M3 Junction 9 Improvement

Scheme Number: TR010055

6.3 Environmental Statement Appendix 7.1 - Landscape and Visual Methodology

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6.3 ENVIRONMENTAL STATEMENT - APPENDIX 7.1: LANDSCAPE AND VISUAL METHODOLOGY

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Author:	M3 Junction 9 Improvement Project Team, National Highways

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Contents

Tables

1 Introduction

1.1.1 This appendix sets out a summary of the methodology used for the assessment of landscape and visual effects for the M3 Junction 9 Improvement (the Scheme). It also provides details on the view location selection process and the technical methodology used for the aspects which have been prepared to support the Landscape and Visual Impact Assessment (LVIA). These include the Zone of Theoretical Visibility (ZTV) Analysis, Baseline Viewpoint Photography, and Visualisations.

1.1.2 The Landscape and Visual Impact Assessment (LVIA) identifies and assesses the adverse and beneficial effects and significance of change arising from the Scheme on the landscape as an environmental resource in its own right and on people's views and visual amenity.

1.1.3 The LVIA was carried out by chartered landscape architects at Stantec UK Ltd, a Registered Practice with the Landscape Institute (LI) and a member of the Institute of Environmental Management and Assessment (IEMA) EIA Quality Mark scheme.

1.1.4 Photographs, visualisations and ZTVs form an important part of planning applications and Environmental Statements (ESs), in which the preparation and presentation of reliable visual information is integral to the assessment of landscape and visual impacts. They are technical documents in this context and should be produced and used in a technically appropriate manner. This appendix sets out the technical methodology for each element.

2 Methodology

2.1 Assessment of landscape effects - Summary

2.1.1 The assessment for landscape effects (including townscape) and on component features (the 'landscape fabric', for example: landform, land use, hedgerows and trees, public rights of way, ponds or other features), would consider effects as a result of the physical change to the landscape and on its perceptual characteristics. A methodical approach is undertaken, and the process includes the following stages:

- Define the study area
- Collect and collate information on the landscape, including landscape designations, topography, land use, landscape scale and complexity, natural features, existing and historic human influences including built form and any discordant features, human interaction, inter-visibility, tranquillity, and qualitative judgements on night-time light sources
- Classification of the landscape into character areas at scales appropriate to the location (national, local, site scale), including a description of the key characteristics of each character area (including key negative features where appropriate) and an appraisal of their condition, with acknowledgement of key elements, features or characteristics that are important or valued
- Define the character and value of the landscape through consultation and desk study
- Carry out site surveys to assess landscape character and condition and augment the desk study
- Judge the susceptibility to change arising from the Scheme for the landscape receptors and combine with its value to confirm the sensitivity of the landscape receptor
- Identify the potential landscape impacts (magnitude and nature of effect) likely to be caused by the Scheme, including the consideration of the overall Scheme (e.g. how well a new highway would fit the existing topography) as well as specific features of the design (e.g. the addition of new signage) including changes on the night-time environment
- Identify and develop mitigation measures as a component of the iterative design process to avoid, reduce and where possible remedy adverse effects
- Undertake the assessment of likely residual effects to report the significance of the residual landscape effects. As part of the iterative design process, the assessment has identified essential and embedded mitigation which has

been included in the design and the final assessment for residual effects considers these measures

2.2 Assessment of effects on visual amenity - Summary

2.2.1 The assessment process for effects on people's views and visual amenity would consider those which occur as a result of the changes in the composition of the view for visual receptors. A methodical approach is undertaken, and the process includes the following stages:

- Determine the extent of visibility of the proposals through a combination of computer analysis and site survey to define the Zone of Visual Influence and study area
- Collect and collate information on the visual context of the Scheme
- Identify visual receptors within the study area as summarised in **Section 2** (visual receptors generally comprise users of public rights of way, public open spaces, public realm or other outdoor recreational facilities, and also travellers in vehicles who may be visiting, living or working within the study area, and their views at particular places)
- Agree selection of view locations (representative, illustrative, and or sequential) and any locations for proportionate visual representations of the Scheme with stakeholders and undertake baseline photography
- Evaluate visual sensitivity (value and susceptibility) for visual receptors.
- Identify the potential effects (magnitude and nature of effects) likely to be caused by the proposals, including qualitative changes on the baseline night-time environment
- Identify and develop mitigation measures as a component of the iterative design process to avoid, reduce and where possible remedy adverse effects
- Assess the significance of the residual visual effects

2.2.2 The following terminology is used to describe the approximate distance between the view location / visual receptor and the Scheme:

- Short / close range: under 0.5km
- Mid-range: 0.5km – 2km
- Far reaching / Long distance: beyond 2km

2.2.3 The type of view, is described in the following terms:

- Glimpsed (i.e., in passing) / Filtered / Oblique / Framed / Contained / Enclosed / Restricted / Open Views / Wide angled Panoramic

2.2.4 No private views were assessed. However, where appropriate, representative view locations were selected from publicly accessible locations within or on the edge of main settlements, property groupings or other buildings likely to be significantly affected by the Scheme. It is noted that it is accepted that there is no right in planning law to a private view.

2.3 Visual receptors and view location selection

2.3.1 A preliminary computer-generated Zone of Theoretical Visibility (ZTV) analysis was undertaken to establish the theoretical extent to which the Scheme is likely to be visible in the surrounding area. The preliminary ZTV informed the initial selection of representative viewpoints and was used as the basis for consultation with stakeholders on the selection of viewpoints to be used for the landscape and visual assessment. Further consultation was undertaken following design changes resulting from the removal of the All-Lane Running Scheme to agree additional view locations based on updated ZTV analysis. The methodology for ZTV analysis undertaken is set out in **Section 3**.

2.3.2 The selection of view locations is made on the basis of the following types of publicly accessible viewpoints:

- Representative views (for example, representing views of users of a particular public right of way (PRoW))
- Specific views (for example, a key view from a specific visitor attraction or heritage asset)
- Illustrative views (chosen to demonstrate a particular effect/specific issue)

2.3.3 All visual receptors are people. Potential visual receptors as identified during the baseline analysis, site survey and consultation with the stakeholders of relevance to this Scheme include:

- Users of PRoWs within the Scheme or its immediate environs
- Users of more distant PRoWs in areas with theoretical visibility of the Scheme
- Users of promoted recreational routes and long-distance routes (LDRs) such as the South Downs Way and the Itchen Way
- Users of Access Land in areas with theoretical visibility of the Scheme
- Recreational users of the River Itchen and its tributaries, such as people engaged in fishing activities

- Occupiers of residential properties in settlements with theoretical visibility of the Scheme, including:
    - Winchester (including the suburb of Winnall)
    - Kings Worthy
    - Martyr Worthy
    - Headbourne Worthy
    - Abbots Worthy
    - Itchen Abbas
    - Easton
    - No Man's Land
    - Littleton
    - South Wonston
- Occupiers of individual residential properties and farmsteads, such as:
    - Manor Farm
    - Lone Barn
    - Winnall Cottage Farm
    - Shoulder of Mutton Farm
    - Winnall Down Farm
    - Magdalen Hill Farm
- Pupils, staff and visitors at St Swithun's School, Winchester and Prince's Mead School at Abbots Worthy
- Users of the existing motorway and main road network
- Users of the local minor and urban road network
- Users of the Southwestern Main Line railway in locations with theoretical visibility of the Scheme
- People at their place of work in areas with theoretical visibility of the Scheme and where their work and/or workplace allows views of the surrounding landscape, such as office workers with views towards the

Scheme and agricultural operatives working in fields with views towards the Scheme

2.3.4 The selection of view locations to be used to assess effects to visual amenity has been agreed through the submission of the Preliminary Environmental Information report (PEIR) (Stantec 2021) and subsequent consultations with stakeholders, notably the South Downs National Park Authority, Winchester City Council and Hampshire County Council. This includes agreement of night-time view locations and locations for the production of Accurate Visual Representations (AVR's). Locations are shown on **Figure 7.4 (View Locations)** of the **ES (Document Reference 6.2)**. Consultation / engagement undertaken is detailed in **Chapter 7 (Landscape and Visual)** of the **ES (Document Reference 6.1)**.

2.3.5 The view locations included in the assessment are set out in **Table 2.1**.

Table 2.1: View Locations for Inclusion in the Assessment

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 1. Easton Lane / National Cycle Network Route 23 *Within South Downs National Park*	Yes	Yes	Yes	Edge of Application Boundary	Residents at White Hill Cottage, Winnall Cottage Farm (and also Shoulder of Mutton Farm) Users of National Cycle Network Route 23 / Easton Lane

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 2. B3047 London Road adjacent to Church Green	Yes	Yes	No	125m to north-west	Residential Receptors in the Kings Worthy Conservation Area to the north

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 3. St Swithun's Way within the Itchen Valley *On edge of South Downs National Park*	Yes	No	Yes	300m to west	Recreational receptors using the St Swithun's Way LDR on the valley floor Representative view location in South Downs National Park viewshed analysis (South Downs National Park Authority VP62) Also represents views from Site of St Gertrude's Chapel (Scheduled Monument)
VL 4. Abbots Barton, Public Open Space (POS) at Lea View	Yes	Yes	No	625m to west	Residential receptors within residential area and associated POS on the far side of the River Itchen Valley to the west
VL 5. Turnpike Down	Yes	No	No	325m to west	Residential receptors and urban road users on the north-facing hillside to the south-west

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 6. B3404 on bridge over M3 *Close to western edge of South Downs National Park*	Yes	Yes	No	Within Application Boundary	Road users in an elevated area to south of main Scheme area
VL 7. PRoW (FP111/1/1) adjacent to railway near Well House Lane	Yes	No	Yes	1.05km to west	Recreational receptors on elevated ground on the far side of the River Itchen Valley to the west – local use
VL 8. PRoW (FP049/13/1) on crown of Magdalen Hill *Within South Downs National Park*	Yes	No	No	1.1km to east	Recreational receptors using PRoW on Magdalen Hill, within the South Downs National Park
VL 9. St Catherine's Hill *Open Access Land within South Downs National Park*	Yes	Yes	Yes	850m to south-west	Recreational receptors using Open Access Land Representative view location in the South Downs National Park viewshed analysis (South Downs National Park Authority VP15)

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 10. PRoW (FP011/707/1) crossing Access Land to south-east of Badger Farm. Also close to Whiteshute Lane (Restricted Byway 056/35/4)	Yes	No	No	2.8km to west-south-west	Recreational receptors using Access Land on southern edge of Winchester
VL 11. Itchen Way north of Easton Down *Within South Downs National Park*	Yes	No	No	160m to east	Recreational receptors using the Itchen Way LDR within South Downs National Park
VL 12. Easton Lane adjacent to retail/commercial development on northern edge of Winnall and close to existing Junction 9 roundabout	Yes	Yes	Yes	Within Application Boundary	Urban/townscape receptors – road users and pedestrians using Easton Road and nearby local services

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 13. Minor Road known as Long Walk close to western edge of South Downs National Park *Within South Downs National Park*	Yes	Yes	Yes	600m to east	Minor road users in an elevated area within South Downs National Park
VL 14. Itchen Way close to A33/A34 bridge over River Itchen *Within South Downs National Park*	Yes	Yes	Yes	Within Application Boundary	Recreational receptors using the Itchen Way LDR within South Downs National Park
VL 15. Down Farm Lane	Yes	No	No	1.45km to north-west	Road users in an elevated area to the north-west.

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 16. St Swithun's School *Within South Downs National Park*	Yes	Yes	No	310m to east of motorway 460m south of main construction compound	Pupils, staff and visitors at St Swithun's School and associated playing fields
VL 17. Winchester Cathedral	Yes	No	No	1.35km to west	Receptors (tourists) experiencing historic panoramic views from the cathedral tower while on walking tours of the cathedral
VL 18. Ridgeway (residential street in western part of Winchester)	Yes	No	No	3.1km to west	Urban/townscape receptors in elevated area of Winchester

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 19. Layby on Morestead Road	Yes	No	No	1.1km to south-east	Road users in an elevated area to the south within South Downs National Park, and representative of nearby users of local PRoW Close to area of Access Land *(Requested by Winchester City Council (*SU500292*))*
VL 19b. Open Access Land (along the mini scarp below Morestead Road) west of Deacon Hill	Yes (summer only)	No	No	750m to the south	Recreational receptors accessing area of Open Access Land within South Downs National Park *(Requested by South Downs National Park Authority)*
VL 20. South Downs Way on footbridge over existing M3	Yes	No	No	Within Application Boundary	Recreational receptors using the South Downs Way LDR close to but outside of boundary of South Downs National Park *(Requested by Winchester City Council and South Downs National Park Authority (VL I))*

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 21. Winchester City Council Sports Ground to south-west of Magdalen Hill Down *Within South Downs National Park*	Yes	No	No	260m to south of main Application Boundary	Receptors using playing fields within South Downs National Park *(Requested by Winchester City Council and South Downs National Park Authority (VL H))*
VL 22. Layby on A31 *Within South Downs National Park*	Yes	No	No	410m to south of central spoil management area	Road users on A31 crossing Magdalen Hill Down within South Downs National Park *(Requested by Winchester City Council and South Downs National Park Authority (VL J))*
VL 23. PRoW (Restricted Byway 128/19/1) between Long Walk and Easton *Within South Downs National Park*	Yes	Yes	No	225m to south-east of main Application Boundary	Recreational receptors using PRoW within South Downs National Park *(Requested by South Downs National Park Authority (VL E))*

View Location (VL) No. and Name	Daytime (Winter and Summer) View	Night-time View	Accurate Visual Representation (Verified) Location	Distance to Application Boundary	Receptor Description / Reasoning for Inclusion
VL 24. PRoW (St Swithun's Way, FP 134/8/2) near B3047 at Abbots Worthy *Within South Downs National Park*	Yes	Yes	No	300m to north-west	Recreational receptors using St Swithun's Way LDR within South Downs National Park *(Requested by South Downs National Park Authority)*

2.3.6 As set out in **Chapter 7 (Landscape and Visual)** of the **ES** (**Document Reference 6.1**), view locations which are identified as likely to experience visual effects that would not be significant were scoped out for the visual impact assessment and reasons for scoping out are set out in **Table 2.2.**

Table 2.2: Scoped Out View Locations

View Location (VL) Name and No.	Receptor description	Reasoning for scoping out
VL A	Itchen Valley along valley floor between A33 and M3	Discounted as represented by VL 24
VL B	Public right of way on northern valley slopes with views south towards search area for excess spoil	Discounted as represented by VL 24
VL C	B3047 road bridge looking south along M3 with area of search for excess spoil in background	Requested for area for excess spoil deposition which is now excluded from the scheme. Limited intervisibility with wider Scheme therefore not taken forward.
VL D	Southern route for Itchen Way along southern side of floodplain with views south towards area of search for excess spoil and M3 carriageway	Requested for area for excess spoil deposition which is now excluded from the scheme. Limited intervisibility with wider Scheme therefore not taken forward.
VL F	Elevated views from northern slopes of Itchen Valley looking southwest across valley to M3 corridor and area of search for excess spoil	Requested for area for excess spoil deposition which is now excluded from the scheme. Limited intervisibility with wider Scheme therefore not taken forward.
VL G	Townscape view from residential properties at Coram Close with views east across Itchen Valley	Limited intervisibility not taken forward
VL K	Views northwest from Chilcomb Church looking northwest towards areas of search for excess spoil along A31.	Limited intervisibility not taken forward

3 Zone of Theoretical Visibility

3.1 Introduction

3.1.1 A Zone of Theoretical Visibility (ZTV) analysis is a computer-generated tool to identify the 'theoretical' extent of visibility for the Scheme.

3.1.2 The ZTV shows theoretical visibility only and so it is important to fully understand that its accuracy is limited to the digital information that it has been based upon and the algorithm used in its calculation. It is stressed that the ZTV remains only as a tool in the landscape and visual impact assessment of the Scheme. A ZTV alone cannot indicate the potential visual impacts, nor show the likely significance of effects that the proposed development would have.

3.1.3 However, it does guide an appreciation of the potential and maximum visibility of the Scheme, that can then be used to focus the visual assessment process on those areas affected and avoids those areas which would not be affected.

3.2 Digital Information

3.2.1 The highway design is provided as an Autodesk AutoCAD (Computer Aided Design) drawing. An observer point is added at every 30m along the centre line of the road scheme including points as they go around any junctions. A height of 4.5 metres has been added to the observer points elevations in the ‘with traffic’ scenario.

3.2.2 A Digital Terrain Model (DTM) has been generated from the environment Agency (EA) 2019 DTM LIDAR data (2 metre resolution). A Digital Surface Model (DSM) has been generated from the EA 2017 DSM LIDAR data (2 metre resolution). The DSM includes heights of objects, such as buildings and vegetation as well as the terrain surface, whereas the DTM is solely the terrain surface, or bare earth model for that matter. Using the DSM allows for a more pragmatic approach to analysing where the potential and maximum visibility of the Scheme would occur, due to having a live screening effect from both the buildings and vegetation contained within the DSM.

3.3 Limitations and Assumptions

3.3.1 The ZTV analysis remains only as a tool in the landscape and visual impact assessment of the Scheme. A ZTV alone cannot indicate the potential visual impacts, nor show the likely significance of effects that the proposed development would have.

3.3.2 DTM ZTV has been based on EA 2019 DTM LIDAR data (2 metre resolution). Gaps in the data have been filled using OS50 data (50 metre resolution).

3.3.3 DSM has been based on EA 2017 DSM LIDAR data (2 metre resolution). Gaps in the data have been filled by assigning OS Open Local buildings and woodland

layers a height of 6 metres and 12 metres respectively and adding these elevations to the DTM derived above.

3.3.4 Within the Application Boundary the ground models (DTM and DSM) have been modified so that the Scheme route located below the existing ground level is considered in the analysis. For the ZTV analysis undertaken the ground model within the Application Boundary area has been removed and replaced with the Scheme's earthworks model (at a 1m resolution) which includes areas of retained existing landform and proposed landform. The DSM also takes account of vegetation removal and retention as detailed in **Figure 2.3 (Environmental Masterplan)** of the **ES (Document Reference 6.2)** and **Appendix 7.5 (Preliminary Arboricultural Impact Assessment)** of the **ES (Document Reference 6.3).**

3.3.5 The ZTV analysis has been clipped to a 5km area.

3.3.6 The analysis considers a range of the Scheme route elements including proposed gantries and Variable Message Signs (VMS). ZTVs have not been prepared for lighting elements as no light columns are included within the Scheme.

3.3.7 The assumptions for various modelled aspects are as follows:

- Traffic height = 4.5m
- VMS height = 10m
- Gantry height = 12m (accounting for gantry-mounted signage)
- Existing vegetation height = 12m
- Existing building height = 6m
- Proposed landscape elements (woodland (LE2.1), linear belts of trees and shrubs (LE2.4) and scrub (LE2.8) = 8m

3.4 Viewer Height

3.4.1 The viewer height in a ZTV is set at 1.6m above ground level. This is higher than the camera height recommended for photograph visualisations (1.5m high) and compensates for potential inaccuracies in digital terrain data and to ensure that the 'worst case' is represented.

3.5 ZTV Scenarios

3.5.1 ZTV analysis for the Scheme has been presented as follows:

- Figure 7.5 - Comparative DTM ZTV - comparing the existing M3, A33, and A34 with the Scheme

- Figure 7.6 – DSM ZTV – Overview ZTV for the full scheme showing all areas of visibility, presented as three colours / hatches for the Highway only scenario, for the with Vehicle's scenario, and for the Gantry / VMS
- Figure 7.7 – DSM ZTV – As Figure 7.6 with view locations presented
- Figure 7.8 – DSM ZTV - ZTV of the Scheme (No Traffic) showing percentage Visibility
- Figure 7.9 – DSM ZTV - ZTV of the Scheme (with Traffic) showing percentage Visibility
- Figure 7.10 – DSM ZTV - ZTV of the Scheme's Gantries and VMS showing percentage Visibility, presented on a series of individual sheets
- Figure 7.11 – DSM ZTV – Overview ZTV for the full scheme (Highway only scenario, for the with Vehicle's scenario, and for the Gantry / VMS) showing all areas of visibility following successful establishment of proposed landscape elements (woodland (LE2.1), linear belts of trees and shrubs (LE2.4) and scrub (LE2.8) as presented on **Figure 2.3 (Environmental Masterplan)** of the **ES (Document Reference 6.2)**

3.6 Method for Calculation of ZTV

3.6.1 The ZTV calculation is performed using ESRI Arc Pro 2.4.1, under the Viewshed analysis tool via the 3D Analyst or Spatial Analyst ArcMap extensions. This is then saved to the ESRI Geodatabase of the Scheme.

4 Viewpoint Photography

4.1 Overview and Guidance

4.1.1 The requirements for baseline photography collation and presentation (together with visualisations) are included within Landscape Institute Visual Representation of Development Proposals Technical Guidance Note 06/19 (TGN 06/19) (Landscape Institute, 2019), and this has been considered.

4.1.2 Baseline photography has been undertaken by Stantec and AVR London on behalf of Stantec.

4.2 Equipment

4.2.1 A good quality camera and lens are essential to the production of photographs and visualisations for landscape and visual impact assessment work.

4.2.2 The project team captured high resolution digital photographs for each view location, typically using a Nikon D90 medium format DSLR camera with a Nikon DX 35mm fixed lens (VL19b was collected using a Canon EOS 1300D medium format camera with a telephoto lens set to 32mm focal lens). These are presented on **Figure 7.12 (Photo sheets (Daytime Winter and Summer))** of the **ES (Document Reference 6.2)** and referred to as baseline daytime photography.

4.2.3 A number of locations were selected for night-time views and photography from these locations has been undertaken using a Nikon D5300 medium format DSLR camera with a Nikon 50mm (35mm full format equivalent) fixed lens. The camera was fixed to a tripod 1.6m above ground, mounted on a tripod. These are presented on **Figure 7.13 (Photo sheets (Night-time))** of the **ES (Document Reference 6.2)** and referred to as baseline night-time photography.

4.2.4 For visualisations prepared to support the LVIA, baseline verified photography was undertaken with a Canon EOS 5DS, a full-frame digital camera using a Canon ef 15mm f/2.8 which is a fixed focal-length lens. 360 degree imagery is captured with the camera fixed to a manfrotto tripod 1.6m above ground. The camera is mounted in portrait orientation on a Nodal Ninja Panoramic head to remove parallax errors. These are presented on **Figure 7.14 (Visualisations)** of the **ES (Document Reference 6.2)** and referred to as baseline night-time photography.

4.2.5 Once stitched and cropped appropriately this method provides a more accurate method of producing verified panoramas (see information on the comparison between 50mm and 15mm lens below). Reference images were also taken using single shot verification methods on a 24mm lens to produce a highly accurate verified single plate images to cross check the stitched verified panoramas.

4.3 Methodology

4.3.1 View locations were agreed with stakeholders (as detailed in **Appendix 7.2 (Baseline)** of the **ES (Document Reference 6.3)** prior to the data capture. For each location, photography was captured and presented in both winter and summer scenario with selected locations being chosen for night-time photography and visualisations. For VL19b only a summer view has been presented due to the time of request and programme constraints.

4.3.2 All photographers were provided with Ordnance Survey (OS) location coordinates indicating the position of each viewpoint on site.

4.3.3 Baseline daytime and night-time photography utilised a marker, put in place at the first visit (Summer Survey 2020), to ensure suitable accuracy in the placement of the photography equipment between the winter, and summer photography.

4.3.4 All photography was captured on site with a 50% overlap between each individual shot to reduce distortion with image blending.

4.3.5 For verified photography, at each location each scene is photographed using a plumb line over a survey pin to accurately position the view location. The centre of the camera lens is positioned at a height of 1.60 metres above the ground to simulate average viewing height. Each view is taken with a lens that gives approximately a 100-degree field of view in landscape format. At each location 360° views were captured, as well as 24mm single plate photography (70 degree horizontal field of view) to enable highly accurate cross checking of stitched views.

4.3.6 For verified photography the photographer briefs the surveyor, sending across the prepared photographs, ground positions and appropriate data. The surveyor established control stations at each camera position, easily and clearly identifiable static points within the view are identified by the qualified land surveyor on site and marked as an overlay on the photograph from that position.

4.3.7 A line of sight, and two baseline stations are established, coordinated and levelled by real time kinetic GPS observations, usually with one of the stations being the camera location. The eastings and northings are aligned to the Ordnance Survey National Grid (OSGB36) and elevation to Ordnance Survey Datum (OSD) using the OSTN15 GPS transformation program.

4.3.8 Once the baseline is established, a bearing is determined and a series of clearly identifiable static points across the photograph are observed using the total station. These observations are taken throughout the depth of field of the photograph and at differing heights within the image.

4.3.9 The survey control stations are resected from the OS base mapping and wherever possible, linked together to form a survey network. This means that

survey information is accurate to tolerances quoted by GPS survey methods in plan and commensurate with this in level.

4.3.10 Horizontal and vertical angle observations from the control stations allow the previously identified points within the view to be surveyed using line of sight surveying and the accurate coordination of these points determined using an intersection program. These points are then related back to the Ordnance Survey grid and provided in a spreadsheet format showing point number, easting, northing and level of each point surveyed, together with a reference file showing each marked up image.

4.3.11 The required horizon line within the image is established during the initial verification setup using the single plate method – this has been found to be much more accurate to establish at this stage prior to any stitching.

4.3.12 Using the established horizon as a guide, each photograph and panorama is checked and rotated, if necessary, in proprietary digital image manipulation software to ensure that the horizon line on the photograph is level and coincident with the information received from the surveyor.

4.3.13 A consistent team of photographers was used to undertake all baseline photography. Photography was undertaken as follows:

- Summer baseline photography was undertaken in October 2020
- Winter baseline photography was undertaken in February 2021
- Night-time baseline photography was undertaken in February 2021
- Winter verified photography was undertaken in March 2021
- Summer verified photography was undertaken in September 2021
- Additional Summer baseline photography was undertaken in June 2022

Comparison between 50mm and 15mm lens

Figure 1: Cropped section from 360 with 50mm panorama overlaid showing no difference in distortion.

4.3.14 Fig 1 shows a section taken from a 360 degree image taken from a 15mm lens with a 50mm panorama (between red lines) overlaid. This identifies no difference in distortion between a 50mm lens and a 15mm lens. This could be shot on any lens, using a panoramic head and stitched to a 360 and it would look exactly the same, the main difference would be the resolution. i.e. 100mm lens = higher resolution.

4.3.15 Stitching a full 360 using a 15mm lens rather than just the 50mm strip has several advantages.

- Stitching: Every time a stitch is made between two images there is room for error. A 50mm 360 panorama requires 23 images and 23 stitches. A 15mm 360 panorama requires 6 images and 6 stitches.

- Rendering: When shooting with the 15mm lens the photographer puts the middle of the site in the middle of the first frame, this means usually the site and render fits in one unstitched image. Rendering an image within one frame is much more accurate than rendering across stitched images.

- Resolution: The 50mm stitched image would be higher resolution than the 15mm stitched image, this is because the 15mm lens uses less images. However, with each frame on the Canon 5DSR measuring 8688 pixels there is more than enough resolution.

- Crop: Having shot on 15mm the image can easily be cropped back down to a 50mm panorama. The field of view on the 360 degree image reads 180 degrees vertically and 360 degrees horizontally. This means the angle of view can be accurately calculated when cropping.

4.4 Presentation

4.4.1 All photography has been presented to showcase a 90° Horizontal Field of View (HFoV) x ~27° Vertical Field of View (VFoV) on an A1 length, A3 height sheet with an image size of 820mm x 250mm, in cylindrical projection, with multiple sheets per view to cover a required angle. There is no horizontal field of view overlap to allow photos to be presented next to each other.

4.4.2 Winter and summer views (**Figure 7.12 (Photo sheets (Daytime Winter and Summer))** of the **ES (Document Reference 6.2)** are presented on consecutive sheets (excluding for VL19b). Each representative view location identifies key existing features visible in the view along the top of the image and the approximate extent of the Application Boundary identified to aid interpretation by the reader. This identified extent includes the affected areas of the view. These focus on core areas of activity and the proposed highway, associated earthworks and mitigation within the Application Boundary which would be visible rather than the full extent of the Application boundary. This approach is taken due to the linear nature of the Scheme, which would result in extensive areas of the view location photographs being identified as falling within the Application Boundary, which would not aid the reader.

5 Visualisations

5.1 Overview and Guidance

5.1.1 The requirements for visualisations are included within Landscape Institute Visual Representation of Development Proposals Technical Guidance Note 06/19 (TGN 06/19) (Landscape Institute, 2019), and this has been considered.

5.1.2 The overall aim of a visualisation is to represent both the landscape context under consideration and the Scheme, as accurately as is practical. A properly constructed visualisation can serve as a useful means of indicating the potential visual impact of a future development.

5.1.3 Visualisations utilise baseline photographs (captured as detailed above) of an actual scene which would be composited with a digital computer-rendered image of the Scheme. They are subject to the same inherent limitations as photographs, for example only showing the scene as it would appear under the same conditions that prevailed when the original photograph was captured. This compositing process would typically include digitally blending the base photography with the computer-rendered image, whilst taking into account any masking by foreground features. Compositing necessarily requires digital manipulation, carried out with visual skill, judgement and objectivity.

5.1.4 The visualisations have been undertaken by AVR London on behalf of Stantec.

5.1.5 For this Scheme Level 3 Accurate Visual Representations (AVR) outputs have been prepared. An AVR Level 3 image identifies the location of the proposals, the size and scale and degree of visibility, and in addition represents the design, form and context to a reasonable degree of objectivity and accuracy. The methodology broadly aligns with TGN 06/19 Type 4 Photomontage output. All AVR outputs are verifiable.

5.1.6 Visualisations have been prepared at locations agreed with stakeholders (**Appendix 7.2 (Baseline)** of the **ES** (**Document Reference 6.3)**) with winter baseline imagery used for an Opening Year (year 1) representation and summer baseline imagery used for a Design Year (year 15) representation. The latter is used to represent the Scheme once the mitigation has successfully established to provide the desired level of mitigation.

5.2 Methodology

5.2.1 The production of a photomontage includes the following tasks:

- Preparation of a base CAD file containing all viewpoints and the alignments of the Scheme to be used for digitising relevant reference elements. These would be captured using aerial photography for positioning and Light Detection and Ranging (LiDAR) data for elevations

- Viewpoints and reference elements brought into 3DS Max and cameras positioned for each viewpoint
- Lighting system (Daylight) set up in 3DS Max
- Cameras are adjusted to best match each photographic panorama against imported reference elements
- Lighting system adjusted to match shadows visible on each photographic panorama
- Receipt of 3D design information added to 3DS Max Software
- Each view is rendered as an image with the 3DS camera matched with the 3D model of the Scheme, at the same size, scale, resolution and aspect ratio as the digital photography
- This gives a series of 3D rendered images ready for compositing with the photos of the existing baseline site
- Non-visible areas of the rendered 3D model are masked in the image using Photoshop
- Features within the baseline photography to be removed are masked in Photoshop, including areas of vegetation removal, light columns, signage, cars, etc. This is a qualitative or subjective process, but effort is made to ensure it provides objectively accurate views of the development as proposed. In addition, foreground details such as trees, buildings or signage are overlaid as masks; ensuring the depth of the various items is represented correctly
- High-resolution render processed for each view – producing a raster image (alpha separated). Photographic textures and materials can be applied, which starts the process of turning the wireframe 3D model into a photo-realistic image
- Final colour balancing/clean-ups carried out and image is exported from Photoshop
- Images imported into CAD using predefined drawing templates for each Viewpoint

5.2.2 As recommended within TGN 6/19, **Table 5.1** sets out the technical methodology checklist for AVR Level 3 outputs.

Table 5.1: Technical Methodology Checklist – AVR Level 3

Technical Methodology	Response
Photography	
Methodology	Verifiable
Method used to establish the camera location (e.g. handheld GPS/GNSS, GNSS/RTK, survey point, visual reference)	GPS
Likely level of accuracy of location (#m, #cm etc)	10mm
If lenses other than 50mm have been used, explain why a different lens is appropriate	Combination of 24mm and 15mm lenses to improve level of accuracy
Written description of procedures for image capture and processing	Yes
If panoramas used: make and type of Pano head and equipment used to level head	Panoramas used: Using Nodal Ninja Panoramic head on a manfrotto tripod
If working outside the UK, geographic co-ordinate system (GCS) used (e.g. WGS-84)	OSGB36
3D Model / Visualisation	
Source of topographic height data and its resolution	Combination LiDAR + OS Terrain 2m and 5m
How have the model and the camera locations been placed in the software?	Based on survey coordinates
Elements in the view used as target points to check the horizontal alignment	Existing buildings, telegraph poles, pylons, gantries, various fixed points
Elements in the view used as target points to check the vertical alignment	Existing buildings, telegraph poles, pylons, gantries, various fixed points
3D Modelling / Rendering Software	Autodesk 3ds Max 2016
Any limitations in the overall methodology for preparation of the visualisations?	n/a
Visualisation Type	AVR Level 3 (Type 4 TGN 06-19)
Projection	Cylindrical and Spherical
Enlargement factor for intended sheet size	100% @A3

Technical Methodology	Response
Date and Time of captured photography	25/02/21 (Winter) and 17/09/21 (Summer)
Make and model of camera, and its sensor format	Canon EOS 5DS
Make, focal length of the camera lens(es) used	Canon EF 24mm and 15mm
Horizontal Field of View (HFoV) of photograph / visual	Varies - dependent on image width
Direction of View: bearing from North (0°) or Compass Direction	Stated on each sheet
Camera location grid coordinates: eastings and northings to relevant accuracy; height of ground in metres Above Ordnance Datum (mAOD)	Stated on each sheet
Distance to the nearest site boundary, or key development feature, as most appropriate	Stated on each sheet
Height of the camera lens above ground level and, if above 1.65m or below 1.5m, why?	1.6m
Additional imagery	
Baseline photograph	Yes
A composite view generated by overlaying multiple layers of image data: the photograph, 3D models of terrain (LiDAR DTM) and / or 3D model of LiDAR DSM, 3D models of proposed development, 3D models of landscape mitigation. This can explain how the photomontage has been generated.	Yes
A photograph of the tripod location to confirm the camera / tripod location	Yes