Development and Infrastructure Service

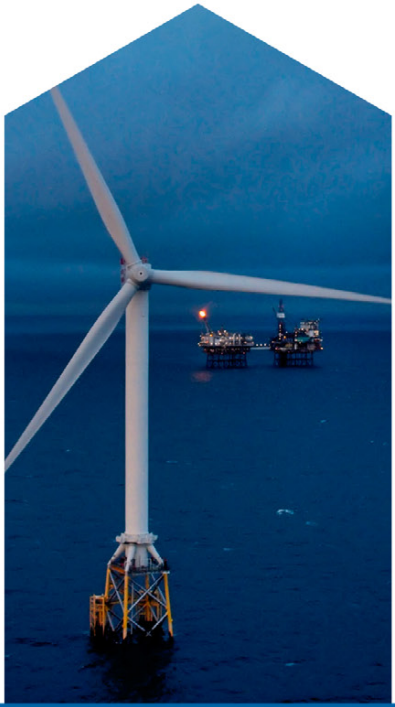
Seirbheis an Leasachaidh agus a' Bhun-structair

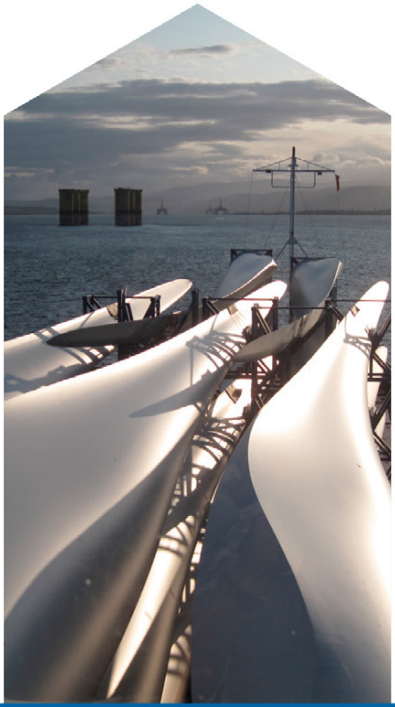
The Highland Council
Comhairle na Gàidhealtachd

Visualisation Standards for Wind Energy Developments

Inbhean Samhlaidh-Shùla airson Leasachaidhean Lùth Gaoithe

July 2016





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AMENDMENTS AND CLARIFICATION

Since the publication of the latest visualisation standards in March 2015, The Highland Council has made some minor amendments as follows:

1. The minimum sensor resolution requirement for 35mm cameras has been removed (page 5, para. 2.11).

2. Due to the difference in visual acuity between the eye and the camera, in cumulative montages which contain any existing wind farms, **all** turbines shall be rendered and remontaged (page 6, para. 2.22).

3. A new Section has been added for Residential Amenity Assessment (Section 7, page 19).

4. The field of view requirements for panoramas have been amended to give maximum angles only because the final field of view will depend on the increment setting on a panoramic head and the stitching software used (page 18, paras. 5.8 to 5.10).

5. The definition of size-constancy scaling has been added to the Glossary (page 26).

6. To retain the 3:2 ratio of the 35mm format, the horizontal and vertical fields of view for a 75mm focal length shall be 27° and 18° respectively.

The Council also wish to clarify the following points which have been raised by practitioners;

1. 'Lens corrected' means the correction required to remove any image distortion created by the camera lens using professional imaging software profiled to the actual camera lens which took the original photograph.

2. Clarification that the Standards shall apply to all other energy related applications involving distances where size-constancy scaling becomes an issue (page 2, para. 1.7).

3. Where the application is an extension to an existing wind farm or forms part of a group of adjoining turbines, all existing turbines shall be rendered and remontaged (page 13, para. 4.12).

4. Under the requirements for the Single Frame Panoramic Viewer in Section 5, applicants are required to submit **both** colour montages and annotated monochrome images (page 17, para. 5.3 and page 18, para. 5.4).

5. The provision of separate Non-Technical Summaries remains a statutory requirement within Environmental Statements and shall be provided as a separate printed document in accordance with Section 8.

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PAGE INDEX

1. INTRODUCTION

1.1 The Highland Council first introduced Visualisation Standards for Wind Energy Developments in draft form in June 2009. These Standards were informed by extensive research and field-testing by officers and responded to growing demands for visual formats that were more representative, could be clearly and easily understood, were accessible to all parties and could be relied upon by planning officers, committee members and the public.

1.2 The first illustrated version of the Standards was made available through the Council's website in January 2010 and was further updated in 2013 in response to feedback and to address some specific new visual purposes. Over the last six years the Standards have become well established with a high level of compliance and have resulted in considerable improvements in the Council's ability to assess both the cumulative and visual impact of wind energy proposals.

1.3 In addition to the greater accessibility of the single frame images, the single frame panoramic viewer system developed by The Highland Council for the assessment of larger schemes and cumulative impact is now in regular use and is proving invaluable for the majority of large scale applications in Highland. In order to safeguard and further advance the improvements so far achieved the Council has continued to monitor applicant's visualisations, encourage feedback and maintain on-going research. This update responds to the changing trends in the nature of applications that the Council receive, the requirement for online digital viewing and feedback from applicants.

1.4 Changes and modifications are intended to clarify and improve the standards and are as follows:

- The requirement for 50mm transparencies has been removed. Any future requirement will be at the discretion of the case officer.
- Images for visual impact assessment have been standardised to a focal length of 75mm for both on-shore and off-shore wind farms.
- Depending on the software used, it is also now acceptable to provide a 3D solid terrain model in light grey with numbered turbines superimposed in solid red instead of a wireline overlay.
- In recognition of some very minor variations between manufacturers in the exact dimensions of 35mm sensors and fields of view of fixed lenses, there is no longer a stated requirement for an exact size of sensor. Instead, the metadata of the original photographs will be used to verify that the image was taken with a full-frame sensor at the correct focal length and to check the accuracy of any recalibrations using a transparency template downloadable from the Council's Planning Guidance and Advice web page.
- The introduction of a requirement for additional monochrome images showing the turbine scale and, where necessary, blade sweeps in colour.
- As cumulative impacts continue to be an important consideration in all applications, it is now a requirement to provide panoramic images for use in the Council's single frame panoramic viewer to be submitted where two or more wind farms are involved.
- The optional use of a 28mm wide-angle lens for panoramic images (65.5°)* with a vertical field of view (VFOV) of a 50mm lens (27.0°)* for landscape assessment.

** It should be noted that the angles of view stated throughout this document are the theoretical angles only. (See 10.3 on page 22).*

1.5 The 50mm focal length is retained as a base photographic reference standard although it is recognised that as a printed image, it will always under-represent landscape scale. It provides a base for the construction of panoramas, for the accurate recalibration of greater focal lengths, facilitates the verification process and is a useful reference for the maximum field of view of detailed human vision. For smaller single turbine applications, in most cases the 50mm single frame also provides adequate context.

1.6 For single turbines or small groups (2-3) with hub heights of 15m and over, a short section has been added to raise the standards of the visual material submitted in applications which are not considered to be Environmental Impact Assessment (EIA) development. The Council recognise that the requirements for such applications are not generally as onerous, however, no exceptions will be made in terms of the required standard of photography, photomontages or site and viewpoint location maps. (see 4.15 - 4.18)

1.7 The Council may seek to apply the Standards to other types of development where scale and distance require to be assessed. This shall include all scales of horizontal and vertical axis wind turbines, hydro-electric developments (including run-of-river and pump store), solar farms and pylon lines. The principles contained in these Standards may also apply to any submission which requires panoramic photomontages.

1.8 In the past access to visualisations within Environmental Statements (ES) has been challenging. To ensure that this does not happen, applicants shall submit a separate Visualisation Document. The visualisations shall be submitted in a single bound A3 document along with a DVD/CD containing the same images in a format suitable for uploading to the Council's ePlanning portal.

1.9 In consideration of the different audiences involved in the planning process and to facilitate public access to reliable visual material, the Council continues to make a clear distinction between images for professional landscape assessment and images for visual impact assessment.

1.10 The Council recognises the need to include wider context within images for professional landscape assessment. The large scale format of the images promoted by the 2014 SNH Guidance is likely to make them expensive and difficult to access for consultees and the wider audience. The Council therefore continues to require a standard panorama of 65.5° which fits comfortably on the standard A3 page format. Should landscape consultants wish to submit panoramic images up to A2 width or larger in accordance with the 2014 SNH Guidance, they shall be submitted in a separate document and clearly labelled '*Additional Images for Professional Landscape Assessment only*'.

1.11 Despite the continual improvement in the quality of submissions, certain elements of the Standards are not consistently being met by some applicants. To ensure that in future applications can be assessed without delay, the following should be borne in mind in preparing submissions:

- Photography taken in dull or unsuitable weather conditions is not acceptable. Photography shall be taken in clear sunny weather free from conditions which obscure the horizon or adversely affect the view of the development. All photography shall be taken in RAW file format only.
- 50mm single frame images for visual impact assessment must not be extracted from images formed by cylindrical projection. These images are distorted if viewed as a flat image and cannot be verified by metadata. This is not permitted and will result in a request to submit new images.
- The 65.5° panoramas for landscape assessment shall be formed by planar rather than cylindrical projection.
- Recalibrations of the 50mm single frame images to 75mm focal length must be accurate. To ensure accuracy, all recalibrations shall be carried out in professional 3D software where the computer camera is set to the exact specification of the 35mm digital camera and lens which took the photograph.

All submissions must fully conform to the standards set out in this document. We encourage all applicants to discuss any queries they have concerning visualisations with the case officer prior to submission.

2. BASE STANDARDS

SELECTION AND IDENTIFICATION OF VIEWPOINTS

2.1 Viewpoints for the assessment of impacts of a proposed development must be agreed with the Council. Consultation is recommended with Scottish Natural Heritage and, where appropriate, with the most likely affected Community Council. The location of viewpoints shall be informed by site survey, mapping and predicted Zones of Theoretical Visibility Maps (ZTVs). Failure to do so results in abortive work, requests for additional visual material and delays in processing applications.

2.2 The Council may also specify on a 1:1250 scale plan the exact viewpoint positions required and provide a reference photograph where considered necessary.

2.3 Although every effort is taken to identify viewpoints early in the process, the Council reserves the right to request additional viewpoints which may be of valid concern to community councils, consultees or the public during the consultation period.

2.4 The purpose of the selected and agreed viewpoints shall be clearly stated in the supporting Landscape and Visual Impact Assessment (LVIA) text. It should be clearly identified whether the viewpoint has been chosen for landscape assessment, visual impact assessment, cumulative assessment, sequential assessment, or to show a representative view for assessment of impact on designated sites, heritage assets, communities, transport routes or individual properties (receptors).

2.5 Viewpoints which do not show the wind farm development shall be excluded unless specifically requested by the Council.

2.6 The Council strongly support the view that wherever possible visualisations should be assessed at the actual viewpoint. Consideration shall therefore be given to accessibility for both the public and members site visits.

2.7 All key accessible viewpoint positions should be marked either with a peg, spray mark or surveyor's pin.

MAP AND LOCATION INFORMATION

2.8 An overall map shall be provided to show the distribution of the selected viewpoints with the boundaries of the development site and turbine locations clearly marked. A detailed list of the viewpoint locations shall also be shown. An example page layout is shown in Fig. 1 on page 4.

2.9 Detailed viewpoint positions shall also be shown on an enlarged 1:25,000 digital Ordnance Survey extract to enable easy identification of the exact location showing direction of view. The page should state the viewpoint number and title, the six figure grid reference, AOD level and the distance to the nearest visible turbine. A detailed written description of the viewpoint location should also be included. Field of view fans must also be shown. An example page layout is shown in Fig. 2 on page 4.

2.10 Where other constructed or approved wind farms exist within a 35km radius of the proposed application site, a clear cumulative map will be required. The site area of each scheme shall be outlined and shaded with the turbines shown as red dots. Each scheme should be clearly labelled. The proposed application will be shown in red, constructed schemes in blue, consented schemes in purple, planning applications in yellow and where appropriate, scoping schemes in green. An example page layout is shown in Fig. 3 on page 5.

DRUIM BA WINDFARM

Site and Viewpoint Location Map

- Estate boundary
- Project site boundary
- Temporary existing masts
- Turbine locations

VIEWPOINT 1	Teavarran / Moniack Mhor Writing Centre
VIEWPOINT 2	North East of Ladycairn/Great Glen Way
VIEWPOINT 3	Loch Laide from Ladycairn Road
VIEWPOINT 4	Abriachan
VIEWPOINT 5	Great Glen Way at Achpopuli
VIEWPOINT 6	Meall na h-Eilrig
VIEWPOINT 7	A833 Layby
VIEWPOINT 8	Ardblair
VIEWPOINT 9	White Bridge, Glen Convinth
VIEWPOINT 10	Dores, Loch Ness
VIEWPOINT 11	B852 – Picnic Area
VIEWPOINT 12	Urquhart Castle Car Park

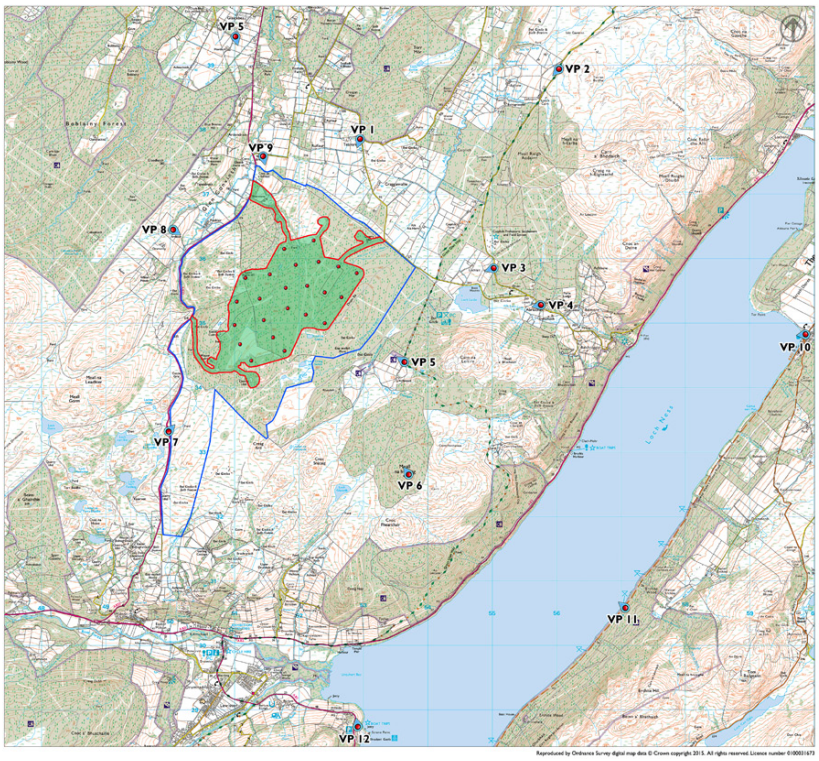
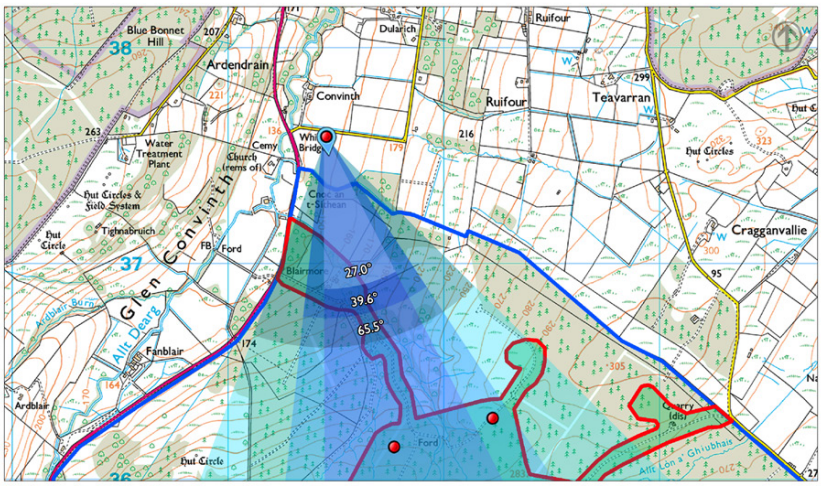


Fig. 1.

VIEWPOINT 9 - White Bridge – from the road to Dularich



Grid Ref: 251433 837619 Distance to nearest turbine: 1.5km AOD: 146m

White Bridge is where the unclassified road from Abriachan meets the main A833 Glen Convinth road. The viewpoint is in the lower straight section lined with sycamore trees. The camera point is one gap down from a small section of wooden paling fencing and is marked with a yellow wooden peg and a striped fence marker. Parking is limited but the verge is firm enough for one car to park between trees.

Fig. 2.

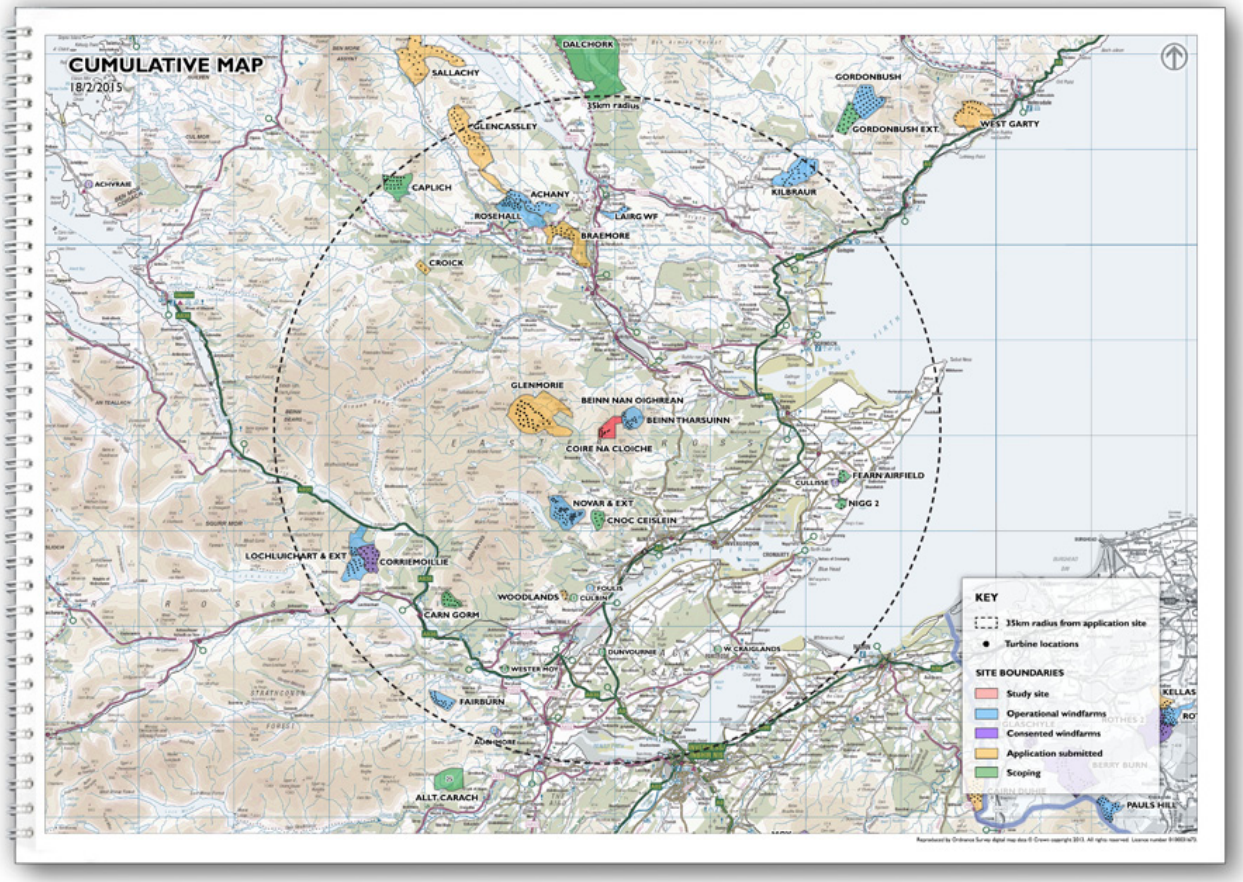


Fig. 3.

PHOTOGRAPHIC STANDARDS

2.11 The Council places considerable importance on high quality professional photography. Only 35mm format cameras shall be used. Images taken with a fixed 50mm lens shall be used as the verifiable base reference for all photographic images for Visual Impact Assessment. Images taken with digital cameras fitted with reduced size sensors shall not be accepted.

2.12 Photographic images shall be taken in clear sunny weather conditions with good visibility to show the worst case scenario in **all** cases. Photographs taken directly into the sun or in poor lighting or weather conditions shall not be accepted.

2.13 Viewpoint micro-siting shall be free from any avoidable foreground objects and other obstructions such as fences, walls, gates, roadways, road furniture, parked cars, trees, shrubs or foliage. Vertical elements in the landscape such as power line poles, and pylons shall be avoided wherever possible by judicious micro-siting.

2.14 All images, whether in single frame or panoramic format shall be taken in landscape orientation only. The height of the centre of the camera lens above ground level shall be 1.5m.

2.15 Photography shall be taken in the RAW format only. Any necessary adjustments to the images should be undertaken using professional software only.

IMAGE VERIFICATION

2.16 The original single frame 50mm and 28mm photographs (see Fig. 5 on page 8) for each viewpoint shall be submitted for verification on DVD/CD-ROM in 'Camera RAW' format. In the case of panoramic images formed from overlapping 50mm photographs, the original single frame photograph which forms the centre of the panorama shall be submitted for verification. Metadata for a photograph would typically include the date and time at which it was taken, along with details of the camera, lens, and settings such as focal length, aperture and exposure.

Fig. 4. Typical image browser showing detailed metadata information for verification

COMPUTER MODELLING REQUIREMENTS

2.17 Only 5-metre or less contour or spot data should be used to create the 3D computer generated terrain model. The use of 10-metre data will only be permitted in locations where 5-metre data is not available. Written confirmation to support this shall be included in the methodology statement.

2.18 The turbines on the 3D terrain model shall be built in accordance with the dimensions of the turbine type proposed and placed at the correct grid co-ordinates and turbine base AOD levels.

2.19 Computer renders for each viewpoint shall show the turbine blades at the centre of the field of view facing the camera in an unsynchronised rotation. For single turbines, one blade shall be shown in a vertical position.

2.20 Rendering of the turbines shall only be undertaken in software which can calculate the precise sun angle based on geographical location and time of day the photograph was taken based on the image metadata.

2.21 If the application forms an extension to an existing wind farm, the computer renders shall also include the existing development with the turbine blades at the centre of the field of view facing the camera in an unsynchronised rotation.

2.22 Due to the difference in acuity between the eye and the camera, when a wind farm forms part of a cumulative view which contains an existing wind farm or wind farms, these turbines shall also be rendered and remontaged based on the **as-built** co-ordinates. The turbine blades shall be orientated so that the centre of the application wind farm faces the camera. All blades shall be shown in an unsynchronised rotation.

2.23 In addition to turbines, significant borrow pits, control building(s), access tracks and significant land use change (eg. forest removal) shall also be included.

PHOTOMONTAGE STANDARDS

2.24 The wind farm shall be shown centrally in both the single frame and panoramic images, unless otherwise agreed with the Council for a specific viewpoint. To help achieve this, photographers should be provided with a wireframe of the scheme from that viewpoint to help them identify the centre of the wind farm. The reason for any off-set shall be provided in the methodology statement.

2.25 The photo-merging of the turbines shall be as realistic as possible, taking into account sun direction, sky conditions and light intensity.

3. IMAGES FOR LANDSCAPE ASSESSMENT

VISUALISATION REQUIREMENTS

3.1 Panoramic images showing the wind farm development in its wider landscape context are required for professional assessment within the planning process in addition to any single frame images for visual impact assessment for a wider audience. They are not required for single turbine applications unless cumulative issues are involved, or specifically requested by the Council.

Note: reference panoramas shall also be required for Visual Impact Assessment if the field of view exceeds that of a 50mm lens (39.6°). See paragraph 4.6 on page 10.

3.2 The base panorama for each viewpoint can be formed in two ways:

- Stitching three or more 50mm photographs together in planar projection. It should be noted that unless the central single frame photograph is in the exact centre of the image, perspective distortion can occur during the stitching process in planar projection. The original 50mm photograph which forms the centre the panorama shall be submitted for verification. Panoramic images formed by horizontally stitching 50mm single frames in cylindrical projection shall not be accepted.

- The base image is taken with a 28mm fixed lens (65.5°), lens-corrected in professional software profiled to the exact camera model and lens specification and horizontally cropped to the vertical field of view of a 50mm lens (27.0°). The original 28mm photograph shall be submitted for verification.

3.3 Each panorama shall be printed at an image width of 390mm on an A3 page. For further information, see Fig. 5 on the next page.

3.4 The set of images required shall be presented on two A3 pages. The first page shall show the photomontage along with the following health warning clearly shown; *'The images contained on this page and the following page are not representative of scale and distance from the actual viewpoint and show the wind farm development in its wider landscape context only'.*

3.5 The wind farm shall be shown centrally within the panorama unless there is a specific reason to offset (eg. proximity to a community, residential properties, specific landscape features or a heritage asset to show their relationship to the proposed development).

3.6 The first page shall be clearly labelled 'IMAGES FOR LANDSCAPE ASSESSMENT' in the top right-hand corner.

3.7 The technical information bar below the image shall contain the following information: viewpoint number, location title, figure number, distance to nearest visible turbine, camera model, vertical and horizontal focal length with fields of view, camera height, date and time of day the photograph was taken.

3.8 The second page shall contain two images: The baseline photograph of the existing view along with a wireline or solid model render. Wireframes containing perspective lines shall not be accepted. Depending on the software used, the terrain model can be presented as a wireline (see Fig. 7 on page 9) or a light grey solid terrain model with a black landscape profile line and the turbines superimposed in solid red (see Fig. 8 on page 9). In either case, the reference number shall also be indicated above each turbine. The bottom left-hand side of each panorama shall contain the title 'existing view', 'wireline' or 'terrain model' as appropriate along with the figure number.

3.9 Should landscape consultants wish to submit additional panoramic images up to A2 width or larger, they shall be submitted in a separate document and clearly labelled 'ADDITIONAL IMAGES FOR PROFESSIONAL LANDSCAPE ASSESSMENT ONLY'.

GEOMETRICAL RELATIONSHIP OF FOCAL LENGTHS

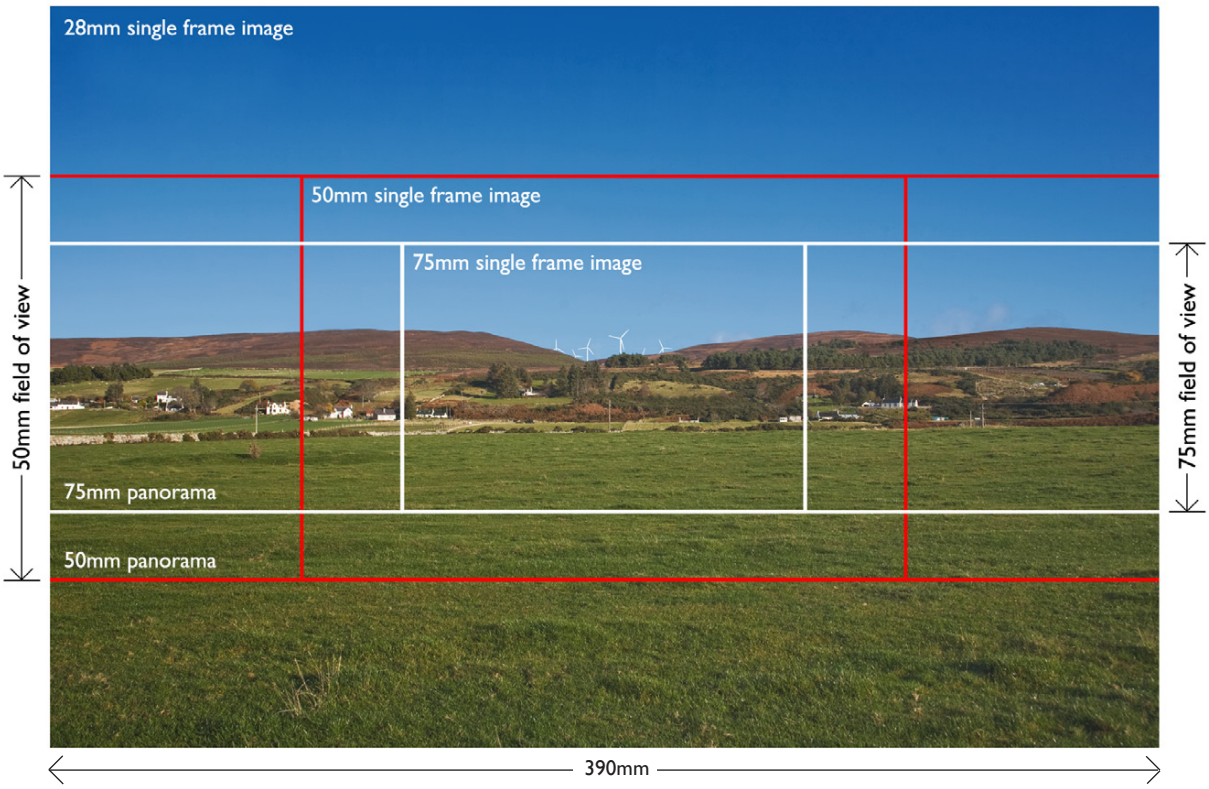


Fig. 5.

LAYOUT FOR FIRST PAGE

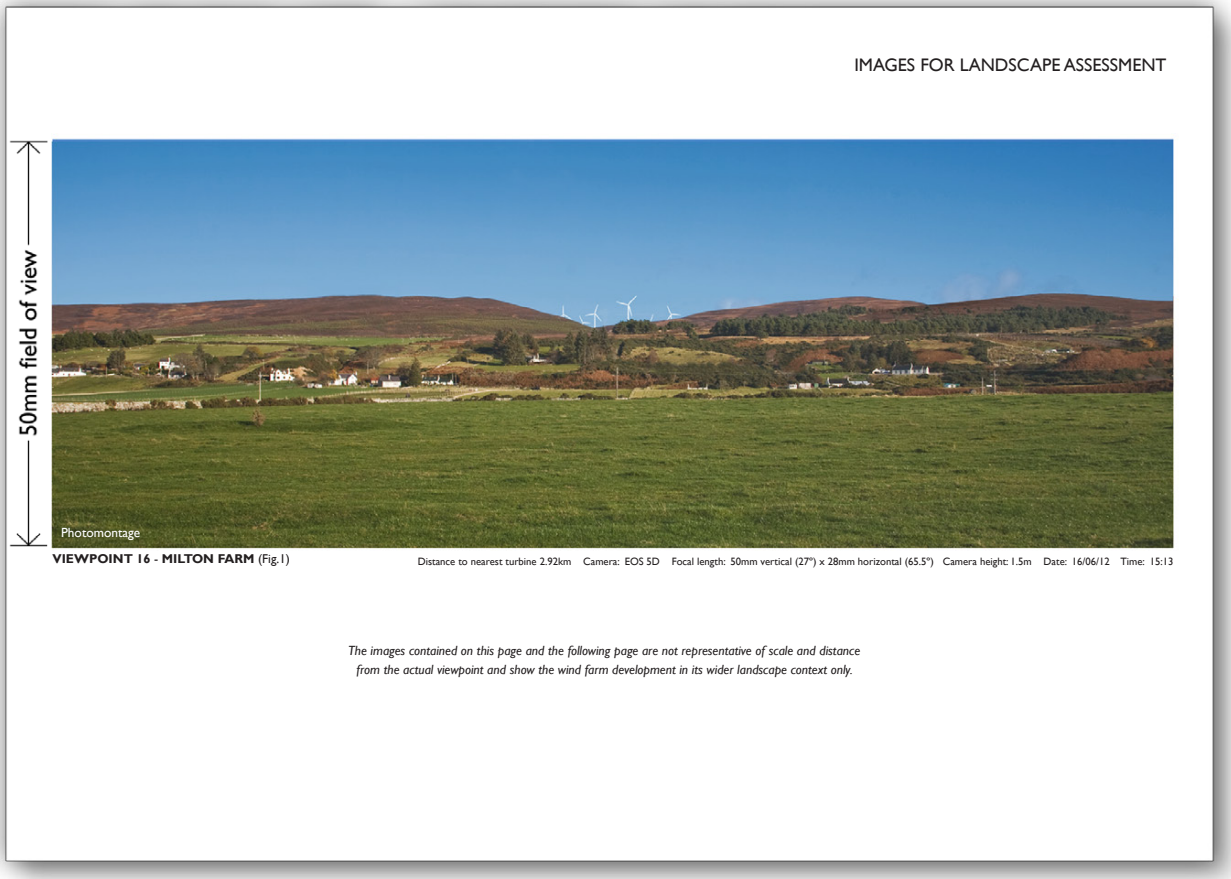


Fig. 6.

LAYOUT FOR SECOND PAGE - Alternative A

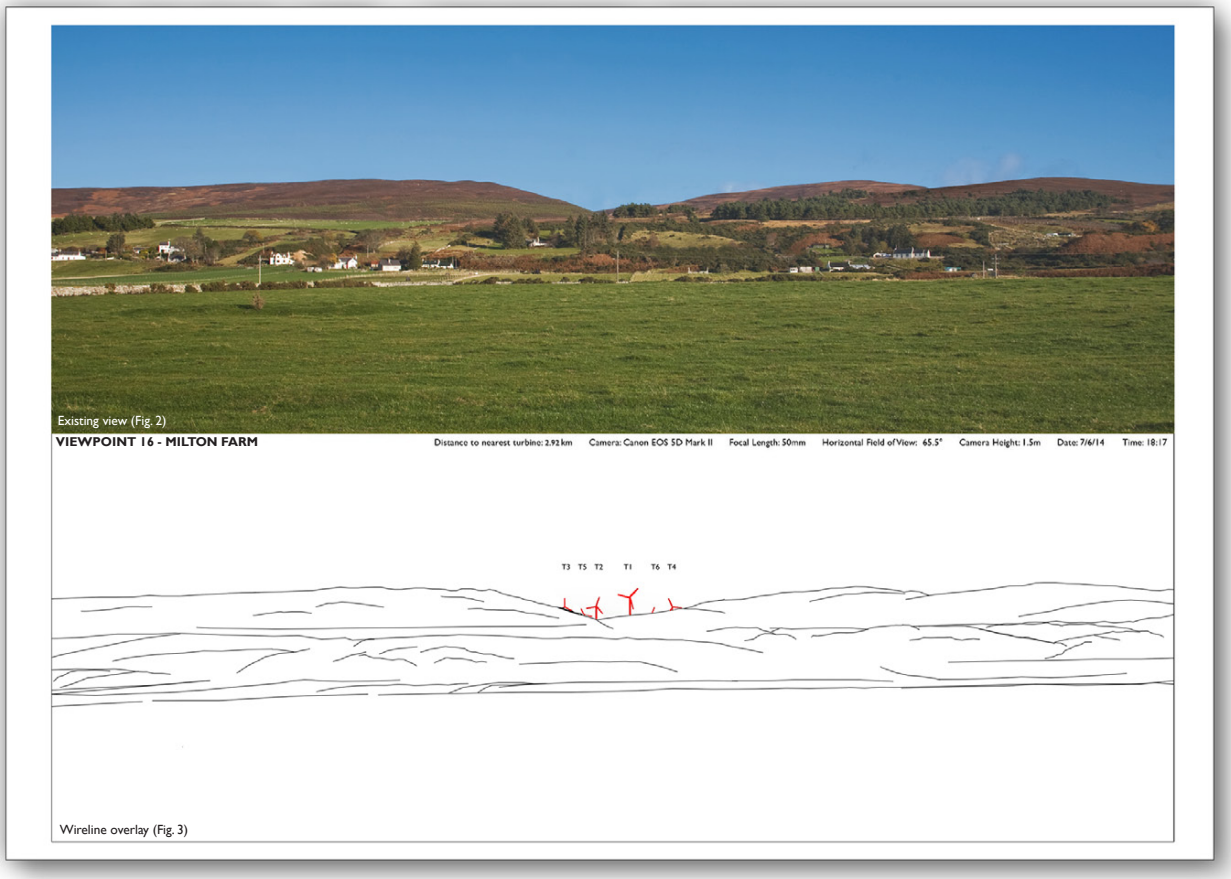


Fig. 7.

LAYOUT FOR SECOND PAGE - Alternative B

Fig. 8.

4. IMAGES FOR VISUAL IMPACT ASSESSMENT

GENERAL

4.1 Single frame images for visual impact assessment are required for professional assessment, to inform the wider audience and provide a realistic impression of scale and distance when viewed on the Council's ePlanning system. The images should be clearly labelled 'IMAGE FOR VISUAL IMPACT ASSESSMENT' in the top right of the image page.

4.2 Single frame images for each viewpoint shall be taken with a 50mm fixed lens in landscape format and lens-corrected in professional software profiled to the exact camera model and lens specification. In addition, 75mm focal length images shall also be provided for each viewpoint recalibrated from the 50mm image for all on-shore and off-shore wind farms.

4.3 For all single frame images, digital copies of the original 50mm photograph with embedded metadata shall be submitted for verification. This shall be submitted on CD/DVD but separate from all information and clearly labelled. 50mm single frame images extracted from cylindrical panoramas or from images taken with a wide-angle lens shall not be accepted.

4.4 All single frame photomontages shall be produced to a standard image size of 390mm x 260mm on A3 pages so that the images can be verified. Standardisation of image sizes enables the Council to check the accuracy of the visualisations presented using acetate or electronic templates.

4.5 The image page shall state how the photomontages should be viewed. For a single frame image viewed normally with both eyes, the natural viewing distance is approximately the diagonal of the page regardless of the focal length. For an A3 page, this is approximately 500mm which is a comfortable arm's length. In addition, an illustration with a caption explaining how the image pages should be viewed on site in accordance with the findings of the University of Stirling Study 2012 shall be included in the methodology statement.

Fig. 9.

The image should be viewed at a comfortable arm's length (approximately 500mm) and viewed normally with both eyes. The page should obscure any foreground not visible within the photomontage itself. This enables the photomontage to be directly compared within the wider context of the real landscape.

4.6 If the full extent of the wind farm can be contained within a horizontal field of view (HFOV) of a 50mm lens (39.6°) but cannot be contained within the field of view of a 75mm focal length (27.0°), the single frame image shall contain the nearest visible turbine. Similarly, if the full extent of the wind farm cannot be contained within the horizontal field of view of a 50mm lens but can be contained within the field of view of a 28mm lens (65.5°), the 50mm single frame image shall contain the nearest turbines. In such cases, a printed 65.5° panoramic image shall be submitted along with a digital image suitable for uploading to the Council's Single Frame Panoramic Viewer in accordance with SITUATION 1 on page 17. If the field of view of the overall wind farm exceeds 65.5°, the panorama shall be submitted in accordance with SITUATION 2 on page 18.

4.7 For each viewpoint, the following graphics are required:

50mm single frame colour photomontage.
75mm single frame colour photomontage.

50mm REFERENCE IMAGE

Fig. 10. A 50mm photomontage showing the technical information bar and health warning if the photomontage is viewed as a printed image.

4.8 The application wind farm shall be shown with the turbine blades at the centre of the field of view facing the camera. The technical information bar below the 50mm image shall contain the following information: Figure number, viewpoint number, location title, distance to nearest visible turbine, camera model, focal length, camera height, and the date and time of day the photograph was taken. No other information or caveats shall be included in the information panel or elsewhere on the image page other than the necessary health warning: *'when viewed at a comfortable arm's length (approx. 500mm), this printed image is representative of our detailed central vision, but is not representative of scale and distance.'*

RECALIBRATION OF THE 50mm IMAGE WITH PERMISSIBLE OFF-SETS

4.9 Where the 75mm single frame image is re-calibrated from the original 50mm photograph, the re-calibrated image shall be centrally located within the appropriate 50mm photograph to retain accurate perspective. Because of the practicalities of exactly framing turbines within the field of view, it is permissible to offset the re-calibrated image without any apparent perspective distortion when viewed in the field. The permissible zone is shown in Fig. 11 on the next page. If the required offset exceeds this zone, a different 50mm photographic base should be used.

Fig. 11. Image showing the framing of the 75mm focal length and the degree of permissible offsets when recalibrated from the original 50mm photograph. An A3 template which can be printed as a transparency is downloadable from the Council's Planning Guidance and Advice web page.

75mm PHOTOMONTAGE

Fig. 12. A 75mm photomontage showing the technical information bar and viewing instructions. The technical information bar below the 75mm image shall contain the same information contained in 4.8, but with the viewing instructions to read: 'This image should be viewed at a comfortable arm's length (approx. 500mm)'

4.10 Monochrome images with coloured turbines can be particularly useful in certain situations. They provide a scaled graphical image which clearly identifies the positioning of the scheme under consideration and shall be a requirement in the following situations;

- Where the turbines are partially screened by landform, trees or other obstructions.
- Where the turbines form an extension to an existing wind farm.
- Where the image frame contains other wind farms.

4.11 Where the turbines are partially screened by landform, trees or other obstructions, in addition to the 75mm colour photomontage for each viewpoint, a monochrome photomontage of the same focal length shall be submitted with all turbines shown in red with a **transparent** blade sweep on a monochrome background. The turbines shall be numbered for easy identification (see Fig. 13 below).

Fig. 13. The blade sweeps shall exclude any landform or permanent structures but not trees or vegetation.

4.12 Where the application is an extension to an existing wind farm, or forms part of a group of adjoining turbines, a monochrome photomontage shall be submitted with the existing turbines shown in blue and the proposed turbines shown in red with **all** turbines numbered for easy identification. The existing turbines shall also be rendered and remontaged with the turbine blades at the centre of the field of view facing the camera with the blades in an unsynchronised rotation (see Fig. 14 on next page).

4.13 Where the 75mm single frame image contains existing or other proposed wind farms, a monochrome montage identifying the wind farms in different colours shall be submitted. The application wind farm shall be shown in red and numbered for easy identification with the turbine blades at the centre of the field of view facing the camera. Other wind farms shall be annotated and shown in green, blue or purple with all turbines facing the same direction as the proposed wind farm in an unsynchronised rotation. (see Fig. 15 on next page). The colour yellow shall be avoided unless the turbines are against a dark landform background.

4.14 The technical information bar below the images shall contain the following information: Figure number, viewpoint number, viewpoint location, monochrome analysis (title), distance to nearest visible turbine, camera model, focal length and camera height. No other information or caveats shall be included in the information panel or elsewhere on the image page other than the viewing instructions stated in Fig. 12.

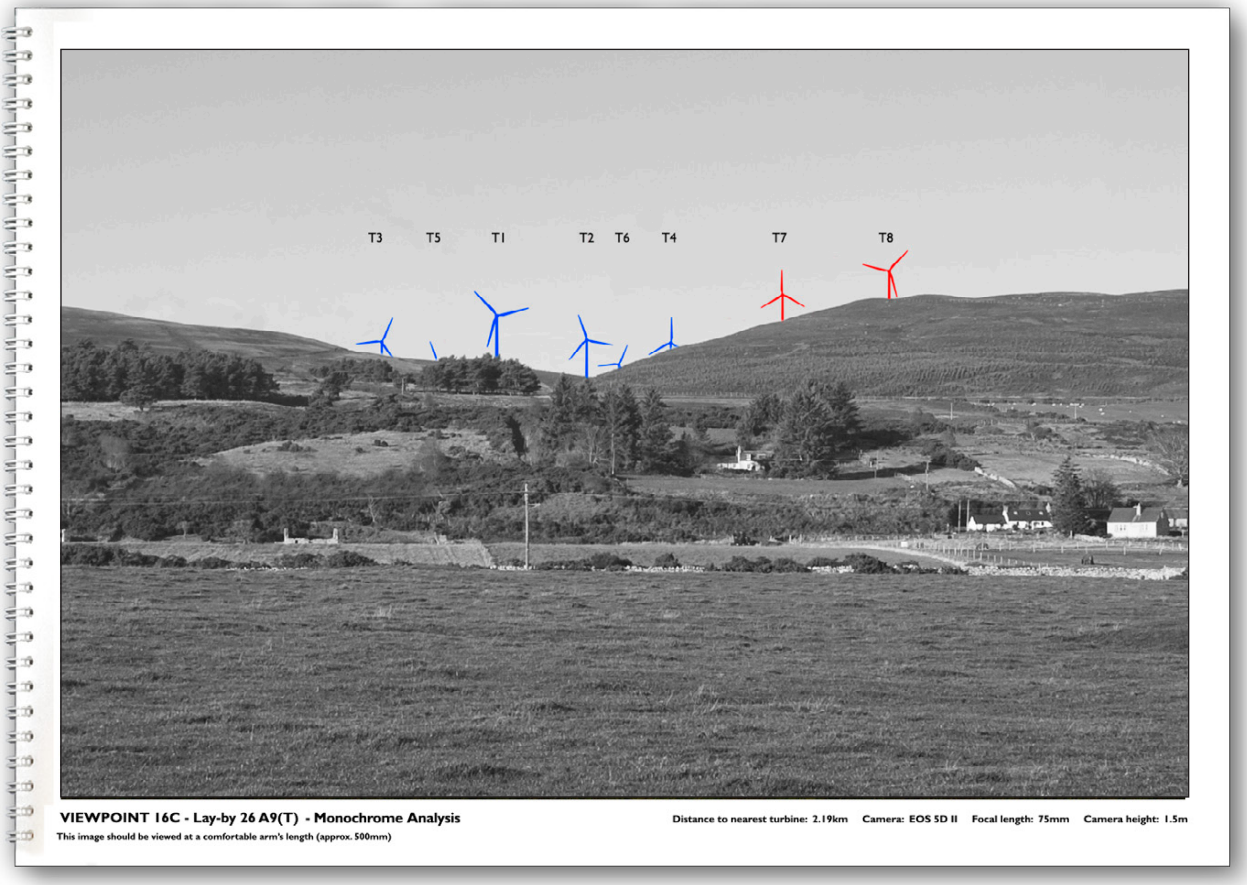

T3
T5
T1
T2
T6
T4
T7
T8
VIEWPOINT 16C - Lay-by 26 A9(T) - Monochrome Analysis
This image should be viewed at a comfortable arm's length (approx. 500mm)
Distance to nearest turbine: 2.19km
Camera: EOS 5D II
Focal length: 75mm
Camera height: 1.5m

Fig. 14.

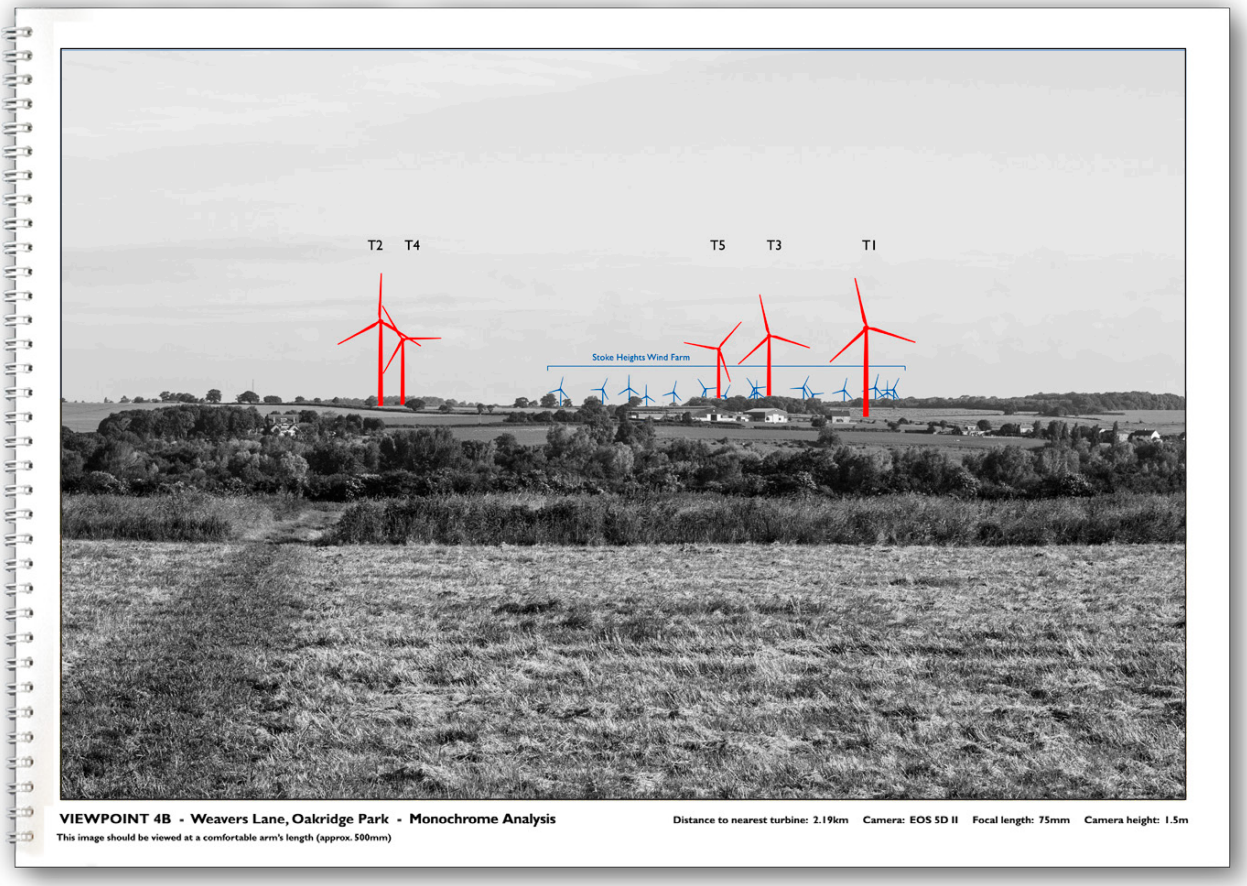

T2
T4
T5
T3
T1
Stoke Heights Wind Farm
VIEWPOINT 4B - Weavers Lane, Oakridge Park - Monochrome Analysis
This image should be viewed at a comfortable arm's length (approx. 500mm)
Distance to nearest turbine: 2.19km
Camera: EOS 5D II
Focal length: 75mm
Camera height: 1.5m

Fig. 15.

VISUALISATION REQUIREMENTS FOR SINGLE AND SMALL GROUPS OF TURBINES

4.15 The Standards shall apply to applications involving single turbines or small groups (2-3) with hub heights of 15m and over, which do not require an EIA. No concessions shall be made in the standard of photography or visualisation requirements which shall be in accordance with Section 4 on pages 10 to 12.

4.16 Where the turbine or turbines are screened by trees or other obstructions a monochrome photomontage showing blade sweeps shall be provided as illustrated in Fig. 18 on the next page.

4.17 Map work, including site and viewpoint maps, detailed viewpoint location maps and cumulative maps should be of a high standard in accordance with Section 2. The size of the study area for the cumulative map will vary according to the overall height of the proposed turbine/s (<50m = 15km, <85m = 25km).

4.18 Panoramic images shall not be required unless cumulative issues are involved. In such cases, where the horizontal field of view does not exceed that of a 28mm lens (65.5°), then the panoramas shall comply with SITUATION 1 on page 17. Where the required field of view is greater than 65.5° then SITUATION 2 on page 18 shall apply.

4.19 Small and medium scale turbine applications are often made for sites on farm or croft land which may be back-clothed by rising moorland or hills. In these instances careful consideration should be given to the colour of the proposed turbine/s and where this occurs, the appropriate colour should be discussed with the case officer prior to the production of any visualisation of the proposal.

4.20 All applications shall be submitted in both digital and printed form and particular care should be taken to ensure that maps and visualisations are clearly identified on any disc and provided at sufficient resolution to ensure high quality presentation on the Council's ePlanning portal.

Fig. 16. A 50mm photomontage showing the technical information bar and health warning.

Fig. 17. A 75mm photomontage showing the technical information bar and viewing instructions.

Fig. 18. Where the turbine is screened by trees or other obstructions, the blade sweep shall be shown on a monochrome background and exclude any landform or permanent structures but not trees or vegetation.

5. SINGLE FRAME PANORAMIC VIEWER

5.1 In 2012 The Highland Council developed a single frame panoramic viewer, accessible through the Council's website, which can be reliably used for the visual impact assessment of large wind farms or the cumulative assessment of two or more wind farms where the 75mm focal length is controlled by computer. When viewed on a computer screen, panning the image has a similar effect to turning the head to view the wider landscape. The viewer can be accurately used for planar images with a horizontal field of view of a 28mm lens (65.5°) or images formed by cylindrical projection for wider fields of view.

5.2 All panoramas regardless of the overall field of view shall have a vertical field of view of a focal length of 75mm (18.0°) based on a recalibration of the 50mm single frame which forms the centre of each panorama and submitted to the Council in JPEG file format (maximum quality), at a height of 1600 pixels.

SITUATION 1 - PLANAR IMAGES FOR VISUAL IMPACT ASSESSMENT

5.3 To supplement the single frame images for visual impact assessment detailed in Section 4 where the extent of the wind farm exceeds the horizontal field of view of a 50mm lens (39.6°), but does not exceed the field of view of a 28mm lens (65.5°). In such cases, the 75mm panoramic image shall be extracted from the 28mm panoramic panoramas shown in Fig 5 and 6 on page 8. In cumulative situations, in addition to the colour photomontage, a monochrome image of the same focal length shall be submitted with the applicant's turbines shown in red and numbered for easy identification as shown in Fig. 20 below. The colour coding for other existing or proposed wind farms/single turbines shall be in accordance with 4.13 and each scheme shall be identified with notation.

Fig 19 Example of a 65.5° panoramic photomontage. When viewed on a computer screen, the mouse can be used to pan the image which has a similar effect to turning the head to view the wider landscape. The correct focal length is maintained across the overall horizontal field of view.

Fig 20. Example of 65.5° cumulative monochrome panorama.

SITUATION 2 - CYLINDRICAL IMAGES FOR CUMULATIVE ASSESSMENT

5.4 Where the cumulative assessment of two or more wind farms/single turbines or the full extent of a single wind farm exceeds the horizontal field of view of a 28mm lens (65.5°), the images shall be formed by cylindrical projection and presented in two different formats: a full colour photomontage along with an annotated monochrome image which can be inter-changed in the Council's viewer.

5.5 The panorama shall be made up of horizontally overlapped 50mm single frame images taken on a panoramic head using professional software. All panoramas regardless of the overall horizontal field of view shall have a vertical field of view of 18.0° based on a recalibration of the 50mm single frame which forms the centre of the image. The 50mm single frame image shall be submitted to the Council for verification.

5.6 In the case of the monochrome panoramas, where the wind farms are distinctly separated from each other horizontally, the turbines at the centre of each individual wind farm shall be orientated towards the camera in a similar way to the images currently presented in wireframes for landscape professionals. The application wind farm shall be shown in red with each turbine numbered for easy identification. The colour coding for other existing or proposed wind farms/single turbines shall be in accordance with 4.13 and each scheme shall be identified with notation.

5.7 The panoramic fields of view shall be limited to that specified in 5.8, 5.9 and 5.10 unless required to contain any significant offset for landscape context or heritage features.

5.8 **Where the HFOV of the wind farm or wind farms exceeds the field of view of a 28mm lens (65.5°).**

Where the horizontal field of view of a single wind farm or cumulative views involving two or more wind farms exceeds 65.5°, the overall field of view shall not exceed 100°.

Fig. 22. A panorama photomontage with a vertical focal length of 75mm (18.0°) and a horizontal field of view of 100°.

Fig. 21. A monochrome panorama with a vertical focal length of 75mm (18.0°) and a horizontal field of view of 100°.

Fig. 23. When viewed on a computer screen, panning the image has a similar effect to turning the head to view the wider landscape. The correct focal length is maintained across the overall horizontal field of view.

Where the HFOV of the wind farm or wind farms exceeds 100°.

5.9 Where the horizontal field of view of a single wind farm or cumulative views involving two or more wind farms exceeds 100°, the overall field of view of the panorama shall not exceed 140° which is the field of view within which the observer can comfortably turn the head to scan the landscape in detail without rotating the body.

5.10 A wider field of view of up to 180° shall only be permitted if there are other existing or proposed wind farms exceeding 140°. In certain cases, a view of up to 360° may be requested by the case officer eg. panoramic views from mountain tops.

To assist the council in setting up the viewer, the type of projection used and the overall horizontal field of view shall be clearly stated in the image file name. *Eg. Viewpoint 1. Cumulative view from Heatherside Road (CP-90°).* The letters CP shall be used for images formed by cylindrical projection and PP for planar projection.

6. ANIMATIONS

6.1 For particularly sensitive viewpoints, the Council reserves the right to ask for photomontages to be animated in 3D software at the discretion of the case officer. All animations shall be viewed within a 3:2 single frame with a focal length of 75mm.

6.2 The animation shall be rendered at 1620 x 1080 pixels in H.264 MP4 format.

6.3 The 75mm focal length shall be recalibrated from 50mm base photograph. In the case of a panorama, the original 50mm photograph which forms the centre of the image shall be submitted to the Council for verification purposes.

6.4 Details of the software used shall be included in the Methodology Statement.

7. IMAGES FOR RESIDENTIAL AMENITY ASSESSMENT

7.1 Where visualisations are submitted for residential amenity assessment, the images shall conform to the single frame visualisation requirements stated in Section 4.

7.2 In addition to the single frames, where the extent of the wind farm cannot be contained within the horizontal field of view of a 50mm lens (39.6°) but can be contained within the horizontal field of view of a 28mm lens (65.5°), the images shall conform to Section 3.

7.3 In addition to the single frames, where the extent of the wind farm cannot be contained within the field of view of a 28mm lens, the image shall conform to the specification in Section 5 for incorporating into the Council's Single Frame Panoramic Viewer.

8. NON-TECHNICAL SUMMARY

8.1 Provision of a Non-Technical Summary (NTS) is a statutory requirement within an Environmental Statement and shall be made available free of charge to the public in printed form upon request. It shall also be downloadable from the local authority ePlanning portal and applicants websites, in a form which can be easily printed. The document shall be in A4 format and contain selected key visualisations which are a direct downsize of the A3 single frame images for Visual Impact Assessment. Maps and visualisations for inclusion in the NTS shall be discussed and agreed at the pre-application stage with both the local authority and affected Community/Parish Councils before the document is prepared. Failure to do so shall result in abortive work, requests for additional visual material and delays in processing applications.

8.2 The NTS is a summary of the ES. Illustrations shall therefore be limited to accurate maps and depictions only. Scenic views and non-specific promotional information and illustrations shall not be included.

8.3 The NTS shall contain only single frame visualisations at a focal length of 75mm for all viewpoints but with the viewing information amended to *'image to be viewed at a comfortable distance'*.

8.4 All photographs and photomontages of a proposed development included in the NTS of an Environmental Statement shall be printed on an A4 page and shall be accompanied with an Ordnance Survey extract printed on a separate A4 page, clearly showing the viewpoint position, description and direction.

Fig. 24.

8.5 Where the horizontal field of view of the wind farm exceeds the field of view of a 75mm image but is contained within the 50mm image, the 50mm image shall also be included. The viewing instructions shall state *'This image is representative of our detailed central vision, but is not representative of perceived scale and distance'*. If the wind farm exceeds the horizontal field of view of a 50mm lens, a panoramic image containing the full extent of the wind farm shall be included in addition to the 75mm image. The viewing instructions shall state that *'This image is for reference only and is not representative of perceived scale and distance'*.

9. PUBLIC EXHIBITIONS

9.1 Community engagement now forms a part of the pre-application process and applicants often engage with local communities by holding exhibitions to deliver advance information. In order to encourage meaningful engagement, comment and understanding, applicants shall ensure that when views of the wind farm proposals are demonstrated to members of the public, they conform to the following requirements:

9.2 If demonstrated on computer screens using a 3D terrain model of the development on one screen and a location map on the other, the horizontal field of view slider shall be set at 27.0° and shown full screen. If the extent of the wind farm exceeds 27.0°, the image shall be panned to reveal the full extent of the wind farm.

9.3 If printed images are displayed, the single frame 75mm photomontages shall be shown in A3 format in accordance with Section 4. The additional display of 50mm single frame images shall only be permitted if the extent of the wind farm exceeds the field of view of 27.0°. The additional display of panoramic images showing the wider landscape context shall not be permitted unless the overall field of view of the wind farm exceeds the horizontal field of view of a 50mm lens (39.6°).

10. VISUALISATION DOCUMENTATION

Printed Visualisation Document

10.1 The A3 document shall be laid out in the following order: Contents page, overall site and viewpoint map, cumulative map if appropriate, methodology statement (see next page), followed by the detailed viewpoint location maps and images for each viewpoint in the sequence below:

- **Detailed viewpoint location map** (see page 4)
- **Images for Landscape Assessment** (see page 7)
  Panoramic images with a vertical field of view of a 50mm lens (27.0°) and the horizontal field of view of a 28mm lens (65.5°)
- **Images for Visual Impact Assessment** (see page 10)
  50mm single frame image.
  75mm single frame image.
  75mm monochrome image if required.
- Any additional visualisation graphics requested by the case officer.

Visualisation Files for ePlanning

10.2 The A3 document files for uploading to the Council's ePlanning portal shall be in PDF format at a resolution of 100ppi for screen viewing. The maximum size for each PDF file shall not exceed 10MB.

The first PDF file shall contain:

- **Introduction page.** The page shall clearly state: *'The Visualisation Document downloadable from the Council's ePlanning portal is low resolution for screen viewing only. High resolution PDF files suitable for printing at 300ppi can be downloaded from the following website: (Applicant's project website address).'*
- **Contents page.**
- **Overall map showing wind farm site and viewpoint locations.**
- **Cumulative map (if appropriate).**
- **Methodology statement and viewing instructions.**

10.3 Each viewpoint shall be submitted as a separate PDF file and clearly labelled (eg. Viewpoint 7 - Blackwell Farm). Each PDF file shall contain the images in the following sequence:

- **Detailed viewpoint location map.**
- **Images for Landscape Assessment.**
  Panoramic images with a vertical field of view of a 50mm lens (27.0°) and the horizontal field of view of a 28mm lens (65.5°).
- **Images for Visual Impact Assessment.**
  50mm single frame image.
  75mm single frame image.
  75mm monochrome image if required.
- Any additional visualisation graphics requested by the case officer.

11. METHODOLOGY STATEMENT

11.1 Details of how photomontages have been prepared shall be provided in the methodology statement. This information shall include details of computer software used, photographic details, terrain data used and modelling methodology. Any limitations of the overall methodology shall be clearly stated.

11.2 Details of the photography shall be given including the weather conditions, the make and model of the 35mm format camera, make and focal length of the fixed lenses used and the make and type of the panoramic head used.

The following information and confirmations shall be included.

- The six figure turbine grid references and turbine base AOD levels.
- Graphic showing how the single frame images should be viewed in the field (see fig. 9 on page 10).
- All photographic images have been taken in landscape format and that the images have not been cropped in any way thus retaining the vertical and horizontal fields of view characteristic of the stated focal length in the 35mm camera format.
- The height of the camera lens above ground level in all visualisations is 1.5m.
- All the viewpoint locations specified by the Council have been visualised.
- A minimum of 5-metre contour or spot data has been used to create the 3D computer model.
- The turbine/s shown in the photomontages have been constructed in accordance with the dimensions stated in the environmental statement and that the dimensions of the turbine column, nacelle, and blades fully conform with manufacturer's specification related to the turbine output and nacelle height. The Council shall require written and technically illustrated evidence of all the major dimensions from the proposed turbine manufacturer for verification.
- That the 28mm, 50mm and the 75mm single frame images conform to the fields of view characteristic of the lenses used. The table on the next page shows the theoretical angles of view relative to the focal length, however it should be noted that the actual fields of view projected by the lenses onto the camera sensor are slightly less to avoid corner vignetting and may vary between manufacturers.

Focal length (mm)	Horizontal field of view (degrees)	Vertical field of view (degrees)	Diagonal field of view (degrees)
28	65.5	46.4	75.4
50	39.6	27.0	46.8
75	27.0	18.0	32.4

Fig. 25. Theoretical fields of view token to one decimal place.

11.3 **If printed composite panoramic images are submitted, confirmation of the following shall be provided:**

- A levelled panoramic tripod head has been used.
- Details of the computer software that has been used for the panoramic stitching.
- Planar projection only has been used.

11.4 **If composite panoramic images for use in a Single Frame Panoramic Viewer are submitted, confirmation of the following shall be provided:**

- Details of the computer software that has been used for the panoramic stitching.
- A levelled panoramic tripod head has been used.
- Type of projection used.
- The overall horizontal field of view of the panorama.

12. DELIVERABLES

12.1 PRINTED DOCUMENTS

A single bound A3 Visualisation Document in accordance with the requirements on page 21 shall be submitted as a separate volume within the Environmental Statement or application documents where the project is not EIA development.

- 2 copies of the A3 document shall be submitted to the local authority using a high quality commercial laser printer or equivalent
- 1 further set shall be issued to each community council.
- 5 copies of the Non-Technical Summary.

12.2 CD-ROM/DVD REQUIREMENTS

- Two CD/DVDs containing high-resolution PDF files suitable for printing in accordance with the requirements stated at 9.3 on page 21.
- Two CD/DVDs containing screen resolution PDF files for uploading to the Council's ePlanning portal in accordance with the requirements stated at 9.3 on page 21.
- One CD/DVD containing the original single frame photographs with embedded metadata shall be submitted for verification purposes in accordance with the requirements stated at 2.16 on page 5.
- One CD/DVD containing JPEG files for panoramic visualisations (if requested by the Council) in accordance with the requirements in Section 5 for uploading to the Single Frame Panoramic Viewer.
- Two CD/DVDs containing the animation files (if requested by the Council) in accordance with the requirements in Section 6 on page 19.

12.3 COMMITTEE REQUIREMENTS

For the Planning Committee meeting, the Council shall require a visualisation booklet for each member containing high quality prints of selected viewpoints which shall be agreed in advance with the case officer. The booklet shall generally contain the following:

- Location map
- Panoramic photomontage (27.0° x 65.5°)
- 50mm single frame
- 75mm single frame
- Monochrome photomontage if required

The booklets shall be required one week in advance of any Planning Committee meeting.

If images are required for the Council's Single Frame Panoramic Viewer in accordance with Section 5 on pages 17 and 18, they shall be submitted two weeks in advance to give the Council sufficient time to upload the necessary material and circulate a link to members.

13. CHECKLIST

ITEM	CONTENTS	YES	NO
A3 Volume of Visualisations	Separate Bound Document		
Viewpoints	All specified viewpoints visualised		
Maps	Overall Site and Viewpoint Map		
	Detailed Location Maps		
	Map of Cumulative sites if required		
Photomontages for LIA	Photomontage panoramas (65.5°)		
	Baseline panoramas and wirelines / solid terrain models		
Photomontages for VIA	50mm single frame images		
	75mm single frame images		
	75mm monochrome images if required		
	Additional visual material as requested		
Visualisations for use in the single frame panoramic viewer	Photomontage panoramas		
	Wirelines / solid terrain models		
	Annotated monochrome panoramas		
Full Methodology Statement	Details as specified in Section 9		
A4 Non-Technical Summary	Single frame views as specified		
	Location maps as specified		
Printed document submission	2 x A3 Visualisation Document - THC		
	1 x A3 Visualisation Document for each affected community council		
	5 x NTS – with further copies readily available to the public		
CD/DVD submission	2 x CD/DVD with A3 Visualisation Document (high resolution)		
	2 x CD/DVD of Document as a PDF for ePlanning (screen resolution)		
	1 x CD/DVD with photographic metadata		
	1 x CD/DVD – Panoramas for the SFPV if required		
	2 x CD/DVD – Animation if required		

GLOSSARY

AOD - Above Ordnance Datum. Used to specify heights above mean sea level on General Arrangement and other technical drawings. Usually specified in metres. (eg 62.0m AOD)

Borrow pit - An excavation dug to provide material (borrow) for fill elsewhere.

Camera RAW - A RAW image file contains minimally processed data from the image sensor of a digital camera. Raw files are so named because they are not yet processed and therefore are not ready to be used with a bitmap graphics editor or printed.

CD/DVD-ROM - Optical disks for storage of digital information. DVDs are of the same dimensions as compact discs (CDs), but store more than six times as much data.

Cylindrical projection - A method used to stitch photographs together to map the image onto a curved surface using computer software. The arc of curvature in degrees is equivalent to the overall horizontal field of view. If viewed as a flat image, the image will appear distorted due to progressive horizontal and vertical compression from the centre line towards the outer edges of the image. This type of projection can only be accurately viewed in a single frame panoramic viewer where the focal length is controlled by the computer.

DTM - Digital Terrain Model or Digital Elevation Model (DEM) is a digital representation of ground surface topography or terrain. A DTM can be represented as a raster (a grid of squares) or as a triangular irregular network. DTMs are commonly built using remote sensing techniques, but they may also be built from land surveying. DEMs are used often in geographic information systems, and are the most common basis for digitally-produced relief maps.

EIA - The term 'Environmental Impact Assessment' describes a procedure that must be followed for certain types of project before they can be given 'development consent'. The procedure is a means of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects, and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision.

Embedded - Integrated with the digital image information.

Focal length - A measure of the collecting or diverging power of a lens or an optical system. Focal length, usually designated f in formulas, is measured by the distance of the focal point (the point where the image of a parallel entering bundle of light rays is formed) from the lens, or more exactly by the distance from the principal point to the focal point.

HFOV - Horizontal field of view.

Landscape format - A printing orientation that prints data across the wider side of the form. Contrast with portrait format.

LIA - Landscape Impact Assessment describes, classifies and analyses the **landscape effects** that are changes in the elements, characteristics, character and qualities of the landscape as a result of development. These effects can be positive (beneficial or an improvement) or negative (adverse or a detraction).

Linear perspective - A form of perspective in drawing and painting and photography in which parallel lines are represented as converging so as to give the illusion of depth and distance.

LVIA - Landscape and Visual Impact Assessment is an umbrella term for description, classification and analysis of landscape and visual effects.

Metadata - (Metadata, or sometimes metainformation) is "data about data", of any sort in any media. Metadata for a digital photograph typically includes the date and time at which it was created and details of the camera settings (such as focal length, aperture, exposure). Full frame 35mm digital cameras record metadata in their digital images in both Camera RAW and JPEG formats.

Panoramic head - A panoramic tripod head is a piece of photographic equipment, mounted to a tripod, which allows photographers to shoot a sequence of images with precise overlaps around the entrance pupil of a lens to produce a panorama. The primary function of the panoramic head is to precisely set the axis of rotation about the entrance pupil for a given lens or focal length, eliminating parallax error.

PDF - Portable Document Format. PDF files have become a popular way to exchange platform independent documents which are viewable using the free Adobe Reader.

Photomontage - Technique by which a composite photographic image is formed by combining images from separate photographic sources.

Pixels/inch - Pixels per square inch or ppi. 300 pixels per inch is the resolution required to produce a high quailty printed image.

Planer projection - A method used to stitch photographs together to map the image onto a flat surface using computer software which can be accurately used for horizontal fields of view up to 78°. This type of projection should be used for all printed panoramic images presented in environmental statements.

Single Frame Panoramic Viewer (SFPV) - A viewing system for panning panoramic images up to an angle of view of 360° on a computer screen where the focal length is accurately controlled by computer. It has a similar effect to turning the head to scan the wider landscape in detail.

Size-constancy scaling - An aspect of perceptual constancy where an object will appear to be the same size to an observer regardless of changes in light, rotation, distance, perspective etc. In linear perspective, the size of an object halves in size as the distance doubles, whereas in the real world, it appears to almost double in size. Our perception of size is related to the actual size of an object in the real world rather than its size on our retinal image because the brain automatically takes into account the distance to an object to re-calibrate its perceived size.

SLR camera - A single-lens reflex (SLR) camera is a camera that uses a semi-automatic moving mirror system which permits the photographer to see what will be captured by the film or digital imaging system.

Turbine - Wind turbine or aerogenerator, including tower, nacelle and rotor.

VFOV - Vertical field of view.

VIA - Visual Impact Assessment describes, classifies and analyses the **visual effects** that are the changes in the appearance of the landscape as a result of development. These effects can be positive (beneficial or an improvement) or negative (adverse or a detraction).

Wireline - A visual line model of an electronic representation of a three-dimensional object.

ZTV or ZVI - A Zone of Theoretical Visibility or Zone of Visual Influence is the area from which a development is theoretically visible. It is usually represented as a map using colour to indicate visibility. Zones of Visual Influence are used to identify the parts of a landscape that will be affected by a development. They are of particular use to Landscape Architects in determining visual intrusion as part of an Environmental Impact Assessment. Zones of Visual Influence have been used extensively in wind farm development. A map will be created showing the number of Wind Turbine that are visible from a particular area. A cumulative Zone of Visual Influence is used to define the cumulative effects of many developments.

Getting Involved

If you would like more information or to get involved in the production of future plans please contact us in one of the following ways:

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For the most up to date news on the work of the Development Plans Team (and more) please follow our twitter account and 'Like' our Facebook page:

Twitter
www.twitter.com/highlanddevplan

Facebook
www.facebook.com/highlandLDPs

Feedback
If you have any experience of Development Planning that you would like to comment on please complete a customer satisfaction survey:
http://www.surveymonkey.com/s/X89YVTY