Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

Environmental Statement

Volume 4

Appendix 6.1: Landscape and Visual Impact Assessment Methodology, Zone of Theoretical Visibility Methodology and Photomontage Methodology

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Haweswater Aqueduct Resilience Programme - Proposed Bowland Section

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Contents

1. LVIA and ZTV Methodology

1.1 Introduction

1) The Landscape and Visual Impact Assessment (LVIA) will identify and assess the potential effects of the Proposed Bowland Section during the enabling works phase, the construction phase, the decommissioning phase and the operational phase at year 1 and year 15 on the landscape and visual resource within a defined study area.

2) The assessment of landscape effects will address the effects of change and development on the landscape as a resource (i.e. landscape receptors such as landscape character units). The assessment will be primarily concerned with the extent to which the Proposed Bowland Section will affect the elements that make up the landscape, the aesthetic and perceptual aspects of the landscape and its distinctive character. Landscapes vary considerably in character and quality and constitute a key component of the distinctiveness of any local area.

3) The assessment of visual effects will address the effects of change and development on the views available to people and their visual amenity (i.e. visual receptors). It will be primarily concerned with how the surroundings of individuals or groups of people may be specifically affected by changes in the content and character of views as a result of the change or loss of existing elements in the landscape and/or the introduction of new elements.

1.2 Guidance and Approach

4) The methodology will be undertaken in accordance with the following publications:

- Landscape Institute and Institute of Environmental Management and Assessment 2013. Guidelines for Landscape and Visual Impact Assessment Third Edition (GLVIA3)[1]
- Natural England, 2014. An Approach to Landscape Character Assessment.[2]

5) The above guidance does not provide a prescriptive LVIA methodology and relies on practitioners to develop their own specific methodologies based on the characteristics of the proposed development and the landscape in which it is located, combined with professional judgement and experience. The assessment has therefore draw on previous experience of similar projects, professional judgement and knowledge of the local landscape within which the Proposed Bowland Section would be delivered.

6) It should also be noted that GLVIA3 promotes a landscape and visual impact assessment that is proportional to the scale and nature of the proposals and the likely landscape and visual effects.

1.3 Overview of the Assessment Process

7) The assessment process comprises the following activities:

- Establishment of the assessment area
- A review and consideration of relevant guidance and policy
- Establishment of the baseline conditions within the assessment area
- Establishment of baseline night-time lighting conditions (a description of night-time baseline determined by a review of existing local lighting sources during the day including street lighting, residential lighting and commercial and industrial lighting sources)
- Identification of landscape and visual receptors
- Identification of the potential effects on landscape and visual receptors

[1] The Landscape Institute and Institute of Environmental Management and Assessment (2013) *Guidelines for Landscape and Visual Impact Assessment Third Edition (GLVIA3)*. Not available online. [Accessed: January 2020]
[2] Natural England (2014). An Approach to Landscape Character Assessment. [Online] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/691184/landscape-character-assessment.pdf [Accessed: January 2020]

- Identification of mitigation measures and iterative design changes in order to reduce and minimise potential impacts on both landscape and visual receptors. This includes the design and development of appropriate landscape mitigation proposals and contributions to a project-wide Environmental Masterplan
- An assessment of the residual effects on landscape and visual receptors following mitigation.
- An assessment of the potential cumulative effects from different developments, in combination with the Proposed Bowland Section (inter-project).

8) Further detail of these aspects of the assessment are discussed below.

1.4 Assessment Area

9) The landscape and visual assessment area (i.e. the assessment area) will be determined by the extent to which the construction activity is likely to be visible from the surrounding landscape during the construction period and give rise to significant effects. This extent has been established with the aid of a series of Zone of Theoretical Visibility (ZTV) models, in order to indicate the maximum extent to which there is the potential for landscape and visual effects and refined through site appraisals to an extent within which significant effects might occur.

10) GLVIA3 advocates a proportionate approach to LVIA, with the emphasis placed on the potential for significant effects. The likelihood of significant landscape and visual effects therefore diminishes with increasing distance from the proposed development.

11) Given the large extent of theoretical visibility during the construction period, an initial ZTV was created with a threshold of 6 km from the centre of each of the construction areas to produce an overarching assessment area. Visibility may extend beyond this threshold; however, it is considered unlikely that the Proposed Bowland Section would result in adverse effects on landscape and visual receptors due to the nature of the proposed development.

12) The ZTV mapping and subsequent site appraisal work has illustrated that visibility would be principally concentrated within the surrounding landscape up to a distance of 3 km. Therefore, the detailed assessment area for landscape and visual receptors has extended up to a threshold of 3 km from each of the construction areas.

13) The landscape assessment area has been defined by the maximum extent of all character areas, which are likely to be significantly affected either directly or indirectly, located partially or entirely within the ZTV of the detailed assessment area. The visual assessment area has been defined by the maximum extents of the ZTV within the detailed assessment area. Where applicable, long-distance views have also been considered at certain locations where these are likely to result in significant effects. The extent of the assessment area has also been informed by considerations raised through engagement with stakeholders.

1.4.1 Zone of Theoretical Visibility (ZTV)

14) A series of ZTVs were prepared using digital terrain modelling (OS Terrain 5) and Geographical Information System (ArcGIS 10.6) base mapping to display the areas from which the assessment points (representative of the proposed development) would be theoretically visible for each proposed development.

15) It is important to note that ZTV mapping is theoretical and illustrates the worst-case scenario in that they are based upon a 'bare earth' topographical ground model. Physical features which might potentially provide screening have not been included in the computer modelling, such as existing trees, hedgerows or buildings, unless otherwise stated. The ZTVs are therefore only an indication of the areas within which visual effects may be expected to occur.

16) The ZTV was modelled on the basis of conservative assumptions about the height of typical construction plant operating within each of the construction areas, in order to represent the maximum extent of the main visible elements. To ensure the ZTV focuses on the likely significant effects, heights of the very tall

construction plant to be used for a relatively short duration (less than two weeks) have been excluded. A duty construction crane, 45 m high, would be in place for the full duration of the tunnelling activities. Therefore, the ZTV modelling has been undertaken for the full 45 m crane height above existing ground levels at the highest point at the proposed tunnel portals.

17) Heights for the duty construction crane were added as a series of assessment points into ArcGIS 10.6 to enable the ZTV to be produced using the 'Viewshed tool'.

18) GLVIA3 states that ZTV mapping should "*assume that the observer height is between 1.5 and 1.7 m above ground level*". A height of 1.6 m above ground level was therefore used to represent the eye level of an average height person.

1.5 Planning Policy and Guidance

19) The assessment, design proposals and mitigation measures has been guided by relevant National Planning Policy Framework policy and local planning policy. Planning policies and designations of relevance to the Proposed Bowland Section have been taken into consideration, for example in terms of assessing the value of receptors and identifying mitigation measures. The compliance of the proposed development in terms of planning policy is dealt with under a separate planning statement supporting the planning application.

1.6 Baseline Conditions

20) In establishing the existing baseline conditions, the assessment has included a description and analysis of the existing landscape character and visual quality of the assessment area. This has drawn on available information considered during scoping and supplemented with field study to account for any environmental trends or new features.

21) Landscape character assessments have been based on published information from local landscape character assessments (district and country level assessments) and Natural England's National Character Assessments (NCA)[3]. Where published information does not extend into urban areas, a townscape character assessment has been undertaken by a landscape specialist following the Landscape Institute's Technical Information Note (TIN) 05/17[4].

22) A winter baseline survey has been undertaken to verify the landscape and visual resource within the assessment area. Field notes and photographs have recorded the existing landscape and visual environment during the most visually exposed period. The winter survey findings have been recorded, against which comparisons can be drawn from a summer survey. Views of the Proposed Bowland Section from properties and communities within the assessment area will form the focus of the visual impact assessment. Visual receptors have also included locations associated with outdoor pursuits and activities, where a viewer's attention or interest is related to views and the landscape, and views which are incidental to a visitor's or user's day-to-day routine. These may include: residential properties; guests at hotels, visitors to heritage or tourist attractions; and, travellers through the landscape (e.g. motorists, tourists, ramblers and outdoor workers).

1.7 Identification of Receptors

23) The receptors on which the LVIA has been based have been identified following baseline studies and a review of the potential for significant effects likely to arise from the Proposed Bowland Section.

[3] Natural England (2014) National Character Area profiles – GOV.UK [Online] Available from: https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles [Accessed: January 2020]

[4] Landscape Institute (2017). Technical Guidance Note 05/17 Townscape Character Assessment [Available online] .https://www.google.com/search?q=Landscape+Institute%E2%80%99s+Technical+Information+Note+(TIN)+05%2F17&oq=Landscape+Institute%E2%80%99s+Technical+Information+Note+(TIN)+05%2F17&aqs=chrome..69i57.1983j0j7&sourceid=chrome&ie=UTF-8 [Accessed: January 2020]

1.7.1 Viewpoints and Visualisations

24) In accordance with GLVIA3[5], a proportionate assessment has been undertaken through the use of a series of representative viewpoints and / or photomontages, which have been developed to assist in understanding how the Proposed Bowland Section interacts with the receiving landscape and affects visual amenity. The visual assessment therefore does not identify effects on every individual receptor (i.e. a receptor-led assessment or complete receptor assessment); however, the number, location and density of the representative viewpoints and / or visualisations have been considered that is proportionate to the scope of the assessment.

25) The location of the representative viewpoints and / or photomontages have been identified and agreed with local authority officers and other key stakeholders, as part of an agreed consultation process. This has taken into account the phase of work to be represented and the proposed locations.

26) All photography and photomontages have been prepared in accordance with the Landscape Institute's Technical Guidance Note (TGN) 06/19 Visual Representation of Development Proposals[6] and its supporting Technical Information Notes (TINs).

1.7.2 Landscape

27) Landscape receptors may include landscape or townscape character areas; specific landscape character types or sub-types; and international, national or locally designated areas and features (e.g. National Parks, Areas of Outstanding Natural Beauty, Special Landscape Areas and Areas of Great Landscape Value).

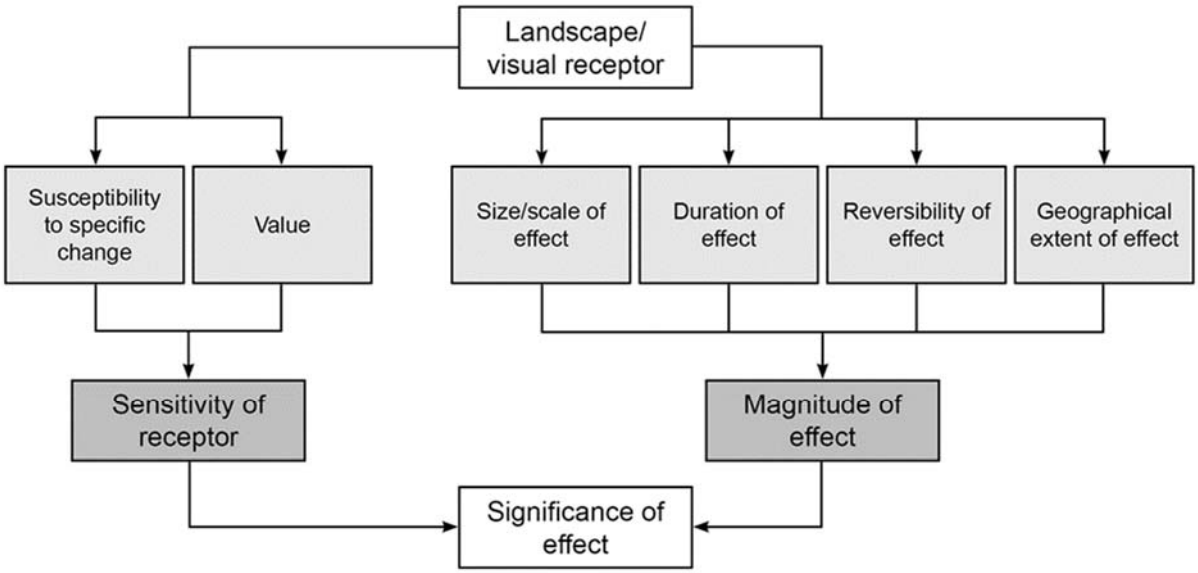
28) For this assessment, landscape receptors have included district level landscape and/or townscape character areas and types within the detailed assessment area. Where published information is to be used, a judgement has been made as to its accuracy and suitability.

1.8 Assessment of Landscape and Visual Effects

29) Assessing the significance of effect on identified landscape and visual receptors is a key part of the LVIA process that combines an evidence-based process with professional judgement. The assessment is a judgement based on a combination of receptor sensitivity and magnitude of effect. An illustrative guide to the process is shown in Illustration 1.1 below.

[5] The Landscape Institute and Institute of Environmental Management and Assessment (2013). *op. cit.*
[6] Landscape Institute (2019). Technical Guidance Note (TGN) 06/19: Visual Representation of Development Proposals [Available online] https://www.landscapeinstitute.org/news/new-visual-representation-guidance-2019/ [Accessed: February 2020]

Illustration 1.1: Method for assessing the Significance of Effect



30) The overarching guidance in GLVIA3 is not prescriptive on the criteria to be used for assessing the significance of effect on landscape and visual receptors. The criteria set out below has therefore been developed based on professional judgement and best practice.

1.9 Assessment Stages

31) The timescales over which the effects of the Proposed Bowland Section have been assessed varies according to the nature of the impact and the time taken for mitigation to become fully effective. The varying nature of landscape and visual effects throughout the timeline of the Proposed Bowland Section has been taken into account in this assessment. The assessment stages applied within this assessment are as follows:

- Enabling works phase - considers impacts during site preparation and mobilisation. Assessments for each receptor will be made during a period when enabling activities have been completed and therefore where impacts are likely to be greatest
- Construction phase – considers construction impacts of the Proposed Bowland Section. Assessments for each receptor will be made during a period when construction activities would be at their peak and therefore where impacts are likely to be greatest
- Commissioning phase – considers commissioning impacts on completion of the construction phase activities and land reinstatement
- Opening Year – considers the operational impacts of the Proposed Bowland Section on a winter's day during the first year before mitigation planting has begun to take effect
- Future Year – considers the operational impacts of the Proposed Bowland Section on a summer's day in the fifteenth year after the opening year but taking mitigation into account such as the maturing of planting. Mitigation planting is assumed to be substantially effective after 15 years.

1.10 Iterative Process and Mitigation

32) Mitigation measures will be proposed in response to the identification of the effects of the Proposed Bowland Section on landscape and visual receptors. The mitigation measures aim to reduce the degree of change and therefore reduce the overall significance of effect resulting from the Proposed Bowland Section.

33) Mitigation measures have been incorporated into the design, as part of an iterative process to avoid, reduce or offset adverse effects. Mitigation has been identified by individual specialists and fed into an Environmental Masterplan, which will be contained within the Environmental Statement.

34) The assessment of likely significant effects has taken account of mitigation proposals developed as an integral part of the overall Proposed Bowland Section design.

1.11 Assessment of Cumulative effects

35) The following section provides an overview of the methodology for assessing potential cumulative effects from different proposed developments and land allocations, in combination with the Proposed Bowland Section (i.e. inter-project cumulative assessment). Data on proposed third party developments and land allocations contained in development plan documents were obtained from various sources, including local planning authority websites, online searches, and consultations with planning officers. Proposed development data were then reviewed with a view to identifying schemes or land allocations whose nature, scale and scope could potentially give rise to significant environmental effects when considered in combination with the likely effects arising from the Proposed Bowland Section.

36) Intra-project cumulative impacts, i.e. two or more types of impact acting in combination on a given environmental receptor, property or community resource, are considered in Chapter 14: Communities and Health.

37) It is important to note that future growth on the local road network was taken into account in the traffic modelling described in Chapter 16: Transport Planning. For this reason, the potential cumulative effects of future traffic growth between the Proposed Bowland Section and other proposed developments are embedded into predicted road traffic-related impacts on highways capacity, air quality and noise.

38) The over-arching cumulative effects of the Proposed Programme of Works i.e. the five proposed replacement tunnel sections in combination, are considered in Chapter 19: Cumulative Effects. In addition, Chapter 19 examines the cumulative effects associated with the outcomes from Volume 2 (delivery and operation of the main construction compounds, tunnel, and construction traffic routes), Volume 5 (proposed off-site highways works and satellite compounds), and Volume 6 (Proposed Ribble Crossing).

2. LVIA Assessment Criteria

39) The criteria for assessing the sensitivity of receptors, magnitude of effects and significance of effects is presented below.

40) The nature of landscape and visual effects may be beneficial or adverse. Beneficial effects are those that enhance and/or reinforce characteristics that are valued. Adverse effects are those that remove and/or undermine characteristics that are valued.

2.1 Evaluation of Sensitivity

41) Sensitivity is defined by GLVIA3 as '*the nature of the receptor likely to be affected*'. In accordance with GLVIA3, the assessment of landscape and visual sensitivity combines judgements on the value attached to that receptor and the susceptibility of the receptor to the specific type of development proposed.

42) Sensitivity has been assessed on a three-point scale of High, Medium or Low. The application of these criteria is not formulaic, and the tables below only indicate general categories of sensitivity.

2.1.1 Landscape Sensitivity

43) For the purpose of this assessment, landscape susceptibility to change is defined as the ability of the landscape receptor to accommodate the Proposed Bowland Section without undue, negative consequences.

44) Susceptibility of landscape receptors to change will be assessed using the criteria detailed in Table 1.1 below.

Table 1.1: Landscape Susceptibility Criteria

Susceptibility	Criteria
High	The landscape is highly susceptible to the nature of the proposed development because the relevant characteristics or elements of the landscape have no or very limited ability to accommodate the development without significantly altering effects. For example, because the proposals would result in in high degree of change to a characteristic such as pattern, grain, use, scale and fabric that are important components of the landscape.
Medium	The landscape is moderately susceptible to the nature of the proposed development because the relevant characteristics or elements of the landscape including scale, pattern, grain, land use of the prevailing character have some ability to accommodate the development without significantly altering effects.
Low	The landscape has a low susceptibility to the nature of the proposed development because the character of the local area, including pattern, grain, use, scale and mass are generally able to accommodate the development without significantly altering effects.

45) GLVIA3 defines landscape value as, "*The relative value that is attached to different landscapes by society*". A review of existing designations (e.g. National Park, AONB, etc.) is usually the starting point in understanding value. Other areas of landscape, or individual elements of the landscape contributing to its character, may not be recognised by a formal designation, but may nevertheless have value.

46) Table 1.2 below sets out the criteria for assessing landscape value.

Table 1.2: Landscape Value Criteria

Value	Criteria
High	Landscapes, elements and/or features designated as international or national importance (e.g. World Heritage Sites, Area of Outstanding Natural Beauty, National Parks), or deemed to be fundamental to the setting of such designations, without which the designation would be significantly undermined. Undesignated landscapes, elements and / or features considered to have a high value: predominately intact and / or in good condition; picturesque quality and very attractive; unique, rare or important examples of landscape types, elements or features; rich cultural and/or nature conservation content; strong recreational experience; wild, tranquil or unspoilt landscapes with limited detractors; highly valued associations.
Medium	Landscapes, elements and/or features of local importance (e.g. Special Landscape Areas or Areas of Great Landscape Value). Undesignated landscapes, elements and / or features considered to have moderate value: some areas intact and in reasonable condition; some degree of scenic quality; some distinctive landscape types, elements or features; some cultural and / or nature conservation content; some contribution to recreational experience; some detractors and valued perceptual qualities; moderately valued associations.
Low	Undesignated landscapes, elements and / or features considered to have low or minimal value: few areas intact and / or in poor condition; limited aesthetic or scenic quality; few examples of unique, rare or important landscape types, features or elements; limited cultural and/or nature conservation content; limited or no contribution to recreational experience; prominent detractors and few valued perceptual aspects; poorly valued associations.

47) Table 1.3 sets out the criteria used to assess the sensitivity of landscape receptors. It incorporates the above assessment of value and susceptibility, along with professional judgement, to determine the overall landscape sensitivity

Table 1.3: Landscape Sensitivity Criteria

Sensitivity	Criteria
High	Landscape of particular distinctive character, which are highly valued and considered susceptible to relatively small changes.
Medium	Landscape of moderately valued characteristics considered reasonably tolerant of change. Some ability to accommodate the proposed development without undue harm.
Low	Landscape of generally low valued characteristics considered potentially tolerant of substantial change.

2.1.2 Visual Sensitivity

48) The susceptibility of different visual receptors to changes in views and visual amenity is mainly a function of:

- The occupation or activity of people experiencing the view at particular locations
- The extent to which their attention or interest may therefore be focused on the views and the visual amenity they experience at particular locations.

49) Table 1.4 below (based on generic guidance in GLVIA 3) has been used to help evaluate the susceptibility of different types of receptors.

Table 1.4: Visual Susceptibility Criteria

Susceptibility	Receptor Type
High	Residents People engaged in outdoor recreation including users of public rights of way, whose attention is likely to be focused on the landscape and on particular views Visitors to heritage assets or other attractions where views of the surroundings are an important part of the experience Communities where views contribute to the landscape setting and are enjoyed by residents Transient users of scenic routes where awareness of views is likely to be particularly high.
Medium	Transient users of road, rail or other transport routes where views are likely to be appreciated Outdoor workers where the viewer's attention or interest is related to views and the landscape.
Low	People engaged in outdoor sport or recreation, which does not involve appreciation of views People at their place of work, education and worship whose attention may be focused on their activities and where the setting is not important. Transient users of road, rail or other transport routes where visual amenity is not the primary concern and incidental to the journey

50) The criteria in Table 1.5 below has been used, along with professional judgement, to help determine the value of the views in relation to designations and helps to equate sensitivity to other factors, for example, residential views.

Table 1.5: Visual Value Criteria

Value	Views from:
High	Viewpoints of national importance, or highly popular visitor attractions where the view forms an important part of the experience, or with important cultural associations. Views of high scenic value where attractive features are prevalent. A view that may be identified in character area appraisals.
Medium	Viewpoints of regional/ district importance and / or moderately popular visitor attractions where the view forms part of the experience, or with local cultural associations. A typical and/or representative view where neither discordant or attractive features form a key part of the view composition.
Low	Viewpoints with no designations and with minimal or no cultural associations. Views where discordant or unattractive features are prevalent.

51) The sensitivity of visual receptors to changes in their views have been evaluated in accordance with the criteria provided in Table 1.6, based on the receptor susceptibility to change and the value of views.

Table 1.6: Visual Sensitivity Criteria

Sensitivity	Criteria
High	Receptors where the changed view is of high value and importance and/or where the receptor will notice any change to visual amenity by reason of the nature of use and their expectations. Receptors where the view is important to users will be considered to be of high sensitivity such as residential or PRoW / long distance routes.
Medium	Receptors where the changed view is incidental, but not critical to amenity and/or the nature of the view, is not a primary consideration of the users (receptors where users are likely to spend time outside or participation in an activity looking at the view and industrial receptors that have offices with windows that take advantage of views).
Low	Receptors where the changed view is unimportant and/or users are not sensitive to change (outdoor receptors where users are unlikely to consider the views an important element of their usage of the site will generally be assessed to be of low sensitivity).

2.2 Evaluation of Magnitude of Effect

52) The magnitude of effect is defined by GLVIA3 as "*the nature of the effect likely to occur*". It combines judgements on the size and scale of the effect; the geographical extent of the area over which it occurs; whether the effect is reversible or irreversible; and the duration of the effect.

53) The overall magnitude of effect is judged on individual merit rather than by a formulaic process, but is guided by the criteria set out below.

2.2.1 Magnitude of Landscape Effects

54) The magnitude of landscape effect has been assessed in terms of its size or scale, the geographical extent of the area that would be influenced, its duration and reversibility. This judgement takes into consideration the following factors:

Size / Scale

- The extent/proportion of landscape elements lost or added
- The contribution of that element to landscape character and the degree to which aesthetic/ perceptual aspects are altered
- Whether the change is likely to alter the key characteristics of the landscape, which are critical to its distinctive character.

Geographical Extent

- The geographical extent of landscape changes has considered how far reaching the changes would be at the following scales:
  - Within the immediate setting
  - Landscape character areas/types
  - At a larger scale, influencing several landscape character areas.

Duration and Reversibility

- Duration and reversibility of the changes has been categorised as follows:
  - Short-term / reversible – change that is reversible and would last up to five years
  - Medium-term / reversible – change that is theoretically reversible but would last for between five years and 10 years

- Long-term / reversible – change that is theoretically reversible but would last for between 10 and 25 years
- Permanent / irreversible – change that would last for 25 years or more, which are deemed as permanent or irreversible.

55) The criteria used to assess the size, scale and geographic extents of landscape effects has been based upon the amount of change that would occur as a result of the scheme, as described in Table 1.7 below.

Table 1.7: Magnitude of Landscape Effects Criteria

Magnitude	Criteria
Major	**Size/Scale:** substantial change to the key characteristics of the landscape; and/or total loss or substantial change to the existing landscape elements; and/or the addition of major new and uncharacteristic features or components. **Geographical Extent:** effects on a large part of the landscape character area/types; and/or a large proportion of landscape elements/features. **Duration and Reversibility:** introduction of permanent / irreversible change.
Moderate	**Size/Scale:** noticeable change to the key characteristics of the landscape; and/or partial loss or noticeable change to existing landscape elements; and/or the introduction of moderate new and uncharacteristic features or components. **Geographical Extent**: effects on a moderate part of the landscape character area/types; and/or a notable proportion of landscape elements/features. **Duration and Reversibility:** introduction of long-term / reversible change.
Minor	**Size/Scale:** minor change to the key characteristics of the landscape; and/or minor loss or slight change to existing landscape elements; and/or the introduction of minor new and uncharacteristic features or components. **Geographical Extent:** effects on a small part of the landscape character area/types; and/or a small proportion of landscape elements/features. **Duration and Reversibility:** introduction of medium-term / reversible change.
Negligible	**Size/Scale:** barely perceptible change to the key characteristics of the landscape; and/or minimal loss or barely perceptible change to existing landscape elements; and/or the introduction of barely perceptible new and uncharacteristic features or components. **Geographical Extent:** effects on a negligible part of the landscape character area/types; and/or a very small proportion of landscape elements/features. **Duration and Reversibility:** introduction of a short-term / reversible change.

2.2.2 Magnitude of Visual Effects

56) Evaluation of the magnitude of effect on visual receptors has been carried out by considering the following factors:

Size and Scale

- The scale of the change in the view with respect to the loss or addition of features and changes in its composition, including the proportion of the receptor's available view affected by the development
- The degree of contrast or integration of any new features or changes in the landscape with the existing landscape elements and characteristics
- The nature of the view of the proposed development, in terms of the relative amount of time over which it will be experienced and whether views will be full, partial or glimpsed.

Geographical extent

- The angle of view relative to the main activity of the receptor
- The distance of the viewpoint from the Proposed Bowland Section
  - Short distance – up to 500 m from the Proposed Bowland Section
  - Middle distance – between 500 m and 1 km from the Proposed Bowland Section
  - Long distance / background –beyond 1 km of the Proposed Bowland Section
- The extent of the area over which changes would be visible.

Duration and Reversibility

- Duration and reversibility of the changes has been categorised as follows:
  - Short-term / reversible – change that is reversible and would last up to five years
  - Medium-term / reversible – change that is theoretically reversible but would last for between five years and 10 years
  - Long-term / reversible – change that is theoretically reversible but would last for between 10 and 25 years
  - Permanent / irreversible – change that would last for 25 years or more, which are deemed as permanent or irreversible.

57) The criteria used to help determine the magnitude of visual effects are shown in Table 1.8 below.

Table 1.8: Magnitude of Visual Effects Criteria

Magnitude	Criteria
Major	**Size/Scale:** the project, or a part of it, would become the dominant feature or focal point of the view; and/or total loss or substantial alteration to key characteristics of the view (e.g. the proposals dominate the view and fundamentally change its character and components); and/or introduction of uncharacteristic features across a large proportion of the view. **Geographical Extent:** the view is available from all or most parts of a specific location; or from the majority of a linear route; and / or is within the direct frame of view; and / or experienced at close proximity from the receptor that the project would form part of the foreground of the view. **Duration and Reversibility:** introduction of permanent / irreversible change.
Moderate	**Size/Scale:** the project, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor (e.g. the proposals are noticeable in the view), affecting its character and altering some of its components and features; and / or partial loss or noticeable alteration to key characteristics of the view; and / or introduction of uncharacteristic features across part of the view. **Geographical Extent:** the view is available from a moderate proportion of a specific location; or from the moderate part of a linear route; and / or is at a slightly oblique angle; and / or experienced at a distance from the receptor that the project would form part of the middle ground of the view. **Duration and Reversibility:** introduction of long-term / reversible change.
Minor	**Size/Scale:** the project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view; and/or slight loss or alteration to key characteristics of the view; and/or the introduction of uncharacteristic features across a small part of the view. **Geographical Extent:** the view is available from a small proportion of a specific location; or from limited sections of a linear route; and / or is at an oblique angle; and/or experienced at a relatively long distance from the receptor that the project would form part of the background of the view. **Duration and Reversibility:** introduction of medium-term / reversible change.
Negligible	**Size/Scale:** only a very small part of the project would be discernible; and/or the introduction of features largely characteristic of the view. **Geographical Extent:** the view is available from hardly any part of a specific location; or from a very limited part of a linear route; and / or is at a very oblique angle; and / or experienced at such a distance from the receptor that the project would form a barely noticeable feature or element of the view. **Duration and Reversibility:** introduction of a short-term / reversible change.

58) Mitigation measures and standard construction and operational management practices has been incorporated into the design and have been considered in the determination of the magnitude of effect.

2.3 Evaluation of Significance of Effect

59) The resulting sensitivity and magnitude assessments has been applied together to determine the significance of effect on each landscape or visual receptor, as shown in the matrix in Table 1.9 below.

60) This matrix forms only a guide (i.e. an aide memoir) to the way that sensitivity and magnitude of effect give rise to a prediction of effects. The assessment of significance of effect relies upon common sense, experience and professional judgement, supported by substantiated reasoning. The predicted effect therefore may not always fit with the matrix. For example, in assessing the significance of an effect, an

assessor may consider changes of a relatively low magnitude to be highly significant if they relate to a highly sensitive (or 'important' or 'vulnerable') landscape or visual resource, whilst a high magnitude of effect on a less sensitive receptor may be deemed to be relatively less significant. The relationship between sensitivity and magnitude of impact is therefore not always linear.

Table 1.9: Significance of Effect Matrix

		Magnitude			
		Negligible	**Minor**	**Moderate**	**Major**
Sensitivity	**Low**	Negligible	Negligible / slight	Slight / moderate	Moderate
	Medium	Negligible / slight	Slight	Moderate	Moderate / major
	High	Slight	Slight / moderate	Moderate / major	Major

61) Effects have been qualified as either 'adverse' or 'beneficial'. The significance of landscape and visual effects has been assessed on a four-point scale of 'major', 'moderate', 'slight' and 'negligible', as set out below in Table 1.10, which are based on professional judgement and informed by GLVIA3.

Table 1.10: Landscape/Visual Significance of Effect Criteria

Category	Landscape	Visual
Major Beneficial Effect - Significant	The project would fit well with the scale, landform and pattern and enhance the character (including quality and value) of the landscape; enable the restoration of characteristic features and elements lost as a result of changes from inappropriate management or development; enable a sense of place to be enhanced.	The project would create a new feature that would greatly enhance the view. For example, new feature or landmark of local importance.
Moderate Beneficial Effect - Significant	The project would improve the character (including quality and value) of the landscape; enable the restoration of characteristic features and elements partially lost or diminished as a result of changes from inappropriate management or development; enable a sense of place to be restored.	The proposals would cause obvious improvement to a view from a receptor of medium sensitivity or a perceptible improvement to a view from a more sensitive receptor.
Slight Beneficial Effect	The project would complement the character (including quality and value) of the landscape; maintain or enhance characteristic features and elements; enable some sense of place to be restored.	The project would cause limited improvement to a view from a receptor of medium sensitivity or would cause greater improvement to a view from a receptor of low sensitivity.
Negligible Effect	The project would be compatible with the existing character (including quality and value) of the landscape; blend in with characteristic features and elements; enable a sense of place to be retained.	No perceptible deterioration or improvement in the existing view
Slight Adverse Effect	The project would not quite fit the character (including quality and value) of the landscape; be at variance with characteristic features and elements; detract from a sense of place.	The project would cause limited deterioration to a view from a receptor of medium sensitivity or cause greater deterioration to a view from a receptor of low sensitivity.
Moderate Adverse Effect Significant	The project would conflict with the character (including quality and value) of the landscape; have an adverse impact on characteristic features or elements; diminish a sense of place	The project would cause obvious deterioration to a view from a receptor of medium sensitivity or perceptible damage to a view from a more sensitive receptor.
Major Adverse Effect - Significant	The project would be at complete variance with the character (including quality and value) of the landscape; cause the integrity of characteristic features, elements and sense of place to be lost.	The project would cause major deterioration or loss of a view from a highly sensitive receptor, and would constitute a major discordant element in the view.

3. Photomontage Methodology

62) A photomontage is the superimposition of a rendered, photorealistic image of the proposals onto a base photograph, to visually represent the scheme. This document provides a description of the methodology proposed for the production of the photomontages.

63) The methodology has been produced to provide transparency of the process to produce photomontages to inform the landscape and visual impact assessment in line with the core guidance document: The Highland Council, July 2016: *Visualisation Standards for Wind Energy Developments*[7] (herein referred to as the Highland Council Guidelines) as supported by other industry guidelines[8].

64) The final figure for each viewpoint comprises a series of eight sheets to reflect the existing views along with photomontages to reflect the Construction and Operational Phases of the scheme. The full list of sheet sets per viewpoint are listed in Section 3.7 below and are summarised as follows:

- Sheets 1 and 2 – existing panoramic views
- Sheets 3 and 4 – proposed panoramic photomontages
- Sheets 5 and 6 – proposed single image photomontages (standard 50mm lens camera)
- Sheets 7 and 8 – proposed single image photomontages (equivalent to 75mm lens camera).

65) These sets of figures are as prescribed within the Highland Council Guidelines to enable both desk top and site-based viewing, as described in more detail below.

3.1 Viewpoint Location Consultation

66) Viewpoints were chosen to reflect the worst-case changes in views from what were considered the most sensitive receptors. The locations of viewpoints have been selected through consultation with the Landscape Specialist working on behalf of the Local Planning Authorities within the proposed Bowland Section through a Planning Performance Agreement (PPA). The locations were identified and described via email and telephone correspondence with Steven Brereton of Lancashire County Council (LCC) between 17 and the 27 March 2020. During this discussion all original viewpoints were agreed as representative and suitable with additional viewpoint locations requested by LCC and the Forest of Bowland AONB Officers. These were considered and assessed with three additional viewpoints as confirmed for addition to the PPA on 24 June 2020.

67) The final list of viewpoints were accepted on 8th August 2020.

3.2 Key Assumptions and Limitations

68) Whilst every effort has been made to ensure a suitable level of accuracy is maintained throughout the production of photomontages, no final image is 100% accurate. Therefore, the following assumptions and limitations have been identified at this stage:

- Some limitation to the access as a result of the Covid-19 pandemic meant that some locations were inaccessible for survey and viewpoint locations as agreed reflect this
- The baseline photographs that form the basis of the photomontage are a flattened 2D representation of what the eye would see (planar projection)
- Further to the assumptions and limitations identified within Section 4.6 in Chapter 4: EIA Methodology (Volume 2) regarding data limitations and technical assumptions, it is acknowledged that the design of the works between construction phase and permanent works has evolved and therefore some level of information shown within the Construction Phase and Operational Phase

[7] The Highland Council (2016) *Visualisation Standards for Wind Energy Developments [Online] Available from:* https://www.highland.gov.uk/downloads/file/12880/visualisation_standards_for_wind_energy_developments *[Accessed: 20 July 2020]*

[8] The Landscape Institute and Institute of Environmental Management and Assessment (2013) *Guidelines for Landscape and Visual Impact Assessment Third Edition (GLVIA3).*

photomontages differ as a result. It has been reviewed during the works and is not deemed materially different to that assessed within the Landscape and Visual Impact Assessment within Chapter 6: Landscape and Arboriculture (Volume 2)

- All design information has been provided in a 2D CAD format and interpreted and modelled following detailed confirmation from United Utilities designers. Section 3.5 below reflects the level of additional modelling and interpretation undertaken to provide a proportionately accurate 3D model rendition of the designs
- Accuracy tolerances for survey and existing site data has been determined based on key information (e.g. Ordnance Survey Digital Terrain Mapping (DTM) data, Light Detection and Radar (LiDAR) data and geomatic survey results from Global Navigation Satellite System (GNSS) and total station techniques) used to provide references for fixing camera perspectives
- It is acknowledged that in certain instances, an accurate reading may not be attainable on site due to remote site locations and / or intervening buildings / structures reducing the ability to receive a suitably strong signal from satellites. Therefore, the camera matching process has required further adjustment to align the 3D model and base imagery. These differences are stated along with the level of deviation from survey within section 3.4, table 1.11 below
- Ordnance Survey 2m contour data used for topography terrain is based on DTM mapping generally considered to be accurate to +/- 2m
- Photographs have been taken at 1.6m above ground which is acknowledged as a departure from the prescribed 1.5m within the Highland Council Guidelines, but still represents the viewing height of a person
- The basis for the single 50 mm (and 75 mm equivalent) focal length photomontages for visual impact assessment focus on the worst-case impact of the scheme proposals in each view for both the Construction Phase and Operational Phase scenarios. Therefore, in certain circumstances the location of this extract may differ between Construction and Operational Phase scenarios as a result of mitigation and residual impacts (see sections 3.6.2 & 3.6.3 below for more details).

3.3 Survey, Photography and Baseline Information

69) Viewpoints were verified on site to maximize views of the scheme and, where possible, avoid any obstructions that limit views. The selected viewpoints are shown on the Zone of Theoretical Visibility (ZTV) & Representative Viewpoints Location Plan. Winter photographs were taken in March, April and September 2020 and summer photography in September and October 2019; in clear conditions where even light levels would prevail. At each viewpoint location, the following survey data was collected:

- GPS reference noting the location of the camera in National Grid coordinates as well as the ground elevation
- The height of the camera above ground level
- Direction of the view (compass bearing)
- Date and time the photograph was taken
- Weather conditions at the time of photograph.

70) The baseline photographs were taken using a Canon EOS 5D digital SLR camera with a fixed 50 mm focal length lens set to the maximum resolution, including recording the metadata. All photographs were taken on a tripod mounted and levelled to the vertical and horizontal axes.

71) Camera locations were recorded in winter and summer by a land surveyor using a Global Navigation Satellite System (GNSS) with the location, where possible, noted using additional photography of tripod location to enable ease of retake during the summer visit.

72) The panoramic photography was undertaken using a series of photographs taken in a landscape orientation. with a minimum of 60% (15 º increments) overlap between frames to reduce barrel distortion.

3.4 Existing site 3D modelling, references and 3D camera matching

73) To assist the process of matching the baseline photograph with the 3D model of the proposals, reference points were identified at each viewpoint location. Reference points are features within a photograph that can be identified from Ordnance Survey (OS) and aerial photographical data. Examples include telegraph poles, field boundaries and pylons.

74) The existing site 3D model was produced at a local grid with a common global shift from OS National Grid [-362472.640, -452158.874]. This was produced using information from 2D and 3D OS DTM and LIDAR contour information as converted using Autodesk Civil3D software and exported to Autodesk 3DS Max Design. This model has been used to vertically place reference objects as extracted from the same working Civil3D CAD model.

75) From the baseline panoramic images, single 50 mm focal length images for use in the camera matching process were cropped to match the 4:3 ratio of a 50 mm lens image. These frames were then be used as backdrops to the equivalent 50 mm 3D camera within Autodesk 3DS Max Design software.

76) The surveyed locations of the viewpoints were added to the base 3D model (with the global shift applied) via export from Civil3D and used as a starting point for fixing the 3D camera. This was undertaken through matching terrain, reference points and other information in the model to the corresponding features in the background image (the 3D camera backdrop).

77) Following detailed camera matching of photography and reference points, minor adjustments to the location of the 3D camera location were required to accurately fix the 3D environment to the photo. The deviation from surveyed points are summarised in Table 1.11 below:-

Table 1.11: Survey information and 3D modelling deviations

Viewpoint S=summer W=winter	Surveyed GNSS GPS Coordinates	3D camera match coordinate equivalent	Surveyed GNSS GPS Elevation (m AOD)	3D camera elevation (m AOD plus 1.6m height of camera above ground)	Maximum horizontal deviation (m)
TR03_01 (S)	363861.335, 465781.779	363861.579, 465782.102	164.306 m	145.281 m	0.404 m
TR03_01 (W)	355206.284, 496658.552	355203.902, 496636.676	176.468 m	176.023 m	22.06 m
TR03_02 (S)	364751.388, 466375.266	364746.844, 466373.097	167.573 m	167.993 m	5.04 m
TR03_02 (W)	364752.304, 466374.799	364746.795, 466373.060	167.651 m	168.003 m	5.78 m
TR03_03 (S)	369354.537, 449348.533	369345.360, 449349.651	141.550 m	142.670 m	9.25 m
TR03_03 (W)	369354.537, 449348.533	369357.048, 449373.873	141.550 m	141.925 m	25.46 m
TR03_04 (S)	368803.170, 449908.978	368805.614, 449907.787	135.581 m	139.389 m	2.72 m
TR03_04 (W)	368802.791, 449908.960	368805.351, 449911.569	139.034 m	141.427 m	3.66 m

78) Once the correct aspect, orientation and any camera roll was confirmed, checked and recorded above; the locations were locked for use in rendering.

3.5 Construction of the 3D scheme design models

3.5.1 Construction Phase 3D model

79) The model has been created using combination of 3D and 2D CAD design information supplied by the United Utilities designers for the Construction Phase compound layouts and access tracks, and further informed through consultation to determine type and sizes of on-site equipment / vehicles / materials. Stock 3D models were also agreed at this time for use in the modelling. Additionally, all construction phase boundary fencing treatments were agreed and locations identified with the United Utilities designers.

80) The final materials and finishes (e.g. concrete, tarmac, grass etc.) were then matched to the relevant models and environment lighting and atmospheric effects set to mirror the conditions as recorded for each viewpoint as closely as possible.

3.5.2 Operational Phase 3D model

81) The model has been created using 3D and 2D CAD design information supplied by the United Utilities designers for the permanent structures, buildings, hard standing areas, and access roads. The environmental mitigation proposals were also used to model all proposed vegetation and ecological mitigation, with all establishment sizes of proposed planting agreed with the Landscape Architect to reflect 15 years growth rates.

82) The final materials and finishes (e.g. buildings, concrete, tarmac, fences, planting and grass etc.) were then matched to the relevant models and environment lighting and atmospheric effects set to mirror the conditions as recorded for each viewpoint as closely as possible.

83) All proposed mitigation planting has been modelled to represent native woodland, trees, shrub and hedgerow planting for the Operational Phase (15 years after completion of the Scheme) as follows :

- Woodland and trees and shrub planting – 7-8m tall;
- Hedgerow (unmanaged), native shrub and scrub planting 2-3m tall;
- Individual native trees – 7-8 tall.

3.6 Compilation of Images

84) The following set of images produced for the final output are as prescribed within the Highland Council Guidelines to enable both desk top and site-based viewing. Instructions and health warnings for each set and their use are further described in this section.

3.6.1 Panoramic baseline and photomontage images for landscape context (Figure sheets 1 to 4)

Existing baseline view panoramic images

85) Panoramic photographs are presented for the existing baseline view and photomontages for landscape context. These are not be representative of scale and distance (see section 3.6.3: 75 mm recalibrated photomontages below).

86) The 50 mm lens photographs has been manually stitched together in Adobe Photoshop software to produce a 65.5° wide panoramic image (390 mm x 157.26 mm) to a reflect a 65.5° horizontal x 27° vertical field of view.

87) During this process only minor improvements have been made to the photographs to balance brightness, contrast etc. where necessary. None of the photographs have been distorted.

88) Once all layering and final adjustment to brightness and contrast levels were complete, all landscape context photomontages were resized to 390 mm x 157.26 mm for inserting to scale into AutoCAD to complete the figure sheets 1 and 2.

Panoramic photomontage images

89) Photoshop software has been used to remove features in the baseline photograph that would be removed by the scheme using additional photography undertaken at the same time as the viewpoint photograph. Furthermore, additional layers taken from the base photograph have been used as retained foreground elements which were layered over the top of the rendered layers.

90) The fixed 3D cameras have been used to render the proposed scheme from 3DS Max as an image file. This was then imported into Adobe Photoshop as a layer over the existing panoramic image.

91) Once all layering and final adjustment to brightness and contrast levels were complete, all landscape context photomontages were be resized to 390 mm x 157.26 mm for inserting to scale into AutoCAD to complete the figure sheets 3 and 4.

3.6.2 Single 50 mm focal length images for visual impact assessment (Figure sheets 5 and 6)

92) The panoramic photomontage images were used as the basis for the single 50 mm focal length photomontages for visual impact assessment, which reflect the central section of the view focused on the main impact of the scheme proposals. This process has been undertaken for both the Construction Phase and Operational Phase scenarios.

93) The 50 mm single frame extract has been cropped from the panoramic photomontage image (235.89 mm x 157.26 mm) and then resized to 390 mm x 260 mm for inserting to scale into AutoCAD to complete the figure sheets 5 and 6.

3.6.3 Single 75 mm focal length photomontages for visual impact assessment (Figure sheets 7 and 8)

94) The final 50 mm photomontage was imported into a recalibration template in Photoshop (see Illustration 1.2 below), whereby the "zone of permissible offset" has been used as a guide to crop out the 75 mm focal length equivalent image (260 mm x 174 mm). A verification template is provided (*see Appendix A – Verification Template*) for verification of image sizes.

95) The recalibrated image has then been resized to 390 mm x 260 mm (300 ppc) for insertion into the A3 AutoCAD frames (figure sheets 7 and 8).

Illustration 1.2: 75 mm recalibration template illustration

3.7 Final output summary

96) The following A3 figure set is provided for each viewpoint. All survey information as well as other important information is provided on figure sheets:

Viewpoints TR03_01, TR03_02, TR03_03 and TR03_04

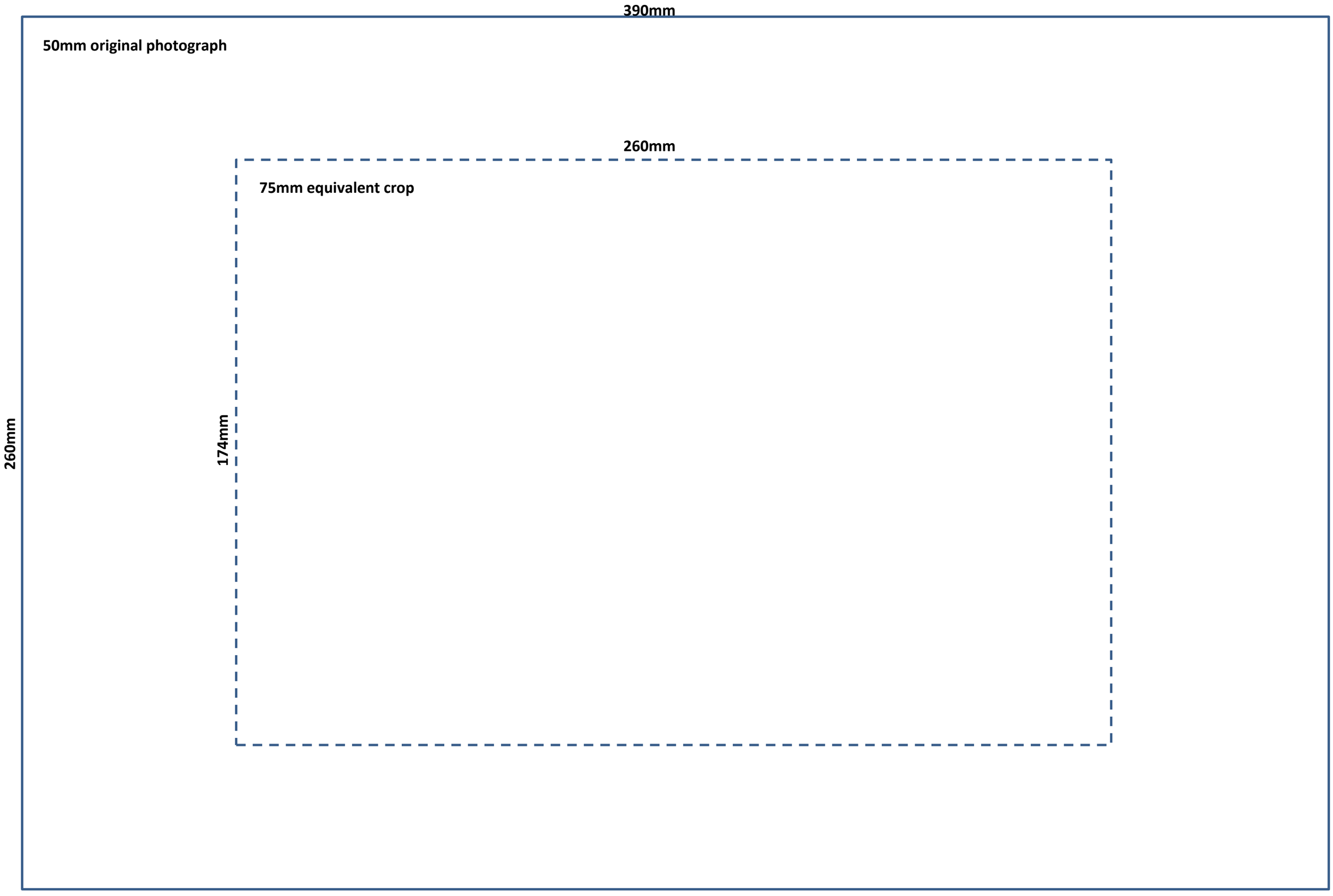
- Sheet 1 = EXISTING VIEW – WINTER / SUMMER 2020
- Sheet 2 = EXISTING VIEW - SUMMER 2020 (not required if single season)
- Sheet 3 = CONSTRUCTION PHASE PHOTOMONTAGE
- Sheet 4 = OPERATIONAL PHASE PHOTOMONTAGE
- Sheet 5 = CONSTRUCTION PHASE 50 mm PHOTOMONTAGE
- Sheet 6 = OPERATIONAL PHASE 50 mm PHOTOMONTAGE
- Sheet 7 = CONSTRUCTION PHASE 75 mm PHOTOMONTAGE
- Sheet 8 = OPERATIONAL PHASE 75 mm PHOTOMONTAGE.

97) The final display of the finished photomontage figures should be printed at high resolution on a good quality printer. Custom margins of 3 mm to all edges of A3 paper (reduced from 5 mm) will be required on some printers to allow full print at a 1:1 ratio.

98) The recalibrated 75 mm photomontage sheets of the figure sheet set will be representative of scale and distance if viewed on site at a comfortable arm's length (approx. 500 mm) – see Illustration 1.3 below.

Illustration 1.3: Illustration of site use of 75 mm recalibrated photomontage.

Appendix A. Verification Template



Verification template