Appendix 4.1: ZTV and Visualisation Production Method

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Introduction

This appendix sets out the approach to viewpoint photography, visualisation production and zone of theoretical visibility (ZTV) mapping for the Scoop Hill 132kV Connection Project Landscape and Visual Appraisal (LVA).

Zone of Theoretical Visibility (ZTV) Production

Evaluation of the theoretical extent to which the proposed overhead transmission infrastructure is visible across the study area is undertaken by establishing a Zone of Theoretical Visibility (ZTV). The ZTV is calculated to individual wood pole height (up to 20m).

ESRI's ArcMap 10.8.1 software is used to generate the ZTV. The Spatial Analyst/Viewshed tool does not use mathematically approximate methods, and the program calculates areas from which the wood pole structures are potentially visible.

This has been performed based on a 'Bare Earth' computer generated DTM which does not take account of potential screening by buildings, woodland, vegetation or other surface features. Further detail about how the ZTVs have been generated and the data used is provided below.

Bare Earth ZTVs

The bare earth DTM is comprised of OS Terrain® 5 (5m resolution) data across the 3km study area. It should be noted that the software uses raster height data, but while it is defined as continuous data (with each grid square referred to as a 'cell'), it assumes a single height value from the centre of that cell for the whole cell. Therefore, any height variations between centre points of cells will not be recognised.

The DTM data has not been altered (i.e. by the addition of local surface screening features) for the production of the Bare Earth ZTV. No significant discrepancies have been identified between the DTM used and the actual topography around the study area. The effect of earth curvature and light refraction has been included in the Bare Earth ZTV analysis and a viewer height of 2m above ground level has been used.

- There are limitations in the use and reliance on this theoretical visibility, and these should be considered in the interpretation and use of the ZTV:
- The ZTV uses a 'bare ground' DTM model, and does not consider the screening effects of vegetation, buildings, or other local features that may prevent or reduce visibility; and
- The ZTV is considered to over emphasise the extent of visibility of the proposed overhead transmission infrastructure and therefore represents a 'maximum potential visibility' scenario.

In light of these limitations, whilst ZTVs are used as a starting point to inform the assessment, providing an indication of where the proposed development will theoretically be visible, the information drawn from the ZTV was verified with reference computer generated wireline images of the proposed development in the field, to ensure that the assessment conclusions represent the visibility of the proposed development reasonably accurately.

Photography

Viewpoint Photography

The methodology for undertaking viewpoint photography is in accordance with guidance from NatureScot (SNH, 2017) and the Landscape Institute (Landscape Institute (LI), 2019). The focal lengths used are in accordance with recommendations contained in guidance and are stated on the figures. Photography was undertaken by LUC in Spring 2022. A Nikon D750 full frame sensor digital single lens reflex (SLR) camera with a fixed 50mm focal length lens was used to undertake photography from all viewpoint locations.

A tripod with vertical and horizontal spirit levels was used to provide stability and to ensure a level set of adjoining images. The cameras were orientated to take photographs in landscape format. A panoramic head was used in each instance to ensure the camera rotated about the no-parallax point of the lens in order to eliminate parallax errors[1] between the successive images and enable accurate stitching of the images. The camera was moved through increments of 24˚(degrees) and rotated through a full 360˚ at each viewpoint. Fifteen photographs were taken for each 360˚ view.

The location of each viewpoint and information about the conditions at the time of the photographs being taken was recorded in the field in accordance with NatureScot (SNH, 2017) and LI guidance (LI, 2019).

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 appropriate 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. Photography opportunities facing into the sun were avoided where possible to prevent the overhead transmission infrastructure appearing in silhouette. Adjustments to lighting of the overhead transmission infrastructure were made in the rendering software to make the infrastructure appear realistic in the view under the specific lighting and atmospheric conditions present at that time the photography was taken.

Photography Stitching

Photographic stitching software PTGui© was used to stitch together the adjoining frames to create panoramic baseline photography using cylindrical projection.

Visualisation Production

Wireline Visualisations

The software package Blender (v3.6) was used to create a 3D environment model. A digital terrain model (DTM) was created within the 3D model from OS Terrain® 5 height data. The DTM includes the proposed development extents, viewpoint locations and all landform visible within the baseline photography. Overhead transmission line infrastructure, cumulative wind farm developments, Moffat Substation extension proposals and viewpoint location coordinates were added.

Photomontage Visualisations

Blender software was used to create the transmission line infrastructure including the specified pole types and heights (a double line of wooden ‘H’ poles). The viewpoint locations were added to the Blender Model using the on-site photography coordinate positions, cross-referenced and micro-sited with high-resolution aerial photography and 3D model views created, which replicated the camera parameters and perspective geometry of the baseline photography.

3D wireline views were exported for each viewpoint and were overlaid and aligned with the photographs within Adobe Photoshop© software to ensure an accurate horizontal and vertical alignment of the wood poles and topography.

A daylight system was then created in the 3D model with the date and time when each range of viewpoint photography was taken applied to each individual camera view. The exposure settings (f/stop, ISO and shutter speed) within the EXIF photography data were also applied to the model camera views.

The 3D model views were then rendered and composited with the baseline photography and wireline exports again using Adobe Photoshop© software. Where the transmission line infrastructure proposals were located behind foreground elements in the photography, those parts of the render were ‘masked’ or removed.

A Shapefile containing areas of tree felling required as part of the proposals was imported into the Blender 3D environment model and exports for each view were imported to the Photoshop files to inform the removal of existing woodland where visible.

The render layer and baseline photograph (showing felling where visible) were then merged to form the photomontages.

[1] Parallax is the difference in the position of objects when viewed along two different lines of sight. In the case of a camera this would occur if the rotation point of the lens was not constant and would result in stitching errors in the panorama.

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

Figure Layout

Adobe InDesign© software was used to present the figures. The dimensions for each image (printed height and field of view) are detailed below and each viewpoint visualisation has been presented as follows:

- 90˚ Baseline photograph (cylindrical projection) and 90˚ Wireline image (cylindrical projection) below. Wireline image shows the proposals and developments considered in cumulative assessment:
  - Page size: 841 x 297mm.
  - Up to two x 90˚ sections presented in this format.
- 53.5˚ Wireline image (planar projection);
  - Page size: 841 x 297mm.
  - Up to two x 53.5˚ sections presented in this format.
- 53.5˚ Photomontage image (planar projection) showing forestry removal where applicable.
  - Page size: 841 x 297mm.
  - Up to two x 53.5˚ sections presented in this format.