atmos CONSULTING

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Environmental Impact Assessment

Sandy Knowe Wind Farm Extension

Technical Appendix 5-1: Landscape and Visual Impact Assessment Methodology

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5 Landscape and Visual Impact Assessment Methodology

A.1. Introduction

This appendix sets out the detailed methodology used in Chapter 5: Landscape and Visual Amenity. The methodology for the production of accompanying visualisations was based on current good practice guidance as set out by NatureScot (formerly Scottish Natural Heritage).

Landscape and visual assessments are separate, although linked, processes. Landscape and visual impact assessment (LVIA) therefore considers the potential 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).

LVIA deals with landscape and visual effects separately, followed by an assessment of cumulative landscape and visual effects where relevant.

A.2. Guidance

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

The methodology has been developed primarily in accordance with the principles contained within the Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3) (Landscape Institute and Institute of Environmental Management and Assessment, 2013). NatureScot cumulative guidance (SNH, 2012) also informs the approach to the assessment of cumulative landscape and visual effects in relation to onshore wind energy development.

A.3. Scope of an Assessment

An 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 as perceived by people. Where it is judged that significant effects are unlikely to occur, the assessment of potential effects on some receptors may be 'scoped out': for an Environmental Impact Assessment (EIA) development this is usually agreed at scoping stage.

A.4. Assessment Methodology

Study Area

The study area for an LVIA is determined by the nature and scale of the development proposed 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).

Methodological Overview

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

- The landscape of the study area is analysed and landscape receptors identified, informed by desk and field survey;
- The area over which the Proposed Development will potentially be visible is established through the creation of an initial Zone of Theoretical Visibility (ZTV) plan[1];
- The visual baseline is recorded in terms of the different receptors (groups of people) who may experience views of the Proposed 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;*
  - *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; and
- The level (and significance) of landscape and visual effects are judged with reference to the nature of the receptor (commonly referred to as the sensitivity of the receptor), which considers both susceptibility and value, and the nature of the effect (commonly referred to as the magnitude of effect), which considers a combination of judgements including size/scale, geographical extent, duration and reversibility.

Direction of Effects

As required by the EIA Regulations, the assessment must identify the direction of effect as either being beneficial (positive), adverse (negative) or neutral.

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 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] A ZTV indicate areas from where a development is theoretically visible, but they cannot show what it would look like, nor indicate the nature or magnitude of landscape or visual impacts.

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 case effect' situation, potential landscape and visual effects relating to commercial scale wind farm developments are generally assumed to be adverse (negative).

Method for Assessing Landscape Effects

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.

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 effect). 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 size and scale of effect, geographical extent, duration and reversibility.

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

Sensitivity of Landscape Receptors

The sensitivity of a landscape receptor to change is defined as high, medium or low and is based on weighing up professional judgements regarding susceptibility and value, as set out below.

Table 1: Sensitivity of Landscape Receptors

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.
Value	Landscapes with high scenic quality, high conservation interest, recreational value, important cultural associations or a high degree of rarity. Areas or features designated at a national level e.g. National Parks or National Scenic Areas or key features of these with national policy level protection.	⟷	Landscape of poor condition, intactness, limited aesthetic qualities, or of character that is widespread. Areas or features that are not formally designated.

Susceptibility of Landscape Receptors

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).

A series of criteria are used to evaluate the susceptibility of Landscape Character Types (LCTs) or Landscape Character Areas (LCAs) 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 Siting and Designing Windfarms in the Landscape (SNH, 2017) and GLVIA3.

Table 2: Aspects Influencing Susceptibility of Landscape Receptors to Wind Turbines

Aspects Influencing Susceptibility of Landscape Receptors to Wind Turbines			
	Aspects indicating reduced susceptibility to wind energy development		**Aspects indicating greater susceptibility to wind energy development**
Scale	Large scale	⟷	Small scale
Value	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 Presence of small scale, historic or vernacular settlement

Skylines	Non-prominent /screened skylines Presence of existing modern man-made features	⟷	Distinctive, undeveloped skylines 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

Published landscape capacity or sensitivity studies (where they exist) are reviewed to inform the evaluation of susceptibility, in addition to 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).

Landscape susceptibility is described as being high, medium or low.

Value of Landscape Receptors

The European Landscape Convention states 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.' The value of a landscape receptor is recognised as being a key contributing factor to the sensitivity of landscape receptors.

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.

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 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.

Landscape value is described as being high, medium or low.

Magnitude of Landscape Effect

The overall judgement of magnitude of landscape effect is based on combining professional judgements on size and scale, geographical extent, duration and reversibility. Further information on the criteria is provided below.

Size and Scale of Effect

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.

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.

The size and scale of the effect is described as being large, medium, small, or barely perceptible.

Geographical Extent of Effect

The geographical extent over which the landscape effect would arise is described as being large (scale of the landscape character type, or widespread, affecting several landscape types or character areas), medium (more immediate surroundings) or small (site level).

Duration of Effect

GLVIA3 states that 'Duration can usually be simply judged on a scale such as short term, medium term or long term.' 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 30 years), e.g. presence of turbines, or are permanent effects which continue after the operational phase, generally lasting over 10 years.

Reversibility of Effect

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 Proposed Development).

Judgements on the magnitude of landscape effect (nature of landscape effect) are recorded as high, medium or low and are guided by the table below.

Table 3: Magnitude of Landscape Effect

Magnitude of Landscape Effect			
	Higher		**Lower**
Size / 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
Geographical	Change in landscape features	⟷	Change in landscape

Extent	and/or character extending considerably beyond the immediate site and potentially affecting multiple landscape character types/areas		features and/or character extending contained within or local to the immediate site and affecting only a small part of the landscape character type/area
Duration	Changes experienced for a period of around 10 years or more	⟷	Changes experienced for a shorter period of up to 5 years
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 Proposed Development

Judging Levels of Landscape Effect and Significance

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

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. 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).

Although a numerical or formal weighting system is not applied, 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.

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 Diagram 1 below. A rigid matrix-type approach, which does not take on board professional judgement and experience, and where the level of effect is defined simply based on the level of sensitivity (nature of receptor) combined with the magnitude of change (nature of effect), is not used. As such, the conclusion on the level of effect is not always the same.

Method for Assessing Visual Effects

Significance of Visual Effects

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).

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).

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 effect should be assessed in terms of the size and scale, geographical extent, duration and reversibility of the effect.

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 visual sensitivity and magnitude.

Sensitivity of Visual Receptors

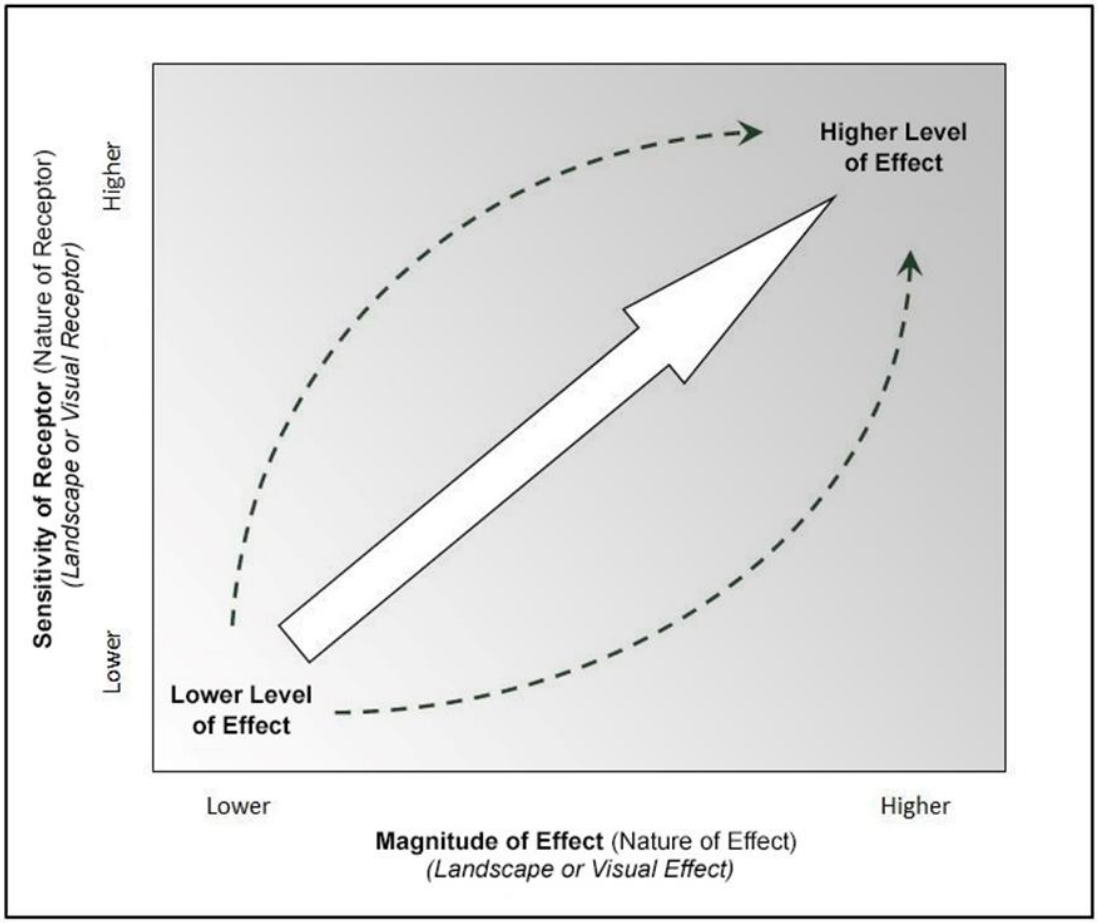

Diagram 1: Judging levels of effect – Landscape or Visual (including cumulative)

The sensitivity of a visual receptor to change is defined as high, medium or low and is based on weighing up professional judgements regarding susceptibility and value, and each of their component considerations, as set out in Table 4.

Table 4: Sensitivity of Visual Receptors

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.
Value	Views may be recorded in management plans, guide books, and/or which are likely to be experienced by large numbers of people. Views may be associated with nationally designated landscapes; local authority designated landscapes; designed views recorded in citations for historic parks, gardens/scheduled monuments etc.	⟷	Views which are not documented or protected. Views which are more incidental, and less likely to be associated with somewhere people travel to or stop, or which may be experienced by smaller numbers of people.

Susceptibility of Visual Receptors

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 (GLVIA 3, para 6.32). This is recorded as high, medium or low informed by Table 5.

Table 5: Susceptibility of Visual Receptors

Susceptibility of Visual Receptors		
High	**Medium**	**Low**
Viewers 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, other attractions and popular hill summits where views of surroundings are an important contributor to experience; and • formal or promoted stopping places on scenic or tourist routes.	• People engaged in outdoor recreation (including users of cycle routes, footpaths and public rights of way whose interest is likely to be partly 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 • 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); and • People engaged in outdoor sport or recreation which does not involve or depend upon appreciation of views of the landscape; • 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

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).

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

- Planning designations specific to views including views with recognised scenic value;
- 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);
- The scenic or panoramic qualities that people may enjoy, including the breadth and depth of the view, its visual diversity, and any detractive elements; and
- The value attached to views by visitors, for example through appearances in guide books or on tourist maps, provision of facilities for their enjoyment and references to them in literature and art.

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 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 it may be a view familiar from photographs or paintings.

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.

Judgements on the value of views or visual amenity are recorded as high, medium or low.

Magnitude of Visual Effect

The overall judgement of magnitude of visual effect (nature of visual effect) is based on weighing up professional judgements on size and scale, geographical extent, duration and reversibility. Further information on the criteria is provided below.

Size and Scale

The size and 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.

All changes are assumed to be during winter, representing a 'maximum 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.

In this assessment scale of visual change is described as being large, medium, small or barely perceptible.

Geographical Extent

The geographical extent of a visual change records the extent of the area over which the changes will be visible e.g. whether this is a unique viewpoint from where the proposed wind farm can be glimpsed, or whether it represents a large area from which similar views are gained. Geographical extent is described as being large, medium or small.

Duration

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).

Reversibility

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 Proposed 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.

Judgements on the magnitude of visual effect are recorded as high, medium or low guided by Table 6.

Table 6: Magnitude of Visual Effects

Magnitude of Visual Effects			
	Higher		**Lower**
Size / Scale	A large visual change resulting from the Proposed Development becoming the most notable aspect of the view, perhaps as a result of the Proposed Development being in close proximity, or because a substantial part of the view is affected, or because the Proposed 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 Proposed Development being in the distance, or because only a small part of the view is affected, and/or because the Proposed 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.
Geographical Extent	The assessment location is clearly representative of similar visual effects over an extensive geographic area.	⟷	The assessment location clearly represents a small geographic area.
Duration	Visual change experienced over around 10 years or more	⟷	Visual change experienced over a short period of up to 5 years.
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.

Direction of Visual Effects

The direction of visual effects (beneficial, adverse or neutral) is determined in relation to the degree to which the proposal fits with the existing view and the contribution to the view that a Proposed Development makes, even if it is in contrast to the existing character of the view.

With regard to wind energy development there is a broad spectrum of response from the strongly positive to the strongly negative. However, to cover the 'maximum case effect' situation, potential visual effects relating to commercial scale wind energy developments are generally assumed to be adverse.

Judging the Level of Visual Effect and Significance

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

The evaluations of the individual aspects set out above (susceptibility, value, size and scale, geographical extent, duration and reversibility) are considered together to provide an overall profile of each identified visual effect. An overview is then taken of the distribution of judgements for each aspect to make an informed professional

assessment of the overall level of effect, drawing on good practice guidance provided in GLVIA3.

The sensitivity of visual receptors may involve a complex relationship between a visual receptor's (e.g. people's) 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 its value.

A rigid matrix-type approach, where the level of visual effect is defined simply based on the level of sensitivity combined with the magnitude of effect is not used. As such, the conclusion on the level of effect is not always the same. Although a numerical or formal weighting system is not applied, 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.

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. As such, the conclusion on the level of effect is not always the same. Judgements are made on a case by case basis, guided by the same principles as set out in Diagram 1 above.

A.5. Cumulative Landscape & Visual Impact Assessment (CLVIA)

The aim of a Cumulative Landscape and Visual Impact Assessment (CLVIA) 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' (Para. 55, SNH, 2012).

The cumulative assessment therefore focuses on the additional cumulative change which may result from the introduction of a Proposed Development. The cumulative assessment also makes reference to total (also referred to as combined) cumulative effects, 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 similar landscape and visual impacts.

As with an LVIA, a CLVIA deals with cumulative landscape and visual effects separately.

Differences between LVIA and CLVIA

Although both LVIA and CLVIA 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.

For the LVIA, the baseline includes existing wind farm developments (either operational or under construction) which are present in the landscape at the time of undertaking the assessment. Their presence has the potential to influence the assessment of effects on landscape character and the assessment of effects on views. For the CLVIA 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 which are currently awaiting determination by the relevant consenting authority, including those at appeal and in some instances those currently at scoping when specifically requested (proposed).

The cumulative assessment considers the operational and under construction sites, as well as consented and proposed sites, and differs from that contained in the assessment of landscape effects and the assessment of visual effects in that it focuses specifically on the cumulative (additional) impact of the Proposed Development in association with all other wind energy developments, and assesses the detailed relationship between them.

Where the magnitude of change that would occur as a result of the introduction of the Proposed Development in the LVIA is identified as either low or barely perceptible, potential cumulative effects are scoped out of the cumulative assessment as it is considered that such an addition would not give rise to a significant cumulative effect.

Types of Cumulative Effects

Assessing the Cumulative Impact of Onshore Wind Energy Developments states that 'cumulative landscape effects can impact on either the physical fabric or character of the landscape, or any special values attached to it' (Para. 48, SNH, 2012).

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; and
- 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. Frequent sequential effects occur where wind farms appear regularly, with short time lapses between points of visibility. Occasional sequential effects occur where long periods of time lapse between views of wind farms, depending on speed of travel and distance between viewpoints.

A.6. Assessing Cumulative Effects

Assessment Methodology for CLVIA

The CLVIA considers the potential effects of the addition of a Proposed Development, against a baseline landscape that includes wind farms that may or may not be present in the landscape in the future, i.e. wind farms 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 CLVIA.

The methodology for the CLVIA follows that of the LVIA, which considers the introduction of a Proposed Development to a baseline which includes existing

(operational and under construction) wind farms. The size and 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 developments seen sequentially 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

As for a LVIA, judging the significance of cumulative landscape and visual effects requires consideration of the sensitivity and the magnitude of effect on those receptors. The following sections set out the methodology applied for the assessment of cumulative effects for both landscape and visual receptors and explain the terms used.

Assessing Cumulative Landscape Effects

Sensitivity

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

Magnitude of Cumulative Landscape Effects

Similarly to the methodology applied for an LVIA, the magnitude of cumulative landscape effect (nature of cumulative landscape effect) is based on combining professional judgements on size and scale, geographical extent, duration and reversibility. Judgements on the magnitude of cumulative landscape effect (nature of cumulative visual effect) are recorded as high, medium or low.

Size and Scale

The size/scale of cumulative landscape change is the additional influence the Proposed Development has on the characteristics and character of the area assuming the other wind farm developments considered in the CLVIA baseline scenarios are already present in the landscape. This is influenced by:

- how the proposal fits with existing pattern of cumulative wind farm 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 wind farm developments (including distance between wind farms, composition, size and scale).

Geographical Extent

As for the LVIA, the geographical extent over which the cumulative landscape change will be experienced is described as being large, medium or small (site level).

Duration & Reversibility

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 LVIA.

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

Levels of Cumulative Landscape Effect and Significance

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

As for the LVIA moderate and major cumulative landscape effects are considered significant in the context of the EIA Regulations.

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 wind farm developments means that the total effect on the landscape is greater than the sum of its parts.

GLVIA 3 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' (para 7.28 GLVIA 3).

This determination of 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.

Assessing Cumulative Visual Effects

Sensitivity

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, and is as recorded in the LVIA.

Magnitude of Cumulative Visual Effects

As for cumulative landscape effects and the methodology for the LVIA, the magnitude of cumulative visual effect (nature of cumulative visual effect) is based on combining professional judgements on size and scale; geographical extent; 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.

Size and Scale

The size/scale of cumulative change to views depends on the additional influence the Proposed Development has on views assuming the other wind farm 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 wind farm developments in terms of design, size and layout;
- the apparent visual relationship of cumulative wind farm 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 wind farm developments from routes.

There has to be clear visibility of more than one wind farm development, of which one must be the Proposed Development, for there to be a cumulative effect (given this is an assessment of the effects of the Proposed Development and not a broader CLVIA of combined cumulative effects or capacity study). Where the Proposed Development is clearly visible and other wind farm developments are not, the effect is likely to be the same as recorded in the LVIA (i.e. the effect is not a cumulative effect).

Geographical Extent

As for the LVIA, the geographical extent of cumulative visual changes records the extent of the area over which the changes will be visible e.g. whether this is a unique viewpoint from where the proposed wind farm can be glimpsed, or whether it represents a large area from which similar views are gained from large areas. Geographical extent is described as being large, medium or small.

Duration & Reversibility

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 LVIA.

Levels of Cumulative Visual Effect and Significance

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

As for the LVIA moderate and major cumulative visual effects are considered significant in the context of the EIA Regulations.

The evaluations of susceptibility, value, size and scale, geographical extent, duration and reversibility are considered together to provide an overall profile of each identified visual effect. An overview is taken of the distribution of judgements for each aspect to

make an informed professional assessment of the overall level of each visual effect, drawing on guidance provided in GLVIA3.

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 developments 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).

This 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. Again, as for the 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.

A.7. Preparation of ZTV, Photography and Visualisations

Guidance

Photography and visualisation production for the Landscape and Visual Impact Assessment (LVIA) has been carried in accordance with current good practice guidance from NatureScot (2017) and the Landscape Institute, with visualisations produced to NatureScot standards.

Data

Regional topographical modelling is based on the 50m resolution Ordnance Survey (OS) Terrain 50 Digital Terrain Model (DTM), available for the whole of the UK mainland. OS Terrain 50 data has been verified to be 4m Route Mean Square Error (RMSE).

Within 5km of the Proposed Development, detailed topographical modelling is based on the 5m resolution OS Terrain 5 DTM dataset within the LVIA study area. OS Terrain 5 data has been verified to be 2.5m Route Mean Square Error (RMSE).

Zone of Theoretical Visibility (ZTV)

Assessment of the extent to which the Proposed Development will be visible within the LVIA study area was undertaken by calculating a Zone of Theoretical Visibility (ZTV) using the Viewshed tool located in the 3D/Spatial Analyst extension of ESRI ArcMap© GIS software.

The ZTV is calculated using a 'bare ground' terrain model on a 50m resolution grid, which does not take account of the potential screening effects of buildings or vegetation. As no screening effects are considered, the results can be considered as the 'worst case' visibility scenario. The 50m grid resolution means that the software calculates the number of turbines visible from the centre point of each 50m x 50m grid cell.

ZTVs are generated to blade tip height (where a turbine is considered visible if any part of the turbine could be observed) or hub height (where a turbine is considered visible if

the nacelle and a vertical turbine blade could be observed). The eye height of observer is considered to be 2m above the terrain model, and curvature of the earth is accommodated within the modelling.

Cumulative Zone of Theoretical Visibility (cZTV)

Cumulative Zones of Theoretical Visibility (cZTVs) are used to show the extent of overlapping visibility of the Proposed Development with one or more other wind farm developments. Instead of mapping the number of turbines visible from a single development, cZTVs map the combination of wind farms theoretically visible within the LVIA study area.

Each wind farm visibility footprint is given a specific colour, and where footprints overlap, an intermediate colour is used to represent combined visibility. Each figure therefore displays areas where the Proposed Development will theoretically be the only development visible (of those developments shown on the figure), where it will add visibility in conjunction with other developments, and where other developments will be visible but the Proposed Development will not.

The visibility radius for individual wind farms displayed on each cZTV is calculated in accordance with NatureScot guidance (NatureScot, 2017), ranging from 15 to 45 km from each turbine. Blade tip height visibility is used in the calculation of all cZTV visibility footprints. Again, as no screening effects are considered for each development, the results can be considered as the 'worst case' combined visibility scenario.

Photography

The photographs used to produce the photomontages have been taken using a Canon EOS 5D Mark II Digital SLR camera with a fixed 50mm lens. This camera has a full frame CMOS sensor, which provides a focal length once combined with a fixed 50mm lens that is commonly considered best practice. The camera is mounted and levelled on a panoramic tripod head at 1.5m above the ground, which itself is mounted on a sturdy tripod. The photographs are taken in landscape format at 15° intervals throughout the 360° panorama, giving approximately 40% overlap between frames.

The location of each viewpoint and information about the conditions was recorded in the field.

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. South facing viewpoints can present problems particularly in winter when the sun is low in the sky. Photographs facing into the sun were avoided where possible to prevent the turbines appearing as silhouettes.

Photomontages – NatureScot Guidance

Photographic stitching software Hugin© was used to stitch together the adjoining images to create panoramic baseline photography.

Wireframe representations that illustrate the Proposed Development, set within a computer-generated model of the terrain are used in the assessment to predict the theoretical appearance of the turbines. Wirelines are produced using Resoft Windfarm

software to illustrate the bare earth scenario, which does not take into account the screening effects of vegetation, buildings or other local features that may prevent or reduce visibility. All wind turbines are shown as worst case with blades set to maximum height and set to face the viewer.

Photomontages have been produced again using Resoft Windfarm software to provide a realistic impression of how the Proposed Development would appear. Wind turbines are rendered according to the lighting conditions within the photographs. Unlike the wireframes, turbine blades are randomly rotated while they are set to face the viewer.

As the adjacent Sandy Knowe turbine was under construction at the time of landscape photography, all turbines for this development have been added to baseline photography based on the microsite turbine coordinates, with turbine blades randomly rotated and set to face the viewer.

For viewpoints within 5km and VP7 – Kirkland Hill (which is approximately 5.5km distant and has an elevated view down to the Proposed Development), access tracks and/or the battery storage compound have been included on the photomontages, where visible. Ground level infrastructure was modelled using LSS Vista software and combined with other modelled elements in Adobe Photoshop.

Whilst every effort has been made to ensure the accuracy of the photomontages, it must be appreciated that no photomontage could ever claim to be 100% accurate as there are a number of technical limitations in the model relating to the accuracy of information available from Ordnance Survey and from the GPS. For a detailed discussion regarding the limitations of photomontages, please refer to Visual Representation of Wind Farms, SNH, February 2017.

The photographs and other graphic material such as wireframes and photomontages used in this assessment are for illustrative purposes only and, whilst useful tools in the assessment, are not considered to be completely representative of what will be apparent to the human eye. The assessments are carried out from observations in the field and therefore may include elements which are not visible in the photographs.