HyNet North West

ENVIRONMENTAL STATEMENT (VOLUME III)

Appendix 12.2 Landscape and Visual Impact Assessment Methodology

HyNet Carbon Dioxide Pipeline DCO

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulations 5(2)(a)

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1. INTRODUCTION

1.1.1. This methodology for the Landscape and Visual Impact Assessment (LVIA) has been produced in accordance with best practice by suitably qualified Landscape Architects that are Chartered Members of the Landscape Institute (CMLI). This methodology is based upon that which was prepared at the Scoping stage and issued at PEIR.

1.1.2. The assessment considers two distinct but closely related areas: landscape character and visual amenity.

- The landscape assessment considers the effects of a development on landscape character and landscape as a resource; and
- The visual assessment considers the views that are available to people who may be affected by a development and their perception and responses to changes in these views.

2. GUIDANCE

2.1.1. In addition to the legislation, policy and guidance set out in **Chapter 5 - EIA Methodology (Volume II),** the primary source of guidance for the **Chapter 12 - Landscape and Visual (Volume II)** is the Landscape Institute with the Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd Edition (GLVIA3) **(Ref. 1)**. The following sources (ordered by date) have also been referred to in the preparation of the methodology for the LVIA and production of visual representations:

- Natural England (2014). An Approach to Landscape Character Assessment **(Ref. 2)**;
- Landscape Institute (2019). Visual Representation of Development Proposals: Landscape Institute Technical Guidance Note 06/19 **(Ref. 3)**;
- Natural England (2019) An approach to landscape sensitivity assessment – to inform spatial planning and land management-Consultation Draft **(Ref. 4)**; and
- Landscape institute (2021). Assessing Landscape Value outside National Designations Technical Guidance Note 02/21 **(Ref. 5).**

3. GLVIA3

3.1.1. The methodology is consistent with the approach and process set out in GLVIA3, as summarised in the **Figure 1 - Flow Diagram from GLVIA3** taken from GLVIA3.

3.1.2. In summary, the assessment involves the following key stages:

- Establishment of the baseline conditions; the landscape character and visual context of the receiving environment and the sensitivity to change of these receptors;
- Contributions to the iterative process of design and mitigation based on understanding the nature, form and features of the DCO Proposed Development in relation to the key landscape and visual sensitivities;
- An evaluation of the magnitude of change likely to result from the DCO Proposed Development, both during construction and in operation on visual amenity and the landscape;
- An evaluation of the cumulative magnitude of change likely to result from the DCO Proposed Development in conjunction with other similar existing or future developments, both during construction and in operation on visual amenity and the landscape resource;
- An assessment of the significance of landscape and visual effects considering the sensitivity of resources and the magnitude of change; and
- An assessment of the cumulative significance of landscape and visual effects considering the sensitivity of resources and the magnitude of change.

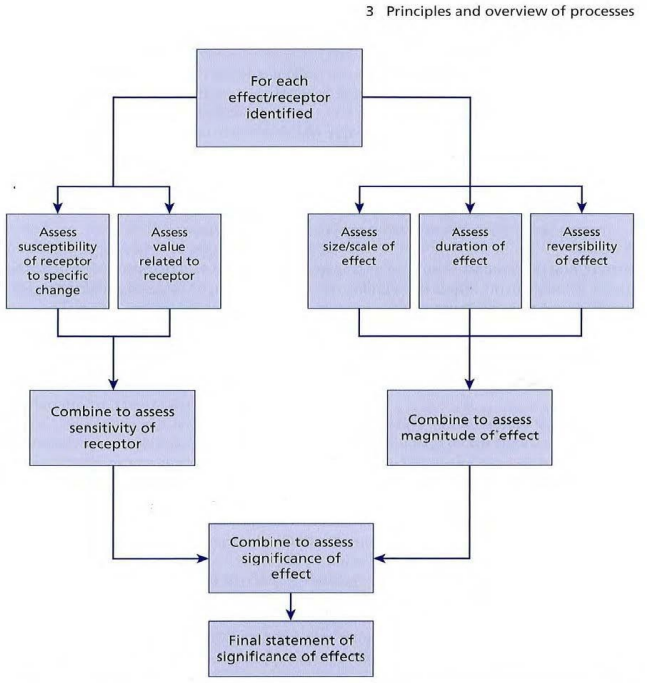

Figure 1 - Flow Diagram from GLVIA3

3.1.3. As stated in **Chapter 5 - EIA Methodology (Volume II)**, the assessment has taken into consideration the 'future baseline' - how the current baseline conditions may change going forward to the point of construction. Due to the uncertainty and lack of reliable data associated with future conditions, a detailed consideration of the effects of the DCO Proposed Development against the future baseline would generally not result in a robust assessment depending on the length of future prediction. However, the future baseline with relevance to LVIA is considered in descriptive terms highlighting where significant effects are likely to arise as far as can be reasonably predicted. This includes developments in construction and consented developments in particular but also other changes such as forestry works, implications of tree diseases change to land use and settlement patterns for example.

3.1.4. For both the landscape and visual assessments, including cumulative assessment, the significance of effect is derived from the combination of the magnitude of change and the sensitivity of the landscape or visual receptor. criteria tables (set out below) are used to guide the decision-making process for assessing sensitivity and magnitude and how these are considered together to reach an assessment of significance of effect. These tables are guidelines to illustrate typical outcomes and not to be used as a prescriptive tool. It should be noted that professional judgement is also used in determining both the sensitivity of a receptor and the magnitude of change. There are situations where the conclusions regarding significance in the LVIA differ from that suggested by the significance matrix which reflects the application of professional judgement.

4. STUDY AREA

4.1.1. The Study Area defines the area in which significant effects are likely to occur. Visual effects can only occur where a development is visible. However, the landscape assessment will consider the effect on the whole of those parts in defined units of landscape character potentially affected, not simply on those parts of the landscape where visibility of the DCO Proposed Development occurs. Where receptors are closer to the Site, it is expected that effects will be greater than those located at the outer edges of the Study Area which are likely to experience lower effects.

4.1.2. The GLVIA 3 clarify how study areas should be determined on a project specific basis for landscape and visual receptors. Paragraph 5.2 of GLVIA 3 states that the study area extent for effects on landscape character should be *"… based on the extent of Landscape Character Areas likely to be significantly affected either directly or indirectly"* and in paragraph 6.2 for visual receptors the study area *"should consider the area from which the proposed development will potentially be visible."*

4.1.3. The proposed Study Areas are based on a combination of professional judgement and an analysis of the height and extent of the DCO Proposed Development, as defined shown on **Figure 12.1 Zone of Theoretical Visibility (Volume IV)** as well as subsequent field visits**.**

5. INFORMATION AND DATA SOURCES

5.1.1. The first stage of the LVIA baseline process is to collect data through a desktop study of the Site and the Study Area. This desktop study identifies information such as landscape related planning designations, landscape character typology, other infrastructure in the area, and initial identification of visibility from key locations such as routes and settlements.

5.1.2. Geographical Information Systems (GIS) and Google Earth **(Ref. 6)** are used to explore the potential visibility of the DCO Proposed Development. The Zone(s) of Theoretical Visibility (ZTV) and Google Earth (**Ref. 6**) Viewshed tool inform the identification of landscape and visual receptors that are likely to be pertinent to the assessment. The technical methodology for producing ZTVs and visualisations is provided in this methodology.

6. DETERMINING SENSITIVITY

LANDSCAPE RECEPTORS

6.1.1. Landscape effects are defined as the changes in the character and quality of the landscape as a result of a development.

6.1.2. Direct and indirect landscape effects are defined in GVLIA 3. Direct effects *"result directly from the development itself"* whilst indirect or secondary effects result from the *"consequential change resulting from the development"*. Indirect effects are often generated away from the site of development or as a result of a secondary association or complex pathway.

6.1.3. To understand the effects of the DCO Proposed Development it is necessary to consider the following:

- Key landscape characteristics - this includes notable elements or combination elements which contribute to defining the character of an area; and
- Landscape fabric / elements - specific features and elements that make up the landscape such as the topography, vegetation and built form.

6.1.4. Aesthetic, perceptual / experiential qualities of landscapes are also considered such as scale, enclosure, diversity, sense of wildness, remoteness, openness and tranquillity that give rise to landscape character and regional and local distinctiveness.

6.1.5. The sensitivity of the landscape receptors is arrived at by separately considering the landscape receptor value and the susceptibility of the landscape receptor to the change proposed. These are described below.

LANDSCAPE VALUE

6.1.6. When determining landscape value, a range of factors are reviewed that fit on a sliding scale from high to negligible, as illustrated on **Table 1.** For example, a National Scenic Area with a strong sense of place in very good condition would be expected to fall within the higher end of the scale. Reference is normally made to the relevant existing national and local studies to draw a list of the factors set out in **Table 1.** Where these don't exist, as set out in page 84 of GLVIA3, a range of factors that can help in the identification of valued landscapes are reviewed.

6.1.7. It should be noted that the importance of a landscape is often based on its designation or recognition through national or local consensus and because of its quality including cultural associations, scenic or aesthetic qualities. The absence of a landscape designation however should not preclude an area being defined as important. Such locations may be of local value informed by local cultural or natural heritage records, works of art or levels of use.

Table 1 - Landscape Value

Value	Recognition	Features	Quality/condition
High	Typically, a landscape or feature of international or national recognition: National Parks, Areas of Outstanding Natural Beauty, World Heritage Sites (where designated for landscape reasons), designed landscapes on the Cadw Historic Environment Service asset register.	Typically, a strong sense of place with landscape / features worthy of conservation; no or few detracting features.	A very high-quality landscape / feature; attractive landscape / feature; exceptional / distinctive.
Medium	Regional recognition or undesignated, but locally valued landscape / features: Local Landscape Areas, Regional Scenic Areas, locally listed designed landscapes and Regional Parks.	Typically, contains distinguishing features worthy of conservation; evidence of some degradation and / or some detracting elements.	Ordinary to good quality landscape / feature with some potential for substitution; a reasonably attractive landscape / feature; fairly typical and commonplace.
Low	Typically, an undesignated landscape / feature.	Few landscape features worthy of conservation, evidence of degradation with many detracting features.	Ordinary landscape / feature with high potential for substitution; quality that is typically commonplace and unremarkable; limited variety or distinctiveness.
Negligible	Typically, an undesignated landscape / feature.	No landscape features worthy of conservation; evidence of degradation with many detracting features.	Low quality landscape / feature with very high potential for substitution; limited variety or distinctiveness; commonplace.

LANDSCAPE SUSCEPTIBILITY

6.1.8. When determining landscape susceptibility, a range of factors are considered on a scale from high to negligible, as set out in **Table 2**. For example, a large-scale development proposed within a small and intimate landscape would be expected to fall within the higher end of the sliding scale.

Table 2 - Landscape Susceptibility

Susceptibility to Proposed Change	
High	Low ability to accommodate the specific proposed change; undue consequences for the maintenance of the baseline situation (receptor value) and / or achievement of relevant planning policies / strategies.
Medium	Moderate ability to accommodate the specific proposed change; some undue consequences for the maintenance of the baseline situation (receptor value) and / or achievement of relevant planning policies / strategies.
Low	High ability to accommodate the specific proposed change; little or no undue consequences for the maintenance of the baseline situation (receptor value) and / or achievement of relevant planning policies / strategies.
Negligible	Very high ability to accommodate the specific proposed change; no undue consequences for the maintenance of the baseline situation (receptor value) and/or achievement of relevant planning policies / strategies.

LANDSCAPE SENSITIVITY

6.1.9. Susceptibility and value can be combined in different ways although it is generally accepted that a combination of high susceptibility and high value is likely to result in the highest sensitivity, whereas a low susceptibility and low value is likely to result in the lowest level of sensitivity. As noted in GLVIA3 there can be complex relationships between the value attributed to a landscape and its susceptibility to change, which can be particularly important when considering change in designated landscapes or those that are being considered for designated status.

6.1.10. However, whilst a valued landscape may serve to increase the overall sensitivity of the landscape receptor, a low value will not necessarily reduce overall sensitivity. Whilst it would be anticipated that landscape receptors considered highly susceptible to the proposed change would be considered to be of high sensitivity, this wouldn't be the case if there were reasons associated with the value that lead to a reduction in sensitivity. For example, where a designated area or area covered by policy may have a deterioration in recent condition and management regime.

6.1.11. The diagram presented as **Figure 2** illustrates how value and susceptibility can be combined. When determining overall landscape sensitivity, it should be noted that the levels are indicative and fall on a scale from high to negligible and professional judgement is used to determine the overall level of sensitivity.

6.1.12. Any landscape receptors assigned a negligible level of sensitivity will not be further considered as part of the assessment on the basis that significant effects are highly unlikely as demonstrated by **Table 8.**

Level of Landscape Sensitivity Diagram

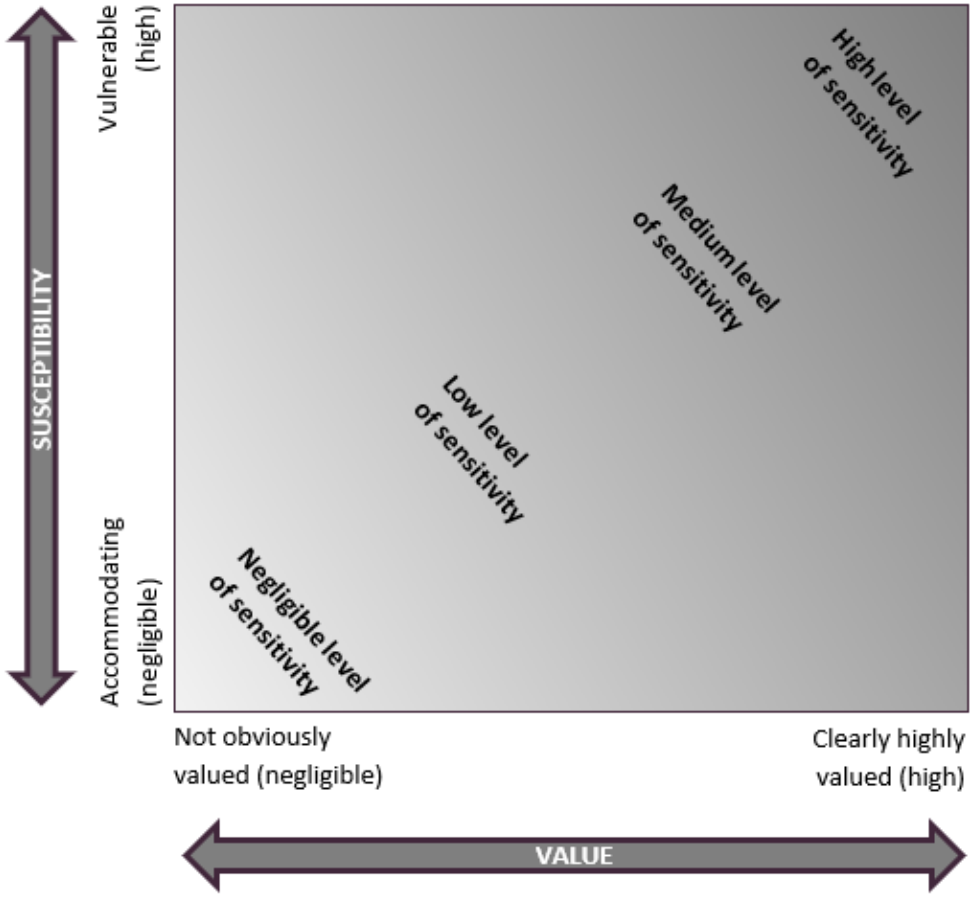

Figure 1 - Level of Landscape Sensitivity Diagram

VISUAL RECEPTORS

6.1.13. Visual effects relate to changes in available views of the landscape and the effect of those changes on people, including:

- The immediate impact of the DCO Proposed Development on the content and character of views (E.g., through intrusion or obstruction and / or the change or loss of existing elements in the view); and
- The broader impact considering the overall change on visual amenity enjoyed by receptors in the area.

6.1.14. GLVIA3 advises that it is helpful to consider (but not restricted to) the following:

- Nature of the view (open, panoramic, framed, enclosed);
- Proportion of the development visible (full, most, part or none);
- Distance of the viewpoint from the development and whether it would be the focus of the view or only a small element;
- Whether the view is stationary, transient or sequential; and
- The nature of the changes to the view.

6.1.15. Additionally, the seasonal effects of vegetation are considered, in particular the varying degree of screening and filtering of views.

6.1.16. The sensitivity of a visual receptor reflects their susceptibility to change and any values which may be associated with the specific view. The sensitivity of the visual receptors is arrived at by separately considering the visual receptor value and the susceptibility of the visual receptor to the change proposed.

VISUAL VALUE

6.1.17. Certain views are highly valued for either their cultural or historical associations, which can increase the sensitivity of the viewer, as set out in **Table 3.**

Table 3 - Visual Value

Value	Recognition	Indicators of value
High	Recognised views from nationally or internationally important landscape or heritage resources may be identified in planning policies or statutory documents.	High value / celebrated view; referred to in national or international guide books, tourist guides etc.; literary and art references; presence of interpretive facilities (E.g., visitor centre).
Medium	Recognised views from local or regionally important landscape or heritage resource may be	Moderately valued view; referred to in local or regional guide books, tourist maps etc.; local literary and art references;

Value	Recognition	Indicators of value
	identified in local planning policies or supplementary planning documents.	presence of some interpretive facilities (E.g., parking places or sign boards).
Low	Locally recognised views, usually informal.	Valued view but no formal references, may include informal footpaths that indicate well used routes by locals. Likely to be common where views are typical of the location with little distinctiveness, lacking in attractors or detractors.
Negligible	Little to no recognition	Not known locally for its views, places that lack evidence of people actively seeking use and therefore any associated views.

VISUAL SUSCEPTIBILITY

6.1.18. When determining visual susceptibility, a range of factors are considered that fit on a scale from high to negligible, as set out in **Table 4.** For example, a view experienced by a resident of a property in close proximity and overlooking the Site would be expected to fall within the higher end of the scale.

Table 4 - Visual Susceptibility

Susceptibility to Proposed Change	
High	• Residents at home; • Walkers on long distance trails and mountain access routes, • Users of footpaths where the attractive nature of the countryside is a significant factor in the enjoyment of the walk, • Cyclists on national and local cycle routes designed to provide an attractive experience; • Road users on recognised tourist routes; and • Visitors to landscape and heritage resources and other attractions where views of the surroundings are an important contributor to appreciation, experience and/or enjoyment.

Susceptibility to Proposed Change	
Medium	• General road users; • Passengers on rail lines where the trains run at low or moderate speeds; • Users of public open space and footpaths where the nature of the surroundings is not a significant factor in the enjoyment of the activity; and • Visitors to landscape and heritage resources and other attractions where views of the surroundings are a minor contributor to appreciation, experience and/or enjoyment.
Low	• People at their place of work or shopping; • Users of high-speed roads and passengers in trains running at high speed; • People engaged in recreational activities where the view of the surroundings is secondary to the enjoyment of the activity (such as playing or spectating at outdoor sports facilities); and • Users of public open space and footpaths where the nature of the surroundings is irrelevant to the enjoyment of the activity.
Negligible	• Users of indoor facilities where the view is irrelevant to their activity.

VISUAL SENSITIVITY

6.1.19. As with landscape, susceptibility and value can be combined in different ways to form a judgement about the visual sensitivity of a given receptor. It is generally accepted that a combination of high susceptibility and high value is likely to result in the highest sensitivity, whereas a low susceptibility and low value is likely to result in the lowest level of sensitivity.

6.1.20. However, whilst a valued view may serve to increase the overall sensitivity of the visual receptor, a low value will not necessarily reduce overall sensitivity. Whilst it would be anticipated that visual receptors considered highly susceptible to the proposed change would be considered to be of high sensitivity, this wouldn't be the case if there were reasons associated with the value of the view that lead to a reduction in sensitivity. For example, a resident at home would generally have a high sensitivity to the proposed change, but if the view they currently experience is of a low value degraded and industrial

landscape it can be expected that their susceptibility to a proposed change of a similar industrial nature would be reduced.

6.1.21. Similarly, receptors considered of low or medium susceptibility are usually in the same category of sensitivity, unless there are reasons associated with the value of the view that lead to an increase in sensitivity, which is shown in **Table 4.** For example, where a road user on a defined tourist route would have a higher susceptibility to the proposed change than if travelling on a busy main road.

6.1.22. **Figure 3** illustrates typical characteristics of the different levels of sensitivity taking into account the value and susceptibility as described above. When determining overall visual sensitivity, it should be noted that the levels are indicative and fall on a scale from high to negligible and professional judgement is always used to determine the overall level of sensitivity.

6.1.23. Any visual receptors assigned a negligible level of sensitivity will not be further considered as part of the assessment on the basis that significant effects are highly unlikely as demonstrated by **Table 8.**

Level of visual sensitivity diagram

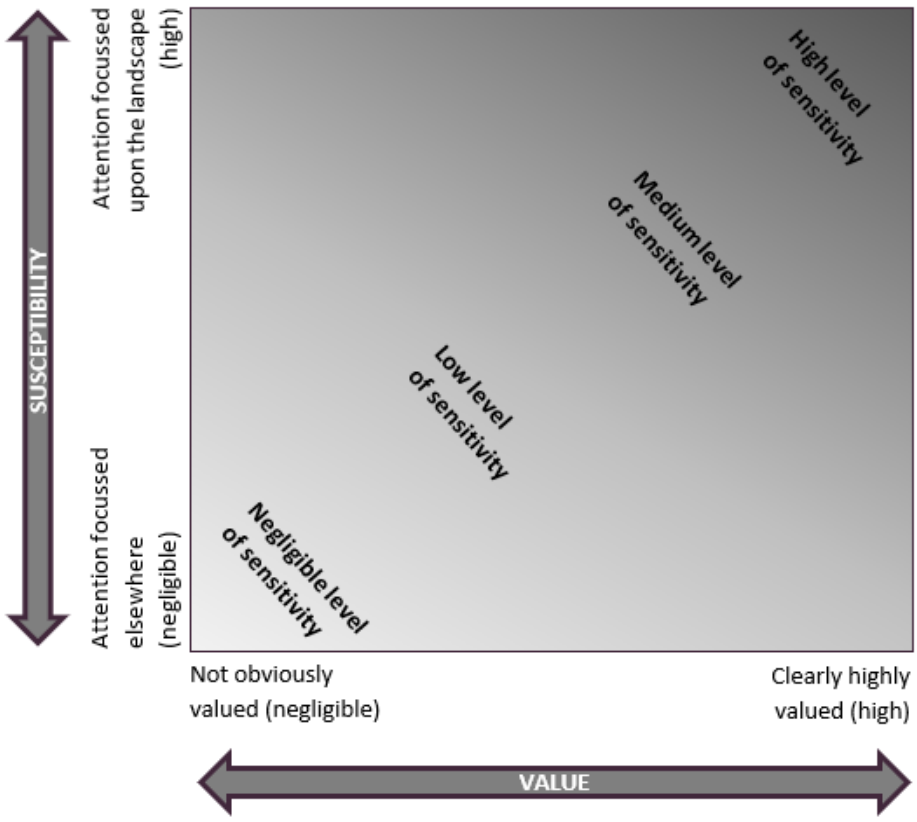

Figure 2 - Visual Sensitivity

7. ASSESSING MAGNITUDE OF CHANGE

7.1.1. The magnitude of landscape and visual change depends upon a combination of factors including:

- The size, scale and nature of change in relation to the context;
- The geographical extent of the area influenced; and
- Its duration and reversibility.

SIZE/SCALE OF CHANGE

7.1.2. The size / scale of change to the landscape and to visual receptors that would arise because of the DCO Proposed Development will take account of the following factors and as set out in **Table 5.**

Landscape:

- The extent of loss or alteration to key existing landscape characteristics and landscape fabric / elements and for designated areas – special qualities and / or purpose of designation;
- The proportion of total extent represented and the contribution this element makes to the landscape;
- The scale of the receiving landscape and whether it can absorb the DCO Proposed Development;
- The distance of the landscape receptor from the DCO Proposed Development; and
- The landscape context within which the DCO Proposed Development is located.

Visual:

- The scale of change in the view (addition or loss of features) and changes to its composition and depth of view;
- The degree of contrast or integration of new features or characteristics into the landscape considering form, scale, mass, height, colour and texture; and
- The nature of the view of the DCO Proposed Development, the time over which it will be experienced and changes in the experience from for instance full, partial, glimpsed to screened.

Table 1 - Scale of Change

Size/scale of change	
High	• Occupies a wide proportion of the view or would obstruct a significant portion of the view; • The DCO Proposed Development would become the dominant feature; and • Considerable change to the majority / many existing landscape elements and/or landscape character; fundamental changes to the surroundings and baseline to a large extent; very noticeable.
Medium	• Occupies much of the view but would not fundamentally change its characteristics; • Changes would be immediately visible but not a key feature of the view; and • Some change to existing landscape elements and /or landscape character; discernible changes to the surroundings of a receptor, such that its baseline is partly altered; readily noticeable.
Low	• Occupies a small portion of the view and would only slightly alter the view's composition; and • Small change to existing landscape elements and/or landscape character; slight, but detectable impacts that do not alter the baseline of the receptor materially; not readily noticeable.
Negligible	• Occupies little or no portion of the view and would not result in a change to the view's composition; and • Little or limited /no change in existing landscape elements and/or landscape character, barely distinguishable change from baseline conditions; not noticeable.

Geographical Extent

7.1.3. The geographical extent over which the landscape effects would be experienced and the geographical extent of the DCO Proposed Development in relation to visual receptors is also considered as set out in **Table 6**. This is distinct from the size and scale of effect.

7.1.4. The extent of landscape effects will vary depending on the nature of the DCO Proposed Development and not all the following scales may be relevant:

- At the site level, within the development site itself;
- At the level of the immediate setting of the site;

- At the scale of the landscape type or character area within which the DCO Proposed Development lies; and
- On a larger scale, influencing several landscape types or character areas.

7.1.5. In terms of visual effects, the geographical extent of the DCO Proposed Development will vary based on the location of the visual receptor and consideration will be given to:

- The angle of the view in relation to the main activity of the receptor and the main focus of the view;
- The distance of the visual receptor from the DCO Proposed Development; and
- The extent of the area over which the changes would be visible.

7.1.6. For visual receptors moving through the landscape (E.g., road and rail users) the length of the journey during which they would see the DCO Proposed Development is reflected in the judgement of the geographical extent of effects.

Table 2 - Geographical Extent of Change

Geographical Extent of Change	
High	The assessment location is representative of similar effects over an extensive geographic area. E.g., the change would influence multiple landscape types or character areas. The change would affect a large number of receptors and would have high influence on the perception of the landscape or view.
Medium	The assessment location is representative of similar effects over a moderate geographic area. E.g., the change would influence the landscape types or character areas within which the proposal lies. The change would affect a moderate number of receptors and would have moderate influence on the perception of the landscape or view.
Low	The assessment location represents a small geographic area. E.g., the change would influence the immediate setting of the site. The development would be perceived locally, with a minor effect on wider landscape character or views.
Negligible	The assessment location clearly represents a small geographic area. E.g., the change would influence the site level within the development site itself. The development would be perceived only locally, with a limited effect on wider landscape character or views.

Duration and Reversibility

7.1.7. Duration and reversibility are particularly important when considering the different stages of the project. As stated in GLVIA3 (paragraph 5.51) "*duration can usually be simply judged on a scale such as short term, medium term or long term*" and is defined in **Table 7**.

7.1.8. Reversibility (paragraph 5.52 of GLVIA 3) "*is a judgement about the prospects and the practicality of a particular effect being reversed in, for example a generati*on." Some forms of development are considered permanent such as housing developments, whilst others such as solar farms can be considered temporary or reversible since they have a limited operational life and can be removed and land reinstated. In the case of underground pipelines, they can be considered reversible in landscape and visual terms on the basis that the majority of the infrastructure is below ground and therefore not perceived within the landscape once construction is completed, and effects largely reversed following the construction stage. With regards to the AGIs and BVS these would be decommissioned and removed at the end of the operational life, but reference should be made to the proposed lifespan of the planning submission. If there are no proposals to limit the lifetime of the DCO Proposed Development (in perpetuity consent) the assessment will consider that the DCO Proposed Development would long term.

7.1.9. The effects during construction of the development are assessed as temporary and short term.

Table 3 - Duration of Change

Duration of Change	
High	Long term / 10 years +
Medium	Medium term / 2 to 10 years
Low	Short term / 1-2 years
Negligible	Brief term / <1 year

MAGNITUDE OF CHANGE

7.1.10. Like with sensitivity, combining the scale, geographical extent, and duration/reversibility of the change together requires careful consideration and professional judgement. As such, the LVIA will separately consider each aspect to form the judgement of overall magnitude. **Table 5 to Table 7** have demonstrated these individual judgements. The following **Figure 4 and Figure 5** illustrate how these are combined through a two-step process. First by considering size and scale together with the geographical extent in step one. The result of this provides a preliminary magnitude of change result.

Magnitude of change diagram: step 1

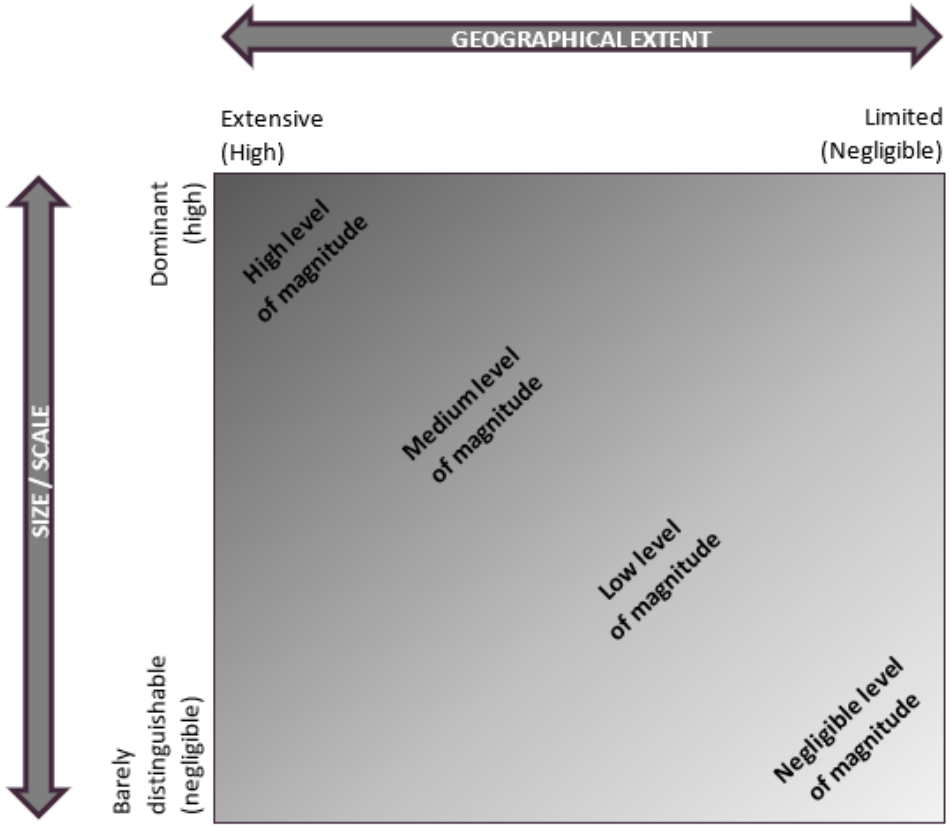

Figure 1 - Magnitude of Change Diagram: Step 1

7.1.11. As illustrated below in the diagram presented as **Figure 5**, for step two, the preliminary result from step 1 is then considered alongside the duration and reversibility which can either increase or decrease the rating accordingly. For example, a high magnitude of change could be reduced if this is only going to be experienced over a short period of time. This is typical of construction activities where they are both short term and of a temporary nature.

Magnitude of change diagram: step 2

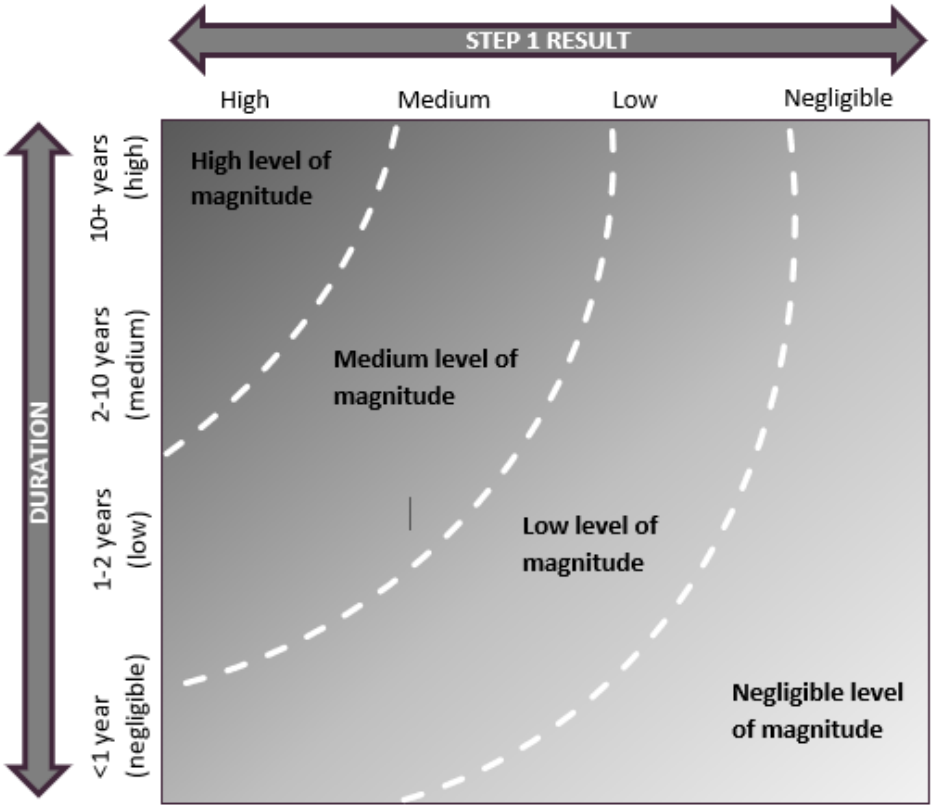

Figure 2 - Magnitude of Change Diagram: Step 2

8. LEVEL OF EFFECT AND SIGNIFICANCE

8.1.1. Combining the stated measures of magnitude and sensitivity indicates the relative importance of different effects. This, combined with an oversight of professional judgement, allows us to evaluate effects and to determine significance their significance.

8.1.2. **Table 8** provides general guidance on the inter-relationship between magnitude of change and sensitivity of receptor. However, this matrix is used as a framework and guide for consistency, not as a prescriptive formula: the level of effect and thus significance will vary depending on the circumstances, the type and scale of development proposed, the baseline context and other factors as set out in the previous sections. **Table 8 and Table 9**, below, gives typical descriptors of the levels of landscape and visual effects.

Table 1 - Significance Matrix

Significance Matrix					
		Magnitude			
		High	**Medium**	**Low**	**Negligible**
Sensitivity	**High**	**Major**	**Major or Moderate**	**Moderate**	Minor or Negligible
	Medium	**Major or Moderate**	**Moderate**	**Moderate** or Minor	Negligible
	Low	**Moderate**	**Moderate** or Minor	Minor	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

8.1.3. As set out in **Chapter 5 – EIA Methodology (Volume II)**, using professional judgement and with reference to the Guidelines for Environmental Impact Assessment (IEMA 2004) **(Ref. 8)**, the assessments within this chapter consider effects of moderate and greater level of effect to be significant (as shown in bold in **Table 8**) while those less than moderate to be non-significant.

8.1.4. For the purposes of proportionality and to ensure the effects that are significant are the key focus of this assessment, any landscape or visual receptors assigned a negligible level of sensitivity will not be further considered as part of the assessment on the basis that significant effects are highly unlikely.

8.1.5. Any receptors assigned an overall negligible level of effect at year 1 will not be further considered or assessed in year 15 on the basis that effects are highly unlikely to increase to a level of significance at year 15 given year 1 is considered to present the worst-case scenario at operation.

8.1.6. Similarly, provided there are no subsequent design changes since the PEIR stage that impact upon these receptors, those with effects assigned as not significant during either the construction phase or operation will not be further considered within the final ES. These will be considered as scoped out. This will allow a focussed and proportionate assessment considering only those receptors with the potential to be significantly affected. The PEIR stage assessment will remain within the relevant appendices for reference and completeness.

Landscape level of effect

8.1.7. Through the steps carried out above, the resulting landscape level of effect is established. **Table 9** below presents the scale for landscape effects and can be summarised in the following descriptions.

Table 2 - Landscape Level of Effect

Landscape Level of Effect	
Major	The DCO Proposed Development would result in major changes to landscape character and these would be considered significant.
Moderate	The DCO Proposed Development would result in moderate changes to landscape character and these would be considered significant.
Minor	The DCO Proposed Development would result in minor changes and these would be considered non-significant.
Negligible	The DCO Proposed Development would result in negligible changes to landscape character and these would be considered non-significant.

Visual level of effect

8.1.8. Through the steps carried out above, the resulting visual level of effect is arrived at. **Table 10** below presents the scale for visual effects and can be summarised in the following descriptions.

Table 3 - Visual Level of Effect

Visual Level of Effect	
Major	The DCO Proposed Development would result in major changes to visual receptors and these would be considered significant.
Moderate	The DCO Proposed Development would result in moderate changes to visual receptors and these would be considered significant.
Minor	The DCO Proposed Development would result in minor changes to visual receptors and these would be considered non-significant.

Visual Level of Effect	
Negligible	The DCO Proposed Development would result in negligible changes to visual receptors and these would be considered non-significant.

Nature of effect

8.1.9. Effects can be either beneficial or adverse and, in some cases, neutral (neither beneficial nor adverse).

8.1.10. The nature of effect of infrastructure on landscape character and visual amenity is very subjective, with a broad spectrum of opinion on the appearance of infrastructure in the landscape. Some people see infrastructure as sculptural features positively addressing the effects of climate change, whilst others regard them as alien and an industrialisation of the countryside.

8.1.11. The aim of the LVIA is to provide an objective assessment of the relationship between the DCO Proposed Development and the landscape in which it would be located and seen. As part of this it is also important to consider the nature of the proposed change in the context of the key characteristics of the landscape. As large, engineered structures are being added to the landscape, it is unlikely that a beneficial nature of effect would be found, but neutral effects could occur where it is considered the DCO Proposed Development does not change the defining characteristics of the landscape.

8.1.12. For the purposes of this LVIA, and to ensure this LVIA assesses the reasonable worst-case scenario, the nature of all effects will be considered as adverse, unless otherwise identified through mitigation.

8.1.13. Other aspects of the DCO Proposed Development may have opportunities for beneficial landscape and visual effects, for example, where improvements are made to access and public rights of way or mitigation planting increasing biodiversity.

9. ASSESSMENT SCENARIOS

9.1.1. The effects of the DCO Proposed Development on receptors vary over time due to daily changes in light level, seasonal variation and over the longer term the maturing of essential mitigation planting. The following scenarios are assessed:

- Construction stage - Day: During construction assuming a maximum perceived change situation (i.e. when construction activity is at its peak) commencing in 2024 and lasting for 16 months);
- Winter (Year 1): A winter's day in the year that the DCO Proposed Development would be viewed from locations that are publicly accessible, occupied by residents and fully operational (i.e., with new planting in place but before any it has become established such as to become visually effective at screening or filtering or offering visual amenity benefits);
- Summer (Year 15): A summer's day in the fifteenth year after opening (i.e., when the planted essential mitigation measures can be assumed to be substantially effective) This is usually a reflection of the near fully mitigated scenario under normal conditions; and
- Decommissioning stage.

10. ASSESSMENT OF CUMULATIVE EFFECTS

APPROACH

10.1.1. GLVIA3 provides the basis for the cumulative assessment methodology. The assessment of cumulative effects is essentially the same as for the assessment of the stand-alone landscape and visual effects, in that the level of landscape and visual effect is determined by assessing the combination of sensitivity of the landscape or visual receptor and the magnitude of change.

10.1.2. A review of applications of a similar size and scale has been carried out to determine which applications within the planning system are included for assessment. These are be referred to as Cumulative Developments.

10.1.3. Receptors judged to receive a negligible level of effect from the DCO Proposed Development on its own are not considered for cumulative assessment on the basis that any significant effects arising will primarily be caused by the Cumulative Developments and unlikely to be contributed by the DCO Proposed Development.

10.1.4. Types of cumulative effect are defined as follows:

- Cumulative landscape effects: Where more than one development may have an effect on a landscape designation or particular area of landscape character. This may also include effects on the physical fabric of the landscape where one or more developments may affect landscape components; and
- Cumulative visual effects: Where the cumulative or incremental visibility of similar types of development combined generate a cumulative visual effect.

10.1.5. The Study Area and receptors remain as per the DCO Proposed Development assessment.

10.1.6. The methodology for the assessment of sensitivity remains the same as per the DCO Proposed Development assessment. The cumulative landscape and visual magnitude of change is determined with reference to the criteria set out above for the main assessment and the following considerations:

- The distance and direction to each visible or potentially visible Cumulative Development;
- The number of visible or potentially visible Cumulative Developments;
- The distance between Cumulative Developments and the DCO Proposed Development;
- The height of features at each Cumulative Development;
- The horizontal extent of the view occupied by Cumulative Developments;
- The vertical scale comparison of Cumulative Developments; and

- Duration of the change of Cumulative Developments.

10.1.7. Determination of the significance of cumulative landscape and visual effects is undertaken by employing professional judgement to combine and analyse the cumulative magnitude of change against the identified sensitivity to change. It should be noted that the cumulative assessment is the result of the addition of the DCO Proposed Development to the identified cumulative baseline scenario.

10.1.8. The results of the cumulative effects assessment is presented in **Chapter 19 - Combined and Cumulative Effects (Volume II).**

11. VISUAL REPRESENTATIONS

11.1.1. The methodology for undertaking ZTVs and preparing visual representations is compliant with relevant sections of:

- Visual Representation of Development Proposals, Technical Guidance Note 06/19', Landscape Institute (LI), 2019 (**Ref. 3**); and
- Guidelines for Landscape and Visual Impact Assessment' Third Edition, Landscape Institute and the Institute of Environmental Assessment, 2013 (GLVIA3) (**Ref. 1**).

11.1.2. The LI guidance provides detail on maintaining a proportionate approach to visualisations, providing advice on selecting visualisation types taking into account the intended purpose, anticipated users, planning stage, sensitivity of the context, and indicative overall level of effect. This is helpful in consideration of responding to stakeholder and public requests where it may not always be appropriate to produce the full suite of visualisations.

ZONES OF THEORETICAL VISIBILITY

11.1.3. ZTVs are used to identify the theoretical visibility of a DCO Proposed Development. It is a computer-generated analysis which evaluates visibility using the height and extent of a DCO Proposed Development against a digital terrain model.

11.1.4. ZTVs are produced using Geographic information System (GIS) software (ESRI ArcGIS). During the PEIR stage, coordinates of the Proposed Development were input into GIS and a selection of max heights including 3m, 6m and 9m (to represent the max height range of various features along the route) are assigned. As the design has developed, the maximum heights are limited to 4.5m for the electrical and instrumentation kiosks (E&I kiosks), and 5m for lighting columns and fan units (that sit 0.5m atop the E&I kiosks) at AGI and BVS sites only. OS Terrain Data 5 is used for the digital terrain model (known as bare earth data) which provides a suitable level of detail to produce the ZTV, in accordance with the above stated guidance. Built form and areas of tree planting data has been illustrated on the ZTV plans to aid the reader understand what is on the ground but the generation of visibility is based on bare earth ground alone. Observer height is set to 1.6m above ground level and the Earth's curvature and atmospheric refraction are taken into account.

11.1.5. The limitations with the preparation of ZTVs, as follows:

- The ZTV illustrates the 'bare ground' situation, and does not take into account the screening effects of vegetation, buildings or other surface features;

- The ZTVs are based on theoretically visibility from 1.6m above ground level; and
- The ZTV does not indicate the decrease in visibility that occurs with increased distance from the DCO Proposed Development. The nature of what is visible from 1 km away would be markedly different from what is visible from 5 km away.

11.1.6. These limitations mean that while the ZTVs have been used as a starting point in the assessment to determine where the DCO Proposed Development would be theoretically visible from, such information needs to be verified in the field to ensure that the assessment conclusions are accurate.

VISUALISATIONS

11.1.7. The necessity for photomontages from agreed viewpoints has been determined in consultation with Natural Resources Wales, Natural England, Flintshire Country Council, Cheshire West and Chester Council, and the Canals & River Trust. All photographs and visualisations have been produced in line with Landscape Institute Technical Guidance Note (TGN) 06/19 (2019); 'Visual Representation of Development Proposals'. Annotated photo-panoramas (to TGN 06/19 Type 1) or photomontages pf the DCO Proposed Development would be produced (to TGN 06/19 Type 3) **(Ref. 3)** for six viewpoints.

PHOTOGRAPHY FOR BASELINE IMAGES

11.1.8. The photographs are captured by the following method:

- A 50mm fixed lens on a DSLR camera with a full frame sensor;
- Tripod with a panoramic head;
- Camera positioned at 1.6m height at the centre of the lens although the camera height may have been different if features such as fences, or hedges obscured the view;
- Minimum of 50% overlap on panoramic photographs to minimise distortion when stitching the photographs;
- Portrait orientation photographs taken for viewpoints close to the DCO Proposed Development to ensure full vertical extent of the DCO Proposed Development is seen;
- At least a 180-degree panorama taken (where the viewpoint allows); and
- Grid reference recorded at each viewpoint location.

PHOTOGRAPHY FOR PHOTOMONTAGES

11.1.9. The photographs are captured by the following method:

- Where possible, the DCO Proposed Development will be positioned in the middle of the panorama. Photographs were taken in suitable weather conditions and ideally in clear visibility;
- The views will be photographed with a digital SLR camera with a full frame sensor and fixed 50mm lens. A Canon 6D Mark III will be used;
- The camera will be mounted in portrait format on a tripod with a panoramic head and levelling base attached. The lens centre (its nodal point) will be set at an eye level of approximately 1.6m although the camera height may have been different if features such as fences, or hedges obscured the view;
- The Camera's location will be recorded using a X, Y, Z coordinate from a surveying total station (accuracy of <10mm) with offset to account for the lens. Camera setup levelled in the horizontal and vertical planes using levelling plate and levelling centre column;
- Camera set to manual focus; ISO100-400 with an aperture set to record an adequate depth of field (F8-F11) and white balance set appropriately to conditions;
- The camera will be rotated between 15-20° to allow for a 50% overlap between each photograph;
- Images will be captured in High Resolution JPEG format which includes lens distortion correction; and
- The photography and surveying will be undertaken simultaneously in order to avoid problems with markers in soft ground moving or being removed altogether.

VERIFIABLE SURVEYING

11.1.10. The following techniques are used to verify the photomontages:

- A Leica Total Station is used by the surveyor to accurately record the camera position and also capture an array of selected survey reference points within the frame of the photographs, which are used to camera match and calibrate the photography. All survey points are captured in the British National Grid (BNG) co-ordinate system, recording an X, Y and Z co-ordinate for each;
- Each camera location is surveyed together with a series of clearly defined detail points within the image (E.g., corners of road markings, features on road signs, corners of building features etc). Where a viewpoint does not contain many or any fixed targets suitable for surveying, temporary targets are set up to allow the survey to be completed at the same time as the photography;
- Each image ensures a sufficient amount of clearly defined detail points are taken across the width of the image and at near, mid and far distance (i.e. a

balance of points across the photograph). Where possible these numbered between 8-12 points. Each detail point is given a unique number that related to the viewpoint number;

- The survey data is post-processed by the chartered surveyor to increase accuracy and then supplied in an Excel table for each set of viewpoint photography; and
- A CAD file is provided containing the detail points and camera positions.

MODEL ASSEMBLY

11.1.11. The following methods are used to assemble the 3D model:

- Surveyed X, Y, Z co-ordinates of reference points and the camera position are set up in 3D Studio Max;
- The 3D computer model of the DCO Proposed Development;
- The 3D computer model is georeferenced using supplied drawing data;
- Within the 3D software a virtual camera is set up using the coordinates provided by the verified survey surveyor and aligned with the reference markers;
- A lighting environment is set up within the 3D software, using the metadata stored in the image and also surveyor location data;
- A 3DS Max model file for each viewpoint is assembled before rendering. The assembled model contains the relevant DCO Proposed Development digital terrain model tiles and any structures, buildings or further elements (as defined above) that can be seen in the viewpoint.

CAMERA MATCHING

11.1.12. The following describes the process of ‘camera matching’ to create a virtual camera:

- The process of camera matching creates a virtual camera in the same location and height and pointing in the same direction as the physical camera used on site to capture the image;
- Each viewpoint has its survey points in place and the camera is set to the required field of view and view direction (generally, between 75-90°)’
- The process involves accurately positioning the 3D model of the Proposed Development within each existing view. This is achieved through a process of matching the surveyed points in the digitised image with those recorded by the survey team on the verifiable photographs;
- The survey points and specifications of the lens type relating to each view are also entered into 3DS Max;

- The survey points of the camera position and each clearly defined detail point (relating to specified objects in the view) are then highlighted on the digitised image;
- Once the process of camera matching is complete, the 3D model of the DCO Proposed Development is accurately positioned within each of the views captured. This is achieved by rendering the camera matched 3D model of the DCO Proposed Development within 3DS Max at the same size as the digitised existing view. The position is then checked and verified by the project Landscape Architect.
- To aid in greater accuracy of real-life camera settings and the production of cylindrical projection, wide angle panoramas which match the photography stitch, a plug-in programme called V-Ray are used. Each of the views are rendered using the V-Ray Rendering Engine software;
- Individual elements are rendered out using different map channels to create masks (for example mask for the digital terrain model, earthworks, fencing, shadows etc). These masks ensured each visible element of the Proposed Development could be independently selected when individually placed into the Adobe Photoshop file for final production.

PRODUCING THE PHOTOMONTAGE

11.1.13. The following describes the process of producing photomontage**:**

- The JPEGs of the verified photography are stitched into a panorama using PTGui software which provides an accurate planar or projection panorama as required. The resulting panorama is cropped to the required horizontal field of view and image size;
- At this stage panoramas are checked for acceptability by the project landscape architect;
- The renders of the 3D model are superimposed onto the baseline panorama in Photoshop. The foreground of the existing photos visible in front of the DCO Proposed Development are then carefully copied and masked to ensure the render of the 3D model sit accurately within the depth of the view. The compositing process involved digitally removing existing features such as trees that were within the extents of the DCO Proposed Development;
- The textured render of the 3D model is then further adjusted to match the resolution, colouring and saturation of the photograph captured to create an accurate impression of what the textured elements of the Proposed Development will look like;
- Soft landscaping is added in Photoshop to as accurately as possibly reflect how the Proposed Development would look during operation in the opening year and year 15, taking into account growth rates of any planting.

PHOTOMONTAGE PRESENTATION LAYOUTS

11.1.14. The following describes how each photomontage is presented:

- The standard Layout is A1 Landscape with a horizontal field of view of 90° with an image size of 820 x 250mm minimum (height as appropriate).
- Each view is annotated with specific camera and viewpoint information as required in TGN-06-19 Appendix 10.
- When printing there should be no scaling or fit to page options selected as this would alter the size of the image. A high-quality print setting with a minimum resolution of 300 dpi should be used.

12. REFERENCES

Ref. 1: The Guidelines for Landscape and Visual Assessment (GLVIA) Landscape Institute (LI) and the Institute of Environmental Management and Assessment (IEMA), 3rd Edition. (2013).

Ref. 2: An Approach to Landscape Character Assessment, Natural England. (2014).

Ref. 3: Visual Representation of Development Proposals: Landscape Institute Technical Guidance Note 06/19, Landscape Institute. (2019).

Ref. 4: An approach to landscape sensitivity assessment – to inform spatial planning and land management-Consultation Draft, Natural England. (2019).

Ref. 5: Assessing Landscape Value outside National Designations Technical Guidance Note 02/21, Landscape Institute. (2021).

Ref. 6: Google Earth [online] [redacted]

Ref. 7: Guidelines for Environmental Impact Assessment, IEMA. (2004).