Tuia Pito Ora
New Zealand Institute
of Landscape Architects

NZILA Visual Representation Guidelines - Post Review Group Feedback

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3 November 2026

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These draft guidelines were prepared by Rhys Girvan, Brad Coombs, Pen Moore, Alan England and Corey Murray following a call for expressions of interest through the NZILA. The authors gratefully acknowledge the review of the initial draft by Dave Mansergh, Gavin Lister, Paul Smith, Rachel de Lambert, Sam Bourne and Shannon Bray; the initial input of Kara Scott on behalf of Te Tau a Nuku (TTaN); and the oversight provided by Simon Button on behalf of the NZILA Board.

1. Purpose & Scope

1.1.1 These guidelines set out recommended practice for preparing, reviewing and presenting visual representations used in landscape assessment, design development, engagement and decision-making. They explain how the purpose, accuracy, assumptions and limitations of visual material should be established and communicated. Importantly, they distinguish visual material that may carry evidential weight when relied upon as Photo Simulations (or Visual Simulations) from other forms of visual representation.

1.1.2 These guidelines adopt the term 'Photo Simulation' for photograph-based representations of proposed landscape change. Photo Simulations form a key type of Visual Simulation, necessary to support a landscape assessment and accurately communicate how change may be experienced.

1.1.3 The guidance is principles-based so that it remains applicable as technology develops. It applies across consenting, plan-making, design development, engagement and other contexts in which visual material is used to portray existing, proposed or potential future landscape conditions and change. This may include change derived through accurate digital models as well as representing realistic scenarios, such as vegetation change or other environmental processes including projected climate change or sea-level rise.

1.1.4 The guidance also recognises the increasing reliance on screens, including for online hearings, digital engagement and remote collaboration, as a primary means by which people view and interpret visual material, including the use of Photo Simulations.

1.1.5 Landscape is experienced over time through multiple senses and through relationships between people and their environments. Photo simulations are therefore one component of a wider suite of landscape assessment tools. This guideline provides guidance on their accurate preparation and interpretation, including how they can be distinguished from other forms of visual representation including photo simulations used to support technical analysis.

1.1.6 In summary, these guidelines are intended to:

a) Support transparency and repeatability across projects and teams.

b) Enable fair interpretation by non-technical audiences while remaining robust for expert review.

c) Clarify the information that should accompany Photo simulations so that its accuracy, limitations and appropriate use can be understood and evaluated by others.

d) Encourage proportionality, with the level of technical effort scaled to the purpose of the visual material and the risk and significance of the matters being considered.

1.1.7 These guidelines are intended to update and supersede NZILA's Best Practice Guide 10.2: Visual Simulations (2010) and should be read alongside Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines (2022). They provide technical guidance on the preparation, verification and presentation of visual material that supports the wider landscape assessment approach described in Te Tangi a te Manu. This includes consideration of developments in digital modelling, image processing and the ways visual material is presented and experienced.

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1.1.8 Ultimately, the guidelines support professional judgement. Following them does not, by itself, establish that an image is accurate, determine the weight to be given to it, or establish the acceptability of the proposal it depicts. Those matters depend on the material, its intended use and the circumstances in which it is considered.

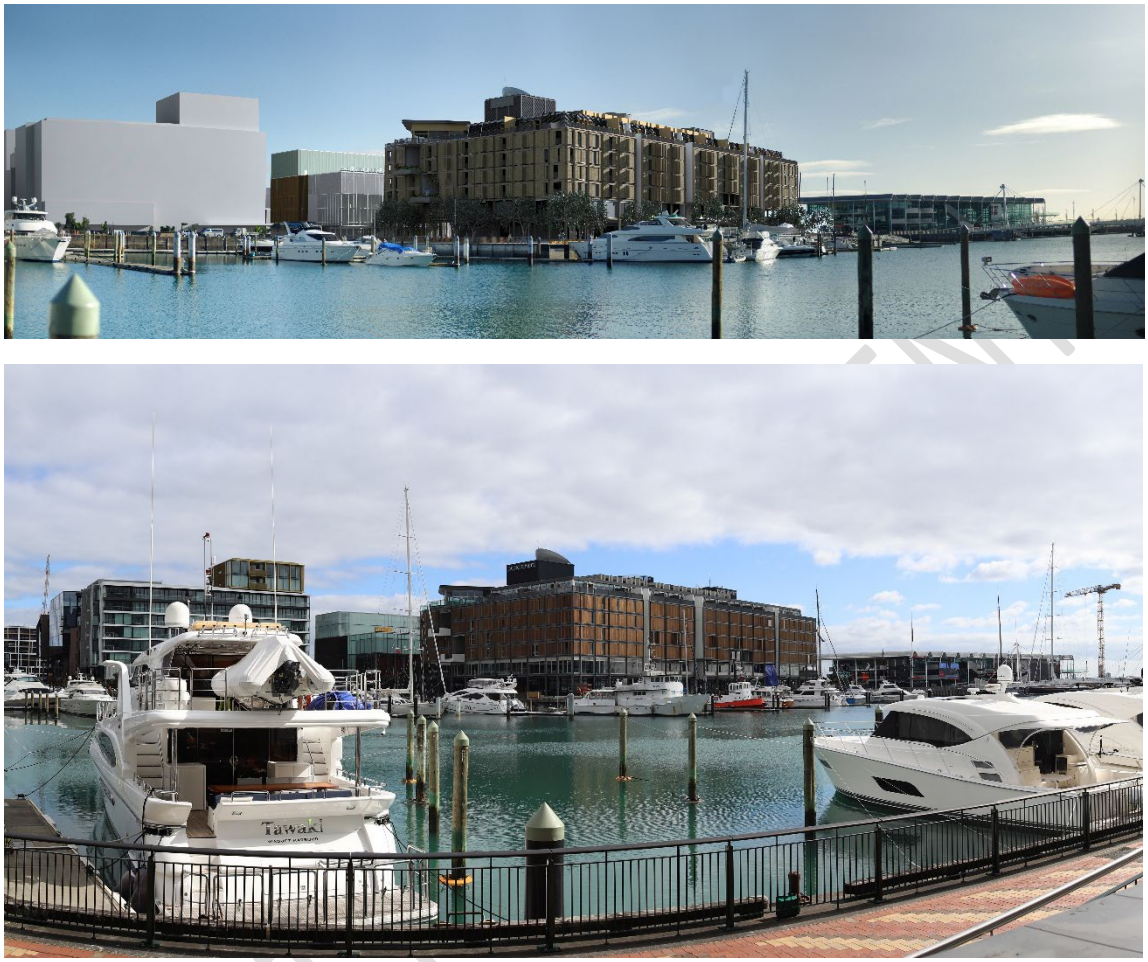


Image 1: Photo Simulation and Completed View of Park Hyatt in Auckland (Credit Boffa Miskell)

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2. Core principles

2.1.1 The preparation and presentation of Visual Simulations should be guided by clear principles that support confidence in the visual information being relied on for assessment, decision-making, or evidence. These principles are intended to apply when tasked with preparing or presenting Visual Simulations, including photography, photomontage, preparing and aligning three-dimensional modelling and rendering as well as other forms of animation, augmented reality, virtual reality and other emerging technologies.

Fitness for purpose: Identify the question the material is intended to address and select a method capable of addressing it. Not all projects require the same level of technical detail.

Accuracy and verification: Establish and check the geometry and other attributes on which the interpretation depends. Identify uncertainty that could materially affect that interpretation.

Transparency and accountability: Identify the sources, assumptions, processing and checks. Retain the records needed for review and identify those responsible for preparation and checking.

Fair Representation: Visual Simulations should neither exaggerate nor downplay effects. Select viewpoints, scenarios, framing, lighting and appearance to explain the relevant landscape change fairly. Material exclusions and simplifications should be disclosed.

Accessible presentation: Provide labels and viewing instructions that enable the intended audience to understand the material and its limitations. Check the delivered format as well as the production file. Assume many viewers will see material presented at scales for printing on paper on screens of varied size and quality.

Respect for people and place: Address access, privacy and the appropriate use of culturally sensitive imagery and information throughout the work.

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3. Definitions (plain language)

3.1.1 These definitions support consistent language and clarify how terms have been used in these guidelines and may be relevant when considering the evidential weight of Photo Simulations.

Artist Impression / Illustrative View: Visual material that illustrates design intent, location or change but is not fully geometrically verifiable (for example concept renders, illustrative montages, indicative model).

Aspect ratio: describes the proportional relationship between the width and height of an image (for example, 3:2, 4:3, or 16:9)

Augmented Reality: the insertion of selected computer-generated objects into views of the real world via tablet, smartphone or headsets.

Bulk and Location Diagrams: A simplified view showing the location, scale, height, extent and overall massing of proposed development.

Digital Elevation Model (DEM): is a digital dataset representing the elevation of the earth's surface, typically as a grid of height values used to model terrain and landform.

Digital Surface Model (DSM): is a digital model of surface elevations, including both the ground and above-ground features such as vegetation, buildings, and structures.

Entrance pupil: The lens as it appears when viewed from the front. Its centre provides the rotation point for panorama photography to minimise parallax between overlapping images.

Field of regard: The total extent of the surroundings a viewer can see by looking around and turning their head or body from a given position.

Field of View (FOV): The angular extent of a scene represented within an image, expressed as horizontal and vertical angles (HFOV and VFOV).

Georegistration (georeferencing): Registering models, imagery and plans to a common coordinate reference system.

Ground control points (GCPs): Surveyed points used to fix x, y, z positions for photogrammetry, LiDAR or model alignment.

Intervisibility: the ability to see in a direct line of sight from one point on the earth's surface to another, with no intervening terrain or obstacles obstructing the view.

LiDAR: (laser imaging, detection, and ranging): A remote-sensing method that uses laser measurements to determine distances and derive spatial information, commonly recorded as a point cloud.

Method Statement: documentation explaining the processes used in preparing a Photo Simulation, citing industry guidelines where appropriate.

NZTM 2000: New Zealand Transverse Mercator 2000 Projection. The current preferred map projection for geospatial data.

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NZVD 2016: New Zealand Vertical Datum 2016. The current preferred vertical datum for geospatial data.

Occlusion: A depth cue in which a nearer object partially or completely blocks the view of an object behind it, indicating their relative position in space.

Panorama Photograph: A photograph comprising a wide field of view, typically created by stitching together two or more overlapping images captured from a single viewpoint.

Parallax: The apparent change in the relative position of objects at different distances when the observer's viewpoint changes.

Photomontage: A composite image made by combining photographs or photographic elements. In practice, the term is used inconsistently and can be confused with evidential Photo Simulations; use it cautiously and define it if used.

Photo Simulation: A type of visual simulation that uses a photograph of the existing landscape as its base, with proposed changes inserted accurately in terms of scale, position and perspective.

Point clouds: A set of points with three-dimensional coordinates, sometimes including attributes such as colour, intensity or classification.

Reading distance: The distance from the viewer's eye to an image specified for its projection and reproduction dimensions. The specified viewing distance enables reconstruction of the scale and perspective geometry seen at the viewpoint.

Viewpoint (VP): The camera or eye location. Record coordinates, height above ground, orientation, tilt and date/time.

Virtual Reality: the creation of a fully immersive computer generated environment, most often viewed via a headset.

Visual Representation: The umbrella term for visual material used to communicate a place, proposal or scenario, including photographs, drawings, maps, diagrams, simulations and interactive media.

Visual Simulation: A representation of how proposed landscape change may appear, constructed using spatially accurate inputs and defined viewing parameters. This includes Photo Simulations, fully modelled views, animations and immersive representations.

ZTV or Viewshed (Zone of Theoretical Visibility): Mapped area from which the proposal may be theoretically visible based on terrain and, if included, surface features.

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4. Digital data and model inputs

4.1.1 The reliability of a Photo Simulation depends on the quality and suitability of its inputs. This requires practitioners to identify the data available, understand its resolution, coordinate reference system and limitations, and assess whether it is appropriate for the intended purpose.

4.2 DATA SOURCES

4.2.1 Several data sources are available in New Zealand for use in preparing Photo Simulations and viewshed maps. Data may describe terrain, surfaces, vegetation or structures, and can come from central government (LINZ), local councils, clients, or consultants. Common types include:

- Contours: lines joining points of equal height. Usually provided as a CAD or GIS file on a known coordinate system.
- DEM (Digital Elevation Model): A digital representation of elevations. Terminology varies between providers; identify whether a dataset represents bare ground or a surface including objects above ground. Typically supplied as tiles of raster data.
- DSM (Digital Surface Model): A 3D model of a visible or measured surface including ground (where present), trees, buildings and structures. Typically supplied as tiles of raster data.
- DTM (Digital Terrain Model): A 3D model of "bare ground" terrain, with buildings and vegetation excluded as far as the source data and processing allow. Typically supplied as tiles of raster data.
- Point Cloud: a 3D dataset of points captured by LidAR or photogrammetry. Each point contains XYZ coordinates (and sometimes RGB colour).

4.2.2 When preparing Photo Simulations, practitioners must identify the nature of available data and consider the limitations of available data sources to ensure the resultant accuracy and reliability of the final output is clear.

4.3 DATUMS & PROJECTIONS

4.3.1 To accurately prepare and position models necessary for Photo Simulation, input data such as parcel boundaries, viewpoint locations and building platforms must be on an XYZ reference system. X and Y are generally quoted in metres (and referred to as Eastings and Northings) and require the use of a "map projection". Z (or elevation) is also expressed in metres and requires a "geodetic datum".

4.3.2 There are several map projections used in NZ but the most used one is the NZ Transverse Mercator 2000 Projection. Drawings or coordinates may be supplied in other map projections such as:

- NZ Circuit 2000 (there are 29 meridional circuits covering NZ)
- NZ Circuit 1949
- NZ Map Grid

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4.3.3 If possible, data should be provided on the NZTM 2000 Projection. However, alternative map projections may also be used. The projection should be stated in the documentation.

4.3.4 NZ uses a geodetic datum called NZGD 2000. While latitude and longitude on the Earth's surface are measured using geodetic datums, elevations and depths are measured using vertical datums.

4.3.5 NZ's vertical datum is NZVD 2016 and should be used where possible however alternative datums may also be used. Examples of alternative datums are:

- Auckland Vertical Datum 1946
- Moturiki Vertical Datum 1953

4.4 MODEL INPUTS

4.4.1 Data sources other than terrain related data will also be required to prepare a Photo simulation. This data will also need to be provided on a recognised coordinate system; if this differs from other data sources it will need to be geographically reprojected to match. Examples of other data inputs are:

- CAD Models (in various 3D software formats such as DWG, FBX, 3DSMax)
- BIM Models (typically RVT (Revit) format)
- 2D Plans and Elevations (that may require drafting into a 3D format)
- GIS and survey data (parcel boundaries, fencelines, building footprints)

4.4.2 Where data is used for Photo Simulations, it is important that the design revision, model date, units and transformations are recorded.

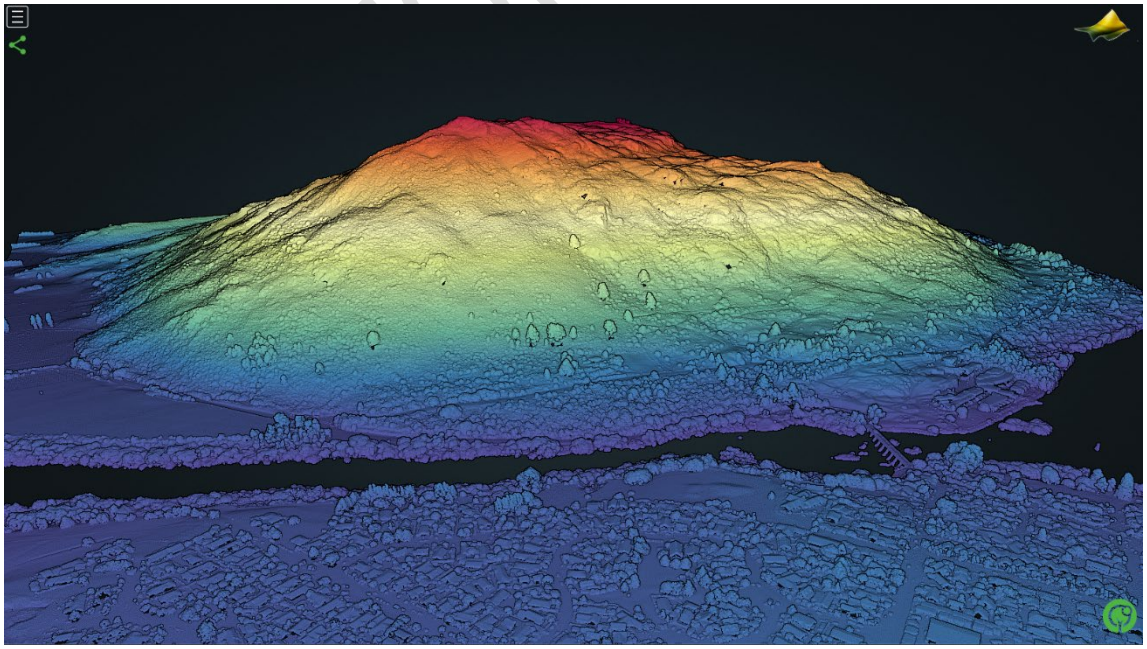


Image 2: LiDAR Point Cloud of Peninsula Hill Queestown (LINZ)

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5. Viewshed Analysis

5.1.1 Viewshed Analysis is also referred to as the "Zone of Theoretical Visibility" (ZTV). This is a digital technique using terrain ("bare ground") or terrain and surface ("above ground") data to identify the intervisibility of a proposed development. For the type of data available in New Zealand please refer to the section on Data Sources. The outputs are typically prepared as overlays to basemaps and provide a useful basis on which to guide the selection of possible viewpoints.

5.1.2 It must be emphasised that ZTVs are not of themselves a tool for the assessment of landscape and visual effects. ZTV maps indicate areas from where an activity or project may be visible within a defined study area; they do not and cannot show how a project will appear, nor do they indicate the nature or magnitude of visual effects.

5.2 USE OF HEIGHT DATA

5.2.1 The accuracy of ZTV maps is necessarily limited by the resolution of the digital height data used. For example, using an 8m resolution DTM as the height data source will return cruder results than from a 1m resolution DTM. Similarly, where DSM (above ground) data is used, this will include the height of vegetation or buildings present at the time of data capture, which may differ from the current heights or extent of vegetation. In some cases, DTM and DSM data can be edited or merged to produce a hybrid digital surface. Relying on bare earth models as the primary basis of ZTV helps avoid 'false negatives' from relying on vegetation which does not result in a complete screen and thereby potentially dismissing potential viewpoint locations where visual effects may indeed occur. Terrain-only and surface models answer different questions. Neither should be described as an infallible visibility envelope.

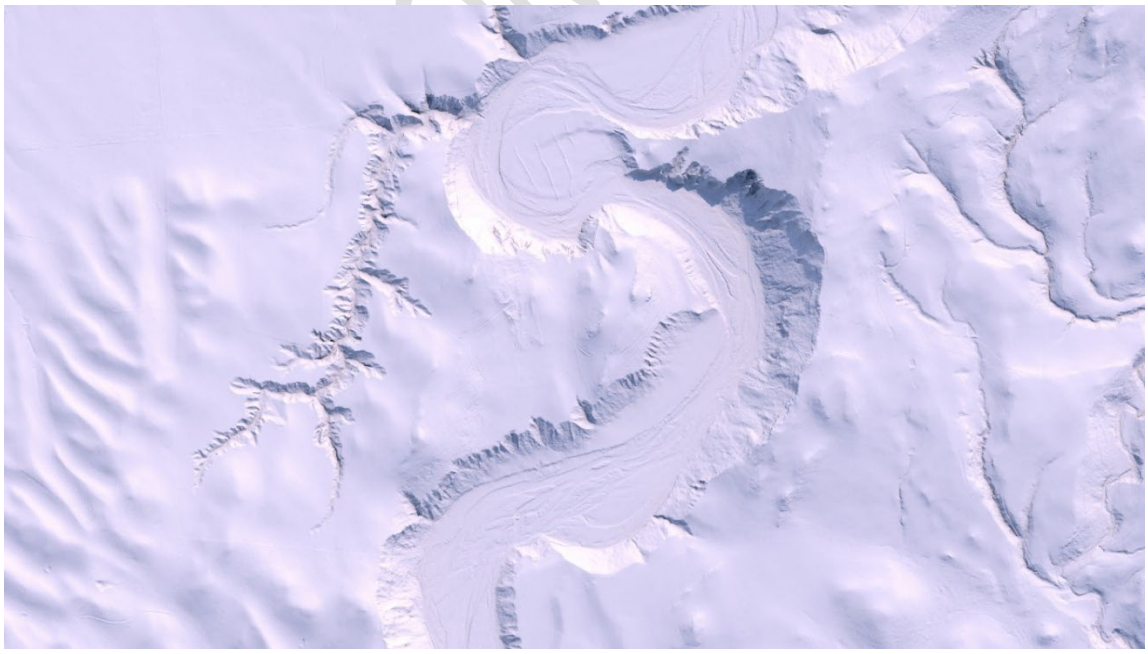


Image 3: 1 metre Digital Elevation Model (DEM) (LINZ)

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5.3 EARTH CURVATURE AND REFRACTION

5.3.1 Accounting for earth curvature and atmospheric refraction ensures that viewshed analysis reflects real-world visibility over longer distances. Incorporating these factors adjusts line-of-sight calculations. Not accounting for the earth's curvature can result in overestimating visibility beyond several kilometres. Conversely, atmospheric refraction slightly bends light downwards, partially offsetting curvature effects, and is typically modelled using a standard coefficient to provide a realistic balance.

5.3.2 Earth curvature and atmospheric refraction should also be considered when preparing and aligning three-dimensional models for Photo simulations, particularly over longer viewing distances. Where these factors materially affect apparent position, height or visibility, they should be accounted for in matching the model to the photograph. The method statement should identify how the software treats curvature and refraction, any assumptions adopted, and any material limitations.

5.4 CUMULATIVE VIEWSHED ANALYSIS

5.4.1 In locations where there are additional built or consented developments within the visual catchment, it may be necessary to run additional ZTVs to assess their intervisibility and potential cumulative effects. If multiple ZTVs are displayed on the same map, consideration should be given to legibility.

5.4.2 When presenting ZTV outputs, all input parameters including height data sources, observer and target heights should be clearly stated, along with confirmation of the use of earth curvature and atmospheric refraction parameters. Any limitations of the data or software should also be identified.

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Image 4: Zone of Theoretical Visibility including cumulative effects (multiple layers)

6. Viewpoints

6.1.1 Viewpoints are representative locations selected from where a proposed activity or development may be visible. Accordingly, the selection of viewpoints is necessarily drawn from a larger set of available views. They represent those locations likely to result in changes in view and therefore inform landscape effects. It must be emphasised that representative viewpoints are just that, a specific view, and effects are not limited to those locations. On the other hand, such viewpoints are often selected to illustrate where the greatest visual impacts and consequent change in views may occur.

6.1.2 When obtaining viewpoints for the purpose of assessing landscape effects, the locations selected are usually limited to publicly available locations. Through a landscape assessment process, public views may be supplemented by views obtained from private property. A restriction of access to private property should not usually impede this process, however private views may be given different statutory weight. Photo Simulations requiring access from private property are prepared with the agreement of the property owner.

6.1.3 The selection of viewpoints requires professional judgement, recognising that their purpose is to address the landscape matters relevant to the assessment. For substantial applications it is helpful to agree a common set of representative viewpoints with other landscape assessors involved with the project (such as a council peer reviewer). The reasons for selecting particular viewpoints, and any limitations in their representativeness, should be explained when interpreting them and reaching conclusions about landscape effects. The following types of location are commonly relevant when selecting representative viewpoints:

- Settlements
- Edges of urban or suburban areas
- Entrance / exits to public places
- Town squares, gathering spaces
- Public amenities
- Main roads/intersections
- Places of assembly
- Marae
- Burial grounds (public or urupā)
- Reserves
- Views from the sea, rivers and lakes
- Walkways/cycleways

6.1.4 Viewpoint selection should consider multiple-owned Māori land, papakāinga and ancestral whenua, including land without existing dwellings. Engagement with mana whenua and landowners or trustees should identify important views to maunga and other tūpuna whenua, including from potential future papakāinga. Māori Land Court mapping can assist identification but does not replace engagement.

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6.1.5 Photo simulations should include all relevant viewpoint information. Sufficient data should be recorded so that a third party could navigate to the location for the purposes of independent verification and assessment. As a minimum this should include:

- Coordinates (Easting and Northing) and Map Projection
- Ground Elevation
- Eye Height (height of camera)
- Date and time of photography

6.2 ENVIRONMENTAL INFLUENCES

6.2.1 The timing and conditions in which photography is obtained will influence visual representations and Photo Simulations. In practical terms, fieldwork requires suitable weather and viewing conditions, including consideration of sun position, cloud cover and, for night-time photography, the phase of the moon. Seasonal and weather conditions can also influence what is visible through changes in vegetation, atmospheric clarity, haze and light. Where viewpoints are located from the air or on the sea, additional consideration should be given to atmospheric visibility, glare, movement of the vehicle and the clarity of the horizon. Where adverse or atypical weather is encountered, this should be considered in relation to the conditions in which the relevant viewing audience is likely to experience the landscape, recognising that weather is itself a dynamic part of the landscape or seascape. As a general principle, photography should be obtained in good, clear and representative viewing conditions wherever reasonably practicable.

6.3 PRIVACY

6.3.1 When obtaining and publishing photography for public engagement or other professional purposes, landscape architects must comply with the Privacy Act 2020 where images contain personal information. Personal information is information about an identifiable individual and may therefore include a photograph in which a person can be recognised or otherwise identified. Photographing people in a public place is not in itself prohibited; however, where photography is undertaken in a professional capacity, the collection of personal information must be necessary for a lawful purpose connected with that professional activity and be undertaken lawfully, fairly and without unreasonable intrusion. Where an image contains personal information, it should generally only be used or disclosed for the purpose for which it was obtained, unless an exception under the Privacy Act 2020 applies. Where identifiable people or other identifying information are incidental and unnecessary to the purpose of a published image, they should, where practicable, be avoided or obscured before publication.

6.4 HEALTH AND SAFETY

6.4.1 Fieldwork, including accessing viewpoints and obtaining photography, must be undertaken in accordance with the Health and Safety at Work Act 2015 and relevant organisational health and safety procedures. Appropriate risk assessment and safe working practices should be followed having regard to matters such as traffic, terrain, weather, water, working at night, private or restricted land, and other site-specific hazards. The selection or replication of a viewpoint should not require a person to place

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themselves at unreasonable risk. Where a viewpoint cannot be safely accessed, an appropriate alternative should be used and any material difference in location or view clearly identified.

7. Human vision and perception

7.1.1 Visual experience involves both eyes, changes in attention, and movement of the eyes, head and body. Fine detail is resolved most effectively near the direction of gaze, while peripheral vision contributes to awareness of the wider scene. A single image does not reproduce this changing experience.

7.1.2 Interpretation is also influenced by context, familiarity, lighting, contrast, movement and the other sensory and associative aspects of landscape. Geometric agreement between an image and a viewpoint does not ensure an identical perceptual experience.

7.1.3 Visual representations should therefore provide sufficient context and detail for their purpose, use appropriate viewing arrangements, and explain material limitations. No single photographic field of view or focal length should be prescribed solely on the basis that it reproduces human vision.

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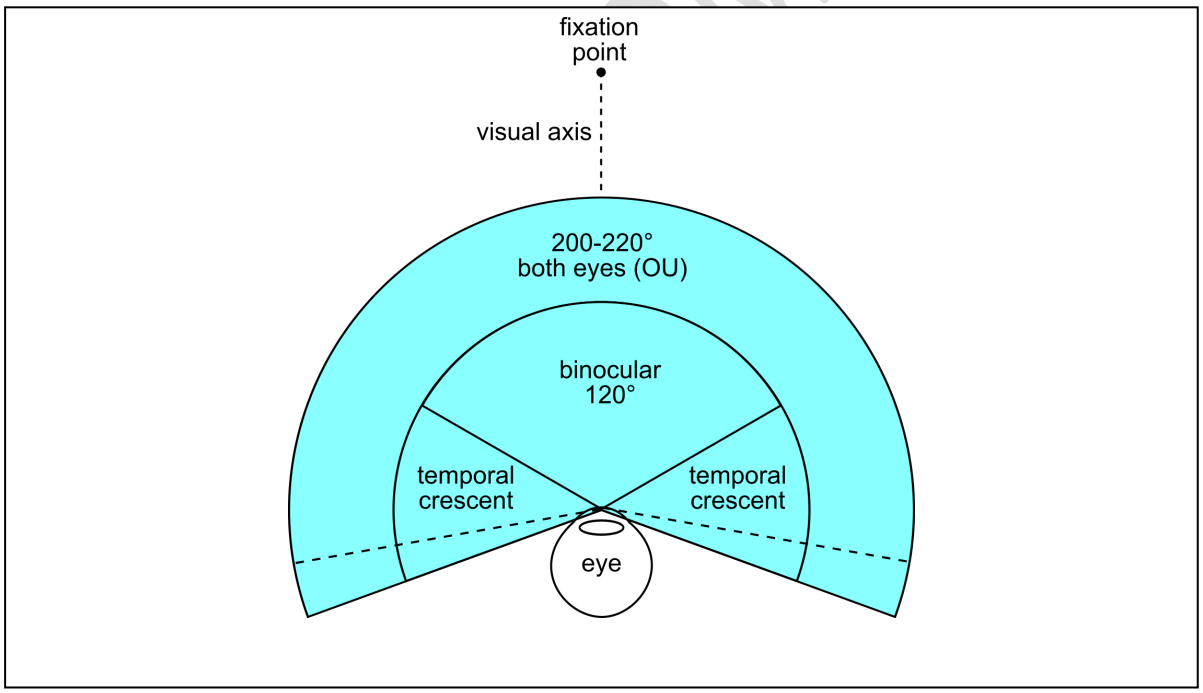


Image 5: Field of View

8. Equipment

8.1.1 The equipment necessary for creating Photo simulations is guided by two interconnected goals:

- First, to strive for the best possible accurate and realistic portrayal of proposed landscape changes; and
- Second, the equally critical need to understand, document, and transparently disclose the technical attributes and inherent limitations of the equipment and methodologies used.

8.1.2 The primary goal is the commitment to accuracy and realism. Photo simulations should accurately represent location, scale, and general appearance, from human perspective. It is therefore vital to understand, document, and clearly identify the technical aspects, software used, and any relevant data, limitations, or assumptions made. This is crucial for transparency and to allow the rationale to be open to scrutiny, enabling others to test and confirm the accuracy and credibility of the resultant Photo simulation.

8.1.3 Knowledge of the limitations of the technology is required. For instance, accompanying information should include all relevant viewpoint information, including camera and photographic data, and any other information necessary including data incorporated into the digital 3D model for the viewer to understand the basis for georeferencing and any limitations of parameters used. For example, the characteristics and limitations of actual or virtual camera lenses, particularly regarding focal length which affects field of view and can introduce distortion (especially with wide-angle lenses) as well as 3D data including GPS should be understood and documented.

8.1.4 To optimise resolution and reduce the potential for distortion when capturing Photo Simulation photography, it is important to fix and record the precise camera location in space where possible, typically with a tripod. A tripod with a levelling base may be paired with a panoramic or geared head that allows rotation about the entrance pupil so that stitched frames minimise parallax error. Typically, the height of the lens would replicate human eye height. GPS locations will have a degree of accuracy that can be supplemented with survey information and mitigated by understanding the concept of diminishing effects over distance.

8.1.5 Photo capture should aim to represent the scene as closely as practicable to how it is perceived by the human eye. This requires minimising photographic artefacts and distortions, such as depth of field, lens flare, colour or white-balance shifts, and motion blur, through appropriate composition, exposure and balancing of aperture, shutter speed, ISO and white balance.

8.1.6 Consumer devices such as smartphones or tablets can be useful for site familiarisation, scoping, or informal engagement, and may also be suitable for Photo Simulations where their capabilities and limitations are well understood and appropriately managed. While phone cameras typically have small sensors, fixed lenses, and in-built processing that can automatically adjust distortion, colour, and tone, many newer devices allow these processes to be reduced or disabled and can capture images in RAW format. Where these devices are used for Photo Simulations, the camera position, height, orientation, field of view and relevant image processing should be documented. The resulting image geometry should remain capable of verification against suitable reference information.

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8.1.7 A crop factor is the ratio between the dimensions of a camera sensor and those of a full-frame (35 mm) sensor, and it influences the field of view recorded by a lens. While the physical focal length of the lens remains unchanged, a smaller sensor captures a reduced portion of the field of regard, producing a narrower field of view that is equivalent to using a longer focal length on a full-frame camera. For example, a 50 mm lens used on a camera with a 1.5× crop factor records the same field of view as a 75 mm lens on a full-frame camera. Crop factor does not alter perspective, depth relationships, or image geometry, which are determined by the camera position; it affects only the extent of the scene captured. When preparing photo simulations, crop factor should therefore be accounted for by using the full-frame equivalent focal length or the actual horizontal field of view when calculating image geometry and reading distance, ensuring the simulation accurately represents the intended view.

8.1.8 Consistent with the principles of accuracy and transparency, photography used for Photo Simulations should be obtained using cameras with known and stable optical characteristics. This includes well-defined focal lengths, calibrated or otherwise understood sensor characteristics, suitable optical quality, reliable geolocation where required, and appropriate methods for managing perspective distortion. Both interchangeable-lens systems and high-quality fixed-lens cameras may be suitable, provided their performance is understood, controlled and capable of being documented.

8.1.9 Where supplementary devices such as Unmanned Aerial Vehicles (UAVs) or smartphones are used, their configuration, limitations, and any sources of distortion (for example, wide-angle lenses or in-built processing) should be clearly understood and documented. The emphasis should be on selecting and operating equipment in a way that ensures accuracy, reproducibility, and transparency. The overriding principle is not the type of device used, but whether its outputs can be reliably calibrated, replicated, and defended, rather than relying on convenience or visual impression alone.

8.1.10 In addition to photography and survey equipment, UAVs or “drones” can be used to supplement available 3D data through photogrammetry and LiDAR, particularly in areas where resolution may be limited or where landcover has been subjected to change. When this is relied upon to prepare Photo Simulations, the use of ground control points to fix x, y, z positions of data obtained should be identified to ensure any potential drift in scale, orientation, or height has been adequately considered.

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9. Photo Simulations

9.1 USING PHOTO SIMULATIONS AS EVIDENCE

9.1.1 Photo Simulations can assist part of evidence to support a landscape effects assessment. Whilst the term photomontage is often used overseas and captures the essential process of overlaying accurate images involved, the term 'Photo Simulation' is more widely used in New Zealand and adopted in Te Tangi a te Manu. To ensure Photo Simulations provide an effective and useful assessment and communication tool, it should adhere to the following requirements:

- Remain as accurate as possible to assist in making well informed and balanced judgments;
- Follow transparent, structured and replicable procedures that enable others to test and confirm the accuracy and credibility of the simulations;
- Use techniques and explanations that best represent the project or scheme in it's true environmental context in a fair and reasonable manner;
- Adopt clear communication which can be easily understood by non-technical viewers.

9.1.2 Photo Simulations may be created to varying accuracies and specifications, depending on the nature of the brief and source data available. The following sections aim to clarify the components required to ensure Photo Simulations address relevant matters and highlight where potential limitations may occur.

9.2 TYPES OF PHOTO SIMULATION

9.2.1 Photo Simulations encompass a spectrum of techniques, ranging from wireframes and massing models through to fully rendered views. Each occupies a distinct role within assessment practice, provided it is anchored to accurately located viewpoints, accurate 3D models, and transparent methodologies. These attributes give simulations their evidential weight in statutory processes. By contrast, illustrative views may remain valuable for communicating design intent or engaging with communities, however they are not guaranteed to adhere to the technical standards recommended for Photo Simulations and may not be suitable for assessment evidence.

9.2.2 Photo Simulations can be created as either single-frame views or panoramas. single-frame view, captured using an appropriate and calibrated lens, provides a comparatively direct representation from a defined viewpoint without the additional processing associated with image stitching. Panoramas allow a wider field of view to be represented but introduce additional considerations associated with capture, projection and stitching. Either may be appropriate depending on the purpose and context of the simulation. The chosen method should be explained and justified, with any material limitations clearly acknowledged.

9.2.3 Photo Simulations may also be used to portray the staging and development of a project over time. Where relevant to understanding landscape or visual effects, consideration should be given to representing different stages, including construction, interim or partially completed states, the completed project, and longer-term conditions such as vegetation establishment, rehabilitation or other anticipated landscape change. This is particularly important where construction or interim stages may remain in place

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for an extended period or give rise to materially different effects from the completed project. Any simulated stage should clearly identify the point in time represented and the assumptions on which it is based.

9.2.4 The principle of ensuring a visual representation is fit for purpose acknowledges that more illustrative outputs may be acceptable for concept communication, while decision-making processes and assessment of landscape and visual effects require Photo Simulations that are accurately referenced, transparent, and capable of withstanding evidential scrutiny.

9.3 3D MODEL INPUTS

9.3.1 The reliability of a Photo simulation depends not only on the photography, but also on the accuracy and appropriateness of the 3D model inputs. Model geometry should be based on survey data and design specifications, ensuring that scale, location, and orientation can be independently checked. Where placeholder or conceptual geometry is used, this should be disclosed and explained as part of the methodology.

9.3.2 Materials, colours, textures and surface reflectance should be based on the proposal's specifications, physical samples or other identifiable references. Their depiction should account for the lighting and atmospheric conditions represented in the base photograph. Where finishes have not been determined, the assumptions used should be stated.

9.3.3 The level of colour control should be proportionate to its importance in the assessment. Where colour or reflectance could materially influence the findings, the references and methods used to control colour reproduction should be documented. These may include a neutral reference for white balance, a colour target for camera profiling, and calibrated and profiled displays. Such controls support consistency but do not remove variation arising from illumination, surface properties, printing or the viewer's display. Shadows, reflections and atmospheric effects should be consistent with the conditions represented.

9.3.4 Practitioners should clearly state the formats, data sources, and software used to create models, as well as any limitations or assumptions. This transparency ensures that others can evaluate and, if needed, replicate the process. The principle is that 3D models are not simply illustrations, but technical representations that must be prepared and presented with care, consistency, and accountability.

9.4 FIELD OF VIEW

9.4.1 Field of view describes the angular extent of a scene represented within an image, expressed horizontally and vertically. A view typically represents a selected portion of the full 360° horizontal view available from a viewpoint. This selection should show the proposal and sufficient surrounding context for the intended assessment. As explained in Section 7, human visual experience involves continual movement of the eyes, head and body and cannot be directly equated with a single photographic frame.

9.4.2 Field of view should be selected together with the image projection, intended presentation size and viewing method. Wide panoramas can help explain the relationship between a proposal and its surroundings. Where the presentation format makes apparent scale or relevant detail difficult to interpret, they should be supported by narrower views or an alternative presentation at a suitable scale.

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9.4.3 Existing and proposed views intended for direct comparison should use the same projection, field of view, cropping and image dimensions. Comparable presentation parameters should also be used across viewpoints wherever practicable, with material differences explained. The final horizontal and vertical fields of view should be stated.

9.4.4 Aspect ratio describes the relationship between image width and height. Its relationship with horizontal and vertical field of view depends on the projection used. Where photo simulations are intended for screen first observation, select the aspect ratio deliberately and retain it when resizing images to avoid underusing portions of the available field of view or stretching or compressing the scene.

9.4.5 Field of view selection should remain deliberate, consistent, and transparently reported, so that the resulting images can be properly understood, assessed, and, where necessary, reproduced.

9.5 IMAGE PROJECTION

9.5.1 Image projection determines how the three-dimensional scene is represented within the resultant flattened two-dimensional image. It affects the geometry of the resulting view and the way it should be presented and interpreted. The projection used for each Photo Simulation should therefore be identified.

9.5.2 Rectilinear projection represents the scene on a flat image plane and preserves straight lines. Stretching towards the edges increases as the field of view widens and can become pronounced at around 120°. The practical field of view should be selected with regard to the scene, presentation size and intended viewing distance.

9.5.3 Cylindrical projection represents the scene on a cylindrical surface and can accommodate a wider horizontal field of view. In a level cylindrical panorama, vertical lines remain straight, while other straight lines generally become curved unless they lie on the horizon. Its viewing geometry differs from that of a rectilinear image and requires appropriate presentation instructions.

9.5.4 In immersive VR, field of view should be distinguished from field of regard. Field of view is the angular extent displayed to each eye at any one time. Field of regard is the wider virtual environment available as the viewer turns or moves, potentially extending around the full 360-degree environment.

9.6 WIDE ANGLE PHOTOGRAPHY VS PHOTO STITCHING

9.6.1 Creating a panorama for use as a base for a Photo Simulation can be done in a number of ways:

- Take a single photograph with a very wide-angle lens
- Take a series of photographs and digitally stitch into a single image
- Using a panoramic production mode using a smart device

9.6.2 For example, an uncropped rectilinear image captured across the 36 mm width of a full-frame sensor requires a focal length of approximately 18 mm to obtain a HFoV of 90°. While this is technically possible, an image captured with such a lens would typically also be subject to pronounced optical distortion and stretching toward the edges, which can compromise geometric accuracy and make later alignment with mapping or

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modelling data difficult. The preferred method for capturing a wide vista is to take a series of individual overlapping photos that can then be digitally stitched together to form a single continuous panorama.

9.6.3 Panoramas are often required to represent wide fields of view accurately, but the method used to create them has a direct impact on their reliability. Best practice is to capture a sequence of overlapping images (approximately 30% overlap) with a calibrated camera and lens mounted on a tripod, preferably with a panoramic head, and rotating about the lens' entrance pupil, then stitch them using software that applies rigorous geometric corrections. This approach maintains consistent perspective and alignment with survey data, ensuring the panorama can be matched to three-dimensional models without introducing distortion.

9.6.4 Automated panoramas can be produced on devices such as iPhones. These functions rely on algorithms that warp or blend images to create a seamless appearance. While mostly visually smooth, the process can compromise geometric accuracy by warping perspectives, shifting scale (horizontal and or vertical), and misaligning and or duplicated reference points. The result is a panorama that may be useful for scoping or informal illustration, but may be difficult to replicate, or rely on.

9.6.5 Where panoramas are prepared, the method used should be documented, including the type of camera, lens, support equipment, and stitching software. The rationale for using a stitched sequence over a single wide-angle frame should also be explained, with clear reference to the benefits of reduced distortion and more reliable vertical geometry. Any limitations of the panorama, such as minor blending artefacts or uncorrected seams, should be acknowledged in the accompanying methodology statement.

9.7 ALIGNING 3D MODELS AND PHOTOGRAPHS

9.7.1 The credibility of a Photo Simulation depends on accurately aligning digital models with geolocated photographs. Reliable alignment ensures that scale, position, and perspective are geometrically consistent with the real-world viewpoint. Practitioners should use georegistration, GCPs, and or survey data to confirm that a dependable match is achieved before rendering. Reference features should be distributed across the relevant image area and depths.

9.7.2 A clear record of alignment steps is essential for transparency and reproducibility. This includes documenting the camera position, lens details, survey reference points, and software processes used. Where alignment is uncertain or approximate, this should be declared, and the limitations of the simulation clearly communicated to ensure fair interpretation by decision-makers.

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Image 6: Aligning Survey data with photograph

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9.8 DEPICTION OF VEGETATION (REALISM, GROWTH RATE SCENARIOS)

9.8.1 Vegetation often plays a critical role in shaping how changes are perceived within a landscape. When represented in Photo Simulations, planting should be depicted with realistic scale, species characteristics, and seasonal condition. Practitioners should clearly state whether vegetation is newly planted, or at a projected growth stage. It may be that vegetation which is proposed as part of a project has been simulated vegetation outside the project area remains unchanged in the base photograph. Similarly, where vegetation is removed, and a view not otherwise available is shown, the basis through which this has been derived should be explained.

9.8.2 Growth scenarios should be based on reliable horticultural data and regional conditions rather than artistic choice. A transparent record of assumptions about species, planting density, and expected growth rates should be maintained, ensuring that both the short-term and long-term effects of planting are fairly represented in the simulation.

9.8.3 Seasonal variation should be considered when depicting vegetation where it may affect the visibility or perceived effects of a proposal. In particular, the potential for increased visibility through or beyond deciduous trees should be identified and, where material, represented. Where seasonal variation could materially alter the assessment, both leaf-on and leaf-off conditions should be represented, or the basis and limitations of depicting a single condition should be disclosed.

Image 7: Stage Growth Rates

9.9 NIGHT SIMULATIONS

9.9.1 Photo simulations prepared for night-time conditions should capture the specific challenges of low light, artificial lighting, and human perception in darkness. Where relevant, the goal of night time photo simulations is not only to illustrate visibility but to represent how lighting influences character, contrast, and potential effects on amenity.

9.9.2 Practitioners should ensure appropriate shutter speed, aperture, and exposure settings represent a fair and plausible night-time condition and control exposure/contrast. Simulated lighting effects should be modelled using realistic intensities, colour temperatures, and spill patterns, avoiding exaggeration or understatement. Simulations should clearly document parameters and acknowledge adaptation and their limitations, since human adaptation to darkness and varying weather conditions will always influence perception beyond what a photograph can show.



Image 8: Night-time photography existing and proposed photo simulation TBC (Credit Boffa Miskell)

9.10 TILT SHIFT LENSES

9.10.1 Tilt-shift lenses can be a valuable tool for reducing geometric distortion in base photography, particularly when tall or vertical structures are part of the scene. By controlling perspective, these lenses allow vertical lines to remain parallel rather than converging toward a vanishing point.

9.10.2 Tilt-shift photography can support the creation of stitched panoramas. By maintaining consistent vertical geometry across multiple frames, the risk of compounded distortion at image joins is reduced, and the resulting panorama can more easily align with survey and model data.

9.10.3 If tilt-shift lenses are used, the specific settings, calibration, and rationale should be documented as part of the methodology. Transparency ensures that the corrections are understood as technical measures to achieve geometric accuracy, not as stylistic adjustments, and that the resulting Photo Simulation can withstand scrutiny as an evidential product.

9.11 METHOD STATEMENT

9.11.1 A method statement is a key component of credible Photo Simulations, ensuring transparency and accountability. It should outline the data sources, survey control, modelling processes, photographic parameters, rendering methods, and assumptions that underpin the output. Without this record, it is not possible for others to test, replicate, or audit the simulation.

9.11.2 The statement should be clear, concise, and accessible, suitable for both technical peer review and non-technical readers. It should also note limitations and uncertainties, providing a balanced account of what the simulation does and does not show, for example; proposed change, mitigation planting and at what age, and manipulation or changes to the receiving environment. In doing so, the methodology statement reinforces the evidential integrity of the material and aligns with best practice internationally.

9.12 PRESENTATION (PRINTING, READING DISTANCE, ON-SCREEN)

9.12.1 The way a simulation is presented strongly influences how it is interpreted. Whether printed, displayed on screen, or viewed in immersive formats, outputs should maintain accurate scale and perspective. Clear guidance should be provided on the correct reading distance for printed material, ensuring that viewers can reconstruct the scale as it would appear in the field. The reading distance should be within a practical range, for example not beyond arms length, or too close. Accepted best practice with using Photo Simulations as a field tool it to present simulations which are at the correct scale when viewed at arm's length.

9.12.2 Reading distance is the distance at which a printed photograph or Photo Simulation should be viewed so that it accurately reconstructs the perspective experienced from the original camera viewpoint. It ensures that the apparent size, scale and spatial relationships of objects within the image match those of the real landscape. Reading distance is determined by the combination of the camera's field of view (or focal length) and the printed image size. If the image is viewed from too close, landscape elements will appear exaggerated in size; if viewed from too far away, they will appear reduced.

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9.12.3 For most landscape simulations, a comfortable viewing distance of approximately 300–500 mm is recommended, as this allows viewers to compare the simulation with the surrounding environment without difficulty. The reading distance for a rectilinear projected image is calculated using the formula:

Reading Distance = Image Width ÷ [2 x tan (Horizontal Field of View ÷ 2)]

9.12.4 Examples of calculated reading distances for centred rectilinear images:

Images Size	HFOV	Reading Distance
418 mm W	40°	574 mm
418 mm W	50°	448 mm
418 mm W	60°	362 mm
418 mm W	90°	209 mm
418 mm W	100°	175 mm
418 mm W	120°	121 mm

9.12.5 These examples apply to centred rectilinear images viewed flat. A short, calculated distance may be uncomfortable or impractical for some viewers. Select the field of view, image size and presentation method together. Options include a larger image, a linked narrower view, or a suitable curved or interactive presentation. No single distance is comfortable for everyone.

9.12.6 Presentation should also account for practical factors such as paper size, colour calibration, resolution, and digital compression. Where limitations are introduced by presentation format, these should be declared so that viewers understand what can and cannot be relied upon. High-quality presentation is a professional responsibility to ensure fairness, clarity, and integrity in decision-making contexts.

9.12.7 Where a Photo Simulation is intended to be viewed on screen at a defined apparent scale, provide the required physical image dimensions and viewing distance. A calibration bar of specified physical length can help viewers adjust the displayed image size. A document zoom percentage alone does not establish the correct scale. Enlarging an image may assist examination of detail, but changes its apparent scale at a fixed viewing distance and should be distinguished from viewing under the prescribed conditions. Where decisions have been made around presentation they should be included and noted. For example:

- Photo location (description / address, coordinates and height)
- Bearing
- Date and Time
- Photographer
- Camera used
- Lens used

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- Approximate age of simulation, for example 5 years of plant growth
- Any image processing applied at time of capture (panoramic processing)

9.12.8 By combining the above information, in conjunction with a detailed project description including drawings, a Photo Simulation may be independently verified for its accuracy.

9.12.9 When presenting Photo Simulations in PDF format, all care should be taken to maintain the original resolution. If file size is reduced, often image quality suffers, and can make simulations harder to use as an accurate or auditable assessment tool.

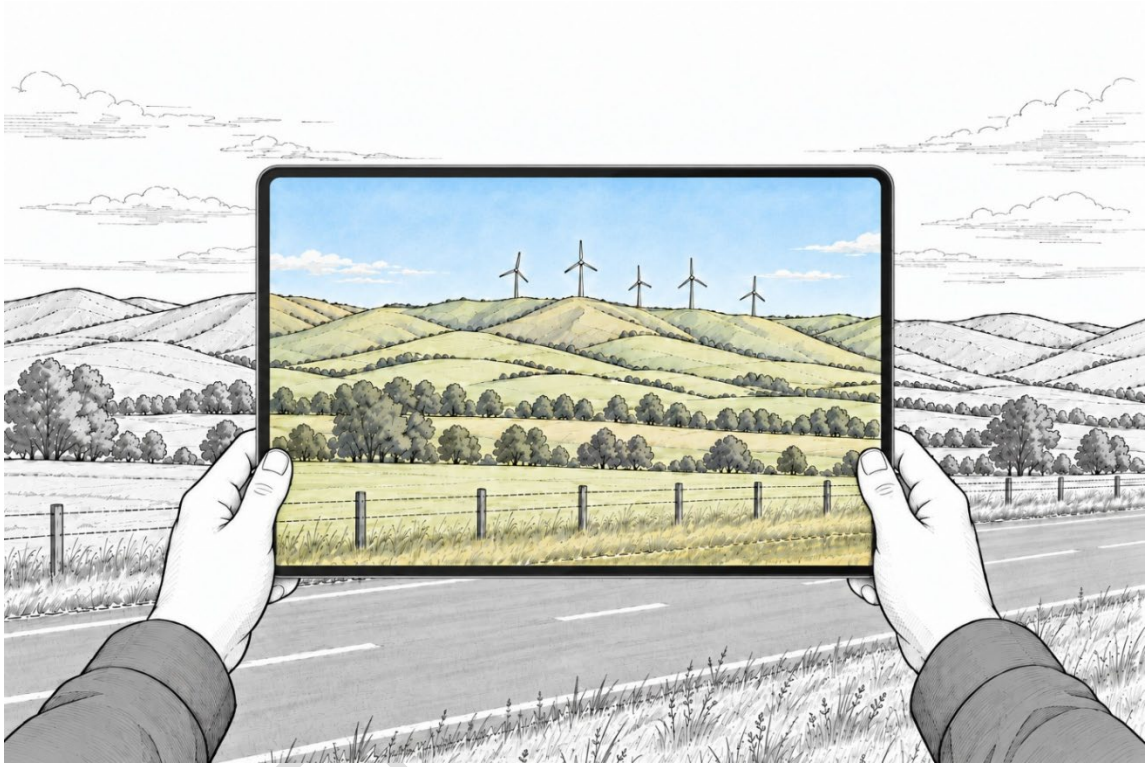


Image 9: Comfortable Reading Distance used to construct the scale as it would appear in the field

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10. Visual Representations

10.1.1 A range of visual representation or visualisation techniques are available to illustrate change in the landscape or simply to illustrate a view of the landscape itself and can sometimes blur the difference between Photo simulations which can be relied upon as evidence. Visual representations can be photographs, drawings, sketches, plans, cross sections, paintings or other ways of illustrating an idea including through photomontage techniques. Visual Representations are generally more conceptual and less accurate, the use of which should be clearly stated as to illustrate or express an idea rather than for the assessment of visual effects. There is an important distinction between visual representations and Photo Simulations.

10.1.2 A sketch or drawing can help to express an idea and can be evocative, as in the illustration of an architectural scheme or landscape. Conversely, a Photo Simulation should provide an accurate representation of changes anticipated within a real-life view, as explained above.

10.1.3 A sketch could be prepared by hand drawings or with the use of a computer program such as a photomontage. Photoshop can be used to combine two images or to put an image of an object, person or change into the setting of another photograph, hence the term 'Photoshopping' an image. Colour and textures can also be added to create a feel of realism.

10.1.4 Paintings and drawings can be used to illustrate landscape change and can range from relatively accurate (where appropriate data (contour plans, survey information, scaled measurements, etc) are used to prepare the image) to evocative for a specific purpose, such as the illustration of an architectural scheme. Equivalent conceptual development may be obtained using 3D computer generated imagery, through such programs as SketchUp, SketchPad, or similar and should be clearly differentiated from reliance on accurate Photo Simulations where engaged.

10.1.5 Photographs can similarly be used to illustrate a concept or element within a landscape. Precedent imagery, or different lenses can be used to focus on different elements and therefore highlight particular aspects of available views. Where photographs are relied upon to assess visual effects from a specific viewpoint, the parameters which have been used should be identified equivalent to photography obtained for the purpose of preparing Photo Simulations. Through the assessment process, the parameters employed should be explained to the extent that these can be easily revisited to ensure consistency and reliability.

10.1.6 Once obtained, photography may also be used to represent or to illustrate a proposal or change in the landscape as part of a design process and assist with understanding the bulk, location or scale of a specific change which may occur. If there are limitations affecting the parameters obtained this must be clearly stated. Where photographs are obtained for the purpose of preparing bulk and location imagery used to assess visual effects, these may provide a form of Photo Simulations in which case any reliance on photographic parameters and available 3D data should be clearly identified to the extent suitable for expert scrutiny.

10.1.7 Less accurate forms of visualisations such as drawings, sketches, paintings, photoshopped images should not be relied upon for the assessment of visual effects (as explained in the Photo Simulation section).

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10.1.8 Conversely, visual representations can help explore future landscape scenarios, including climate change, land-use change and adaptation. Scenarios should illustrate plausible futures, helping people understand potential consequences and consider different responses. Their timeframes, supporting evidence, assumptions and uncertainties should be clearly stated. Where scenarios are compared, consistent viewpoints and presentation parameters should be used. The realism of an image should not imply certainty about the future it depicts.

Image 10: Sketch showing how an idea or outcome can be clearly conveyed

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11. Animation (Video Simulation) and real-time models

11.1.1 Video sequences and real-time models extend Photo Simulation beyond static imagery, enabling viewers to experience shifts in perspective and movement through the landscape. They may be particularly useful where movement is an inherent characteristic of the proposal, such as the rotation of wind turbine blades within a wind farm, and where a static image alone cannot fully portray how the proposal is likely to be experienced. When anchored to surveyed viewpoints, accurate 3D models, and transparent workflows, dynamic simulations can provide a more immersive understanding of scale, visibility, and spatial relationships.

11.1.2 Creating credible animation requires more than technical proficiency or adherence to standard guidance. While the same methodological principles apply as for single-frame Photo Simulations, additional consideration is needed to ensure outputs are meaningful, ethical, and impactful. Key factors include the fidelity of the simulation to real-world systems, the cognitive load placed on viewers, the degree of interactivity, and the balance between performance and realism. Frame rates should support smooth playback, typically 24 to 60 frames per second depending on platform and purpose, so that movement reads naturally and does not introduce visual distortion.

11.1.3 Video and real-time models introduce the dimension of time, and with it, new freedoms that should also be handled carefully. Camera movement should be deliberate: is the viewpoint maintaining a human eye-level perspective, or presenting a bird's-eye vantage? If existing landscape elements are modelled, their accuracy, scale, and adherence to real-world physics should match that applied to proposed changes. Practical considerations around the control and distribution of digital media are also critical, for example, whether playback speed can be altered in ways that could misrepresent reality. Timelapse simulations may be useful in presenting long term temporal changes, but will not reflect the reality of movement at one point in time.

11.1.4 Animation and real-time models can reduce reliance on fixed, surveyed viewpoints, which are fundamental to the auditability of static Photo Simulations. As the camera moves through space, individual frames are no longer tied to a single, clearly defined and repeatable location, making it more difficult for others to independently verify alignment, scale, and position against real-world conditions. This can limit the ability to test and reproduce results, particularly in evidential contexts. Where animation is used, it is important to clearly identify and document any keyframes or representative viewpoints that correspond to surveyed locations, so that critical moments within the sequence can be isolated, assessed, and, if necessary, replicated.

11.1.5 Aspect ratio becomes a practical constraint in animation and real-time models, as outputs are typically tied to standard display formats (for example 16:9 for HD and 4K). This differs from the aspect ratios often used in static Photo Simulations and can affect how horizontal and vertical fields of view are expressed. A reduced horizontal field of view limits the amount of surrounding context visible in a single frame, while an increased vertical field of view can introduce a perspective that is less consistent with typical human binocular vision. Both outcomes represent a departure from the preferred parameters used in static Photo Simulations. Where 16:9 formats are used, these constraints should be recognised and documented, and care should be taken to ensure that any loss of context or change in perception does not influence interpretation of visual effects.

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11.1.6 Compression and delivery formats can significantly influence how visual information is perceived. Animated outputs are typically distributed via video files, presentations, or streaming platforms, all of which apply compression that reduces image quality, sharpness, and colour fidelity. This contrasts with printed Photo Simulations, which are commonly produced at high resolution (typically around 300–600 dpi), allowing fine detail and texture to be clearly resolved. These differences can affect the visibility and perceived prominence of features within a scene. Where animation or screen-based outputs are used, the implications of reduced resolution and compression should be recognised, and care should be taken to ensure that critical details are not lost or misrepresented through the chosen delivery format.

11.1.7 Although animation is more often limited to illustrative material, when produced to the same technical standards as static simulations, it can hold evidential weight in statutory processes. As with any Photo simulation, its credibility ultimately rests on methodological rigour.

12. Virtual Reality and Augmented Reality

12.1.1 Virtual Reality (VR) and Augmented Reality (AR) technologies have developed through a range of military, aerospace, research and entertainment applications and are now widely adopted across numerous industries, including gaming, healthcare, education and training. They also have application as landscape assessment tools. Such tools fall into two distinct categories:

- Virtual Reality: the creation of a fully immersive computer-generated environment, most often viewed via a headset;
- Augmented Reality: the insertion of selected computer-generated objects into the real world via tablet, smartphone or headsets.

12.1.2 In the context of assessing landscape effects, the application of AR, VR and related immersive technologies continues to develop, particularly in relation to evidential use, verification and presentation protocols. Where these tools form part of a package of evidence as Photo simulations, their use should be accompanied by a clear understanding of their capabilities, limitations and the implications these may have for interpretation.

12.2 POTENTIAL ADVANTAGES

12.2.1 AR and VR can allow the viewer to look around a scene or Field of Regard rather than being restricted to a predetermined photographic frame. Where the underlying model is sufficiently accurate, this can improve understanding of spatial relationships, apparent scale and the relationship between proposed development and its wider landscape context.

12.2.2 Three-dimensional environments can also represent dynamic conditions, including moving elements, different stages of development, vegetation growth, time of day and alternative lighting or weather scenarios. Where such scenarios are relied upon for assessment, the assumptions and parameters used should be identified and capable of verification.

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12.2.3 Head-mounted displays can present imagery as an immersive experience filling our full field of view rather than a prescribed printed image size and reading distance. This can reduce some of the limitations associated with presenting wider fields of view on conventional printed or flat-screen media. However, accurate apparent scale still depends on correct calibration of the virtual camera, spherical projection, stereoscopic geometry, display optics and viewer position.

12.3 LIMITATIONS AND CONSIDERATIONS

12.3.1 The apparent realism of an immersive representation is not, in itself, a measure of its accuracy, although it may influence how the view or representation is perceived and interpreted. Terrain, buildings, vegetation, materials, lighting and atmospheric conditions may vary considerably in their level of detail and reliability, and any material simplification, assumption or uncertainty should be clearly disclosed.

12.3.2 Display characteristics can also influence perception. Relevant factors may include field of view, angular resolution, colour and luminance reproduction, optical distortion, stereoscopic calibration, latency and image processing. These characteristics vary between devices and can change rapidly as technology develops, so limitations should be assessed for the particular hardware and software used rather than assumed from the technology type.

12.3.3 AR introduces an additional requirement for accurate registration between the digital model and the real environment within which representations are observed. Errors in device position, orientation, tracking, elevation or spatial anchoring can cause the proposed development to appear in an incorrect location, at an incorrect scale or with inappropriate alignment relative to existing features.

12.3.4 VR and interactive real-time environments also present particular challenges for repeatability and independent verification because viewers may choose different directions of view or move freely through a model. Where immersive material is relied upon as evidence, key viewpoints, routes, viewing parameters and model states should be documented so that relevant observations can be reproduced and scrutinised.

12.3.5 Production effort, specialist expertise and equipment requirements may be greater than for conventional static Photo Simulations. Their use should therefore be proportionate to the assessment purpose and should complement, rather than automatically replace, verified static simulations and field observation.

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13. Artificial Intelligence

13.1.1 Artificial Intelligence is a rapidly improving tool that can assist with many aspects of visual representation, but its application should support transparency, reproducibility, cultural safety and above all evidential integrity. AI is useful for productivity tasks such as masking, texture creation, dataset processing and handling, and creating evocative illustrative material for engagement, however AI image generation currently cannot be relied upon to independently produce accurate and reproduceable Photo Simulations that meet the standards of accuracy expected in statutory or court processes.

13.1.2 At the time of writing, AI image generation can get close to real world scale and location, but struggles to maintain all aspects of the input image. The technology treats user supplied examples as a guide to produce a new image, rather than "drawing over the top" of an existing image, often with hard to detect, yet substantially unreliable results. When compared with a manual process, AI produced images are often different in location, scale, and lighting. Errors may accumulate and ultimately show an incorrect level of visual impact.

13.1.3 As AI-generated placement of models in three-dimensional space, camera alignment, shadows, vegetation and other environmental features remain unreliable, practitioners should declare where and how AI is applied, preserve baseline data, and maintain full provenance and audit trails including metadata, project files and method notes.

13.1.4 Where AI outputs are engaged, they should be checked for drift in colour, tone or style against calibrated references and kept clearly distinguishable from components relied on as assessment evidence. Engagement and illustrative visual representations may use AI more freely, but they should be noted as illustrative.

13.1.5 Looking ahead, it is recognised that AI technologies are evolving quickly and may, become more reliable in supporting evidence-based Photo Simulation. Practitioners are therefore encouraged to remain familiar with this wider body of documentation, to apply new methods cautiously and transparently, and to continue relying on professional judgement as the benchmark for credible outputs.

13.1.6 The overarching principle is that Generative AI can complement but as yet cannot replace transparent methodology, professional expertise and documented technical processes in the production of reliable Photo Simulations.

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14. Frequently Asked Questions

What determines the accuracy of a Photo Simulation? i.e. where on the spectrum does a montage or artist impression become a Photo Simulation or vice versa?

The line is drawn less by the artistic style and more by how tightly the resultant image is tied to measurable reality. A few anchors that typically decide whether something counts as a Photo Simulation:

1. Geometric control
    - Camera location, lens, height, and orientation are documented.
    - The proposed design is placed using recognised coordinates and true dimensions.
    - The output can be re-measured and checked against CAD or GIS data.
2. Data provenance
    - RAW photos, 3D digital models, and all processing steps are retained.
    - Any edits have been documented and repeatable; lighting and textures match known or modelled conditions.
3. Disclosure and review
    - A qualified practitioner signs off method and assumptions.
    - A method statement has been included to allow independent auditing.

The reliability of a visual simulation depends on the significance of any uncertainty for its intended use. Where a parameter is estimated or cannot be independently verified, the method statement should explain the basis of the estimate, the checks undertaken and any resulting limitations. Material that cannot adequately support a particular assessment conclusion should not be relied upon for that purpose.

How does someone looking at a simulation know how it has been constructed or how accurate it is?

A viewer can form a view about the accuracy of a Photo Simulation from the method statement: if camera parameters, geolocation, source data, modelling rules, and post-processing steps are recorded, the image can be assessed for accuracy. Missing or vague documentation is the single biggest red flag.

How does the advent of Generative AI imagery affect perceptions of Photo Simulations?

Generative AI makes people more cautious about images. It is now easy to create scenes that look real but are not, so Photo Simulations should show how they were made and prove the source data is reliable to ensure the Photo Simulation output is credible.

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The line between an accurate Photo Simulation and an illustrative rendering is easier to blur, which means outputs which can be relied upon through each step of creating Photo Simulations should be clearly identifiable to reinforce reliability. AI can still help with tasks like masking or producing textures, but every use needs to be recorded to keep the final image trustworthy.

What are the limitations of Photo Simulations with regard to distance from subject?

The ability of a Photo Simulation to represent what would be perceived depends both on the distance between the viewpoint and the subject and on the distance at which the simulation itself is viewed. As subject distance increases, objects occupy a progressively smaller part of the image and fine-scale detail becomes more difficult to represent reliably, particularly for narrow or slender elements such as turbines, masts or poles. The subject occupies fewer pixels, so fine details blur, and small survey or model errors in position or elevation become more noticeable. Atmospheric effects, including haze, glare and changing light, can also affect apparent colour, contrast and visibility.

The viewing distance of the simulation is equally important. A scale-representative printed image should be viewed at its specified viewing distance; if viewed further away, objects will appear smaller and detail contained within the image may fall below the viewer's visual acuity, while viewing it too closely effectively magnifies the image. At greater subject distances, simulations are therefore generally most useful for understanding visibility, apparent scale, overall form and relationship to the surrounding context rather than fine detail. Where uncertainty remains material, it should be identified and the representation should avoid understating the likely visual effect without artificially exaggerating it.

What are the limitations of printing (mainly wide) Photo Simulations on an A3 sheet?

Printing wide angle Photo Simulations on a single A3 sheet of paper can limit how much detail and scale can be shown. While this enables an observer to appreciate the context of the landscape in which a proposed change is visible, the scale at which a panorama is presented is often reduced in width to fit the page, so small elements can lose clarity, and fine textures can disappear. This is because the reading distance required is often far less than optimal (~40 cm) and this reduces the ability for an observer to focus on the detail which may be otherwise available in the landscape.

Where more detail is required or understanding the extent to which individual elements are visible is necessary, it is recommended that combined A3 pages are used or both panorama and single frame equivalent 50 mm lens images are provided ensuring the field of view and reading distance are clearly identified in such circumstances.

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Can Photo Simulations be viewed using a head mounted device?

Yes, they can. High-resolution panoramas or 3D models can be exported to formats supported by head-mounted displays (VR headsets or 360° viewers). This lets someone "stand" at the viewpoint and look around at full scale.

There are however a few caveats:

- The headset's resolution and colour accuracy set the visual limit; fine details may still soften compared to a large print.
- Lenses and display optics can introduce slight geometric distortion, so careful calibration and a clear method note are needed if it's for formal assessment.
- Files must be prepared in the correct projection (e.g. equirectangular) and with enough pixel density to avoid a grainy look.

Used well, head-mounted viewing can give a stronger sense of immersion, but it doesn't replace the need for documented, measurable source data.

Can I use my iPhone or mobile device to take photos for Photo Simulations?

Yes, where the capture and processing permit the relevant position, geometry and appearance to be established and checked. Apply the same verification principles as for other cameras. Automatic panoramas or processing whose material effects cannot be checked may limit the use of the image. Assess the output and method rather than the device name.

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Appendix A. Information checklist

Photo simulations should be accompanied by information sufficient to understand their purpose, preparation, verification and limitations. The following records should be provided or retained as appropriate to the method and intended reliance. Where an item is not applicable, or information is unavailable, explain this where it affects interpretation or review.

The following checklist identifies the information that may accompany each Photo Simulation, having regard to its purpose and the level of evidential reliance placed on it.

Viewpoint and capture

- **Viewpoint schedule:** Coordinates and coordinate reference system; ground elevation; camera height; bearing, orientation and tilt; date and time; and access notes.
- **Camera and capture details:** Device and sensor; lens and focal length, including full-frame equivalent where relevant; exposure and white-balance settings; and RAW availability.
- **Base imagery:** Source RAW files retained; image sequence, overlap and capture method recorded; and any stitched panorama documented.

Data and image geometry

- **3D model sources:** Design files; terrain and surface data; coordinate system; horizontal and vertical datums; source dates; resolution; and known limitations.
- **Alignment checks:** Survey, ground-control or reference points used; alignment method; and residual errors or other quality-control checks.
- **Earth curvature and atmospheric refraction:** Treatment in viewshed analysis and model alignment, including relevant assumptions and limitations.

Rendering and appearance

- **Rendering settings:** Software and version; rendering method; lighting and sun position; and any atmospheric effects.
- **Appearance:** Material, colour and texture references; lighting assumptions; colour-management or calibration methods; and vegetation, mitigation or growth-stage assumptions.
- **Edits and tools:** Masking, retouching, post-processing, generative AI or other tools applied, including any material effect on the source imagery.

Presentation and delivery

- **Image geometry:** Final projection; horizontal and vertical fields of view; aspect ratio; image dimensions.
- **Printed output:** Paper and image dimensions; projection; calculated rectilinear reading distance or cylindrical/interactive viewing arrangement; and viewing instructions.

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- Screen or video output: Display format and image dimensions; calibration instructions; output pixel dimensions; frame rate; and playback settings, where relevant.
- File quality: Export format; pixel dimensions; compression or resizing applied; and any resulting limitations or loss of detail.

Method statement

- Key assumptions, limitations, software, workflows and quality-control checks.

DRAFT FOR COMMENT