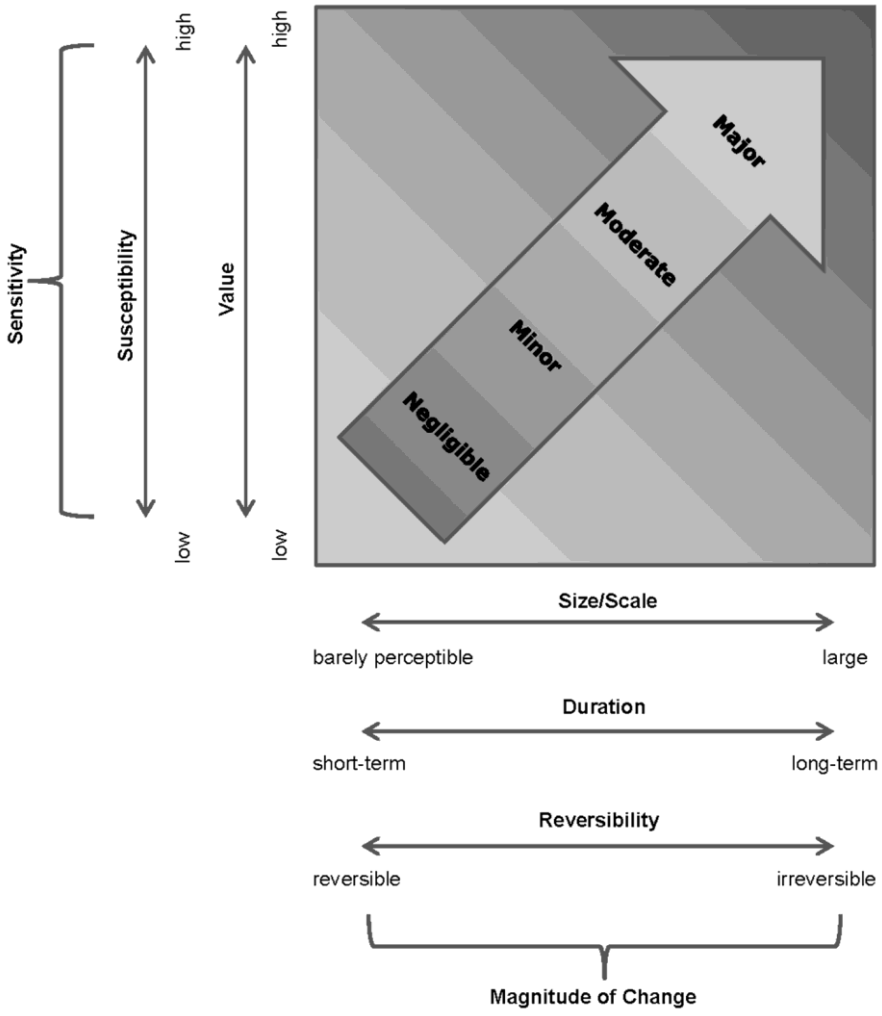

Figure A5.1.1 Judging levels of effect – Landscape or Visual effects (including cumulative)

Method for Assessing Landscape Effects

1.16 As outlined in GLVIA3 "*An assessment of landscape effects deals with the effects of change and development on landscape as a resource*" (GLVIA3, Para 5.1, Page 70). Changes may affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character.

1.17 An assessment of landscape effects requires consideration of the nature of landscape receptors (sensitivity of the receptor) and the nature of the effect on those receptors (magnitude of change). GLVIA3 states that the nature of landscape receptors should be assessed in terms of the susceptibility of the receptor to the type of change proposed, and the value attached to the receptor. The nature of the effect on each landscape and visual receptor, commonly referred to as its magnitude, should be assessed in terms of size and scale of effect, duration and reversibility. The geographical extent of the landscape change is described separately i.e. the area over which the landscape effect will arise.

1.18 These aspects are considered together to form a judgement regarding the overall significance and extent of landscape effects (GLVIA3, Figure 5.1 Page 71). The following sections set out the methodology used to evaluate sensitivity and magnitude.

Significance of Landscape Effects

1.19 The introduction of a development could affect the elements which make up the landscape, the aesthetic or perceptual aspects of the landscape or its distinctive character.

1.20 Landscape receptors are the constituent elements of the landscape, its specific aesthetic or perceptual qualities and the character of the landscape in different areas (GLVIA3, Para. 3.21, Page 36).

1.21 An assessment of landscape effects requires consideration of the nature of landscape receptors (sensitivity of receptor) and the nature of the effect on those receptors (magnitude of change). GLVIA3 states that the nature of landscape receptors, commonly referred to as their sensitivity, should be assessed in terms of the susceptibility of the receptor to the type of change proposed, and the value attached to the receptor. The nature of the effect on each landscape receptor, commonly referred to as its magnitude, should be assessed in terms of scale of effect, duration and reversibility. The geographical extent of the landscape effect should also be considered.

1.22 The judgements of sensitivity and magnitude are then combined to reach an overall determination of the level of effect, and its significance (GLVIA3, Figure 5.1, page 71). The following sections set out the methodology used to evaluate sensitivity and magnitude.

Sensitivity of Landscape Receptors

1.23 The sensitivity of a landscape receptor to change is defined as high, medium or low (or graduations between) and is based on weighing up professional judgements regarding susceptibility and value, as set out in the table below.

Table 1.1 Sensitivity of Landscape Receptors

	Higher		Lower
Susceptibility	Attributes that make up the character of the landscape offer very limited opportunities for the accommodation of change without key characteristics being fundamentally altered by wind energy development, leading to a different landscape character.	↔	Attributes that make up the character of the landscape are resilient to being changed by wind energy development.

	Higher		Lower
Value	Landscapes with high scenic quality, high conservation interest, recreational value, important cultural associations or a high degree of rarity.	↔	Landscape of poor condition and intactness, limited aesthetic qualities, or of character that is widespread.

1.24 There may be a complex relationship between the value attached to a landscape and the susceptibility of the landscape to a specific change. Therefore, the rationale for judgements on the sensitivity of landscape receptors needs to be clearly set out for each receptor. Further information on the criteria is provided below. It should be noted that whilst landscape designations at an international or national level are likely to be accorded the highest value, it does not necessarily follow that such landscapes all have a high susceptibility to all types of change, and conversely, undesignated landscapes may also have high value and susceptibility to change (GLVIA3, Page 90).

Susceptibility of Landscape Receptors

1.25 Susceptibility is defined by GLVIA3 as "*the ability of the landscape receptor (whether it be the overall character or quality/condition of a particular type or area, or an individual element and/or feature, or a particular aesthetic and perceptual aspect) to accommodate the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policies and strategies*" (GLVIA3 paragraph 5.40).

1.26 A series of criteria are used to evaluate the susceptibility of Landscape Character Types (LCT) [2] to wind energy development as set out in the table below. These criteria or aspects are drawn from a range of published sources relating to wind farm development, including SNH's Siting and Designing Windfarms in the Landscape (2017) and GLVIA3.

Table 1.2 Landscape Susceptibility Criteria

	Aspects Indicating Reduced Susceptibility to Wind Energy Development		Aspects Indicating Greater Susceptibility to Wind Energy Development
Scale	Large scale	↔	Small scale
Landform	Absence of strong topographical variety, featureless, convex or flat	↔	Presence of strong topographical variety or distinctive landform features
Landscape pattern and complexity	Simple Regular or uniform	↔	Complex Rugged and irregular
Settlement and man-made influence	Presence of contemporary structures e.g. utility, infrastructure or industrial elements	↔	Absence of modern development
Skylines	Non-prominent /screened skylines	↔	Distinctive, undeveloped skylines

[2] Scottish Landscape Character Types Map and Descriptions | NatureScot

	Aspects Indicating Reduced Susceptibility to Wind Energy Development		Aspects Indicating Greater Susceptibility to Wind Energy Development
	Presence of existing modern man-made features		Skylines that are highly visible over large areas or exert a large influence on landscape character Skylines with important historic landmarks
Inter-visibility with adjacent landscapes	Little inter-visibility with adjacent sensitive landscapes or viewpoints	↔	Strong inter-visibility with sensitive landscapes Forms an important part of a view from sensitive viewpoints
Perceptual aspects	Close to visible or audible signs of human activity and development	↔	Remote from visible or audible signs of human activity and development

1.27 Published landscape sensitivity studies including the East Ayrshire Landscape Wind Capacity Study (2024) [3], where they exist, are reviewed to help inform the evaluation of susceptibility, in addition to desk-based research and fieldwork undertaken across the study area. This review includes an evaluation as to the relevance of the publication to the assessment being undertaken (e.g. consideration of the purpose and scope of the published studies and whether they have become out of date).

1.28 Landscape susceptibility is described as being high, medium or low (or graduations between).

Value of Landscape Receptors

1.29 The European Landscape Convention advocates that all landscape is of value, whether it is the subject of defined landscape designation or not, *"The landscape is important as a component of the environment and of people's surroundings in both town and country and whether it is ordinary landscape or outstanding landscape"* (Explanatory Report to the European Landscape Convention, Page 6). The value of a landscape receptor is recognised as being a key contributing factor to the sensitivity of landscape receptors.

1.30 The value of landscape receptors is determined with reference to:

- review of relevant designations and the level of policy importance that they signify (such as landscapes designated at international, national or local level); and/or
- application of criteria that indicate value (such as scenic quality, rarity, recreational value, representativeness, conservation interests, perceptual aspects and artistic associations) as described in GLVIA3, paragraphs 5.44-5.47; and/or
- aspects relating to landscape character and *"the value of individual contributors to landscape character, especially the key characteristics, which may include individual elements of the landscape, particular landscape features, notable aesthetic, perceptual or experiential qualities, and combinations of these contributors*." (GLVIA3, Para 5.44, Page 89).

1.31 Internationally and nationally designated landscapes would generally indicate landscape of higher value whereas those without formal designation (such as a widespread or common landscape type without high

[3] Landscape wind capacity study

scenic quality) are likely to be of lower value, bearing in mind that all landscapes are valued at some level. There is however variation across both designated and undesignated areas, and so judgements regarding value are also informed by fieldwork.

1.32 Landscape value is described as being high, medium or low (or graduations between).

Combining Landscape Susceptibility and Value Judgements

1.33 An overall judgement of landscape sensitivity is derived by combining the separate judgements on landscape susceptibility and landscape value, as per the 'sequential combination' approach referred to in GLVIA 3 (paragraph 5.55). The process of combining the judgements of susceptibility and value is one of professional judgement. There may be a complex relationship between the value attached to a landscape and the susceptibility of the landscape to a specific change. Therefore, the rationale for judgements on the sensitivity of landscape receptors needs to be clearly set out for each receptor. The starting point is an even weighting given to susceptibility and value, but each situation is different and there may be instances where susceptibility or value has more influence. In each case the judgement is clearly explained.

Magnitude of Landscape Change

1.34 The magnitude of landscape change is based on combining professional judgements on scale, duration and reversibility to determine where significant and not significant effects occur. The geographical extent of landscape effects is then described independently. Further information on the criteria is provided below.

Scale of Change

1.35 For landscape elements/features this depends on the extent of existing landscape elements that would be lost or changed, the proportion of the total extent that this represents, and the contribution of that element to the character of the landscape.

1.36 In terms of landscape character, this reflects the degree to which the character of the landscape would change as a result of removal or addition of landscape components, and how the changes would affect key characteristics.

1.37 The scale of the change is described as being large, medium, small, or barely perceptible (or graduations between).

Duration

GLVIA3 states that *"Duration can usually be simply judged on a scale such as short term, medium term or long term"* (GLVIA3, Page 91). For the purposes of the assessment, duration is often determined in relation to the phases of the Proposed Development, as follows:

- Short-term effects are those that occur during construction, and may extend into the early part of the operational phase, e.g. construction activities, generally lasting 0-5 years;
- Medium-term effects are those that occur during part of the operational phase, generally lasting 5-10 years; and
- Long-term effects are those which occur throughout the operational phase (in this instance the lifetime of the project), e.g. presence of turbines, or are permanent effects which continue after the operational phase, generally lasting over 10 years.

1.38 Duration is also a relevant consideration for effects which are intermittent (for example lighting).

Reversibility

1.39 In accordance with the principles contained within GLVIA3, reversibility is reported as reversible, partially reversible or irreversible (i.e. permanent), and is related to whether the change can be reversed at the end of the phase of development under consideration (i.e. at the end of construction or at the end of the operational lifespan of the development).

Combining Magnitude of Landscape Change Judgements

1.40 An overall judgement for the magnitude of landscape change is derived by combining the judgements on size/scale and duration. In most cases, size/scale of change tends to have the largest influence on overall magnitude. Reversibility does not tend to influence the overall magnitude of change, but is recorded for clarity. Geographical extent is described separately i.e. the area over which the effect on landscape character will arise is recorded for each assessment unit.

1.41 Judgements on the magnitude of landscape change are recorded as high, medium, low or barely perceptible (or graduations between) and are guided by the table below:

Table 1.3 Magnitude of Landscape Change

	Higher		Lower
Scale	Extensive loss of landscape features and/or elements, and/or change in, or loss of key landscape characteristics, and/or creation of new key landscape characteristics	↔	Limited loss of landscape features and/or elements, and/or change in or loss of some secondary landscape characteristics
Duration	Changes experienced for a longer period e.g. 10 years or more Continuous	↔	Changes experienced for a shorter period e.g. up to 5 years Intermittent or occasional
Reversibility	Change to features, elements or character which cannot be undone or are only partly reversible after a long period	↔	A temporary landscape change which is largely reversible following the completion of construction, or decommissioning of the development

Geographical Extent

1.42 In GLVIA3 geographical extent is also considered as forming part of the magnitude of landscape change (when combined with the scale of effect, duration and reversibility). However, the process of combining all four considerations in one judgement with equal weighting can distort the aim of identifying significant effects of a proposed development. For example, a high magnitude of change, based on scale, may be reduced to a lower overall level of magnitude if it was to occur across a localised geographical area. This may result in a potentially significant effect being overlooked if the effect is diluted down due to the limited geographical extent. Therefore, for this assessment the magnitude of landscape change is based primarily on scale (with a consideration of duration and reversibility). The geographical extent of landscape effects is then described independently.

Judging Levels of Landscape Effect and Significance

1.43 The final step in the assessment requires the judgements of sensitivity and magnitude of change to be combined to make an informed professional assessment on the significance of each landscape effect (GLVIA3, Figure 5.1, Page 71).

1.44 Consideration of the relative importance of each aspect is made to feed into the overall decision. Levels of effect are identified as negligible, minor, moderate or major where **moderate** and **major** effects are considered **significant** in the context of the EIA Regulations.

1.45 This determination requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. Judgements are made on a case-by-case basis, guided by the principles set out in Figure A5.1.1. A numerical scoring or rigid matrix-type approach, where the level of effect would be defined simply based on the level of sensitivity (nature of receptor) combined with the magnitude of change (nature of effect), is not adopted.

Method for Assessing Visual Effects

Significance of Visual Effects

1.46 As outlined in GLVIA3 *"An assessment of visual effects deals with the effects of change and development on views available to people and their visual amenity"* (GLVIA3, Para 6.1, Page 98). Changes in views may be experienced by people at different locations within the study area including from static locations (normally assessed using representative viewpoints) and whilst moving through the landscape (normally referred to as sequential views, e.g. from roads and walking routes).

1.47 Visual receptors are individuals or groups of people who may be affected by changes in views and visual amenity. They are usually grouped by their occupation or activity (e.g. residents, motorists, recreational users) and the extent to which their attention is focused on the view (GLVIA3, Paras. 6.31-6.32, Page 113). Note, residential visual amenity is considered separately in Technical Appendix 5.2, which also sets out the mythology for this assessment.

1.48 GLVIA3 states that the sensitivity of visual receptors should be assessed in terms of the susceptibility of the receptor to change in views and/or visual amenity and the value attached to particular views. The magnitude of visual change should be assessed in terms of the scale, duration and reversibility of the effect. The geographical extent of the visual effect should also be considered.

1.49 These aspects are considered together, to form a judgement regarding the overall significance of visual effect (GLVIA3, Figure 6.1, Page 99). The following sections set out the methodology used to evaluate sensitivity and magnitude.

Sensitivity of Visual Receptor

1.50 The sensitivity of a visual receptor to change is defined as high, medium or low (or graduations between) and is based on weighing up professional judgements regarding susceptibility and value, and each of their component considerations, as set out in the table below.

Table 1.4 Sensitivity of Visual Receptors

	Higher		Lower
Susceptibility	Viewers whose attention or interest is focused on their surroundings, including communities/individual residential receptors/people engaged in outdoor recreation/ visitors to heritage assets or other attractions where views of surrounding area an important contributor.	↔	People whose attention is not on their surroundings (and where setting is not important to the quality of working life) such as commuters/people engaged in outdoor sports/people at their place of work.

	Higher		Lower
Value	Views may be recorded in management plans, guide books, and/or which are likely to be experienced by large numbers of people.	↔	Views which are not documented or promoted.

1.51 The sensitivity of visual receptors may involve a complex relationship between their susceptibility to change and the value attached to a view. Therefore, the rationale for judgements of sensitivity is clearly set out for each receptor in relation to both its susceptibility (to the type of change proposed) and the value of the view. Further information on the criteria is provided below.

Susceptibility of Visual Receptor

1.52 The susceptibility of visual receptors to changes in views/visual amenity is a function of the occupation or activity of people experiencing the view and the extent to which their attention is focused on views (GLVIA3, para 6.32). This is recorded as high, medium or low (or graduations between), and is informed by the table below.

Table 1.5 Susceptibility of Visual Receptors

High	Medium	Low
People whose attention or interest is focussed on their surroundings, including: – Communities where views contribute to the landscape setting enjoyed by residents; – Visitors to heritage assets or other attractions where views of surroundings are an important contributor to experience; and/or – Visitors to formal or promoted stopping places on scenic or tourist routes and at key hill summits.	– People engaged in outdoor recreation (including users of cycle routes, footpaths and public rights of way whose interest is likely to be partially focused on the landscape); – People travelling in vehicles on scenic routes and tourist routes, where attention is focused on the surrounding landscape, but is transitory; and/or – People at their place of work whose attention is focused on the surroundings and where setting is important to the quality of working life.	– People travelling more rapidly on more major roads, rail or transport routes (not recognised as scenic routes); – People engaged in outdoor sport or recreation which does not involve or depend upon appreciation of views of the landscape; and/or – People at their place of work whose attention is not on their surroundings (and where setting is not important to the quality of working life).

Value of View or Visual Amenity

1.53 GLVIA3 also requires evaluation of the value attached to the view or visual amenity and relates this to planning designations and cultural associations (GLVIA3, Para. 6.37, Page 114).

1.54 Recognition of the value of a view is determined with reference to:

- planning designations specific to views;

- whether it is recorded as important in relation to designated landscapes (such as views specifically mentioned in the special qualities of a National Scenic Area);
- whether it is recorded as important in relation to heritage assets (such as designed views recorded in citations of Gardens and Designed Landscapes (GDL) or views recorded as of importance in Conservation Area Appraisals); and
- the value attached to views by visitors, for example through appearances in guidebooks or on tourist maps, provision of facilities for their enjoyment and references to them in literature and art.

1.55 A designated viewpoint or scenic route advertised on maps and in tourist information, or which is a significant destination in its own right, such as a Munro/Corbett summit, is likely to indicate a view of higher value. High value views may also be recognised in relation to the special qualities of a designated landscape or heritage asset, or may be a view which is familiar from photographs or paintings.

1.56 Views experienced from viewpoints or routes not recognised formally or advertised in tourist information, or which are not provided with interpretation or, in some cases, formal access, are likely to be of lower value.

1.57 Judgements on the value of views or visual amenity are recorded as high, medium or low (or graduations between).

Magnitude of Visual Change

1.58 The magnitude of visual change (nature of visual effect) is based on weighing up professional judgements on scale, duration and reversibility to determine where significant and not significant effects occur. The geographical extent of visual effects is then described independently. Further information on the criteria is provided below.

Scale

1.59 The scale of a visual change depends on:

- the scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the Proposed Development;
- the degree of contrast or integration of any new features or changes in the landscape with the existing or remaining landscape elements and characteristics in terms of form, scale and mass, line, height, colour and texture; and
- the nature of the view of the Proposed Development, in terms of the relative amount of time over which it will be experienced and whether views will be full, partial or glimpses.

1.60 All changes are assumed to be during winter, representing a 'maximum case effect' or 'worst case effect' scenario with minimal screening by vegetation and deciduous trees. Note that wireframes and ZTVs prepared to illustrate potential visual effects are calculated on the basis of bare ground and therefore demonstrate the maximum extent of visibility possible, in the absence of buildings or vegetation. Where forestry is present, consideration is given to felling regimes if levels of screening by forestry are likely to change notably during the lifetime of the Proposed Development.

1.61 In this assessment scale of visual change is described as being large, medium, small or barely perceptible (or graduations between).

Duration

1.62 The duration of visual effects is reported as short-term, medium-term or long-term, as defined for the duration of landscape effects (see above).

1.63 Duration is also a relevant consideration for effects which are intermittent (for example lighting).

Reversibility

1.64 Reversibility is reported as irreversible (i.e. permanent), partially reversible or reversible, and is related to whether the visual change can be reversed at the end of the phase of development under consideration (i.e. at the end of construction or at the end of the operational lifespan of the development). Operational visual effects are generally considered to be partially reversible as the decommissioning phase will remove turbines and most infrastructure at the end of the operational phase.

1.65 Judgements on the magnitude of visual change are recorded as **high, medium, low** or **barely perceptible** (or graduations between) guided by the table below.

Table 1.6 Magnitude of Visual Receptor Change

	Higher		Lower
Scale	A large visual change resulting from the Proposed Development is the most notable aspect of the view, perhaps as a result of the development being in close proximity, or because a substantial part of the view is affected, or because the development introduces a new focal point and/or provides contrast with the existing view and/or changes the scenic qualities of the view.	↔	A small or some visual change resulting from the Proposed Development as a minor or generally unnoticed aspect of the view, perhaps as a result of the development being in the distance, or because only a small part of the view is affected, and/or because the development does not introduce a new focal point or is in contrast with the existing view and/ does not change the scenic qualities of the view.
Duration	Visual change experienced over a longer period, e.g. 10 years or more. Continuous longer periods of time when travelling along a linear route.	↔	Visual change experienced over a short period e.g. up to 5 years. Intermittent or occasional Shorter periods of time when travelling along a linear route.
Reversibility	A permanent visual change which is not reversible or only partially reversible following decommissioning of the Proposed Development.	↔	A temporary visual change which is largely reversible following the completion of construction, or decommissioning, of the Proposed Development.

Geographical Extent

1.66 In GLVIA3 geographical extent is also considered as forming part of the magnitude of landscape change (when combined with the scale of effect, duration and reversibility). However, the process of combining all four considerations in one judgement with equal weighting can distort the aim of identifying significant effects of a proposed development. For example, a high magnitude of change, based on scale,

duration and/or reversibility may be reduced to a lower overall level of magnitude if it was to occur across a localised geographical area. This may result in a potentially significant effect being overlooked if the effect is diluted down due to the limited geographical extent. The magnitude of visual change in this assessment is therefore based primarily on scale (with a consideration of duration and reversibility).

1.67 The geographical extent over which the visual effect (or similar visual effects) will arise is then described independently (e.g. whether it is a unique viewpoint from where the proposed development can be glimpsed, or whether it represents a large area from which similar views are gained) and focussing on the largest scale of visual change experienced by the visual receptor(s).

Judging the Level of Visual Effect and Significance

1.68 As for landscape effects, the final step in the assessment requires the judgements of sensitivity of visual receptor and magnitude of visual change to be combined to make an informed professional assessment on the significance of each visual effect.

1.69 This determination requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. Judgements are made on a case-by-case basis, guided by the same principles as set out in Diagram 1 above.

1.70 Consideration of the relative importance of each aspect is made to feed into the overall decision. Levels of visual effect are identified as negligible, minor, moderate or major where **moderate** and **major** visual effects are considered **significant** in the context of the EIA Regulations. A numerical scoring or rigid matrix-type approach, where the level of effect would be defined simply based on the level of sensitivity (nature of receptor) combined with the magnitude of change (nature of effect), is not adopted. As such, the conclusion on the level of effect is not always the same.

Cumulative Landscape and Visual Impact Assessment

1.71 The aim of a cumulative assessment in LVIA is to *"describe, visually represent and assess the ways in which a proposed windfarm would have additional impacts when considered together with other existing, consented or proposed windfarms"* (NatureScot page 8, 2021).

1.72 The cumulative assessment therefore focuses on the change which may result from the introduction of a proposed development because of its interaction with other development in an alternative and theoretical future baseline (which includes operational, consented and proposed wind farms).

1.73 The cumulative assessment may also make reference to in-combination (also known as combined or total) cumulative effects with other projects, where these have the potential to be significant. A cumulative assessment may also consider the potential interactions between different types of development (e.g. transmission infrastructure, other energy generation stations or other built development) if these are likely to result in significant landscape and visual impacts. Note, the Likely Grid Connection Route and the Proposed Development are considered to be a 'single' project for the purposes of the EIA, and cumulative effects of the Proposed Development with other schemes, therefore, inherently considers the impacts of the Likely Grid Connection too.

1.74 Cumulative landscape and visual effects are described separately, as for the 'primary' LVIA.

Differences Between the Primary LVIA and the Cumulative Assessment

1.75 Although both the primary LVIA and the cumulative assessment look at the effects of a proposed development on the landscape and on views, there are differences in the baseline against which the assessments are carried out.

1.76 For the primary LVIA, the baseline includes existing wind farms and other developments which are present in the landscape at the time of undertaking the assessment, which may be either operational or under construction (assuming it is well advanced and, in the case of wind farms, the turbines are already present). The presence of existing development has an influence on the assessment of effects on landscape

character and the assessment of effects on views, for example in that the existing character may be influenced by wind turbines, and this characteristic might be intensified. The primary LVIA takes account of cumulative effects against the current baseline as part of the judgements which are made. For the cumulative assessment of potential future effects, the baseline is partially speculative and includes (in addition to existing wind farms):

- Scenario 1: Wind farms which have been granted planning consent but are not yet constructed (consented); and
- Scenario 2: Submitted valid wind farm applications (proposed) which are currently awaiting determination by the relevant consenting authority, including those at appeal.

1.77 Scoping stage schemes are mapped, as shown on **Figure 5.1.7**. However, given the high degree of uncertainty around these schemes, these are not included in the cumulative assessment. **A cut-off date of 28/01/2026 was applied for the inclusion of developments within the cumulative assessment.**

Types of Cumulative Effect

1.78 NatureScot's Assessing the Cumulative Impact of Onshore Wind Energy Developments (2021) states that "cumulative landscape effects can impact on either the physical fabric or character of the landscape, or any special values attached to it".

1.79 Three types of cumulative effects on visual amenity are considered in the assessment: combined, successive and sequential:

- Combined effects occur where a static viewer is able to view two or more wind farms from a viewpoint within the viewers' same arc of vision (assumed to be about 90 degrees for the purpose of the assessment).
- Successive effects occur where a static viewer is able to view two or more wind farms from a viewpoint, but needs to turn to see them.
- Sequential effects occur when a viewer is moving through the landscape from one area to another, for instance when a person is travelling along a road or footpath, and is able to see two or more wind farms at the same, or at different times as they pass along the route. Frequently sequential effects occur where wind farms appear regularly, with short time lapses between points of visibility. Occasionally sequential effects occur where long periods of time lapse between views of wind farms, depending on speed of travel and distance between viewpoints.

Method for Assessing Cumulative Landscape Effects

1.80 The primary LVIA considers the introduction of a proposed development to a baseline which includes existing (operational) wind farms, or those that are already at an advanced stage of construction (i.e. they are present in the landscape). The cumulative assessment considers the potential future effects of the addition of the Proposed Development, against a landscape baseline that includes wind farms that may or may not be present in the landscape in the future, i.e. wind farms that are in the early stages of construction where turbines are not yet present, those that are consented but not yet built, and/or undetermined planning applications. The wind farms included in each scenario are assumed to be present in the landscape for the purposes of the assessment.

1.81 The scale of cumulative change focuses on:

- the pattern and arrangement of wind farms in the landscape or view, e.g. developments seen in one direction or part of the view (combined views), or seen in different directions (successive views in which the viewer must turn) or as a series of developments seen in sequence (sequential views) when moving along a route;
- the relationship between the scale of the wind farms, including turbine size and number, and if wind farms appear balanced in views in terms of their composition, or at odds with one another;
- the position of the wind farms in the landscape, e.g. in similar landscape or topographical context;

- the position of the wind farms in the view, e.g. on the skyline or against the backdrop of land; or how the Proposed Development will be seen in association with another development (separate, together, behind etc.); and
- the distances between wind farms, and their distances from the viewer.

Significance of Cumulative Effects

1.82 As for the primary LVIA, judging the significance of cumulative landscape and visual effects requires consideration of the sensitivity and the magnitude of change on those receptors. The following section sets out the methodology applied for the assessment of cumulative effects for both landscape and visual receptors and explains the terms used. As with the primary assessment, graduations between assessment levels can also be identified.

Sensitivity

1.83 An assessment of cumulative landscape effects requires consideration of the sensitivity of the landscape receptors. This requires consideration of susceptibility and value, as detailed in the primary LVIA.

Magnitude of Cumulative Landscape Change

1.84 As for the primary LVIA, the magnitude of cumulative landscape change is based on combining professional judgements on scale, duration and reversibility. Judgements on the magnitude of cumulative landscape change (nature of cumulative visual effect) are recorded as high, medium or low. The geographical extent of landscape effects is then described independently.

Scale

1.85 The scale of cumulative landscape change reflects the additional influence the Proposed Development has on the character of the area, assuming the other developments considered in the future baseline scenarios are already present in the landscape. This is influenced by:

- how the proposal fits with existing pattern of development, including the relationship to landscape character types and areas; and
- the siting and design of the Proposed Development in relation to other existing and proposed developments (including distance between wind farms, composition, size and scale).

Duration and Reversibility

1.86 For the purpose of the cumulative landscape assessment, consideration of the judgements of the duration and reversibility of landscape effects are as recorded in the primary LVIA.

1.87 Judgements on the magnitude of cumulative landscape change are recorded as high, medium or low.

Levels of Cumulative Landscape Effect and Significance

1.88 The final step in the assessment of future cumulative landscape effects requires the judgements of sensitivity and magnitude of cumulative landscape change to be combined to make an informed professional assessment on the significance of each cumulative landscape effect.

1.89 As for the primary LVIA, the levels of cumulative landscape effect are described as negligible, minor, moderate or major where **moderate** and **major** cumulative landscape effects are considered **significant** in the context of the EIA Regulations.

1.90 More significant effects are likely where:

- the Proposed Development extends or intensifies a landscape effect;
- the Proposed Development 'fills' an area such that it alters the landscape resource; and/or
- the interaction between the Proposed Development and other projects means that the total effect on the landscape is greater than the sum of its parts.

1.91 Less significant effects are likely where:

- the interaction between the Proposed Development and other projects means that the total effect on the landscape is less than the sum of its parts;
- other proposed projects mask, screen or wrap around the Proposed Development; or
- the relationship with landform or landscape character becomes more logical.

1.92 GLVIA3 states *"The most significant cumulative landscape effects are likely to be those that would give rise to changes in the landscape character of the study area of such an extent as to have major effects on its key characteristics and even, in some cases, to transform it into a different landscape type. This may be the case where the project being considered itself tips the balance through its additional effects. The emphasis must always remain on the main project being assessed and how or whether it adds to or combines with the others being considered to create a significant cumulative effect"* (GLVIA3, Para 7.28).

1.93 This determination of potential future cumulative landscape effects requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. Judgements are made on a case-by-case basis, guided by the same principles as set out in Diagram 1 above.

Method for Assessing Cumulative Visual Effects

Sensitivity

1.94 The assessment of the significance of cumulative visual effects requires consideration of the sensitivity of the visual receptors. This requires consideration of susceptibility and value, as recorded in the primary LVIA.

Magnitude of Cumulative Visual Change

1.95 The magnitude of cumulative visual effect (nature of cumulative visual effect) is based on combining professional judgements on scale; duration and reversibility. Judgements on the magnitude of cumulative visual effect (nature of cumulative visual effect) are recorded as high, medium, low or barely perceptible. The geographical extent of visual effects is then described independently.

Scale

1.96 The scale of cumulative change to views depends on the additional influence the Proposed Development has on views assuming the other developments are already present in the landscape. This is influenced by:

- whether the Proposed Development introduces development into a new part of the view so that the proportion of the developed part of the view increases;
- the relationship between the Proposed Development and other developments in terms of design, size and layout;
- the apparent visual relationship of developments to landscape character types and or landscape character areas; and/or
- in the case of magnitude of change to routes, the relative duration of views of development from routes, and whether these will be intermittent or continuous.

1.97 There has to be clear visibility of more than one development from any one place, or sequentially when moving along a route, of which one must be the Proposed Development, for there to be a combined, successive or sequential cumulative effect.

Duration and Reversibility

1.98 For the purpose of the cumulative visual assessment, consideration of the judgements of the duration and reversibility of visual effects are as recorded in the primary LVIA.

Levels of Cumulative Visual Effect and Significance

1.99 The final step in the assessment of cumulative visual effects requires the judgements of sensitivity and magnitude of cumulative visual change to be combined to make an informed professional assessment on the significance of each cumulative visual effect.

1.100 Levels of effect are identified as negligible, minor, moderate or major where **moderate** and **major** visual effects are considered **significant** in the context of the EIA Regulations.

1.101 More significant effects are likely where:

- the Proposed Development extends or intensifies a visual effect;
- the Proposed Development 'fills' an area such that it alters the view/ visual amenity;
- the interaction between the Proposed Development and other projects means that the total visual effect is greater than the sum of its parts; and/or
- the Proposed Development will lengthen the time over which effects are experienced (sequential effects).

1.102 Less significant effects are likely where:

- the interaction between the Proposed Development and other projects means that the total visual effect is less than the sum of its parts;
- other projects will mask, screen or wrap around the Proposed Development; and/or
- when also taking account of other projects, the visual composition and its relationship with the landscape/landform becomes more logical.

1.103 The determination of cumulative visual effects requires the application of professional judgement and experience to take on board the many different variables which need to be considered, and which are given different weight according to site-specific and location-specific considerations in every instance. As for the primary assessment of landscape and visual effects, judgements are made on a case-by-case basis, guided by the same principles as set out in Diagram 1 above.

Combined (in-combination) Cumulative Effects

1.104 GLVIA3 refers to the focus of cumulative LVIA being either *"additional effects of the main project under consideration, or on the combined effects of all the past, present and future proposals together with the new project." (paragraph 7.18), but in doing so acknowledges that "…assessing combined effects involving a range of different proposals at different stages in the planning process can be very complex. Furthermore the assessor will not have assessed the other schemes and cannot therefore make a fully informed judgement. A more comprehensive overview of the cumulative effects must rest with the competent authority."*

1.105 This type of cumulative effect is only described where it is considered likely to be a relevant consideration in the determination of the Proposed Development. In considering the detailed cumulative landscape and visual effects set out in **Chapter 5: Landscape and Visual Amenity**, broad observations are made, where relevant, within the summary of effects. These relate to how the combined (also called in-combination) cumulative effects of multiple future developments may influence landscape character, views and visual amenity and designated landscapes.

ZTV Mapping and Visualisation Methodology

Introduction

1.106 This section sets out the approach to the production of the figures and visualisations which accompany **Chapter 5: Landscape and Visual Amenity**. Figures referred to in this appendix are located in **Volume 3a Figures** of the EIA Report and visualisations are included in **Volume 3b: Landscape and Visual Amenity Visualisations (Part 1) and 3c: Landscape and Visual Amenity visualisations (Part 2) and Cultural Heritage Visualisations** of the EIA Report.

1.107 The methodology for the production of figures and visualisations was based on current good practice guidance from NatureScot (2017) and the Landscape Institute (2019), unless otherwise stated. Further information about the approach is provided below.

Data Sources

1.108 Data used for generating maps and visualisations:

- Ordnance Survey Terrain 50 (OST50) mid-resolution height Digital Terrain Model (DTM) data (50 m grid spacing, with a 4 m Root Mean Square Error - RMSE) across the full 45 km study area;
- Ordnance Survey Terrain 5 (OST5) mid-resolution height DTM data (5m grid spacing, with a 2.5 m RMSE) covering a 20 km radius from the Site;
- Ordnance Survey 1:50,000 raster data (to show surface details such as roads, forest and settlement detail equivalent to the 1:50,000 scale Landranger maps); and
- Ordnance Survey 1:250,000 raster data (to provide a more general location map).

Zone of Theoretical Visibility (ZTV) Mapping

1.109 Evaluation of the theoretical extent to which the Proposed Development would be visible was informed by establishing a ZTV, using specific computer software designed to calculate the theoretical visibility of the proposed turbines within their surroundings (Note: no ZTV was required for the underground cable grid connection component of the project). ESRI's ArcPro 3.2.0 software was used to generate the ZTV. The tool calculates areas from which the turbine hubs and maximum blade tip height are potentially visible. This is performed on a 'bare ground' computer generated terrain model, which does not take account of potential screening by buildings or vegetation. The software uses raster [4] height data, but while it is displayed as continuous data (with each grid square referred to as a 'cell'), it assumes a single average height value for each cell. Therefore, any height variations across cells are not recognised.

1.110 The Digital Terrain Model (DTM) used for the analysis is OS Terrain® 50 height data, obtained from Ordnance Survey in 2025. The DTM data has not been altered (i.e., by the addition of local surface screening features) for the production of the ZTV. No significant discrepancies between the DTM and the actual topography around the study area were noted. The effect of earth curvature and light refraction was included in the ZTV analysis. A viewer height of 2 m above ground level was used. As the model uses a 'bare ground' situation, it is considered to over-emphasise the extent of visibility of the Proposed Development and therefore represents a 'maximum potential visibility' scenario which is not likely to be possible in reality. The ZTV is used as a starting point in the assessment to provide an indication of theoretical visibility. This information was verified in the field.

1.111 The ZTV was calculated to show the potential number of turbines visible to maximum blade tip height (up to 200 m) and maximum candidate hub height (up to 119 m) [5]. Subsequent figures which include the ZTV make use of the ZTV which indicates visibility up to the top of the blade tips.

[4] Raster data is a matrix of cells (or pixels) which contain a value representing information.
[5] A candidate turbine has been used for assessment purposes. The hub height of the Proposed Development, if consented, may differ.

1.112 To prepare cumulative ZTVs which illustrate the cumulative visibility of the Proposed Development in conjunction with other wind farms, the ZTV to tip height of each wind farm was generated (based on the tip height of each turbine) and then combined with the Proposed Development ZTV. The cumulative ZTVs are colour coded to distinguish between areas where the Proposed Development is predicted to be visible (either on its own, or in conjunction with other wind farms), and areas where other wind farms would be visible, but the Proposed Development would not be.

1.113 The aviation lighting visibility ZTV (**Figure A5.3.1**) is based on the hub height ZTV, but calculated only on those turbines which are proposed to be lit. ESRI's ArcPro 3.2.0 software was used to generate the ZTV.

1.114 To illustrate the potential variability in lighting intensity in relation to vertical viewing angle, a lighting intensity ZTV is provided in **Figures A5.3.2 and 3**. ESRI's ArcPro 3.2.0 software was used to generate the ZTVs.

1.115 The tool calculates areas from which the lit turbine hubs are potentially visible. Separate ZTVs were run between vertical bands below and above the horizontal to help understand light intensity values across the study area.

1.116 A limitation of this ZTV is that brightness is described in candela, which does not incorporate variability in lighting intensity resulting from the distance at which the lights are viewed. Additionally, differing atmospheric conditions are not accounted for, therefore the ZTVs represent clear conditions and the maximum possible level of visibility.

1.117 As illustrated by the ZTV, visibility of the hub lights at their greatest intensity (or perceived brightness) would generally be limited to views experienced from more elevated locations. These areas are less likely to be regularly frequented during the hours of darkness. Conversely, from lower lying areas, which are the focus of most settlement and habitation, the lights (where visible) will generally be perceived at substantially reduced intensity due to the viewing angle being below the horizontal plane.

Viewpoint Photography

Day Time

1.118 The baseline photography for the assessment viewpoints (as agreed through consultation) was taken in accordance with guidance from NatureScot (2017). The focal lengths used are in accordance with recommendations contained in guidance and are stated on the figures. Photography was captured between summer 2025 and spring 2026, using a Nikon D750 full frame digital SLR camera, with a fixed 50 mm focal length lens. The methodology for photography is in accordance with guidance from NatureScot (2017).

1.119 A tripod with vertical and horizontal spirit levels was used to provide stability and to ensure a level set of adjoining images. A panoramic head was used to ensure the camera rotated about the no-parallax point of the lens in order to eliminate parallax errors between the successive images and enable accurate stitching of the images. The camera was moved through increments of 24 degrees and rotated through a full 360˚ (degrees) at each viewpoint. Fifteen photographs were taken for each 360˚ view.

1.120 The location of each viewpoint was recorded (GPS grid reference, location map and photograph of the tripod) in accordance with NatureScot and Landscape Institute guidance (2019).

1.121 Weather conditions and visibility were considered an important aspect of the field visits for the photography. Where possible, visits were planned around clear days with good visibility. Viewpoint locations were visited at times of day to ensure, as far as possible, that the sun lit the scene from behind, or to one side of the photographer.

Night-time/ Hours of Darkness

1.122 Baseline photographs from the two dusk assessment viewpoints were taken between winter 2025 and spring 2026, in clear weather conditions, using the same camera equipment and similar procedure as

the daytime views. 360˚ ranges of photography were taken at regular intervals starting shortly before sunset with subsequent ranges taken as natural light faded and existing manmade light sources became visible.

1.123 Exposure settings were carefully optimised at each viewpoint with shutter speed, aperture and ISO levels balanced to ensure the photography provided an accurate representation of the conditions at the time.

Photography Stitching, Wirelines and Photomontages

1.124 Photography stitching software (PTGui© 12.26) was used to stitch together the adjoining images to form panoramic images in cylindrical projection. A selection of identical control points was created within each of the adjoining frames to increase the level of accuracy when stitching the 360° panoramic photography.

1.125 The software package ReSoft© WindFarm version 5.0.2.1 was used to view the Proposed Development from selected viewpoints in wireline format. OS Terrain 5 and OS Terrain 50 data were used to create a DTM which provided a detailed and reliable representation of the topography for the wireline view. Turbine locations, type and size, and viewpoint location coordinates were entered. Photomontages have been constructed to show the candidate turbine with the specified tip height, hub height and rotor diameter. Viewer height was set to 1.5 m above ground level. On limited occasions this viewer height was increased by a small increment to achieve a closer match between the terrain data and photographic landform content. The pre-prepared panoramic photos were imported into the ReSoft© WindFarm software and the wireline views overlaid and aligned with the photographs.

1.126 Wind farm layouts included within the cumulative assessment were added to the ReSoft© WindFarm model.

1.127 The presentation of fully rendered photomontages involved additional stages as follows. The panoramic baseline daytime photographic images were imported into ReSoft© WindFarm software. From each viewpoint, the wireline views of the landform model with the Proposed Development were carefully adjusted to obtain a match. Fixed features on the ground, such as buildings and roads, were located in the model and used as markers to help with the alignment process where necessary. Each view was rendered taking account of the sunlight and the position of the sun in the sky at the time the photograph was taken. Blade angle and orientation adjustments were also made to represent a realistic situation.

1.128 The exported renders were imported into Adobe Photoshop© where they were aligned and composited with the baseline photography. Turbines or sections of turbines which were located behind foreground elements in the photograph were masked (removed) where they were located behind foreground elements that appeared in the original photograph to create the photomontage.

1.129 The software package Blender© version 4.1 was used for adding infrastructure elements (including access tracks, hard standings, substation and other ancillary features) and modelling forest felling, where visible and within 5 km. Infrastructure data was provided in GIS shapefile format and imported into the model. Views were rendered and exported images composited with the turbine renders and photographs to create the photomontages.

1.130 Finally, where applicable the images were converted from Cylindrical Projection to Planar Projection using PTGui© 12.26 software.

Night-time/ Hours of Darkness

1.131 A 3D scene file was created for each Dusk/Night-time viewpoint location in Autodesk3DS Max© Vray© modelling and rendering software. A virtual ‘camera’ was created within each scene to match the coordinate locations of the baseline photography and set to a default viewer height of 1.5 m above ground level using OS Terrain 5 DTM as reference. The virtual camera in the 3D scene was set to match the perspective attributes (horizontal field of view and projection) of the physical camera used for the baseline photography. Exposure settings (Aperture, ISO and Shutter speed) contained within the metadata of each photograph was also matched to the virtual cameras.

1.132 The proposed turbine layout created for the daytime visualisations was linked to the dusk/night-time 3D scene files and the turbines were orientated with the nacelle/hub facing the camera within each 3D scene (and not obscured by turbine blades). This ensured that the images show the maximum visibility of the lighting proposed to be installed on the nacelle, with blade angle and orientation adjustments made to represent a realistic situation.

1.133 The dimensions of the nacelle light modelled reflect the specification (the 'CEL-WT-MIC [6]) of a typical candidate light within Autodesk3DS Max© software. The aviation lights were positioned on four of the proposed turbine nacelles (T1, T3, T4 and T5), as proposed in **Technical Appendix 5.3: Aviation Lighting Night Time Impact Assessment** (and as agreed with the CAA – see **Technical Appendix 4.3: Aviation Assessment),** and set to 10% of their maximum intensity (200 cd – which is the candela level they will be viewed at in clear weather conditions). The lights were coloured red to match the specification of those proposed. Each light was set up as eight individual light sources radiating horizontally out from a central, spherical light source. The directional strength and directional value of the light sources was adjusted to mimic the horizontal falloff in strength. Note that in practice the lights will be a complex composite of multiple bulbs. The modelling is therefore indicative, and vertical directional intensity mitigation may vary.

1.134 A daylight system was created in the 3D model view with lighting strength and direction applied to closely represent the conditions present at the date and time when each photograph was taken. Vray Suns 'PRG Clear Sky' sky model allowed an accurate simulation of light values in the sky after the sun has dropped below the horizon line.

1.135 Settings within Vray© rendering software were optimised (minimum sub-divisions were increased and the overall 'noise' threshold decreased) to ensure the rendered outputs maintained a high level of accuracy in terms of pixel resolution. This is especially important when the software is computing lower levels of light source and rendering lighting objects at distance.

1.136 It is very difficult for photography to accurately capture light sources at night in the same way that the naked eye perceives them. Light sources often are seen in photography with bloom and glare effects which create a 'glow' around them. This effect was artificially replicated using 'Vray Lens Effects'.

1.137 The 3D renders of turbines and lighting scenarios were then combined with the baseline photograph using Adobe Photoshop© and converted from Cylindrical Projection to Planar Projection using PTGui© software. As with the daytime images, Adobe Photoshop© software was used to combine the images and remove turbines or sections of turbines which were located behind foreground elements in the original photograph.

1.138 As with the daytime images the exported renders were then composited with the baseline photographic view using Adobe Photoshop© software and converted from Cylindrical Projection to Planar Projection using PTGui© software.

1.139 The photomontages do not seek to replicate the additional variable influence which distance (between the light and the viewpoint/observer) or atmospheric attenuation by moisture (cloud/rain/fog) or by dust or other particulates can have on the observed brightness of the lights. However, it is understood that the additional influence of these factors could lead to a further decrease in the brightness as it is perceived.

1.140 The photomontages illustrate a likely 'maximum case effect' in clear conditions for each representative viewpoint, providing an indicative tool, which is referred to when visiting the viewpoint in the field. As with any visualisation, limitations are recognised, including issues relating to print quality and paper surface if printed, or size, screen brightness and output resolution if viewed on screen.

[6] CEL Aviation Lighting (2024) Medium Intensity Red 2,000cd Light, 230VAC – LED Aircraft Warning Light – Datasheet [Online]. Available at: https://www.aircraftwarninglights.co.uk/wp-content/uploads/2024/12/CEL-WT-MIC-rev1.pdf

Presentation of Photomontages

1.141 Adobe InDesign© software was used to present the figures. The dimensions for each image (printed height and field of view) are in accordance with NatureScot requirements. Photography information and viewing instructions are provided on each page where relevant.

1.142 The elongated A3/A1 width format pages presented for each viewpoint are set out as follows:

- The first A3 page contains an OS 1:50,000 scale map showing the viewpoint location, direction of the 90˚ baseline photography, wireline views and 53.5˚ photomontage view. Wind turbine locations for the Proposed Development and other existing or proposed wind farms are also shown.
- The following pages contains 90˚ baseline photography and wireline to illustrate the wider landscape and visual context. These are shown in cylindrical projection and presented on an A1 width page. Additional pages in the same format are provided where relevant to illustrate wider cumulative visibility up to 360˚.
- The subsequent two pages contain a 53.5˚ wireline and photomontage. These images are both shown in planar projection and presented on an A1 width page.
- For wireline only viewpoints, relevant 90 degree cumulative baseline sections and a 53.3 degree wireline of the Proposed development have been provided.
- For the dusk viewpoints baseline dusk and proposed night time photomontage views are provided at 53.5˚.

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