3 Evolution of Design and Alternatives

3.1 Introduction

3.1.1 This chapter provides a description of the reasonable alternatives studied by the Applicant, which are relevant to the Proposed Development and its specific characteristics, in accordance with regulation 5(2)(d) and schedule 4 (paragraph 2) of the EIA Regulations.

3.1.2 This chapter is supported by the following figures which are presented in **EIAR Volume 2: Figures,** as well as the Technical Appendices (TAs) **(EIAR Volume 4)** stated in **Table 3-1**:

- Figure 1.1: Site Location Plan
- Figure 2.1: Site Layout
- Figure 2.2: Key Environmental Constraints
- Figure 3.1: Scoping Layout
- Figure 3.2: Post-Scoping Layout (Technical)
- Figure 3.3: Post-Scoping Layout (Environmental)
- Figure 3.4: Post Engineering Walkover Layout
- Figure 3.5: Design Chill Layout
- Figure 3.6: Design Freeze Layout
- Figure 3.7: Design Evolution

3.1.3 The chapter is structured to provide:

- A summary of the key planning policy context relevant to the site selection and design evolution process;
- A review of the site selection considerations;
- An overview of the design objectives;
- A description of the reasonable alternatives considered (noting that this consideration is limited to the issues relevant to this Proposed Development); and
- A description of main reasons for the selection of the final Proposed Development design, including a comparison of the environmental effects.

3.2 Key Policy Considerations

3.2.1 An evaluation of the policy context for the Proposed Development is provided in **Chapter 4: Planning and Energy Policy (EIAR Volume 1)**. The key policy context for the consideration of reasonable alternatives includes the international commitments made by the UK to The Paris Agreement (2016)[1] and subsequent policy and legislative responses in the UK, including the declaration of a climate emergency in both Scottish and UK parliaments in 2019[2] and commitments from the Scottish Government in the Onshore Wind Policy Statement (2022)[3] to an ambition of a minimum of 20GW of installed onshore wind capacity in Scotland by 2030 and policy statement from The Department for Energy Security and Net Zero (UK Government) to the need for significant increase (doubling) of current onshore wind capacity by 2030, 08

[1] UNFCC (2012) Paris Agreement. Available at: https://unfccc.int/sites/default/files/english_paris_agreement.pdf [Accessed 7/5/2024]

[2] Scottish Government (2019) The Global Climate Emergency - Scotland's Response: Climate Change Secretary Roseanna Cunningham's statement - gov.scot [Accessed 7/5/2024]

[3] Scottish Ministers, 2022. Onshore Wind Policy Statement. Online. Available at: https://www.gov.scot/publications/onshore-wind-policy-statement-2022/ [accessed 23/05/2024]

July 2024. Taken together, along with many other legislative and policy provisions around addressing climate commitments and renewable energy targets, the policy context establishes a clear need for the Proposed Development, given it will make a significant and material contribution to renewable energy capacity in the UK. On this basis the consideration of a 'do nothing' alternative, where the Proposed Development is not taken forward, is not considered a reasonable or relevant alternative for the purpose of this EIAR.

3.2.2 For the consideration of wind energy development, Policy 11 (Energy) of the National Planning Framework 4 ('NPF4')[4] is the lead policy and the main policy of relevance in informing priorities when considering site selection and alternatives.

3.3 Site Selection and Context

Site Context

3.3.1 The 'Site' (defined by the red line boundary on **Figure 1.1: Site Location (EIAR Volume 2)** is approximately 1,103 ha, located approximately 45 km west of Perth within the Drummond Estate and approximately 2.8 km east of Lochearnhead, Stirling, Scotland. The Site includes land within the Perth and Kinross local authority area and the Stirling local authority area. The wind turbine generator (WTG) array will be within Perth and Kinross, while the site entrance and a portion of the access track is located within Stirling. The Site extent has been reduced since EIA scoping, to better reflect the buildable area.

3.3.2 There are two valleys within the Site: Glen Tarken and Glen Beich. Glen Beich and Beich Burn form the western boundary of the Site. Most of the meandering burns within the Site drain into Loch Earn. The majority of the Site is an area of heathland and moorland or rough hill pasture. The Landscape Character, Designations and Fabric are discussed in detail in **Chapter 5: Landscape and Visual (EIAR Volume 1)**. The southern edge of the Site has areas of arable land as well as forests and woodland. On the western border of the Site is an area of Ancient Woodland (AW).

3.3.3 There are a number of watercourses that traverse the Site. The Site is drained by Beich Burn, Glentarken Burn and Allt an Fhionn, which flow southwards into the 10.1 km long Loch Earn, situated to the south of the Site. Two lochans are present in the northeast of the Site; Loch Eas Domhain and Lochan na Creige Ruahidhe. The hydrological features of the Site are discussed in **Chapter 8: Geology, Peat, Hydrology and Hydrogeology (EIAR Volume 1).**

3.3.4 A number of environmental designations are present within 5 km of the Site including the River Tay Special Area of Conservation (SAC) and a number of Sites of Special Scientific Interest (SSSIs) designated for ecological features. Loch Lomond and the Trossachs National Park (LLTNP) lies approximately 1 km to the west and south of the Proposed Development, to the nearest WTGs. The ecological features and designations are discussed in **Chapter 7: Ecology (EIAR Volume 1)** with ornithological assets and species outlined in **Chapter 6: Ornithology (EIAR Volume 1)**.

3.3.5 Peatland habitat is present across the Site, primarily formed of blanket bog, dry heath, grassland mosaics and small stands of other habitat types. In contrast, the access corridor contains more woodland,

[4] Scottish Government (2023) National Planning Framework 4. Available at: https://www.gov.scot/publications/national-planning-framework-4/documents/ [Accessed 23/05/2024].

grassland, bracken, and wet heath. Peatland habitats, peatland condition and peat are discussed in **Chapter 7: Ecology (EIAR Volume 1); Chapter 8: Geology, Peat, Hydrology and Hydrogeology (EIAR Volume 1);** and **TA 8.2: Peat Management Plan (EIAR Volume 4).**

3.3.6 There are no Listed Buildings, Scheduled Monuments or Conservation Areas within the Site. The closest Listed Building is the Category B - Loch Earn, Dalveich Cottage which lies approximately 200 m west of the Site. The St Fillans Conservation Area lies 1.8 km south of the Site, and Dundurn Fort, St Fillan's Hill is the closest Scheduled Monument which lies 3.9 km south of the Site. **Chapter 10: Cultural Heritage (EIAR Volume 1)** discusses the Cultural heritage assets, both designated and non-designated within the Site and the outer Study Area.

3.3.7 Key environmental constraints are presented in **Figure 2.2: Key Environmental Constraints (EIAR Volume 2)**.

Site Feasibility

3.3.8 A key, early phase of the site selection process is identifying whether a site is feasible to develop a wind farm. The site must exhibit favourable wind conditions such as consistent, strong winds and in the correct direction. It is also essential that the site location has access to the existing power grid, ensuring the efficient transmission of generated electricity with minimal infrastructural modifications. Areas designated for natural heritage protection or those noted for their high landscape or scenic quality, are a key consideration. Accessibility is another critical factor; the site should be readily accessible via existing road networks to facilitate the transport of materials and equipment, and also for future maintenance operations. These preliminary assessments are key in identifying a site that aligns with technical, environmental, and logistical requirements.

3.3.9 Criteria set out under Policy 11 of NPF4[5] has been considered during the site feasibility stages and subsequent design processes.

3.3.10 A full description of the Proposed Development site (the 'Site') is provided in **Chapter 2: Development Description (EIAR Volume 1).**

3.4 Design Process

3.4.1 Consistent with renewable energy policy, the key overall objectives are to maximise the energy generation potential of the Site, ensuring the protection of sensitive environmental receptors. A design process was agreed with the engineering and environmental team that included the parameters set out in the following paragraphs.

3.4.2 The approach to design was informed by and responded to:

- Good practice and windfarm design guidance such as Scottish Natural Heritage (SNH) (2017) Siting and Design of Wind Farms in the Landscape (Version 3a)[6];

[5] Scottish Government (2024) NPF4. Policy 11. Available at: https://www.gov.scot/publications/national-planning-framework-4/pages/3/ [Accessed 7/5/24].
[6] Scottish Natural Heritage (2017). Siting and Designing Wind Farms in the Landscape. Available at: https://www.nature.scot/sites/default/files/2017-11/Siting%20and%20designing%20windfarms%20in%20the%20landscape%20-%20version%203a.pdf [Accessed: 23/08/2024].

- Planning policy documents (e.g. NPF4, Perth and Kinross Local Development Plan (2019)[7] and Stirling Local Development Plan (2018)[8]); and
- Consultation responses received through pre-application consultation, EIA scoping and the Gatecheck process.

3.4.3 Details of all consultation feedback and the Applicant's response is provided in **TA 1.2: Consultation Register (EIAR Volume 4).**

Design Brief

3.4.4 A design brief was agreed with the Applicant setting out key parameters for the Proposed Development. The brief included:

- A preliminary technical engineering WTG layout was developed principally to respond to the landscape and visual context of the Site and surrounding area;
- Details of land available (illustrated by the Site boundary); and
- Requirements for ancillary infrastructure such as Site construction compounds, borrow pits, substation, battery energy storage system (BESS), laydown areas, access track geometry and crane hardstanding geometry.

3.4.5 The design brief subsequently set the scope for constraint mapping with the Applicant defining technical requirements such as WTG spacing to mitigate energy production losses as a result of 'wake effects'[9] between WTGs, maximum acceptable gradient of slope of potential WTG locations considering the ability to deliver safe and efficient construction and associated track infrastructure.

3.4.6 Following agreement of the design brief, the team was instructed to undertake all necessary desktop studies and field work to identify key environmental receptors and constraints (including cumulative constraints) of relevance to the design and assessment of the Proposed Development.

3.4.7 Further analysis was completed to categorise constraints as either 'hard constraints' or 'soft constraints'. Hard constraints were defined as those features with formal protection as defined in legislation or adopted planning/ industry guidance, whereas soft constraints were characterised as having potential to shape the development through effective design and/ or mitigation measures.

3.4.8 A number of Design Workshops were held (from January to August 2024) between the design team and technical specialists in order to discuss engineering constraints, technical requirements, wind yield, WTG requirements and environmental constraints. Six iterations of the design were developed in response to the environmental constraints the engineering constraints and the technical requirements.

3.4.9 The Proposed Development WTG layouts considered throughout the design evolution process are further explained in Section 3.6 below and are presented in **Figures 3.1-3.6: Turbine Design Iterations (EIAR Volume 2)**. **Figure 3.7: Design Evolution (EIAR Volume 2)** presents all six design iterations on a single

[7] Perth and Kinross Council (2019). Local Development Plan. Available at: https://www.pkc.gov.uk/ldp2 [Accessed: 11/09/2024].

[8] Stirling Council (2018). Stirling Council Local Development Plan. Available at: https://www.stirling.gov.uk/planning-and-building/planning/development-planning/the-statutory-development-plan/

[9] Wake Effects - disturbance in the airflow caused by the turbine blades as they capture wind energy. When the wind passes through a turbine, some of the wind energy is extracted by the turbine's blades, causing a reduction in wind speed and changes in the flow direction behind the turbine. This disturbed area is known as the wake.

figure to show the evolution of the design. A summary of the key environmental constraints is illustrated in **Figure 2.2 Environmental Constraints (EIAR Volume 2).**

3.5 Environmental Issues and Design Constraints

3.5.1 The environmental issues for consideration in the design process were identified following a baseline characterisation of the Site. Recommendations for how environmental constraints should be addressed in the design process were made in relation to each technical topic. The key design analysis and recommendations is summarised in **Table 3-1.**

3.5.2 Issues were considered through design with the aim of avoiding or minimising potential significant effects. Where it was not possible to mitigate by design, the issues have been considered further as part of the EIA.

Table 3-1: Preliminary Site and Design Guidance for Glentarken Wind Farm

Topic	Analysis	Design Recommendations
Landscape and Visual: Landform and Landscape Fabric	The Site largely comprises upland moorland covered mountainous ridges that lie between Loch Tay and Loch Earn. A vehicle track runs along the lower valley slopes which splits to enter Glen Beich past Creag Dubh with fence lines found at the lower reaches of the valley. There is limited tree cover along the Beich Burn lower valley slopes with pasture found in this area up to the A85 which follows the shores of Loch Earn.	The Proposed Development has been designed to relate to the landform of the Site and fit comfortably with the underlying pattern of the landscape.
Landscape and Visual: Landscape Character and Designations	The Site is situated within the upland summits and plateaux, part of a broad upland ridge that separates Loch Earn and Loch Tay within the landscape character types (LCTs) of LCT 147 Summits and Plateaux Central and LCT 376 Summits and Plateaux Tayside. The majority of the Site (including all of the proposed turbines) is not located within national or regional landscape planning designations. The western section of the Site, including part of the access track, is located within the Creag Garbh LLA. A small section of the Site at the entrance, is located within the Loch Lomond and the Trossachs National Park. Other landscape designations within the LVIA Study Area include: • National Scenic Areas (NSAs) – Loch Rannoch and Glen Lyon NSA; and River Earn (Comrie to St Fillans) NSA. • Perth and Kinross Council Special Landscape Areas (LLAs) – Loch Tay LLA; Loch Lyon & Loch an Daimh LLA; Glen Quaich LLA; Sma Glen & Glen Almond LLA; and Upper Strathearn LLA • Stirling Council Local Landscape Areas (LLAs) – Glen Lochay LLA; and Uamh Bheag LLA. • Gardens and Designed Landscapes (GDLs) – Meggernie Castle; Taymouth Castle; Monzie Castle; Ochtertyre; Drummond Castle; Aberuchill Castle; and Dunira. Wild Land Areas are also found within the Study Area, including: WLA07 Ben More-Ben Ledi; WLA10 Breadalbane-Shiehallion; WLA11 Lyon-Lochay; and WLA12 Ben Lawers.	The Proposed Development has been designed to minimise the effect on the surrounding landscape and visual resource. The design strategy for the Proposed Development has been guided by the following landscape and visual objectives: • The design and layout of the turbines should express the function of the Proposed Development as an energy generator as clearly as possible by avoiding complexity and visual confusion (particularly from key viewpoints). • The turbine layout should relate to the landscape character of the Site and its surroundings, including potentially affected designated landscapes. • The turbine layout should relate to the scale of the landscape in which it is located. • To space turbines evenly over the Site area avoiding a random appearance with limited instances of visual stacking and outlying turbines (particularly from key viewpoints). • To respond to the various other environmental and technical constraints identified within the Site. • The design and layout of the turbines should be viewed as a visually balanced composition of turbines against the landscape, skyline and in association with other cumulative windfarm developments. Therefore, the turbine layout design has evolved with the intention and key objective of presenting a simple, well-balanced image of the Proposed Development in the majority of views. The detailed landscape and visual aspects of the layout iteration process are discussed in Section 5.6 of **Chapter 5: Landscape and Visual (EIAR Volume 1).**
Landscape and Visual: Visual Amenity	There are a range of visual receptors in the surrounding landscape, including hill walkers, road users, visitors, settlements and properties. Twenty-two viewpoints have been selected and agreed in consultation with Perth and Kinross Council, Stirling Council, NatureScot, Loch Lomond and Trossachs National Park Authority and Mountaineering Scotland. The viewpoints used in the assessment have been selected to cover points of specific importance such as recognised viewpoints, designated landscapes, settlements, important routes and attractions, and to inform the definition of the likely extent of significant visual effects arising from the Proposed Development.	
Cultural Heritage and Archaeology: Designated heritage assets (and non-designated heritage assets of national importance) on-site.	There are no designated assets located within the Site. The Stirling Historic Environment Record (HER) contains nine non-designated heritage assets of local to regional importance within the Site boundary. The Perth and Kinross HER contains five non-designated assets of local importance within the Site boundary. Designated and non-designated assets are protected by NPF 4, Historic Environment Policy for Scotland (HEPS) and the Local Development Plan. Considering preservation in situ as a priority, groundbreaking works should within these areas should be avoided or minimised, thus limiting the potential for direct impacts. The proximity of turbines and infrastructure to these assets should be carefully considered so that they can be avoided by design as much as possible.	WTGs and infrastructure should be sited to minimise impacts on the non-designated heritage assets within the Site, where possible. Buffers have been suggested to minimise, as much as possible, the potential for significant impacts. Modifications to the access track will be incorporated to avoid significant effects on the non-designated assets located in proximity. There is no guidance as to what should, or may, constitute a hard constraint buffer and those allocated are based on professional judgement of what may be appropriate as an initial basis to seek to reduce potential for adverse effects.
Cultural Heritage and Archaeology: Designated and Non-designated heritage assets off-site (regional or local importance)	Within 10 km of the Proposed Development, there are 23 Scheduled Monuments; 217 Listed Buildings (7 of Category A, 49 of Category B and 161 of Category C); three Conservation Areas; and two Inventory Gardens and Designed Landscapes. There are no World Heritage Sites or Inventory Historic Battlefields within 10 km of the Site.	There is no guidance as to what should constitute an appropriate 'stand-off' distance sufficient to maintain the integrity of the asset's settings. Each should be considered on its own merits.
Ecology	Key considerations for the Site include: • River Tay SAC - afforded protection in legislation under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and the Nature Conservation (Scotland) Act 2004. • Ancient semi-natural woodland or Plantations on ancient woodland sites – afforded protection under Scottish Government's policy on control of woodland removal (NPF4 Policy 6b).	River Tay SAC scoped out of the assessment; no implications for design. Avoid direct impact / land-take of ancient woodland. Following best practice guidance (NatureScot et al, 2021), a distance of 50 m between turbine blade tip and nearest woodland (or other key habitat features) should be applied as a basic

Topic	Analysis	Design Recommendations
	• Bats – A European protected species – are afforded protection in legislation under Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Within the Site several individual trees and a group of trees were assessed as having moderate suitability for roosting bats. Within the riparian areas of the tributaries of the Beich Burn, two small groups of trees and two individual trees were assessed as having low suitability for roosting bats. No high potential roosts were recorded within the Site. • There are a number of watercourses within the Site that may contain fish species, including migratory salmonids and lamprey species. • Evidence of otter (spraints) and common lizard (sightings and potential hibernacula) was recorded. Squirrel feeding signs were recorded and a potential pine marten scat was found along a mammal track by Beich Burn. • Four mammal holes were recorded across the Site. It was not possible to determine if this was attributable to water vole or badger as there were no other distinguishable features. • The main Site is largely formed of blanket bog (E1.6.1), dry heath (D1.1) and dry heath/acid grassland mosaics (D5) with a large number of other habitat types also present, usually in smaller stands. The access corridor contains more woodland (A1.1.1), acid grassland (B1.1/B1.2), marshy grassland (B5), bracken (C1.1/C1.2) and wet heath (D2). • Localised areas of Priority Habitats present of the Site (specified in Annex I of the Habitats Directive; Biodiversity Action Plan or Scottish Biodiversity List). • Presence of potential Groundwater Dependent Terrestrial Ecosystems (GWDTE) within the Site.	standard mitigation measure, including all key-holed sites, which may present an increased risk of bat collisions. Although no suitable roost features were identified near to the turbines, a 30m buffer should be applied to potential roosts in the woodland in proximity to the proposed main access track to avoid impacts on bats. As a result of potential mammal holes being recorded on Site, a suitable buffer zone should be utilised to avoid impacts. Watercourse crossings should be minimised and a 50 m buffer around watercourses for all infrastructure should be maintained except where a minimum number of crossings are essential. This was incorporated into the design. The main priority will be to avoid areas of blanket bog (E1.6.1) and any deeper areas of modified bog (E1.7) as far as possible. Priority peatland habitat should be avoided where possible. Where priority peatland is unavoidable, infrastructure should be oriented to lessen any impact, and on-site tracks should be floated. Peatland restoration will be required to compensate for any direct or indirect loss of peatland habitat. Where restoration or biodiversity enhancement is required, detail will be outlined in the Biodiversity Enhancement Management Plan (BEMP). An Outline BEMP is provided in **TA 7.7 (EIAR Volume 4**). Potential GWDTE confirmed in **Chapter 8: Geology, Peat, Hydrology and Hydrogeology (EIAR Volume 1**). Infrastructure sited over 250 m of confirmed GWDTE where a high risk has been identified.
Ornithology	Baseline surveys were undertaken between 2021 and 2023 for the proposed Development. The surveys recorded the following: • Red kite *Milvus milvus* – located along the access track and is out with the Site boundary. • Merlin *Falco columbarius*– continued to be present across the three years of surveys. • Black grouse *Lyrurus tetrix* – identified to be lekking in four areas along the access track.	A constraint buffer for Merlin and Black Grouse of 500 m are recommended for WTGs and ancillary infrastructure.
Hydrology and Hydrogeology	No water dependent designated sites are considered hydraulically connected to the Proposed Development. Key design constraints with regard to hydrology and hydrogeology include: • Groundwater has been classified by SEPA as Good and vulnerability as Class 4 and 5 • Areas of potential GWDTE have been identified by NVC mapping • Watercourses within the Site have been classified by SEPA as Good to Moderate • Loch Earn surface water catchment has been designated as a Drinking Water Protected Area; and • Private water supplies have been confirmed and considered to be at risk from the Proposed Development, without appropriate controls.	In accordance with best practice[10] wind farm construction a 50 m buffer to all watercourses and waterbodies on the Site has been applied, as shown on **Figure 8.1 (EIAR Volume 2)**. In accordance with SEPAs-LUPS 31 guidance if potential GWDTE or springs which supply private water supplies are identified within (a) 100 m of roads, tracks, and trenches, or (b) within 250 m of borrow pits and foundations, then it is necessary to assess how the potential GWDTE and springs may be affected by the Proposed Development. Potential areas of GWDTE are shown on **Figure 8.8 (EIAR Volume 2)** and assessed in **TA 8.5: GWDTE (EIAR Volume 4)**. No springs associated with private water supplies have been noted within 250 m of the Proposed Development. Private water supplies are discussed in full in **TA 8.6: PWSRA (EIAR Volume 4).**
Peat	Peat probing on Site and a review of the SNH Carbon Rich Soil, Deep Peat and Peatlands Habitat Map (2016) confirms areas of peat and organic material are present within the Site. Phase 1 and 2 peat probing surveys identified that no peat (0-0.5 m depth) is present across 57% of the Site; >1 m depth is present across 80% of the Site; and Peat >1.0 m depth is present at 20% of the Site.	The design should avoid siting of infrastructure and turbines in areas of peat, where technically possible, in particular in deep peat (>1 m depth) and peat which is considered in near natural condition. Potential effects on peat are discussed in **TA 8.1: PLHRA** and **TA 8.2: PMP (EIAR Volume 4)**.
Traffic and Transport	Traffic and Transport impacts are associated with the movement of general HGV (and LGV) traffic travelling to and from the Site during construction. It is anticipated that each WTG is likely to need up to 11 abnormal loads to deliver the components to the Site. Components will be delivered on extendable trailers which will be retracted to a standard HGV size on the return journey.	All HGVs will utilise the Site Access Junction located along the A85.
Noise	Four operational noise sensitive receptors have been identified: • Woodhouse • Brae Farm	The nearest NSRs to the Proposed Development lie approximately 3 km to the south-west.

[10] SEPA (2017). Land Use Planning System SEPA Guidance Note 4. Available at: https://www.sepa.org.uk/media/136117/planning-guidance-on-on-shore-windfarms-developments.pdf

Topic	Analysis	Design Recommendations
	• The Kopje • Roadside Cottage A further seven receptors have been identified to be construction noise receptors: • Glenbeich Lodge • Ardveich House • Keeper's Cottage • Drummond Fish Farm • Glenbeich Farm • Woodend Cottage • Ardveich Cottage	Site Specific Noise Limits must be set to individual developments and should ensure the 'Total ETSU-R-97 Noise Limits' are not exceeded.
Aviation	There is high potential for an effect on the NATS Lowther Hill ATC radar where the WTGs are in line of sight. The Site is located within the Low Flying Area (LFA) 14, a strategically important LFA within the UK Low Flying System.	The proposed solution to mitigate adverse impacts on the NATS Lowther Hill ATC radar is Multi-Radar Tracker (MRT) blanking. There will be continued negotiations with NATS to deliver suitable radar mitigation strategy prior to the operational phase of the Proposed Development. With respect to the LFA, there is a statutory Civil Aviation Authority (CAA) requirement to provide visible aviation warning lights for structures of a height of 150 m above ground level (agl) or more. The Ministry of Defence (MOD) request that all WTGs are fitted with MOD-accredited infra-red lighting which is not visible to the naked eye but is visible to aircrew using night vision equipment. A Lighting Plan has been prepared **TA 13.1: Lighting Report (EIAR Volume 4)** and approved by the CAA and MOD taking into account the requirements for aviation lighting. Further details are provided in **Chapter 13: Aviation (EIAR Volume 1).**
Telecommunications	A review of the Ofcom Spectrum Information Portal identified no microwave links crossing the Site. One microwave transmitter/receiver mast is within 2 km of the Site. Angus, Craigkelly and Black Hill main television transmitters and the Crieff, Killin, Lochearnhead and St Fillans local transmitters all provide some coverage of areas with 10 km of the Site. Joint Radio Company (JRC) do not foresee any potential problems based on known interference scenarios.	Design recommendations include ensuring the WTGs are outside telecommunication zones where unacceptable effects are anticipated. Detailed calculations have been carried out to identify potential interference between the WTGs and telecommunications links.

3.6 Design Evolution and Alternative Layouts

Alternatives

Do-Nothing Alternative

3.6.1 The 'do nothing' scenario is considered in the EIAR as a basis for comparing the development proposal. This scenario represents the current baseline situation as described in the individual chapters of the EIAR. Section 3.3 above outlines the Site Context which characterises the baseline environment and assumed future environmental conditions assuming no development on the Site is established.

3.6.2 It is recognised that the baseline would not remain static for the lifetime of the Proposed Development. In particular, and apart from any changes arising from economic and agricultural policies and economic market considerations, it is predicted that biodiversity and landscape would undergo some level of change as a result of climate change. Two publications from the Landscape Institute and Scottish Natural Heritage (now NatureScot) consider the potential climate change effects on the landscape character[11]. Due to the complexities and uncertainties inherent in attempting to predict the nature and extent of such changes to landscape and biodiversity during the lifetime of the Proposed Development, it has been assumed that the current baseline would subsist. It is considered that this represents an appropriate approach for EIAR preparation purposes.

Design Evolution

3.6.3 **Figure 3.7 (EIAR Volume 2)** summarises the wind farm design evolution from scoping stage to the design freeze layout. The following paragraphs explain the changes made through the six key iterations, taking account of the design recommendations stated in **Table 3-1**.

Layout 1: Scoping Layout [14 WTGs]

3.6.4 Following Site feasibility assessments, an indicative design for a potential WTG layout containing up to 14 WTG delivering up to 84 MW was included as part of the Applicants submission for a scoping opinion to the Scottish Government in December 2022.

3.6.5 The Scoping Layout is presented in **Figure 3.1 (EIAR Volume 2).**

Layout 2: Post-Scoping (Technical) [18 WTGs]

3.6.6 Following the Scoping stage, the design was optimised from an energy generation perspective, increasing the WTG (T) number from 14 to 18 and the predicated 84 MW to 104 MW grid connection capacity. The following adjustment were then made from the technical engineering perspective:

- T16 was re-located due to the proximity to a tunnel linked to the Breadalbane Hydro-Electric Power scheme;
- T9 and T17 were moved onto flatter topography;
- T7 and T16 were moved out of deeper peat;
- The main spine track within the Site was set to achieve the required gradient;

[11] NatureScot (2017). Climate Change: Impacts on Landscape. Available at: https://www.nature.scot/climate-change/climate-change-impacts-scotland/climate-change-impacts-landscapes

- Permanent/ temporary WTG hardstand areas were incorporated based on worst case hardstand layout for N163 WTG model;
- Indicative locations for construction compounds, laydown areas and batching plant were proposed adjacent to spine track and where the topography was suitable;
- Indicative borrow pit (BP) locations were proposed; and
- An indicative substation platform location was proposed.

3.6.7 These changes resulted in the Post-Scoping (Technical) Layout which is presented in **Figure 3.2 (EIAR Volume 2).**

Layout 3: Post-Scoping (Environmental) [16 WTGs]

3.6.8 The optimised technical layout was then reviewed from an environmental perspective, primarily peat depths and landscape and visual impacts, whilst accommodating engineering and technical constraints such as the steep topography and wind energy optimisation.

3.6.9 During the design workshop, the following elements were discussed:

- The need to present a more cohesive layout from an LVIA perspective, to avoid the WTGs appearing in two separate clusters and to set the turbines further back from the LLTNP. The four most westerly WTGs (T12, T13, T15, T16) were the main focus;
- In line with recommended SEPA guidance, the avoidance of deep peat which is greater than 1 m deep. Design preferences were agreed that the placement of infrastructure and WTGs would aim to be out with areas of peat where technically feasible and acceptable from an engineering perspective;
- Avoidance of blanket bog habitat (where possible), priority peatland national vegetation communities (NVC) communities in particular;
- Application of a 50 m watercourse buffer to avoid any direct impacts;
- Ornithological constraints including the implementation of a buffer zone for the Merlin, a Schedule 1 Raptor, which are located within the area; and
- Following ecological surveys, the presence of potential bats roosts, mammal holes and woodland were identified along the western Site access. Constraints and potential buffer zones regarding reptiles that were identified on Site were also discussed.

3.6.10 Following the above discussion and an engineering feasibility check, the following changes were made to the Layout 3:

- T13 and T15 were removed, as these were undesirable from a construction perspective as a result of steep slopes. The 30% cross slope is illustrated in **Plate 3-1** and **3-2** below;

Plate 3-1: Cross Slope for T13.

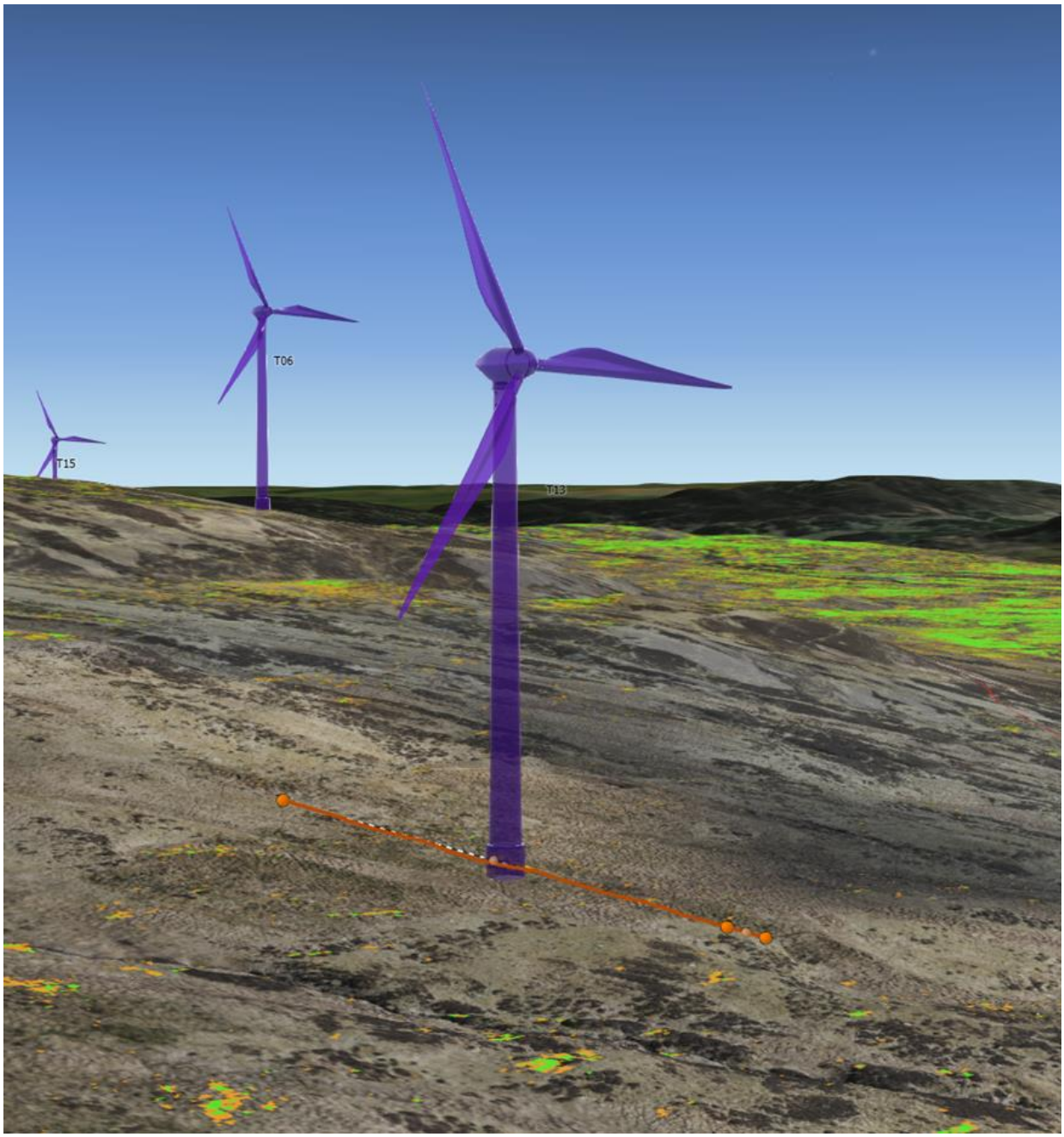
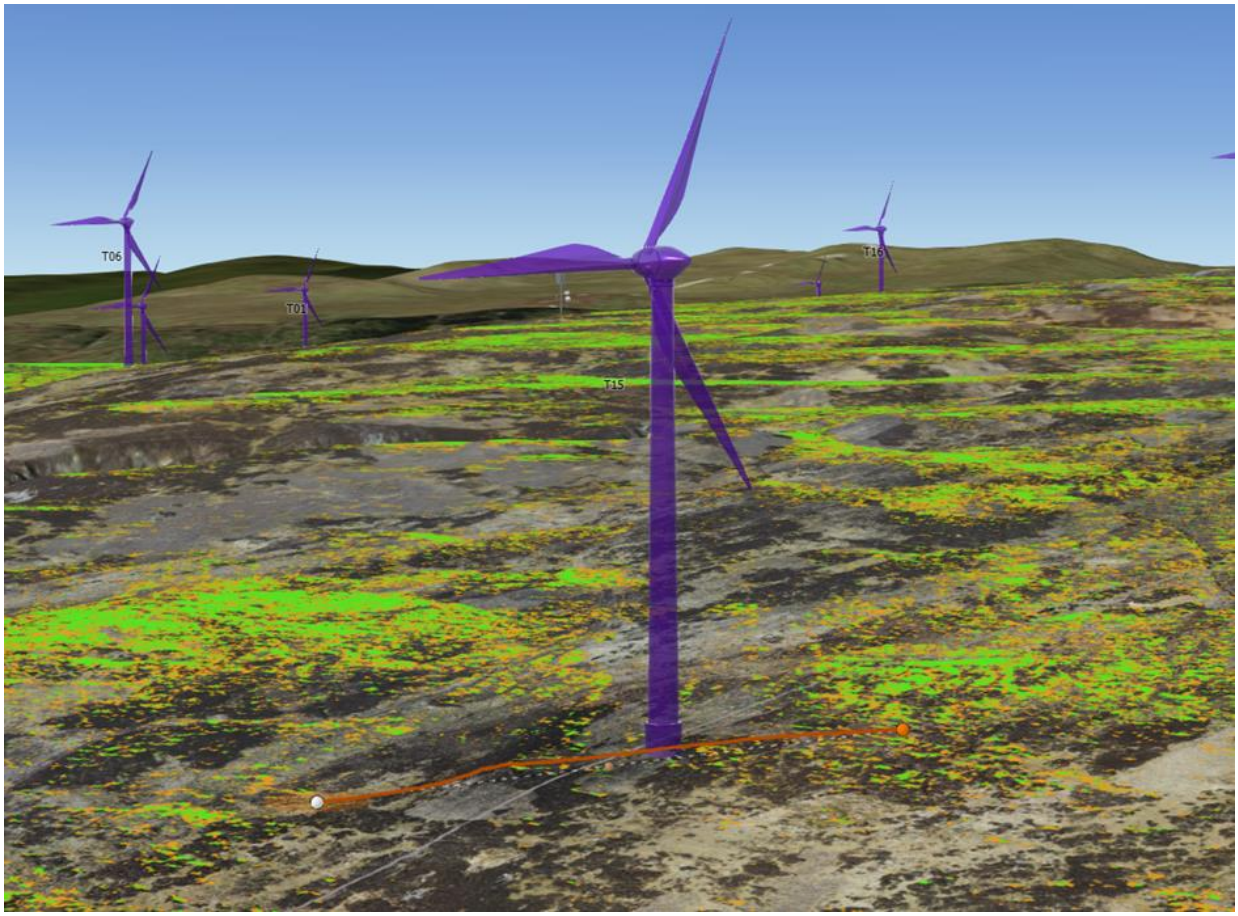


Plate 3-2: Cross Slope for T15.



- T1 was moved approximately 1 km south setting it further back into the upland plateau. While it could be repositioned to the east to avoid the dominant Groundwater Dependent Terrestrial Ecosystems (GWDTE), this would place the turbine and hardstand in an area of deep peat, which is less desirable;

- Turbine 16 was moved to the original T5 position in order to avoid deep peat **(Plate 3-3)**;

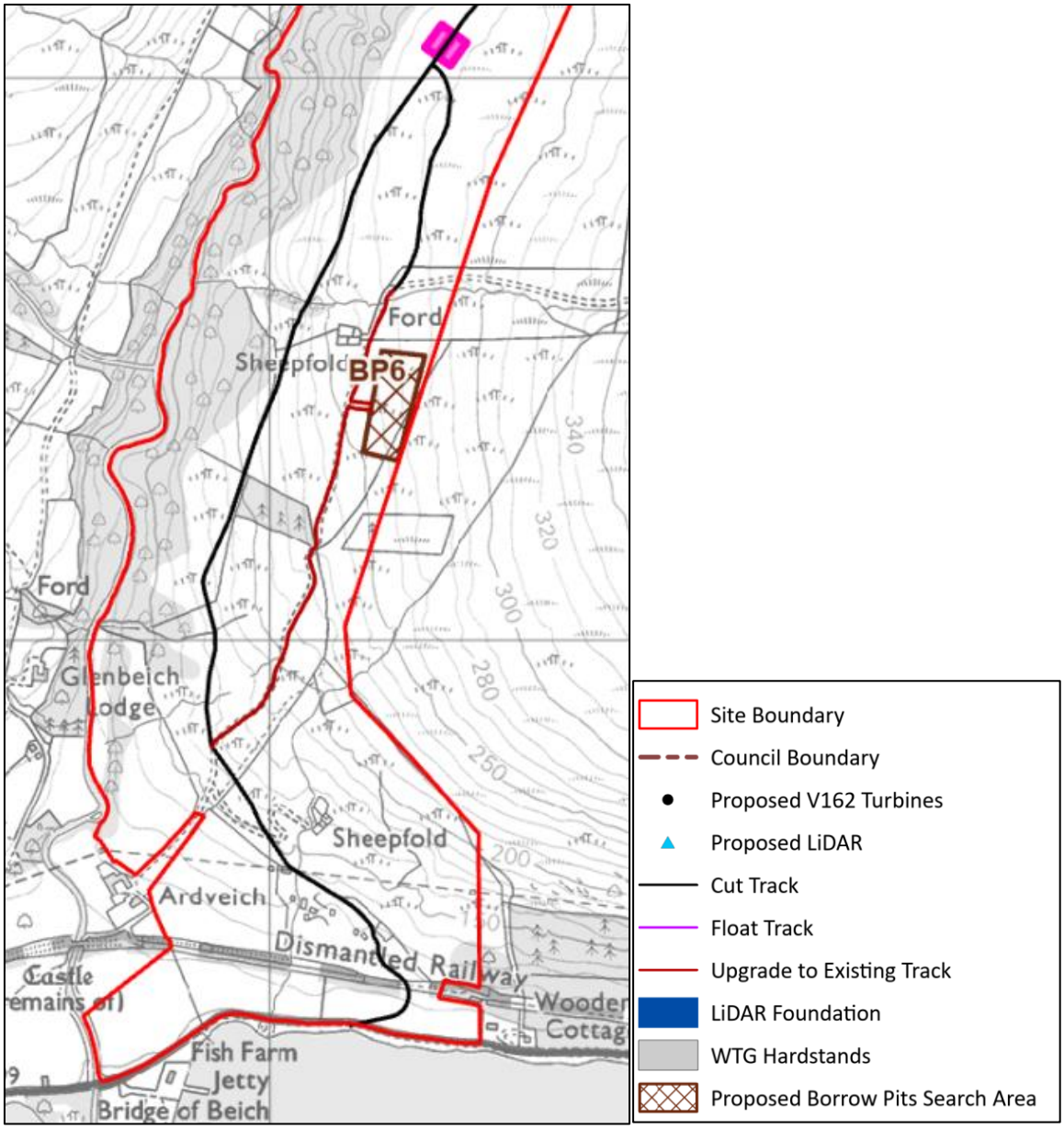
Plate 3-3: Peat Depth around relocated T16.

- T12 was re-located to the south-eastern section of the Site to produce a more cohesive layout from a landscape and visual perspective;
- T2 was re-located away from the edges of the upland ridge to reduce its prominence from an LVIA perspective. This area is also characterized by shallow peat and gentle gradients. The orientation of the hardstand and access track has been optimized to minimize earthworks, although substantial earthworks remain necessary due to the Site's inherent characteristics;
- T3 was re-located to accommodate the avoidance peat and ecological habitats. In addition, the access route to the hardstand has been revised to allow access from T2, thus minimizing disturbance from the access tracks;
- T10 was re-located chosen to minimize the impact on the peatland habitat and to reduce interference with adjacent turbines. However, T10 is situated within an area of deeper peat **(Plate 3-4).** Significant movement of this turbine would require a comprehensive redesign of the site, although micro-siting adjustments could potentially provide some mitigation; and

Plate 3-4: T10 Re-location.

- T7 was re-located to accommodate the avoidance peat and ecological habitats.
- The use of two sections of track at the Site entrance was reviewed and implemented **(Plate 3-5)**. The existing farm track will be upgrading (in orange) to reach BP 6. However, the gradients are too steep for WTG deliveries/ operations, therefore an additional new section of track (to the left) is also required.

Plate 3-5: Access Track Upgrade to BP6



3.6.11 The potential for a BESS was also considered at this stage of the design. A BESS could optimise the contribution the Proposed Development can make to renewable energy targets by storing energy when there is an excess/ grid constraint and releasing it when it is needed. Combining technologies such as batteries and wind can complement energy generation, contributing to a more stable grid at source. This results in the delivery of more power to the grid at the right time and more effective use of the existing grid connections, infrastructure, and land.

3.6.12 The removal/ re-location of the four westerly WTGs, resulted in a unified WTG layout which allows the development to appear as one cohesive development rather than appearing as two separate developments, reducing potential landscape and visual effects.

3.6.13 These changes resulted in the Post-Scoping (Environmental) Layout which is presented in **Figure 3.3 (EIAR Volume 2).**

3.6.14 Layout 3 was presented at the public exhibition held on 28th (St Fillans) – 29th May 2024 (Lochearnhead). Further details on the feedback received from the public exhibition are presented in the Pre- Application Consultation (PAC) Report, provided as a supporting document to this EIAR.

Layout 4: Post Engineering Walkover Layout [14 WTGs]

3.6.15 A detailed site walkover was undertaken by engineers to assess the buildability of Layout 3. The terrain around T12 **(Plate 3-6)** and T18 **(Plate 3-7)** was too steep to build the required hardstanding area, and they were subsequently removed.

Plate 3-6: T12 hardstanding (pink=cut areas, turquoise= fill areas).

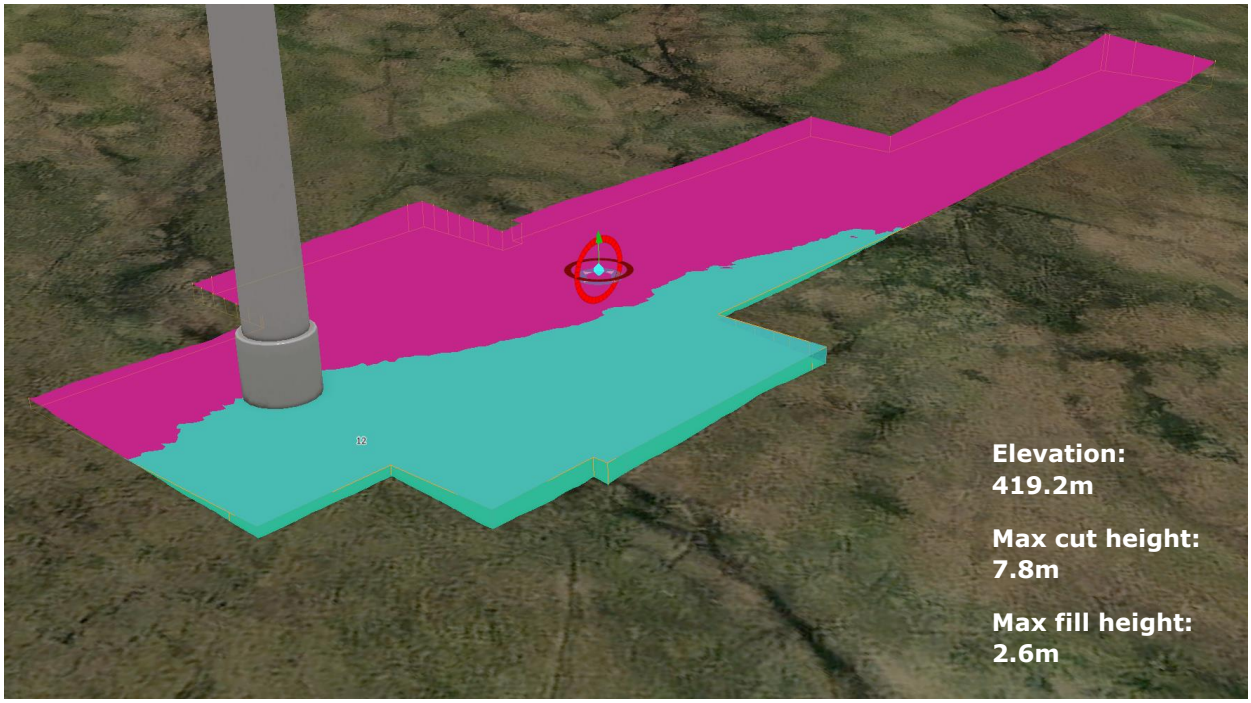
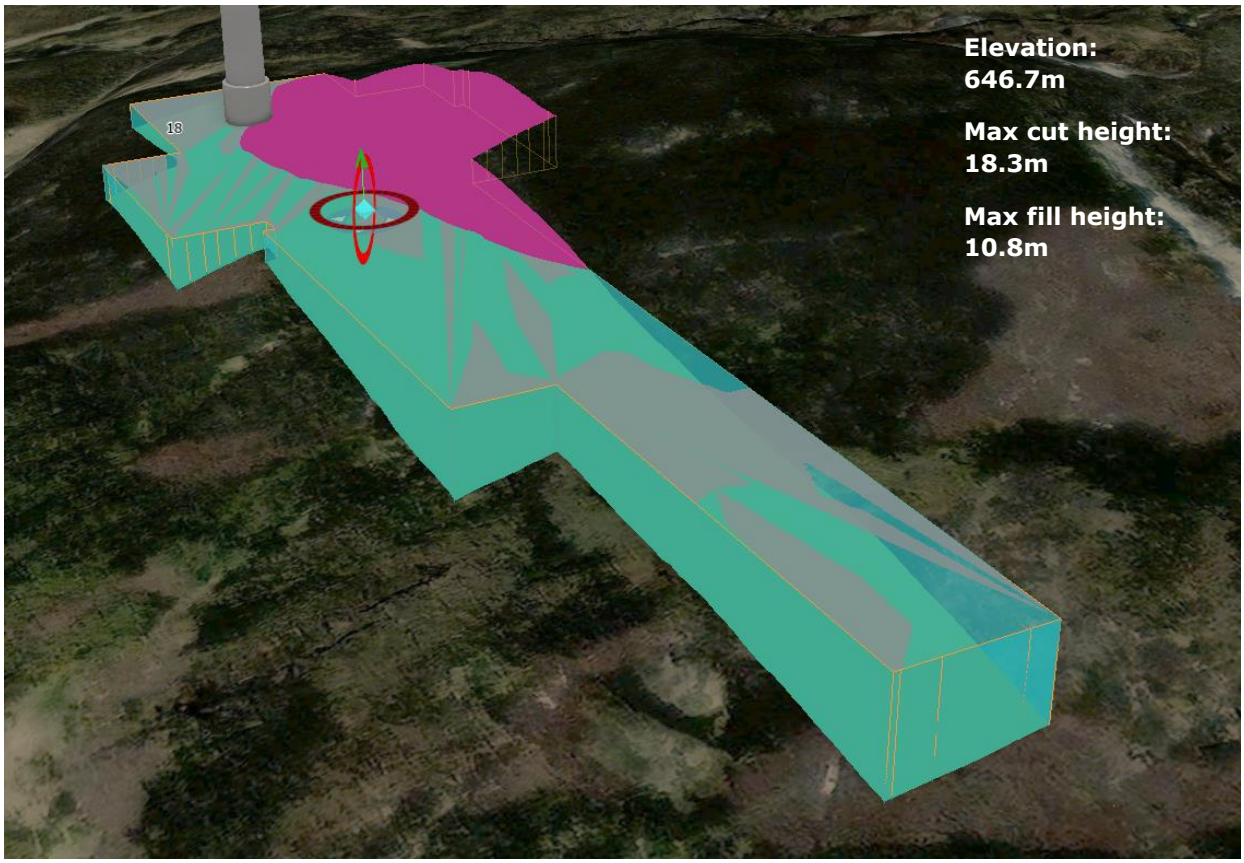


Plate 3-7: T18 hardstanding (pink=cut areas, turquoise= fill areas).



3.6.16 Due to the challenging topography and the implications for earthworks required at each WTG location to create the required platforms for each WTG foundation and crane hardstanding, detailed consideration was given to optimising the conceptual layout and hardstanding arrangement to reduce earthworks where possible. The base case WTG model was reviewed and the decision was made to change the turbine model, as the hardstanding arrangements improve the cut/ fill requirements.

3.6.17 The Site boundary was also amended to reflect the buildable area and to capture the two access points off the A85.

3.6.18 These changes resulted in the Post Engineering Walkover Layout which is presented in **Figure 3.4 (EIAR Volume 2).**

Layout 5: Design Chill [12 WTGs]

3.6.19 At this stage the associated WTG infrastructure and access track design was reviewed in more detail. The cut and fill requirements for each WTG (and hardstanding) were also reviewed in detail.

- T7, T9, T14 & T17 were removed due to the level of cut and fill required **(Plates 3-8, 3-9, 3-10, 3-11)**;

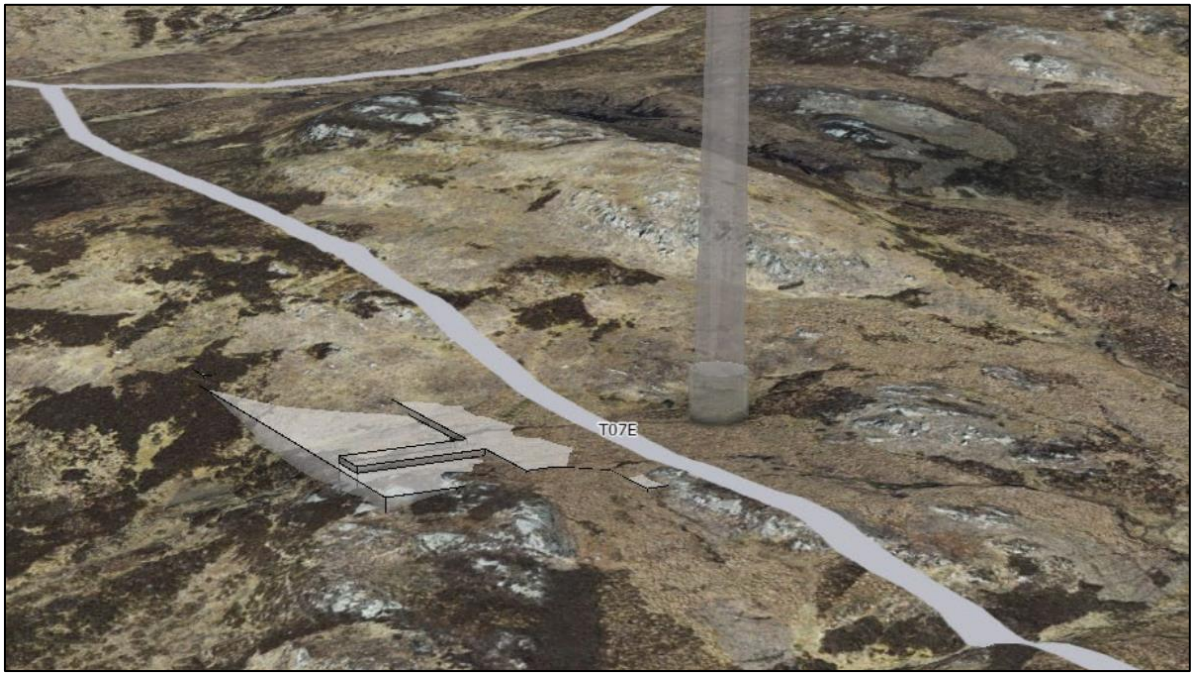


Plate 3-8: T7 Topographical Challenges

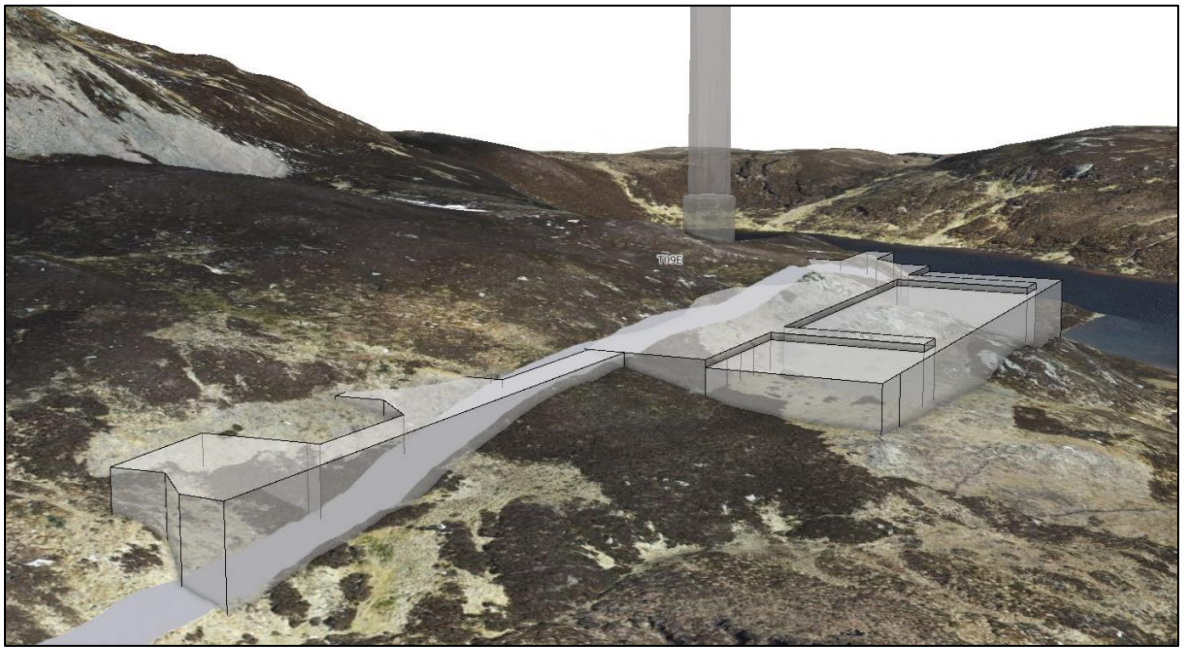


Plate 3-9: T9 Topographical Challenges

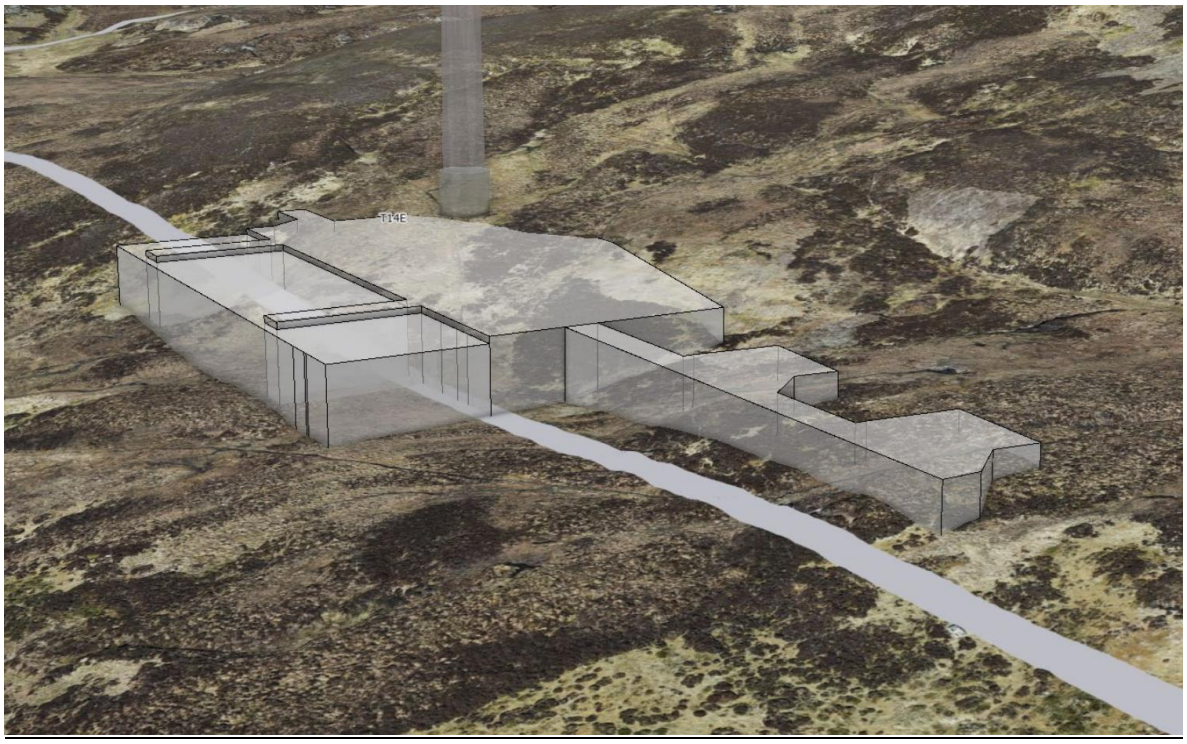


Plate 3-10: T14 Topographical Challenges

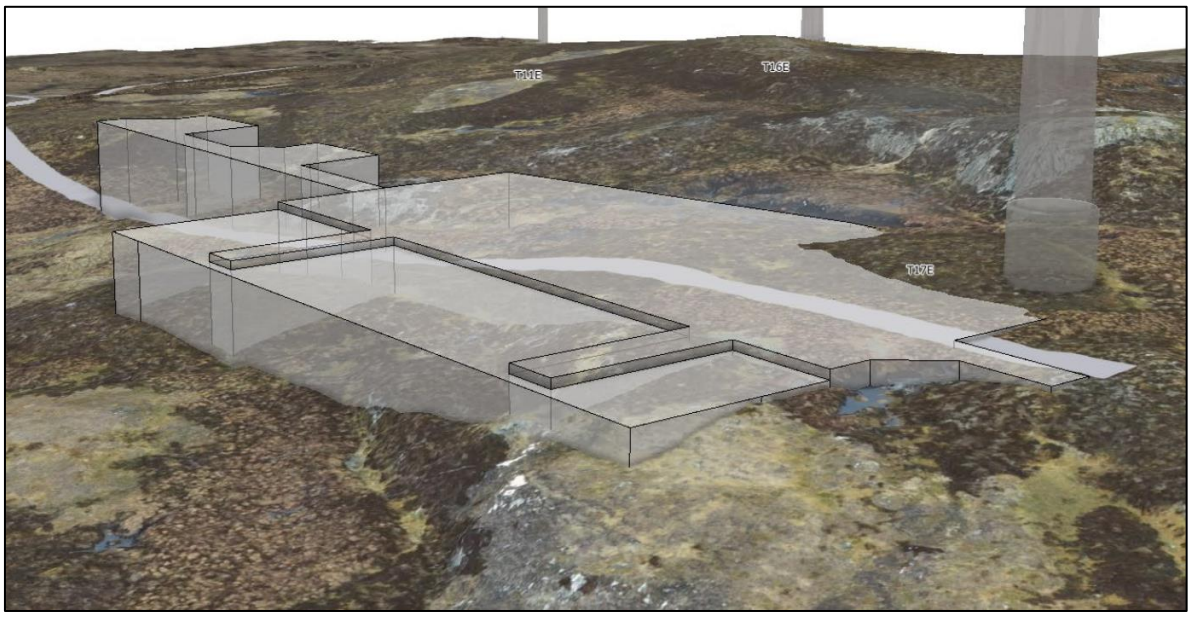


Plate 3-11: T17 Topographical Challenges

- Two WTGs (T20, T21) were added to more buildable locations within the space between the removed T7 and T14.
    - T20 is located on flat ground adjacent to the main access track **(Plate 3-12)**. The hardstand orientation has been optimized to minimize disturbance to deeper peat, given the topographical constraints. Micro-siting potential is limited due to steep slopes to the south and access track constraints to the north;

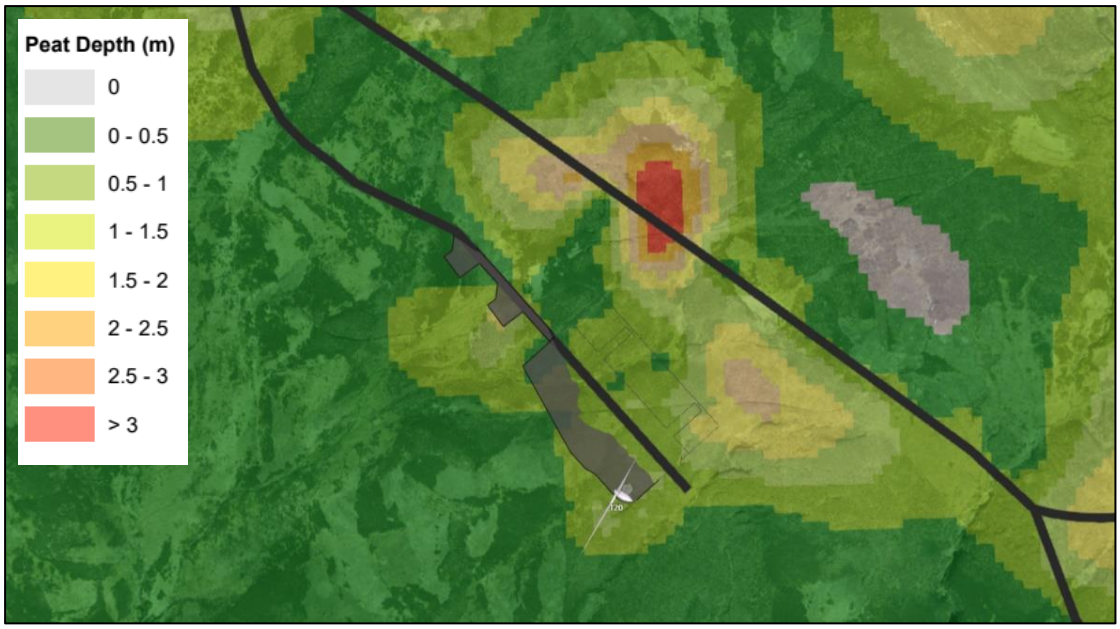


Plate 3-12: T20 Location

- T21 Initially, deep peat was not indicated in the area of Turbine T21. However, recent peat probing has revealed that the turbine base and hardstand are situated within deep peat **(Plate 3-13)**. Relocating the turbine is challenging due to its interaction with other turbines, infrastructure, and steep slopes to the east and west.

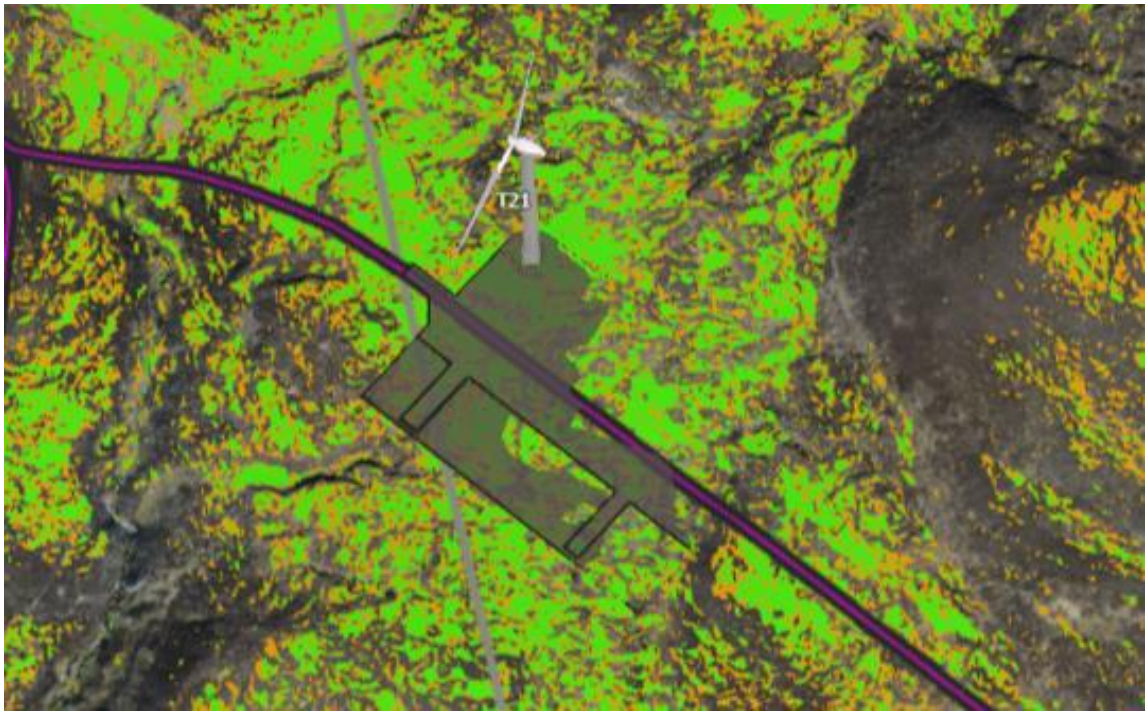


Plate 3-13: T21 Location

- Minor amendments to WTG locations and hardstanding orientation were made where possible, in response to environmental constraints;
- Access track positions were adjusted to avoid development within the 50 m water buffer; and

- Access tracks were extended to cover the provision of access to borrow pit search areas.

3.6.20 These changes resulted in the Design Chill Layout, which is presented in **Figure 3.5 (EIAR Volume 2).**

Layout 6: Design Freeze Layout [12 WTGs]

3.6.21 Stage 2 peat probing was undertaken based on Layout 5 (design chill). Layout 5 was also circulated to the technical specialists for comment.

3.6.22 Following the stage 2 peat probe and borrow pit survey, feedback from the wider environmental team, the following changes were made:

- The western access track was realigned to avoid remains of a pre-medieval settlement (non-statutory cultural heritage asset);
- Laydown area near T10 was adjusted slightly (approx. 4 m) to move one corner out of blanket bog;
- Indicative borrow pit locations were confirmed, resulting in six search areas. Access tracks to borrow pits were also finalised;
- Slight movement of T5 and T21, due to steep topography, environmental and technical considerations;
- Relocation of the construction compound, due to steep topography;
- Relocation of substation compound, due to steep topography;
- The decision was made to use ground based LiDAR rather than a permanent mast for meteorological measurements during the operational phase. The LiDAR unit would be located next to the substation to minimise additional access tracks and additional cabling; and
- Following an engineering site walkover further detailed analysis, the Site boundary was further reduced, as this south eastern corner was not required for the Proposed Development.

3.6.23 These changes resulted in the Design Freeze Layout, which is presented in **Figure 3.6 (EIAR Volume 2).**

3.7 Summary of Preferred Option

3.7.1 The preferred option taken forward for assessment is the Layout 6: Design Freeze Layout as presented in **Chapter 2: Development Description (EIAR Volume 1)** and shown in **Figure 2.1: Site Layout (EIAR Volume 2)**.

3.7.2 By following the design guidance described in **Table 3-1**, the number of WTGs was reduced from 18 to 12 WTGs. The WTGs and associated infrastructure were sited to reduce potential impacts to landscape, peat, heritage features, ecology and ornithology when compared to earlier iterations of the design. The infrastructure footprint was optimised to minimise overall track length and the number of watercourse crossings. In summary, the main reasons for selecting the proposed layout are the reduced impact on areas of deep peat, the provision of a unified layout from a landscape and visual perspective, and the reduced impact on priority peatland habitats habitat. The proposed layout has been chosen as it provides an optimised layout from an environmental and construction perspective. It has adopted the mitigation hierarchy with the aim of avoiding and minimising as far as practicable, likely significant effects.

3.7.3 At detailed design stage (following consent), further ground investigation surveys will be undertaken, and consideration will be given to further micrositing (within 50 m) where feasible.