

16 Forestry

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16 Forestry

16.1 Executive Summary

- 16.1.1 The Proposed Development is situated within an extensive area of commercial forestry known as the Cumberhead Forestry Complex, which was originally planted between 1974 and 1989. Felling and replanting has been taking place under a Forestry Commission Scotland (FCS) approved Forest Plan since 2006, steadily restructuring the age and species profile of the forest.
- 16.1.2 This chapter details the design approach adopted to optimise the fit between the Proposed Development and the existing Baseline Forest Plan, before analysing the differences between the Baseline Forest Plan and Wind Farm Forest Plan in order to assess the potential impacts.
- 16.1.3 The Proposed Development will have an infrastructure and associated tree free area footprint of 39.36 ha, requiring 32.25 ha of conifer woodland to be felled. Of this 39.36 ha area, 33.08 ha was due to be replanted predominantly with Sitka spruce under the Baseline Forest Plan. As the Proposed Development precludes this replanting, 33.08 ha (1.6 % of the total forest area) will be subject to compensatory planting, to be delivered through the Compensatory Planting Plan on land under the ownership of the Developer in South Lanarkshire. Borrow pits may be required within forestry areas however as the exact location and extent of these are as yet unknown, an additional 2 ha has been included within the compensatory planting calculation, taking the total compensatory planting commitment to 35.08ha.
- 16.1.4 The Proposed Development results in an additional 57.49 ha of harvesting in Phase 2 of the Forest Plan between (2021 to 2025), which represents a 13.1 % change from the Baseline Phase 2 felling area but only 2.8 % change over the entire forest property. The relatively minor changes required to accommodate the Proposed Development are reflected in the timber production forecasts. The Wind Farm Forest Plans results in an increase in timber production of 13,503T or 9.4 % in Phase 2 between (2021 to 2025), however a 2 % decrease in total production over the 20-year Forest Plan period compared to the Baseline.
- 16.1.5 Timber harvesting to facilitate construction will occur ahead of the main construction phase, with all timber extracted via the existing forest road access to Station Road at Douglas West. As the Proposed Development has been designed to fit closely with the Baseline Forest Plan, there is little generation of forestry residues, however a Forest Residue Management Plan has been produced detailing how the small volumes generated will be utilised.
- 16.1.6 Overall, the Proposed Development is considered to have a good fit with the Baseline Forest Plan and a correspondingly modest effect on the social, economic and environmental benefits delivered by the Cumberhead Forest Complex, with the wind Farm Forest Plan having an overall minor beneficial effect.

16.2 Introduction

- 16.2.1 Cumberhead Forest extends to 2,019.30 ha and is held in a single private ownership of which approximately 359.7ha form part of the Proposed Development. For the purposes of this report, Cumberhead Forest has been assessed as a single forestry management unit, as this is how it is currently managed and will continue to be managed irrespective of the Proposed Development.
- 16.2.2 Cumberhead Forest was originally planted between 1974 and 1989 predominantly with Sitka spruce, with smaller proportions of other conifers including Lodgepole pine, Japanese larch and Scots pine. Integral open ground is found throughout the forest, primarily associated with rides, riparian corridors and hill tops. The site is a productive commercial woodland with yield classes varying from 4 to 20, with the majority of the crop recording yield classes of 12 to 20. As such Cumberhead can be considered a good commercial forest property.

- 16.2.3 Restructuring is now underway with greater species diversity having been introduced since 2006 when harvesting commenced, including areas of diverse conifers, native broadleaved trees associated with riparian corridors and designed open ground to improve landscape design.
- 16.2.4 This chapter describes the forestry related aspects of the Proposed Development, which consists of thirteen turbines, which are to be located within areas of established commercial forestry within Cumberhead Forest. The forest is currently undergoing restructuring through an FCS approved Forest Plan (the Baseline Forest Plan), detailing the sequential felling and replanting of conifer crops, gradually increasing the age class structure, species diversity and improving landscape design, with tree crops currently having planting years between 1974 and 2018.
- 16.2.5 Wherever possible, turbines have been located as sympathetically as possible reflecting the current forest structure, felling phases and replanting design identified within the Baseline Forest Plan, and keyholing of turbines into the forest to minimise the area impacted by the Proposed Development.
- 16.2.6 Replanting will take place up to the keyhole areas with bat protection buffer zones of 75 m radius around turbine bases to minimise woodland removal. The infrastructure associated with the Proposed Development, as described in the EIA Report (refer to Chapter 3), including access tracks and site compounds will also require some limited removal of trees. Borrow pits and the temporary laydown and construction compound areas will be re-instated following the construction period and replanted (although following pre-application consultation with FCS, these areas will be accounted for in the compensatory planting calculations).

16.3 Legislation, Policy and Guidelines

- 16.3.1 Relevant legislation and guidance documents have been reviewed and taken into account as part of this forestry assessment. Chapter 5 sets out the planning policy framework that is relevant to the EIA. The policies set out below include those from the South Lanarkshire Local Development Plan 2015. This section also considers the relevant aspects of Scottish Planning Policy (SPP), Planning Advice Notes and other relevant guidance. Of relevance to the forestry assessment presented within this chapter, regard has been had to the following policies:
- Scottish Forestry Strategy (SFS), 2006;
 - Scottish Land Use Strategy (SLUS), 2016;
 - Scottish Planning Policy (SPP), 2014;
 - National Planning Framework for Scotland 3 (NPF3), 2014;
 - Control of Woodland Removal Policy (CoWR), 2009;
 - Guidance to FCS staff on implementing the Scottish Government's Policy on Control of Woodland Removal, 2015;
 - Supplementary guidance to support the FC Forests and Peatland Habitat Guidance Note, 2000;
 - Management of Forestry Waste, 2017;
 - Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Position Statement and Guidance, 2014;
 - Clydeplan Strategic Development Plan and Local Development Plan, 2017; and
 - Glasgow and Clyde Valley Forestry and Woodland Strategy, 2011.
- 16.3.2 These documents and their relevance to this chapter are described in more detail below.

National Policies

- 16.3.3 The SFS (FCS, 2006) is the Scottish Ministers' framework for taking forestry through the first half of this century and beyond. The strategy sets out the Ministers' vision for a Scottish forestry sector that is:
- "diverse and strong; in tune with the environment; employing many people in a wide range of enterprises; and providing the many other services and benefits that people need, now and for the future".*
- 16.3.4 This vision is built on the key themes of climate change, timber, business development, community development, access and health, environmental quality and biodiversity.
- 16.3.5 The SFS sets out the following targets:
- 16.3.6 Increase Scotland's woodland cover to 25 % by the second half of 21st century (This has been clarified as an 'aspirational' target. A revised target of 100,000 ha of new forest creation between 2012 and 2022 is now in place);
- bringing 80 % of special features on Scotland's nationally important nature sites into favourable condition by March 2008;
 - the forestry sector delivering annual carbon savings of 0.6 million tonnes of carbon (MtC) by 2010, 0.8 MtC by 2015 and 1MtC by 2020.
- 16.3.7 The Scottish Forestry Strategy Implementation and Plan 2015-18 Report details the following specific action relating to forestry and renewables:
- encourage wind farm designs that reduce the need for woodland loss and the requirement for compensatory planting.
- 16.3.8 The SLUS is a strategic framework for achieving the 'best' use from Scotland's land resource. The strategy aims to achieve a more integrated approach to land use, maintaining the future capacity of the land resource and is based on the three pillars of sustainability; economy, environment and communities. Attaining multiple benefits from land is a key theme, and the focus on forestry is the identification of areas best for tree planting in an integrated land use system. Regional Forestry and Woodland strategies developed by local authorities are identified as the delivery mechanism to promote good practice and multi benefit land use.
- 16.3.9 Trees and woodlands are addressed in the SPP, which recommends local authorities prepare woodland strategies to support the development of forestry and woodlands in their area (Paragraph 201). The opportunities for woodland creation are highlighted in Paragraph 217, along with the need for the Control of Woodland Removal Policy to be taken into consideration in relation to development (Paragraph 218), stating woodland removal should only be permitted where it would achieve significant and clearly defined additional public benefits. Where woodland is removed in association with development, developers will generally be expected to provide compensatory planting.
- 16.3.10 NFP3 details the national woodland expansion target of 100,000 ha over the ten years between 2012 and 2022, with a subsequent review of woodland expansion targets in the 2020s to ensure national objectives on emissions and land use are achieved.
- 16.3.11 In general, there is a strong presumption against woodland removal, and replanting of harvested forests is a normal condition of gaining felling approval. The ability of woodlands to sequester carbon, and hence their role in possible mitigation of climate change, is an important factor in shaping regulatory mechanisms.
- 16.3.12 The control of forestry felling is usually administered under the Forestry Act 1967 (as amended). Woodland removal, defined as *"the permanent removal of woodland for the purposes of conversion to another land use"* falls within the scope of Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017, except in cases when woodland removal is associated with

- development. In the case of wind farm development, potential significant environmental effects of woodland removal are assessed by the Scottish Ministers for consent applications over 50 MW as is proposed here.
- 16.3.13 The Scottish Government’s policy document on Control of Woodland Removal provides the broad framework under which accompanying implementation guidance has been produced to give details and background on the latest guidance, policy and to discuss the principles, criteria and process for managing the policy's implementation in respect of forestry removal on development sites.
- 16.3.14 Principal aims of the Control of Woodland Removal Policy are to provide a strategic framework for appropriate woodland removal and to support climate change mitigation and adaptation.
- 16.3.15 The Control of Woodland Removal Policy is built on the following principles:
- strong presumption in favour of protecting Scotland's woodland resource;
 - woodland removal should be allowed only where significant and clearly defined additional public benefit can be demonstrated. A proposal for compensatory planting may add additional public benefit;
 - approval for woodland removal should be conditional on the undertaking of actions to ensure full delivery of the defined additional public benefits;
 - planning conditions and agreements are used to mitigate the environmental impacts arising from development and FCS will also encourage their application to development-related woodland removal; and
 - where felling is permitted but woodland removal is not supported, conditions conducive to woodland regeneration should be maintained through adherence to good forestry practices as defined in the UK Forestry Standard.
- 16.3.16 The Control of Woodland Removal Policy identifies the following criteria for areas where woodland removal may occur without a requirement for compensatory planting:
- enhancing priority habitats and their connectivity;
 - enhancing populations of priority species;
 - enhancing nationally important landscapes, historic environment and geological Sites of Special Scientific Interest (SSSIs);
 - improving conservation of water resources;
 - improving conservation of soil resources; and
 - public safety.
- 16.3.17 The requirements raised in the policy may be addressed by implementing changes to forest design, adapting design and/or undertaking compensatory planting.
- 16.3.18 In relation to the Proposed Development, the Control of Woodland Removal Policy (FCS, 2009) has been taken into account with woodland removal being restricted to areas essential for operational requirements as described in Chapter 3: The Proposed Development, of the EIA Report as well as "keyholing" of turbines to reduce the need for felling. Where woodland removal is required, this has been identified and compensatory planting of an area equivalent to the public benefit loss of the woodland being removed has been allowed for. Due to the limitation of suitable open ground within Cumberhead Forest Complex, areas for compensatory planting are being explored out-with the site boundary, as detailed in the Compensatory Planting Plan in section 16.8.
- 16.3.19 In 2013 SEPA produced guidance on the Management of Forestry Waste in response to renewable energy developments on afforested land and more recently The Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Position Statement and Guidance was produced by SEPA,

SNH and FCS to complement this advice (Scottish Environment Protection Agency, Scottish Natural Heritage, FCS, 2014). The guidance notes do not apply to conventional forestry activities as no land use change is involved, there being exclusions under the EU Waste Framework Directive applicable to forestry (European Commission, 2008). Where trees are being removed for conversion to a non-forestry land use, the guidance note advises the following considerations:

- 16.3.20 Professional forester input to quantify the likely volumes, markets and economic uses of trees to be exported from the site:
- Developer commitment to employ a professional forester (preferably the same one used to provide advice on the EIA Report) to implement and maximise the removal of timber and forest residue on site.
 - Quantify the likely volumes of material for which no economic off-site use can be found.
 - Identify if there are valid uses on site for material for which no economic off-site use can be found, using professional ecological consultant input where ecological uses are proposed, and using professional water quality expertise when material is to be retained on site. Boundaries of areas proposed for such uses should be set out on plans, and information on depth and size of material to be used for such uses provided, within the EIA Report.
- 16.3.21 In relation to the Proposed Development these issues have been addressed in Section 16.8.1 (Forest Residue Management Plan) and Section 16.8.28 (Compensatory Planting Plan) of this chapter and in Chapter 3: The Proposed Development of this EIA Report.

Regional Policy

- 16.3.22 The Proposed Development falls within South Lanarkshire Council which is covered by the South Lanarkshire Local Plan and supported by the Clydeplan Forest and Woodland Strategy (Glasgow and the Clyde Valley Strategic Development Planning Authority, 2015).
- 16.3.23 Clydeplan Forest and Woodland Strategy (the Strategy) aims to support and integrate national policies with all eight Local Authorities covered by the Strategy (including South Lanarkshire), guiding forestry and woodland expansion in the region, providing a policy and spatial framework to maximise the contribution of woodland and forestry to the people, environment and economy of the region.
- 16.3.24 The Strategy is in line with national policy, emphasising a presumption against woodland removal. The facilitation of other forms of renewable energy development has been identified where it does not result in a net reduction of woodland cover.
- 16.3.25 Regional priorities for woodland expansion and management are detailed by spatial landscape zones, with the Proposed Development falling within the Plateau Moorlands zone. South Lanarkshire's Plateau Moorland zone is characterised by gently sloping moorland with a mixture of peatland, grassland and coniferous forests. The Strategy identifies the surrounding land as either preferred or sensitive to woodland expansion.
- 16.3.26 One of the key issues identified within this zone is the restructuring of commercial forests to retain commercial productivity while improving their landscape and ecological value, as well as having potential for a significant increase in new woodland cover including:
- productive commercial woodlands with suitable access;
 - mixed and energy woodlands close to communities or associated with mineral working to provide screening and forming part of site restoration when extraction is complete; and
 - native woodland expansion to contribute to habitat networks along river valleys.
- 16.3.27 The Proposed Development is close to the border with East Ayrshire which is covered by the Ayrshire and Arran Forestry and Woodland Strategy (East Ayrshire Council, 2014). The neighbouring landscape zone within this Strategy is the Muirkirk Upland Zone, much of which is open moorland

covered by the Muirkirk and North Lowther Uplands (SPA) and is identified as being "sensitive" to woodland expansion (new woodlands) or compensatory planting.

16.4 Consultation

16.4.1 Table 16.1 Summarises the responses from the Scoping process and additional post-scoping comments received relevant to forestry and how these have been addressed in the EIA Report.

16.4.2 In addition to the formal Scoping process, pre-application consultation was undertaken with FCS, with a site meeting to review and discuss the Wind Farm Forest Plan proposals.

Table 16.1 - Summary of Forestry related Consultation Responses

Consultee	Scoping Response	Consultee Response
FCS	The report should include a stand-alone chapter on 'Woodland Management and Tree Felling' prepared by a suitably qualified professional and supported by existing records, site surveys and aerial photographs. The chapter should describe and recognise the social, economic and environmental values of the forest and the woodland habitat and take into account the fact that, once mature, the forest would have been managed into a subsequent rotation, often through a restructuring proposal that would have increased the diversity of tree species and the landscape design of the forest.	This forestry chapter has been prepared by a suitably qualified professional and supported by all necessary data and maps. Pre-application consultation and site meetings were conducted with FCS to agree proposals before use in this report.
FCS	The chapter should describe the baseline conditions of the forest, including its ownership. This will include information on species composition, age class structure, yield class and other relevant crop information. The chapter should clearly indicate proposed areas of woodland for felling to accommodate the proposed infrastructures, including access roads, tracks and any ancillary structures. Details of the area to be cleared around those structures should also be provided, along with evidence to support the proposed scale and phasing of felling. The chapter should consider the combined impact of this proposal and the neighbouring Cumberhead Extension proposal on the woodland, especially in regard to wind stability.	Detailed Baseline and Forest Plans are provided with an assessment of changes relating to the timing and scale of changes between the two plans including felling programmes, timber production, haulage, species composition and age structure.
FCS	The chapter should describe the changes to the forest structure, the woodland composition and describe the work programme. The felling plan should clearly identify which areas are to be felled and when. Trees felled must be replaced by on-site (replanting) or off-site compensatory planting. On-site replanting must always be considered first.	Comparisons of the Baseline and Wind Farm Forest Plans are provided detailing changes to felling programmes, timber production, timber haulage, age structure and species

Consultee	Scoping Response	Consultee Response
	The replanting plan should show which areas are to be replanted and when during the life of the project. The plan should clearly identify and describe the replanting operations including changes to the species composition, age class structure, timber production and traffic movements.	composition over the course of the 20-year Forest Plan period as well as associated with the Proposed Development.
FCS	Applicant should consider potential cumulative impact of the development in respect to the local and regional context. Consideration should be given to the implication of felling operations on such things as habitat connectivity, landscape impact, impact on timber transport network and forestry policies included in the local and regional Forestry and Woodland Strategies and local development plans.	Cumulative impacts of wind farm developments are detailed in this chapter (Section 16.10).
FCS	Specifics of proposed mitigation should be included in a replanting plan, appropriately described in the EIA Report, to understand the development in full.	Mitigation measures relating to replanting and compensatory planting are detailed in the report (Section 16.8.28).
FCS	Both felling operations and on and off-site compensatory planting must be carried out in accordance to good forestry practice- the EIA Report must clearly state that the project will be developed and implemented in accordance with the UK Forestry Standard.	A commitment to deliver all forestry operations to UKFS and UKWAS standards is included in the forestry chapter along with a compensatory planting plan (refer to Figure 16.6).
FCS	FC Scotland should be consulted throughout the development of the proposal to ensure that proposed changes to the woodland are appropriate and address the requirements of policy on control of woodland removal and the principles of sustainable forest management.	Pre-application consultation was carried out with FCS as well as a site meeting and provision of draft proposals which were agreed before use in the report.
SEPA	Require a map and table detailing forest removal.	Woodland removal is detailed on Figure 16.5.
SEPA	Require the inclusion of a comprehensive breakdown on all aspects of the 'forestry works' planned at the site, including proposals for the use of 'forestry by-products'.	A forest residue management plan is provided in this chapter (section 16.8.1).

16.6 Assessment Methodology and Significance Criteria

16.6.1 This chapter follows the assessment methodology set out in the Guidance to Forestry Commission staff on implementing the Scottish Government's Policy on Control of Woodland Removal – Annex 1 Environmental Statement (FCS 2015). This report also draws on the principals set out in *The Forestry (Environmental Impact Assessment) (Scotland) Regulation 2017* in assessing the overall significance of environmental effects (Scottish Government, 2017).

16.6.2 A number of parameters were taken into account in considering the felling requirements for the Proposed Development, including creating the following tree free areas:

- 20 m wide corridors within which necessary access tracks would be located and around the substation, control room and energy storage facility;
- 75 m radius centred around each turbine to establish bat protection buffer zones (as set by Bat Conservation Trust Good Practice Guidelines (BCT, 2016)) to be maintained as tree free for the life of the turbines; and
- 10 m tree free buffer zone around crane pads, temporary construction compounds and borrow pits;

16.6.3 Permanent infrastructure areas and their associated buffers will be cleared and maintained as tree free while temporary infrastructure areas will be cleared, restored and replanted following construction.

16.6.4 Restored areas will be replanted but will not be included in the replanting figures and will instead be included in the requirements for compensatory planting calculations due to concerns raised by FCS over the suitability of restored sites for woodland post-restoration.

Desk Study

16.6.5 Cumberhead Forest benefits from an existing Baseline Forest Plan (refer to Figure 16.1) and good base data relating to current tree species, planting years, Yield Class, Wind Hazard Class and LiDAR tree crop height data, combining to provide reliable information to support silvicultural decision making. This plan was reviewed, with data updated reflecting changes to species composition, ages and yield classes arising from the ongoing programme of harvesting and replanting as well as in response to observed growth rates within the forest. This review fed into a series of field surveys to verify and update the baseline forestry data.

Site Visit

16.6.6 Ground truthing of specific aspects of the forest was undertaken (01 February 2019) to support the desk study and to provide quantitative validation for specific aspects of the proposal, particularly those identified in pre-application consultation and site meetings with FCS. Field survey validation was primarily in relation to tree canopy top heights and felling phasing in proximity to specific turbine locations to help inform the appropriateness of turbine specific management proposals.

Assessment of Potential Effect Significance

Forest Plans

16.6.7 In 1919 the Forestry Commission was established and tasked with encouraging large-scale forest expansion, to provide a strategic timber reserve for the United Kingdom. Afforestation often took place in the uplands with a limited number of tree species capable of successful establishment. As these forests have matured and policy has changed, a move towards creating more diverse, multi-purpose woodlands has developed.

16.6.8 Restructuring of even age, single species dominated forests to achieve a more diverse age and species structure is required through the UKFS and certification systems such as the UK Woodland Assurance Standard (UKWAS, 2018). Forest restructuring is approved through the forest planning

process, usually in the form of a Forest Plan, which is assessed and authorised by FCS as the Competent Authority.

- 16.6.9 Forest Plans can relate to individual forests or groups of woodlands and represent a strategic document describing forest operations such as harvesting, replanting and road building over a 20-year period, broken down into four, 5-year phases. Forest Plans bring together and attempt to balance management objectives, silvicultural prescriptions and other considerations relevant to the forest area such as landscape, access, biodiversity and the water environment. Forest Plans describe how the management strategy will deliver these objectives, through the structures detailed within the UKFS and UKWAS requirements. Silvicultural prescriptions are underpinned by site specific conditions such as location, species, age structure of the woodlands and the risk of windblow damage to commercial conifer crops.
- 16.6.10 A Baseline Forest Plan is in place at Cumberhead Forest, which is due for a mid-term review in 2020/21 and full renewal in 2026. As part of the EIA consultation process, proposed felling and restocking plans have been drafted in consultation with FCS. Prior consultation and a site meeting were conducted with FCS with the site meeting being held on 01 February 2019 to discuss and agree the principles of the felling and replanting plans for the Proposed Development.
- 16.6.11 The Felling and Replanting Plans from the Baseline Forest Plan are presented in Figures 16.1 and 16.2 along with the Felling and Replanting Plans for the Wind Farm Forest Plan which are detailed in Figures 16.3 and 16.4.
- 16.6.12 An assessment of potential significant effects on forestry can be achieved by comparing key comparable statistics for the Baseline Forest Plan and Wind Farm Forest Plan to quantify:
- areas felled across the felling phases;
 - timber volumes to be felled over the course of the Forest Plan phases;
 - changes to species composition; and
 - requirements for compensatory planting.

Design Methodology

- 16.6.13 Initial proposals were scoped with FCS in 2018 and a site meeting was held in February 2019 to consider the potential impact of the 13 turbines. Following feedback from FCS and other consultees a number of design iterations were undertaken in order to balance the impacts on forestry as well as ecology, landscape and other considerations.
- 16.6.14 In locating turbines for the Proposed Development, a range of factors were considered and balanced including detailed consultee feedback, tree height and crop age structure, felling and replanting plans in the Baseline Forest Plan as well as landscape and topography at individual turbine locations. This process involved looking at opportunities for:
- Using larger turbines to remove issues associated with wind resource and turbine warranties in relation to felling requirements.
 - Locating turbines in areas where the potential for woodland removal is minimised based on the Baseline Forest Plan restructuring design e.g. areas of open ground.
 - Locating near to existing forest roads and rides to reduce crop loss to infrastructure.
 - Locating turbines where there would be least impact on the current forestry felling phases (in young crops or in compartments due to be felled).
 - Reducing keyhole requirements to the absolute minimum area required to accommodate turbines and associated bat protection zones.
- 16.6.15 The following section explores how the various elements of this design approach fed into the iterative Wind Farm design process, leading to the final design.

Cumberhead Forest Plan

- 16.6.16 Cumberhead is a large commercial forest complex with a wide range of crop ages, from young, recently felled and replanted crops, through to mid rotation crops as well as mature crops ready for harvesting. This complexity is added to by the presence of Nutberry Hill Wind Farm located near the centre of the property.
- 16.6.17 Age diversity at Cumberhead offers a number of opportunities when considered in the context of planning a wind farm development:
- Existing Baseline Forest Plan; detailed forest management proposals balancing forest management objectives with key economic, social and environmental considerations and subject to full public consultation.
 - Good existing crop data and knowledge of the property by both the Forest Managers and Forestry Commission staff.
 - Age class diversity across the site offers greater potential for siting turbines in young crops where there will be limited requirement for felling to wind-firm edges or for wind resource or felling areas in line with the existing harvesting coupes and phases.
 - A greater number of wind-firm boundaries have been created through past harvesting and replanting operations with a greater understanding of site susceptibility to windblow.
- 16.6.18 Cumberhead Forest has been managed since planting as a commercial forestry, with a strong focus on commercial production and has operated under an approved Forest Plan since 2006. One of the benefits of having a Baseline Forest Plan is as a benchmark for "normal" management against which the Proposed Development can be assessed.
- 16.6.19 Key issues for wind farm developments in relation to forestry often revolve around what felling and replanting would be acceptable under "normal" forestry operations against which an assessment of the wind farm forestry proposals can be assessed. In this instance the presence of a Baseline Forest Plan provides the baseline against which to compare the Proposed Development, while providing a vital tool for helping to prioritise turbine locations where there is greatest synergy with routine forest management.

Keyholing

- 16.6.20 The design concept has been to avoid woodland loss wherever possible and where this is not possible, to have the smallest possible keyhole and associated felling within afforested areas. The size of the keyhole is dependent on a number of factors relating to the crop, turbine selection and other factors such as the presence of protected species.
- 16.6.21 This design approach considered location, altitude, topography, soils, exposure, tree height, age and species which all influence the scale of keyholes and associated felling. Young crops require no additional felling to wind-firm boundaries, as there is very low risk of inducing windblow by "cookie cutting" the turbine keyhole into the existing crops. Mature crops may require more extensive felling to wind-firm boundaries before replanting the felled area back to the desired keyhole. Both approaches result in the same keyhole area, but the latter requires more initial felling.
- 16.6.22 Turbine selection also plays a significant role in the size of the keyhole area. In basic terms, the taller the hub height, the greater the potential to reduce keyhole sizes as the rotor blades will be higher above the forest canopy. This is also the preferred approach for wind resource, as the higher the turbines, the greater the wind resource and less interference from the forestry below. Limiting factors in this situation have been:
- Rotor blade length – this is the largest single component to be transported to site.
 - Landscape – the need to ensure the selected turbines are appropriate to the scale and setting of the area and comparable in appearance to neighbouring wind farms.

- 16.6.23 Turbines with a tip height of up to 200 m have been selected for the Proposed Development in order to maximise potential for woodland retention and wind resource, while balancing other key considerations. The selected turbines would permit retained tree heights of 20 m adjacent to turbines minimising woodland removal.
- 16.6.24 A further important design consideration in keyhole size is the presence of bats, which are European Protected Species and require tree free stand-off zones between tree canopies and the swept edge of the turbine blades, as detailed in EIA Report (refer to Chapter 7: Ecology and Nature Conservation). In this design approach, a bat protection buffer zone has been the limiting factor in how close the tree edge can be to the base of turbines. For the turbines and rotor blades proposed, the bat protection buffer zone radius used for this assessment is 75 m.

Wind Resource and Turbine Warranties

- 16.6.25 Wind resource engineers and turbine manufacturers were engaged to determine the potential for an upper height limit for tree canopy retention directly adjacent to turbines. Initial feedback indicated (subject to turbine selection) a canopy height of 20 m. This figure was a compromise balancing retaining forestry to an economic height against crop loss for bat protection buffer zones, as the taller the crops, the larger the tree free buffer zone required and associated woodland removal around each turbine.
- 16.6.26 Windblow risk was assessed using a combination of past experience at Cumberhead Forest along with standard silvicultural Critical Height and Terminal Height figures for the Wind Hazard Classes (WHC) at each turbine location. The majority of the site is classified as WHC 5 with smaller areas of WHC 4 and 6. Critical Height is the height at which the onset of windblow can be expected and the Terminal Height is the height at which significant windblow can be expected (defined as 40% or more of the stand area). Table 16.2 details the age at which the yield classes of crop found within the Proposed Development area will reach Critical and Terminal Heights for WHC 5.

Table 16.2 - Summary table for the ages at which yield class 6 to 20, unthinned Sitka spruce crops will reach Critical and Terminal Heights for Wind Hazard Class 5 sites.

Yield Class (YC)	Critical Height (16m)	Terminal Height (19.5m)
6	60 years	70 years
8	50 years	65 years
10	42 years	54 years
12	36 years	46 years
14	34 years	41 years
16	30 years	37 years
18	24 years	34 years
20	20 years	31 years

- 16.6.27 The table above broadly supports field observations at Cumberhead Forest which indicate unthinned crops of Sitka spruce between 18 m and 23 m in height will start to suffer significant windblow.
- 16.6.28 Combining observational and theoretical evidence to assess tree canopy retention heights shows a good degree of overlap:
- wind resource engineer and turbine warranty feedback: Canopy heights of 18 m to 24 m subject to bat protection buffer zone;
 - Critical Height and Terminal Height figures for WHC 5 sites: Canopy heights of 16 m to 19.5 m; and

- field observations of windblow: Target harvesting height of 18 m to 23 m.

16.6.29 The reasonably flexible approach to tree heights adjacent to turbines adopted by the wind resource engineers, turbine manufactures in combination with the turbine and rotor blade selection introduces substantial flexibility for siting turbines in order to minimise woodland loss.

Topography and Landscape

16.6.30 A full landscape and visual assessment of the Proposed Development is provided in Chapter 6: Landscape and Visual and a landscape analysis is included as part of the Baseline Forest Plan. Forestry and landscape are considered here within the context of the Proposed Development and current forestry best practice under the UKFS and supporting documentation including the *UKFS Guidelines - Forests and Landscape* (Forestry Commission, 2017) and Forestry Commission Guidance Notes such as *Design Techniques for Forest Design Planning* (Forestry Commission, 2014).

16.6.31 **It is important to note that the majority of the felling detailed in the Wind Farm Forest Plan will be approved by FCS through the routine Forest Plan approval process, with the only the felling required for the immediate infrastructure footprint and associated tree free buffer zones being applied for as part of the Proposed Development.** As such, forestry harvesting coupe design, scale and acceptability for the majority of felling will fall under the assessment of FCS as the Competent Authority.

16.6.32 The design approach was to adhere to the principles for the Baseline Forest Plan in relation to coupe design, scale and, as far as possible, existing felling phases and crop separation considerations.

Timber Harvesting Volume Calculation Methodology

16.6.33 Timber volumes are derived from Forestry Commission Yield Models using the age of the tree crops and estimated Yield Class (YC) based on LiDAR data and field verification.

16.6.34 The default yield model used was Sitka spruce, 2 m initial planting spacing, no thinning, as this reflects the dominant species and planting regime within the forest.

16.6.35 Net volumes have been used for the purposes of this assessment. These have been calculated by deducting 15% of the gross volume to account for drainage ditches, rides and small open spaces within the crop.

16.6.36 An industry standard conversion factor of 1.08 has been used to convert the net volume into tonnage and this was used to determine forecast timber volumes.

Summary of Design Methodology

16.6.37 Turbine locations were assessed against the Baseline Forest Plan and forecast crop heights in 2021 with compartments assessed to highlight the level of fit with the Baseline Forest Plan. This assessment formed the basis of a more detailed pre-application consultation and site visit with FCS to explore appropriate approaches to design and mitigation to limit forestry impacts.

16.6.38 The result of this process should be a Wind Farm Forest Plan design with an acceptable fit with the Baseline Forest Plan and associated felling and replanting designs, resulting in the smallest possible impact on the overall forest when considered in the context of felling areas, harvesting volumes or replanting design. The key test of the success of this approach should be a Wind Farm Forest Plan that is capable of being supported by FCS following the pre-application site visit and subsequent submission.

Requirements for Mitigation

16.6.39 Where woodland removal is an unavoidable consequence of land use change, compensatory planting will need to be delivered in accordance with the Implementation Guidelines for the Control of Woodland Removal Policy (Forestry Commission Scotland, 2015), with the details for delivery set out in a compensatory planting plan.

- 16.6.40 Where felling and replanting are not being carried out as part of routine forestry operations, there is the scope for the production of non-forestry residues. In such cases a forest residues management plan will need to be produced.

Assessment of Residual Effect Significance

- 16.6.41 Comparable forest statistics will be produced for the Baseline Forest Plan and the Forest Plan in order to assess the scale, magnitude and speed of changes proposed between the two Forest Plans as well as their delivery against UKFS and UKWAS standards.

Limitations to Assessment

- 16.6.42 The precise scale and location of borrow pits is not yet known, however it is anticipated that these will be relatively small in extent and will not exceed 2 ha in area. An approach as to how these will be handled in relation to forest design and compensatory planting is detailed in paragraph 16.8.36.

16.7 Baseline Forest Plan

- 16.7.1 Forest Plans are a critical tool in strategic forest management, designed to balance the objectives of the owner with site specific considerations such as landscape, biodiversity, protection of soils and water, archaeology and public access, i.e. balancing the social, economic and environmental aspects of the forest.

- 16.7.2 The Baseline Forest Plan at Cumberhead runs from 2016 to 2035, with detailed approvals for felling and replanting covering the first ten-year period (leading up to 2025) and indicative felling phases for the second ten-year period (2026 to 2035).

- 16.7.3 Key site factors assessed in the Cumberhead Baseline Forest Plan are summarised below.

Social

- 16.7.4 Community engagement and Scoping was carried out as part of the Forest Planning process. Through this process the key actions identified by local residents were:

- Improved access (installation of gates) on the tracks leading into Cumberhead from South Cumberhead Farm and Stockhill Farm; and
- Opening up of a historic footpath running through the eastern corner of the property through compartments 426, 435 and 436.

- 16.7.5 An archaeological survey was commissioned as part of the Baseline Forest Plan, which revealed no Scheduled Ancient Monuments within Cumberhead Forest but identified 21 archaeological or potential archaeological features. Most features related to past agricultural use such as sheepfolds, enclosures and dykes as well as some disused mines and associated infrastructure.

- 16.7.6 All identified archaeological features have been mapped and recorded for forest management purposes, to ensure they will be marked on site prior to felling and protected from harvesting operations, with 20 m unplanted buffers around major features and 10 m open ground buffers around minor features.

- 16.7.7 This large area of mid to late rotation forest has been planted on land that can be characterised as extensive plateau moorland, dominated by large, gently sloping areas of forest that rise sharply onto the slopes of the hills to the south. Wedder Hill (465 m), Hagshaw Hill (470 m), Common Hill (488 m), Burnt Rig (441 m) and Arkney Hill (375 m) form a ridge to the south, which act as a topographic screen from potential viewpoints to the south-west through to the south-east.

- 16.7.8 To the west and northwest, Cumberhead Forests extends over the Law (419 m), Black Hill (360 m) and Tod Law (380 m), screening views into the Hagshaw Hill landscape unit. From the north, views into the forest are extremely distant with intervening topography, obscuring all but the upper margins of the forest from Lesmahagow, located 5.5 km to the north, on the far side of the former opencast workings.

- 16.7.9 Views from the east and northeast have the greatest number of potential vantage points and visual receptors, most of which are relatively distant, at oblique angles, with only the upper margins of the forest visible. Coalburn is located 1.5 km north-east of Cumberhead Forest but sits relatively low in the landscape with the lower village sitting in the valley and the upper village partially screened by the former opencast workings and intervening woodlands. Where the forest is visible from the top of Coalburn Road and Bellfield Road, only the eastern-most section of the forest is visible, with considerable foreshortening of lower and mid-slope woodlands as a result of the gentle gradient. More distant views from the northeast are taken from the main north-south transport corridor along the B7078 and the M74 corridor ranging from 3.5 km to 5.5 km.
- 16.7.10 Views from the village of Douglas, just over 2.5 km to the east, are extremely limited as the forest is over the brow of the hill, with the village sitting down on the lower slopes of the Douglas Water valley, topographically screened by the escarpment running from Douglas West to Curly Brae upon which Long Plantation is located.
- 16.7.11 While views from the north-east are the most prominent in relation to the Hagshaw Hill landscape unit of Cumberhead Forest, distance, intervening topography and the foreshortening effect of the woodland on the gentle sloping middle to lower plateau slopes, mean the sensitivity of Hagshaw Hill in terms of coupe scale and design is considered to be low to moderate.
- 16.7.12 A landscape character assessment was carried out for the Baseline Forest Plan which was supported by viewpoint images, which recorded most areas as having low or moderate landscape sensitivity. The greatest landscape design considerations in relation to the Hagshaw Hill landscape unit are were considered to be the upper margins and the most easterly section of the forest. In designing felling coupes, consideration was given to their scale and fit within the landscape, ensuring coupes are proportional to the relatively large scale of the forest unit and relatively low sensitivity of the landscape setting.
- 16.7.13 The resulting coupe size and design had relatively large coupe sizes to reflect the scale of the landscape and the need to fell to existing wind-firm boundaries given the risk of windblow, while replanting design was used to improve future forest design. Coupe size varied from 10 ha to in excess of 100 ha over the four felling phases, with the first ten-year period detailing 798 ha of felling, with average coupe sizes between 50 ha to 70 ha.

Economic

- 16.7.14 One of the key management objectives identified in the Baseline Forest Plan is to maximise the financial return from growing timber through the sound practice of silviculture in balance with other site considerations. Cumberhead Forest is owned by a pension fund, with a requirement for steady, predictable annual income. This regular and reliable production of timber also helps to supply and support considerable regional rural economic benefits associated with both in-forest and downstream industries.
- 16.7.15 This objective was delivered through the Baseline Forest Plan by developing felling coupes that allowed for regular harvesting on an economic scale and replanting plans that maximised future timber production from the most suitable ground (the right tree in the right place). Replanting plans were designed to be both UKFS and UKWAS compliant while retaining the optimum area for commercial forestry using improved site preparation, drainage and improved planting stock to enhance productivity of second rotation crops. These proposals were balanced with other site-specific considerations, with areas of less suitable ground removed from production to deliver other benefits such as creation of riparian corridors as natural buffer zones and habitat networks as well as including designed open ground associated with hill tops, access routes and archaeological features.

Environmental

- 16.7.16 As part of the Baseline Forest Plan and UKWAS certification an ecological audit was commissioned to identify significant features and inform recommendations for future management. Recognising the importance of the Muirkirk and Lowther Uplands SPA/Muirkirk Uplands SSSI and a geological

- SSSI located in compartment 107 on the northern boundary, SNH was consulted as part of this process.
- 16.7.17 As well as statutory designations, a number of additional datasets were assessed including the Ancient Woodland Inventory and deep peat deposits database to check for the presence of these features. This was supported by desk-top and site surveys which recorded past and present use of the area associated with Nutberry Hill by black grouse (*Tetrao tetrix*) and notable populations of cloudberry (*Rubus Chamaemorus*) as well as small areas of semi-natural woodlands.
- 16.7.18 The Baseline Forest Plan was designed to reflect the natural characteristics of the site, with generous use of designed open ground in the upper reaches of the riparian corridors, narrowing where the watercourses become incised, using native broadleaves to emphasis this design, especially in the lower sections of the property.
- 16.7.19 Where the forest borders the SSSI/SPA, greater areas of open ground and lower density stocking of Sitka spruce and native broadleaves were included to create a mosaic of open ground and scattered sheltered woodland to be kept as natural reserves to provide valuable shelter and a food source for black grouse.
- 16.7.20 Reflecting the records of high elevation deep peat associated with Priesthill Heights and to improve the linkage between the SSSI/SPA and open ground habitats of Nutberry Hill, replanting was designed to be held back in these areas (compartment 241, 242 and 243). This design was supported by creating long term retentions and natural reserves in crops on the lower elevations of Nutberry Hill in the west and to the north of the Birkenhead Burn.
- 16.7.21 Areas of very low yield class crops recorded in compartments 209 to 211 were identified for reversion to open ground habitats and low-density native woodlands, while also helping to redesign the long, linear crop boundaries at high elevations in this section of the forest.
- 16.7.22 High elevation planting boundaries in compartments 233 and 234, where crop growth has been limited by poor soils and exposure were designed to bring the treeline down the hill while creating a more natural feature in the landscape. Similarly, poor, waterlogged soils at lower elevations in compartments 226 to 229 associated with the Pockmuir Burn flood plain were designed to create areas of open ground in the centre of the forest.
- 16.7.23 In 2011/12 the six turbine, Nutberry Wind Farm was consented and built on The Law in the centre of the property, located within compartments 232, 301, 304 and 305. This development was accommodated within the forest through an amendment to the Forest Plan, which saw these compartments felled to wind-firm boundaries before being replanted back to 100 m keyholes around the six turbines with delayed restocking by five years.

Baseline Forest Plan

- 16.7.24 The Baseline Forest Plan can be used as a benchmark against which to show the changes associated with the Wind Farm Forest Plan. By using comparable forest statistics relating to the composition of the forest (felling and replanting plans) it is possible to accurately quantify and assess the potential impact of the Proposed Development.
- 16.7.25 For the purpose of this report, summary statistics for the area of forest being felled within each of the felling phases has been used, along with timber production forecasts, haulage requirements, replanting areas, species and proportions and benchmarked against both UKFS and UKWAS requirements. Statistics will be replicated for both the Baseline Felling and Replanting Plans and the Wind Farm Felling and Replanting Plans.

16.8 Potential Effects – Wind Farm Forest Plan

- 16.8.1 As set out above in Section 16.6, the premise for designing the Proposed Development in relation to forestry reflected both the Landowner's management objectives and Scottish Government Policy in terms of minimising impact on the Baseline Forest Plan. In doing so, the resulting proposal

maintains the social, economic and environmental aspects set out in the Baseline Forest Plan, while including sustainable energy production into the forest planning process.

- 16.8.2 A discussion and assessment of the impacts of the Wind Farm Forest Plan in relation to the social, economic and environmental aspects of the forest detailed in the Baseline Forest Plan follows.

Social

- 16.8.3 Access consideration identified in the Baseline Forest Plan Scoping are being delivered; The access gates leading to South Cumberhead and Stockhill Farm have been installed and the opening up of the historic footpath following harvesting in compartments 426, 435 and 436 is planned when this area becomes due for felling and replanting.
- 16.8.4 There are no identified archaeological features within the areas proposed for forestry operations as part of the Proposed Development. A single archaeological feature, a circular enclosure, Canmore ID 46518, is recorded within the forest boundary of the Proposed Development, however this is located in the centre of a coupe where no harvesting is planned until phase 3 (2026-2030) and as such no harvesting is planned in this area as part of the Proposed Development.
- 16.8.5 Known and newly discovered archaeological features will continue to be marked on site prior to felling and protected from operations, with 20 m unplanted buffers around major features and 10 m open ground buffers around minor features.
- 16.8.6 Further discussion of archaeological aspect in relation to the Proposed Development is covered in Chapter 10, Cultural Heritage, which sets out full details of the consideration and potential impact of the Proposed Development on archaeology and Cultural Heritage.
- 16.8.7 The approach to coupe design reflecting the relative landscape sensitivity, landscape character assessment and topography in the Baseline Forest Plan has been adopted in the Wind Farm Forest Plan. Phasing of coupes has been based on LiDAR yield class data and supported with ground truthing of tree heights. Coupe structures in the eastern Hagshaw Hill section of the forest reflect the scale and setting of the landscape to create interlocking coupes of varying sizes. Draft coupe design and phasing for the Wind Farm Forest Plan were consulted upon and agreed with FCS before use in this report.
- 16.8.8 Thirteen turbines are proposed in the eastern most section of Cumberhead Forest, known as Hagshaw Hill. This is the youngest section of the forest planted over a four-year period between 1986 and 1989 and represents approximately 25 % of the total forest. The approved Felling Phase design restructures this area in 14 felling coupes between 2021 and 2035. The Proposed Development is located across the easternmost section of this ground with the operational Hagshaw Hill Wind Farm immediately to the south, Galawhistle Wind Farm to the south-west and Nutberry Hill Wind Farm to the west. The context of the Proposed Development in the landscape in relation to existing, consented and proposed wind farm developments is considered in full in Chapter 6: Landscape and Visual of the EIA Report.
- 16.8.9 General Forestry Practice Guideline 15, of the UKFS (Forestry Commission, 2017) states "*In forests characterised by a lack of diversity due to extensive areas of even-aged trees, retain stands adjoining felled areas until the restocking of the first coupe has reached a minimum height of 2m; for planning purposes this is likely to be between 5 and 15 years depending on establishment success and growth rates*".
- 16.8.10 UKFS recognises that this is not always possible and as such this is a guideline and not a requirement, however, the aim should be to minimise separation issues between coupes. In order to assess potential separation issues, the objective of the guidelines needs to be considered in the context of the forest property. The objective of the guideline is to encourage age class diversity into even aged plantations while minimising visual impacts of harvesting operations.
- 16.8.11 Cumberhead was part of the first cohort of forest properties in Scotland to be managed under a Forest Plan when these were first widely introduced under the Scottish Forestry Grant Scheme. The Forest Plan has seen the property restructure from 13 original planting years when harvesting

started in 2006, to 24 planting years at time of writing, with further age diversity forecast to be introduced steadily over the next 20 years of the Forest Plan. By the time restructuring of all first rotations crops is complete the age range will be in excess of 40 years, with no single coupe accounting for more than 5% of the forest area. Cumberhead will be in a state of near continuous sustainable timber production.

- 16.8.12 No harvesting has yet occurred in this section of the forest, however under the Baseline Forest Plan the area of forest associated with the Proposed Development details felling to commence in Phase 2 (2021-2025) continuing through to the end of phase 4 (2031-2035). This is the same under the Wind Farm Forest Plan, with construction felling planned for early 2021, with all turbines proposed in areas where mature conifer crops will need to be felled and replanted back to infrastructure keyholes.
- 16.8.13 Under the Wind Farm Forest Plan felling areas, age structure and species diversity do not change significantly, with the tree free buffers around the base of the turbines being sufficiently small to be screened by the proximity of adjacent trees, therefore, having a **negligible** effect on the forestry landscape.
- 16.8.14 The coupe and replanting designs in the Baseline Forest Plan reflect site specific considerations, using existing wind-firm boundaries for the felling coupes with interlocking designs of varying sizes, appropriate to the scale of the landscape and the low to moderate landscape sensitivity of the forest. This approach is carried through to the Wind Farm Forest Plan coupe design and was a key feature of the pre-application consultation with Forestry Commission.
- 16.8.15 The most visually prominent section of the forest is broadly east of Shiel Burn, out to the eastern edge of the property (corresponding to compartments 425 to 436 within the forest), where the sensitivity is considered moderate. Within this, the most prominent areas are the middle to upper slopes where the ground rises more steeply, while the gentler, lower slopes and ground west of the Shiel Burn are topographically screened or have views foreshortened by the gentle gradient of the slope.
- 16.8.16 Under the Wind Farm Felling Plan the core of the coupe design, scale, structure and phasing remain the same in the most sensitive eastern section of the forest, with little observable difference from key viewpoints. Areas on the lower slopes and to the west of the Proposed Development required changes to the felling phases, however these areas are of a scale and design appropriate to their setting.
- 16.8.17 Crop productivity is variable in this section of the forest, with forecast crop heights at the point of construction estimated at between 14 m and 24 m. Reflecting the height, age and wind hazard class (5) and critical height for unthinned crops (16 m), the risk of inducing catastrophic windblow by keyholing turbines directly into these crops is considered too great and therefore requires management felling to wind-firm boundaries.
- 16.8.18 In designing the felling coupe for these turbines, key considerations were to:
- minimise the area required for the turbines;
 - maximise fit with Baseline Forest Plan;
 - use of existing wind-firm boundaries; and
 - appropriate scale and fit within the landscape.
- 16.8.19 This approach resulted in a coupe design comparable to the Baseline and in-line with the average coupe size across the forest, suitably reflecting the scale of the landscape setting, with interlocking coupes addressing separation with adjacent coupes. As these will be the first areas to be felled in this section of forest, there are no crop separation issues.
- 16.8.20 The Baseline replanting design breaks up geometric patterns from first rotation crops, with generous use of native broadleaf woodlands along the wide riparian corridors. As elevation increases, native woodland gives way to increasing amounts of open ground, until reaching the

treeline which has been brought down the hill. This design creates a more natural visual linkage between low ground and open hill above the forest, especially when combined with greater species diversity on the lower, more fertile ground which is most visible from the north and east.

Summary of Potential Social Effects

- 16.8.21 The Wind Farm Forest Plan has followed the design principles set out in the Baseline Forest Plan. Key access and archaeological considerations and deliverables remain unchanged from the Baseline Forest Plan. The scale, design and timing of harvesting coupes in the eastern-most section of the Hagshaw which has moderate landscape sensitivity remain unchanged, with any redesigning of coupes occurring further west and at lower levels within the forest which are visually less prominent. The keyhole areas associated with each turbine will be sufficiently small so as to screen any additional open ground by the proximity of adjacent trees as they grow, as well as having mature trees crops retained downslope providing further visual screening. The appropriate scale and design of the proposed windfarm felling coupes and the retention of the Baseline Replanting Plan (minus the smallest possible keyhole) combine to create a **negligible** effect on the forestry landscape compared to the Baseline Forest Plan. Overall there can be considered to be a **negligible** effect on the social benefits delivered by Cumberhead Forest as a result of the Proposed Development.

Economic

- 16.8.22 This objective continues to be delivered through the Wind Farm Forest Plan by retaining the balanced approach to harvesting set out in the Baseline Forest Plan allowing for regular harvesting on an economic scale and replanting plans maximising production from the most suitable ground. Inclusion of 1.6 % additional open ground across the forest to accommodate the Proposed Development does not significantly adversely impact the forest's ability to deliver sustainable, economic production of timber or the support this provides to the rural economy in terms of in-forest and downstream industry employment. These potential impacts are further mitigated through the local delivery of compensatory planting, ensuring no net loss of woodland related benefits. The economic benefits of the Proposed Development also contribute to delivering this objective, with the benefits in this case shared between the local community, the developer and the pensioners within the large national pension scheme (the landowner).

Summary of Potential Economic Effects

- 16.8.23 As a result of diversification of the forestry asset to include renewable energy generation and the increased revenue generation, there is considered to be a **minor beneficial** effect on the economic benefits delivered by Cumberhead Forest as a result of the Proposed Development.

Environmental

- 16.8.24 As the Wind Farm Forest Plan differs very little in scope, scale and timing from the Baseline Forest Plan, the original environmental considerations will continue to be managed and delivered under the Proposed Development. The good existing internal road infrastructure results in a limited impact from new roading on woodland areas. Areas felled to accommodate the Proposed Development will be replanted back to the bat protection buffer zones around each turbine. The primary differences in relation to replanting programmes are associated with small, localised areas of commercial woodlands being converted to open ground associated with bat protection buffer zones. Any loss of woodland cover is mitigated through the delivery of a local compensatory planting programme of equivalent area.
- 16.8.25 Closely following the Baseline Forest Plan in relation to the areas, timing and volumes of timber to be harvested means standard forestry harvesting practice and guidelines can be used, generating little additional timber traffic and non-forestry residues.

Summary of Potential Environmental Effects

- 16.8.26 The minimal reduction in overall planted area of 33.08 ha which is being converted from commercial forestry to open ground, is being mitigated through the delivery of compensatory planting. When

combined with the significant renewable energy generation and carbon reduction benefits arising from the Proposed Development, overall there is considered to be a **minor beneficial** effect on the environmental benefits delivered by Cumberhead Forest as a result of the Proposed Development.

Summary of Differences between the Baseline and Wind Farm Forest Plans

Felling Plans

- 16.8.27 In order to assess the potential impacts of the Proposed Development in a forestry context, it is necessary to consider the Baseline and Wind Farm Forest Plans using comparable statistics.
- 16.8.28 Table 16.3 provides a comparison between the Baseline and Wind Farm Felling Plans.

Table 16.3 - Comparison of Baseline and Wind Farm Felling Plans

Felling Phase	Baseline Forest Plan (ha)	Wind Farm Forest Plan (ha)	Variance (ha)	Change (%)
Phase 1 (2016 to 2020)	360.04	360.04	0.00	0.00%
Phase 2 (2021 to 2025)	438.37	495.86	57.49	13.1%
Phase 3 (2026 to 2030)	177.57	155.60	-21.97	-12.4%
Phase 4 (2031 to 2035)	134.39	98.86	-35.52	-26.4%
Outwith Plan Period	908.94	908.94	0.00	0.00
Total	2019.30	2019.30		

- 16.8.29 In Phase 1 (2016 to 2020) no additional felling is required to accommodate the construction of the Proposed Development.
- 16.8.30 In Phase 2 (2021 to 2025) an additional 57.49 ha of felling is required to accommodate the revised coupe design for the Proposed Development. This 13.1 % increase across the five-year felling phase is not considered significant, especially when considered in the context of the Forest extending to 2,019 ha.
- 16.8.31 Changes to the areas recorded in Phases 3 and 4 are relatively minor, corresponding to felling brought forward into Phase 2 to accommodate the turbines towards the west of the Proposed Development.
- 16.8.32 The treatment of borrow pits in relation to felling, replanting and compensatory planting is addressed in Section 16.8.
- 16.8.33 In summary, the core of the felling phases to the east of the Proposed Development remain relatively unchanged from the Baseline Felling Plan, with changes to the west relating mainly to the redesigning of felling coupe boundaries, with some areas being brought forward one or two phases earlier than originally planned and other areas dropping back, overall resulting in an additional 57.49 ha of felling, or some 2.8 % of the total forest area. The Proposed Development is therefore not considered to be

Timber Harvesting and Production

- 16.8.34 Table 16.4 shows timber production associated with the Baseline and Wind Farm Felling Plans.

Table 16.4 - Comparison of Baseline and Wind Farm Felling Plan Timber Harvesting Tonnage

Felling Phase	Baseline Felling Tonnage (T)	Wind Farm Felling Tonnage (T)	Variance (T)	Change (%)
Phase 1 (2016 to 2020)	102,178	102,178	0	0
Phase 2 (2021 to 2025)	143,253	156,756	13,503	9.4 %
Phase 3 (2026 to 2030)	63,892	59,026	-4,866	-7.6 %
Phase 4 (2031 to 2035)	60,813	44,923	-15,890	26.1 %
Total	370,136	362,883	-7,253	-2.0 %

16.8.35 Despite an 13.1 % increase in the total area being felled in Phase 2 under the Proposed Development there is only a 9.4 % increase in the associated tonnage of timber harvested over the same five-year period. This variance arises from areas of harvesting being brought forward in the felling programme. The relatively small difference (3.7 %) between the increase in area being felled and the increased tonnage of timber reflects that the majority of the felling under the Wind Farm Forest Plan is either being felled as per the Baseline Felling Plan or close to the original phasing.

16.8.36 The majority of harvesting associated with the Proposed Development can be considered routine in relation to coupe area and crop size and as such, will be harvested using conventional forestry practices and associated guidelines. All timber harvested from site will be transported to conventional timber markets via the existing forestry access road to Station Road at Douglas West. There will be no requirement for felling to waste or mulching.

Timber Haulage

16.8.37 Chapter 12: Traffic and Transport details the considerations associated with the Proposed Development in more detail. Changes to felling programmes associated with the Proposed Development have potential implications for traffic and transport in relation to timber haulage. The number of timber lorry round trips has been assessed for both the Baseline and Wind Farm Forest Plans on the basis of 25 tonnes of timber per loaded lorry. Table 16.5 provides a comparison of timber haulage over the 20-year Forest Plan period for both the Baseline and Wind Farm Forest Plans.

Table 16.5 - Comparison of Baseline and Wind Farm Forest Plan Timber Haulage (lorry loads)

Felling Phase	Baseline Felling No. of Timber Lorries	Wind Farm Felling No. of Timber Lorries	Variance (T)	Change (%)
Phase 1 (2016 to 2020)	4,087	4,087	0	0.0 %
Phase 2 (2021 to 2025)	5,730	6,270	540	9.4 %
Phase 3 (2026 to 2030)	2,556	2,361	-195	-7.6 %
Phase 4 (2031 to 2035)	2,433	1,797	-636	-26.1 %
Total	14,805	14,515	-290	-2.0 %

16.8.38 Over the 20-year operational period of the Forest Plan, timber haulage decreases by 2.0 % (or 290 fewer loaded lorry movements) as a result of the Proposed Development, which can be considered a **negligible** effect. This reflects the modest additional requirements of the Proposed Development however it is important to note that within Phase 2 of the Forest Plan, when construction is planned, there is a 9.4 % (or 540 additional loaded lorry movements) increase in timber haulage. This additional movement is not considered significant in the scale of the forest’s production forecast. The table above does not include brash recovery from harvesting sites, as while this is being increasingly employed, it is highly site dependant. Brash recovery associated with the Proposed Development is detailed in section 16.8.11.

16.8.39 Coupes to be felled to accommodate the Proposed Development will be harvested in 2021 ahead of the main construction operations, with all timber being transported to conventional timber markets via the existing forestry access road.

Replanting Plans

16.8.40 Forestry is a long-term industry and the long-term forest structure based on the Baseline and Wind Farm Replanting Plans requires 33.08 ha of additional open ground, or 1.6 % of the total forest area, to accommodate the Proposed Development. The majority of change is in areas of spruce dominated crop (30.82 ha) with the remainder being a combination of broadleaf woodland and open ground planned to be established after the current crop of Sitka spruce is felled. On this basis, it can be considered that there is a **negligible** long-term impact on the forest environment arising from the Proposed Development.

Table 16.6 - Comparison of Baseline and Wind Farm Long Term Replanting Plans

Species	Baseline Forest Plan (ha)	Wind Farm Forest Plan (ha)	Variance (ha)	Change (%)
Sitka spruce	1,128.32	1,097.74	-30.58	-2.7 %
Sitka spruce/Larch	76.34	76.34	0.00	0.0 %
Sitka spruce/Lodgepole pine	43.26	43.26	0.00	0.0 %
Norway spruce	48.39	48.15	-0.24	-0.5 %
Scots pine	0.35	0.35	0.00	0.0 %
Native Broadleaves	50.41	49.00	-1.41	-2.8 %
Native Broadleaves/Open ground	94.97	94.12	-0.85	-0.9 %
Open ground	440.69	473.77	33.08	7.5 %
Long-Term Retentions	73.15	73.15	0.00	0.0 %
Natural Reserves	56.18	56.18	0.00	0.0 %
SSSI	7.24	7.24	0.00	0.0 %
Total	2,019.30	2,019.30	0.00	

16.8.41 This modest change in replanting across the forest property reflects the close alignment between the Baseline and Wind Farm Forest Plans due to the design approach adopted. It should be noted that the figures above do not include ground to be re-instated and replanted after construction (borrow pits, construction compounds etc), as it has been agreed with FCS that these areas will be included in the compensatory planting requirement calculation in this report.

16.8.42 Guidelines under the UKFS recommend owners diversify forest composition so that no more than 75 % of the forest management unit is allocated to a single species and a minimum of the following are incorporated:

- 10 % open space;
- 10 % of other species or ground managed for environmental objectives; and
- 5 % native broadleaved trees or shrubs.

16.8.43 Table 16.7 demonstrates how both the Baseline Forest Plan and the Wind Farm Forest Plan deliver against these guidelines.

Table 16.7 - Baseline and Wind Farm Forest Plan Compliance with UKFS Species Diversity Guidelines.

Species	Baseline Area (ha)	Baseline Percentage	Wind Farm Forest Plan (ha)	Wind Farm Forest Plan Percentage	Change (%)
Sitka spruce dominated crops	1,247.92	61.8 %	1,217.34	60.3 %	-1.5 %
Mixed Conifer	48.74	2.4 %	48.50	2.4 %	0.0 %

Native Broadleaves	145.38	7.2 %	143.12	7.1 %	-0.1 %
Open Ground	447.93	22.2 %	481.01	23.8 %	1.6 %
Long-Term Retentions	73.15	3.6 %	73.15	3.6 %	0.0 %
Natural Reserves	56.18	2.8 %	56.18	2.8 %	0.0 %
Total	2,019.30	100 %	2,019.30	100 %	

- 16.8.44 Both the Baseline and Wind Farm Forest Plans have less than 75 % of the forest management unit allocated to a single species. The Baseline Forest Plan has 22.2 % open ground, with the Wind Farm Forest Plan having a corresponding additional 1.6% (representing the Proposed Development infrastructure).
- 16.8.45 Site suitability limits species choice for a greater diversity of conifer species with the best ground identified for replanting with Norway spruce. The requirement for 10 % other species or ground managed for environmental objectives is delivered through a combination of Long-Term Retentions, Natural Reserves (primarily established adjacent to the SSSI and SPA) and additional native broadleaf planting over and above the 5 % minimum area, taking both Plans to 13.6 % and 13.5 % respectively. Both the Baseline and Wind Farm Forest Plans can demonstrate compliance with the requirements of UKFS in relation to diversity.
- 16.8.46 As all areas will continue to be managed as part of a UKWAS certified commercial forest, current UKFS and industry best practice will continue to be followed for the replanting of all felled areas. Replanting methodology will vary depending on whether commercial conifers or native broadleaves are being replanted, however both methods will follow UKFS and UKWAS guidelines.
- 16.8.47 Commercial conifer replanting methodology:
- Site preparation by machine mounding and drainage;
 - Manual planting at a minimum density of 2,700 stems per hectare; and
 - Ongoing establishment maintenance such as the replacement of failed trees, weed control and pest protection as necessary to ensure satisfactory establishment.
- 16.8.48 Native broadleaved replanting methodology:
- Site preparation by machine mounding and drainage where necessary;
 - Manual planting at a minimum density of 1,250 stems per hectare using native, local provenance tree species most appropriate to the site;
 - Trees and shrubs protected in 1.2 m or 0.6 m staked tubes according to species; and
 - Ongoing establishment maintenance such as the replacement of failed trees, weed control and pest protection as necessary to ensure satisfactory establishment.
- 16.8.49 Replanted areas will form part of the existing and on-going crop establishment work at Cumberhead Forest which has seen the successful establishment of both conifer and broadleaf replanting programmes. Crop establishment will include protection against browsing damage from wild animals (deer, hare, rabbit, weevil) and domestic stock, as well as drainage and weed maintenance to ensure crop establishment. Replanted areas will be protected and insured against fire in common with the rest of the property.

Construction

- 16.8.50 Harvesting of timber crops will commence as detailed in the Forest Plan, with felling to accommodate the Proposed Development due to start in 2021 ahead of the main phase of construction. All timber will be harvested following standard forest practices:
- Harvesting coupes will be identified and agreed with FCS and approved for felling through the formal Forest Plan approval mechanism.
 - Coupes will be marketed before harvesting using conventional wheeled machinery, with no requirement for specialist equipment.
 - All felled material will be cut into product specific lengths, forwarded to the forest road for uplift and haulage to conventional local timber markets. There will be no requirement to fell to waste or mulching of crops.
 - Timber will be hauled via the existing forest road network to the public road via Douglas West.
 - Subject to site suitability, brash will be recovered from parts of the site and sold into biomass markets.
- 16.8.51 From a forestry perspective, the scale and timing of forestry operations is relatively unchanged from the Baseline Forest Plan, with the majority of forestry operations directly associated with the Proposed Development occurring ahead of the main construction phase.

Operation

- 16.8.52 There will be no operational effects on forestry resources or operations as a result of the Proposed Development.

Decommissioning

- 16.8.53 There are no effects on forestry resources or operations associated with the decommissioning of the Proposed Development.

16.9 Mitigation

Forest Residue Management Plan

- 16.9.1 Consideration has been given to the production of non-forestry residues in line with the *Management of Forestry Waste WST-G-027 version 3* (SEPA, 2017) and the accompanying *Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Position Statement and Guidance* (SNH, SEPA, FCS 2014).
- 16.9.2 These policies require consideration of unmerchantable timber, residual brash and stumps produced by tree harvesting to facilitate developments where standard forestry replanting is not being undertaken.
- 16.9.3 In the context of the Proposed Development, this relates to previously afforested areas associated with:
- 75 m radii tree free bat protection buffers around turbines (brash);
 - 20 m radii hard standing areas around turbine bases and substation (brash and stumps);
 - 20 m wide tree free road corridors (brash);
 - 6 m wide road construction corridor (within the 20m tree free road corridor) (brash and stumps);
 - Temporary construction compounds and control buildings (brash and stumps); and

- Borrow pits (brash and stumps).

16.9.4 The following Forest Residue Management Plan (FRMP) has been produced to address the areas of forest where trees will be harvested and not replanted in order to accommodate the Proposed Development, detailing the amount and management of unmerchantable trees, brash and stumps generated.

Ground Conditions

16.9.5 A high proportion of the turbines and associated infrastructure are located in elevated and exposed locations on gley, peaty-gley or peat dominated soils. Wet, infertile, peat dominated ground result in tree crops with poor, checked growth. Such soils are at risk of being damaged as part of forestry operations, regardless of being associated with routine forestry or renewables developments.

16.9.6 The passage of forestry machinery used for felling, processing and extraction of timber can result in rutting, compaction and soil erosion unless appropriate ground protection measures are employed as detailed under the Section 16.8.25 in this FRMP. Further details of ground conditions across the Proposed Development site, including details of peat distribution and condition, are provided in Chapter 11: Hydrology, Hydrogeology and Geology.

Access

16.9.7 The existing forestry access via Douglas West onto the A70 will be used for all forestry purposes and will therefore be entirely separate from the Proposed Development construction access, with harvesting taking place in 2021 ahead of the main construction phase of the Proposed Development.

Timber Markets

16.9.8 At the time of writing timber markets are buoyant and Cumberhead Forest is well located to take advantage of major sawlog, wood panel and pulp mills located in the region. As well as traditional timber markets (saw log, pallet wood, pulp and chip wood) the emerging biomass market has grown steadily in recent years, with the FCS *Woodfuel Demand and Usage in Scotland Report* (Forestry Commission, 2013) predicting continued growth.

Materials Generated

Merchantable Timber

16.9.9 Of the Phase 2 harvesting required to accommodate the Proposed Development, only 32.25 ha constitutes crops which will be felled and not be replanted. This mature conifer crop carries merchantable timber, defined as having a diameter greater than 7 cm, over bark, as detailed in SEPA's *Guidance Note on the Use of Trees Cleared to Facilitate Development on Afforested Land* (SEPA, 2014).

16.9.10 These areas will be conventionally harvested, as part of a routine planned phased felling programme, using standard forestry timber harvesting and forwarding machinery, with merchantable material stacked by product at roadside ready for onward haulage to market. A critical part of the harvesting approach at Cumberhead will be the use of brash mats to support harvesting and extraction machinery and to protect underlying soils from rutting, compaction and erosion.

16.9.11 Based on an average production of 341 cubic metres (m³) or 316 tonnes per hectare over the 32.25 ha of ground to be felled and not replanted, 10,997 m³ of merchantable timber, weighing approximately 10,191T and requiring 408 loaded lorry movements will be generated.

Unmerchantable Timber

16.9.12 No unmerchantable material will be generated from the Proposed Development.

Brash and Stumps

16.9.13 Unlike timber volumes and tonnages, there is an absence of published research data regarding volumes and tonnages of brush and stumps produced per hectare of commercial conifer crop. A common assumption used by forest managers is that brush volumes are equivalent to 20-30 % of the standing volume of merchantable timber. Therefore, if a Sitka spruce tree crop is measured at 400T of standing timber, then 80-120T of brush may be produced.

16.9.14 For the purposes of this report an industry rule has been used based on evidence from harvesting managers who have been at the forefront of forest residue recovery. It has been assumed that the tonnage of brush and stumps produced is equal to the tonnage of standing merchantable timber, with equal amounts of brush and stumps. Therefore, a tree crop of 400T of standing timber per hectare should produce 200T of brush and 200T of stumps per hectare.

16.9.15 On this basis, calculating brush generation is achieved by multiplying the area of merchantable crops being felled and not replanted (32.25 ha) by half the average timber production per hectare (341 m³ or 316T per hectare):

$$\text{Brush Production} = 32.25 \text{ ha} \times 170 \text{ m}^3/\text{ha} = 5,499 \text{ m}^3 \text{ (5,096 T)}$$

16.9.16 Stump removal will only be carried out where required for the physical infrastructure footprint. This relates to:

- 20 m radii hard standing areas around turbine bases and crane pads;
- 6 m wide road construction corridor (within the 20m tree free road corridor); and
- temporary construction compounds and substation/control building.

16.9.17 Reflecting the smaller area associated with the infrastructure footprint where stump removal is required, stump generation is calculated in much the same way as for brush using the revised area of 7.92 ha:

$$\text{Stump Production} = 7.92 \text{ ha} \times 170 \text{ m}^3/\text{ha} = 1,350 \text{ m}^3 \text{ (1,251 T)}$$

16.9.18 A summary of forecast brush and stumps production is provided in Table 16.8.

Table 16.8 - Summary of Brush and Stump Production from the Proposed Development

Feature	Area (ha)	Volume (m ³)	Tonnage (T)
Brush from areas felled and not replanted	32.25	5,499 m ³	5,096 T
Stumps from areas cleared for infrastructure footprint	7.92	1,350 m ³	1,251 T
Total		6,849 m³	6,347 T

16.9.19 A total of 6,849 m³ or 6,347 T of brush and stump forest residues are estimated to be generated from the Proposed Development.

Destination of Forestry Material

16.9.20 The following section details the use and destination of the various forestry materials resulting from felling associated with the Proposed Development.

Merchantable Timber

16.9.21 Merchantable materials will be sold into existing markets, which for sawlogs are likely to include BSW at Dalbeattie, James Jones & Son at Lockerbie and Forest Garden at Lockerbie. Small roundwood markets are likely to include Egger at Barony (Cumnock), UPM Caledonian at Irvine and Iggesund at Workington.

Unmerchantable Material

16.9.22 No unmerchantable material will be generated as a result of the Proposed Development.

Brash and Stumps

- 16.9.23 As trees are felled the branches and tips of the trees are removed to leave clean tree trunks, which are cut into product specification lengths, forming the merchantable material. The remaining branches and "lop and top" form the brash, which are collected up to form brash lanes/brash mats to protect the soil by helping support the weight of harvester and forwarder movements across the site. This results in brash lanes across the harvesting site approximately every 10-15 m, with the intervening areas being relatively free from brash.
- 16.9.24 The use of brash mats is particularly important on wet, peaty soils characteristic of those found over much of Cumberhead and following industry best practice, the use of brash mats is considered essential as part of routine harvesting. As the brash mats break down and drop needles the brash mats will be renewed using fresh material generated from harvesting. As brash mats degrade in service, they become embedded in the soft, wet ground. It is proposed brash mats are left in-situ within keyhole areas and areas where there is no infrastructure post-harvesting, as the ground disturbance associated with digging out brash material from the ground is considered to be greater than leaving it in place. It is estimated that some 5,499 m³ of brash will, however, be removed from the 32.25 ha of ground associated with the infrastructure footprint and tree free buffers.
- 16.9.25 Due to the risk of soil erosion associate with stump removal on peaty soils on elevated sites, tree stumps in areas to be harvested and maintained as tree free will remain in-situ and allowed to degrade naturally along with the brash as per standard forestry practice for areas reverting to open ground habitats in forests. Only areas required for the physical construction footprint of the Proposed Development will have stumps removed. On this basis, it is estimated 1,350 m³ of stumps will be generated.
- 16.9.26 The combined brash and stump production associated with the Proposed Development is therefore forecast to be 6,849 m³. Brash recovery for use in the biomass market is now a routine part of forestry operations with operators such as Jenkinson's, Land Energy and Estover Energy all competing in this market. The intention would be to sell the brash and stumps generated from the Proposed Development into this market along with material from the surrounding coupe ground being felled under Forest Plan approval.

Conclusions

- 16.9.27 This FRMP demonstrates that all forestry materials generated as a result of felling to construct the Proposed Development can be sold into existing timber markets. On this basis there will be no requirement for mulching or spreading of crops across the site.

Compensatory Planting

- 16.9.28 **In accordance with best practice, and as agreed with FCS in pre-application consultation, approval is only being sought for felling directly associated with the infrastructure footprint and tree free areas under this submission.**
- 16.9.29 The infrastructure and tree free footprint is 39.36 ha, of which 32.25 ha is currently comprised of mature Sitka spruce forestry, with the remaining 7.11 ha represented by existing open ground (tracks, rides, riparian corridors etc.).
- 16.9.30 In the Baseline Replanting Plan the areas of current mature crop, once felled, are to be replanted predominantly with commercial Sitka spruce forestry while introducing native woodland along the margins with the existing open ground along the riparian corridors. Under the Baseline Plan, some areas, which are currently open ground, were to be replanted with native broadleaves resulting in a net reduction in open ground from the current area of 7.11 ha to 6.28 ha following replanting.
- 16.9.31 Under the Baseline Replanting Plan 6.28 ha of the infrastructure and associated open ground footprint of 39.36 ha is detailed as open ground. Under the Wind Farm Forest Plan the balance of this area, 33.08 ha is required as additional open ground to accommodate turbines, bat protection buffer zones, infrastructure and associated tree free areas.

- 16.9.32 All other changes associated with felling phases and replanting plans will be subject to a Forest Plan amendment through FCS in the event the Proposed Development is consented.
- 16.9.33 Using the most up to date (March 2015) *Guidance to FCS staff on implementing the Scottish Governments' Policy on Control of Woodland Removal*, compensatory planting areas have been calculated on the basis of a "hectare for hectare" replacement of woodland areas lost to development. The Baseline Forest Plan, in the absence of the Proposed Development has been taken into account, which would have restructured the woodland to conform with current best practice forest planning principles. No further reductions to compensatory planting requirements have been applied to account for the Proposed Development access tracks, as it is considered these would not have been required to serve the forest.
- 16.9.34 Table 16.9 summarises the considerations in arriving at the level of compensatory planting for addressing the Scottish Government's *Control of Woodland Removal Policy* in relation to the Proposed Development.

Table 16.9 - Compensatory Planting Calculation associated with the Proposed Development

Feature	Area (ha)
Infrastructure and associated tree free area footprint	39.36 ha
Less Designed Open Ground within Baseline Forest Plan	-6.28 ha
Area to be accounted for under the Control of Woodland Removal Policy	33.08 ha
Borrow pits	2.00 ha
Total area to be accounted for under the Control of Woodland Removal Policy	35.08 ha

- 16.9.35 An area of 35.08 ha has been identified as requiring compensatory planting under the *Control of Woodland Removal Policy*. As agreed with Forestry Commission in pre-application consultation, this area does not include areas of ground due to be restored and replanted post-construction.
- 16.9.36 Within the application a broad search zone has been identified for borrow pits. The operational experience associated with forest road construction and previous wind farm applications within the Forest is that the geology is predominantly mudstones, unsuitable for track construction. The search zones have been identified as potential areas for stone subject to more detailed site investigation works which will be conducted closer to the point of construction.
- 16.9.37 While it is not currently considered likely, if suitable sources of stone were identified within the search area, the operations necessary to open-up and work these areas would have implications for forestry in relation to opening-up stands to windblow, coupe phasing and design as well as compensatory planting.
- 16.9.38 As it is currently unknown whether these borrow pits will be required, or exactly where they might be located, it is difficult to account for them within the Wind Farm Forest Plan at this stage. Acknowledging that if this matter arises it will need to be adequately addressed, it is therefore proposed that an appropriately worded condition be attached to any consent granted, requiring further detailed consultation with FCS in relation to the design, scale, location and associated forestry impacts of any borrow pit(s) proposed to be worked following completion of detailed Site Investigation works post-consent but pre-commencement. As an act of Good Faith, an additional area of 2 hectares has been added to the compensatory planting to account for any potential net woodland loss associated with the working of any borrow pit(s).

Compensatory Planting Plan

- 16.9.39 It is proposed that the required area of compensatory planting, in line with the *Control of Woodland Removal*, will be delivered via a Planning Condition. Due to the lack of appropriate open ground within the Forest, it is not possible to deliver compensatory planting on site, however, suitable areas

have been identified on properties under the ownership of the neighbouring landowner (part of the same group of companies as the Applicant).

- 16.9.40 Compensatory planting will therefore be delivered offsite, but within the local authority area and very close to the Proposed Development site. This ground will be subject to full consultation and associated EIA determination by FCS under the *Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017*.
- 16.9.41 Ground for compensatory planting will be secured via a lease over the identified ground to the Applicant, with the Applicant meeting all costs for planting, protection and establishment plus associated professional costs for monitoring and management.
- 16.9.42 Compensatory planting will be delivered in the first planting season following commencement of the Proposed Development with forestry reports submitted to FCS in years 1, 5 and 10, detailing full stocking assessment, establishment and management recommendations.
- 16.9.43 All areas will be protected within a deer fence with rabbit netting with incursions shot out to ensure tree protection. Ground will be mounded where machine access is possible, with manual screef ground preparation on steeper ground where machine access is not possible. Mounding density should achieve 2,700 trees per hectare for commercial conifers, 1,700 trees per hectare for native woodland areas and 1,250 for W4 (wet woodland) areas, into which commercial conifers and native, local provenance trees appropriate to site will be planted.
- 16.9.44 Target stocking density will be to achieve no less than 2,500 stems per hectare for commercial conifers, 1,600 stems per hectare for native woodland areas and 1,200 stems per hectare for W4 areas at establishment, with trees capable of onward growth without significant additional management input.
- 16.9.45 Delivery of the planting, establishment and maintenance will be overseen by Bidwells on behalf of the Applicant, conducting regular inspections and producing annual silvicultural management recommendations to be delivered by the Applicant in order to ensure the delivery of successful and timely tree establishment. Maintenance will include protection against browsing damage from wild animals (deer, hare, rabbit, weevil) and domestic stock, as well as drainage and weed maintenance (as required) to ensure crop establishment. All compensatory planting areas will be protected and insured against fire by the Applicant.
- 16.9.46 Establishment will be defined as the point when the average tree height is 2.0 m or more with average stocking densities of 2,500 stems per hectare for conifers, 1,600 stems per hectare for native woodland areas and 1,200 stems per hectare for W4 areas. At this point FCS will be invited to inspect the compensatory planting, before seeking agreement that the compensatory planting commitment has been delivered. It is anticipated establishment will take 5 to 10 years to achieve and the Applicant will retain the lease for this period, or such additional time as may be required to deliver establishment of the compensatory planting. After the area is agreed as being established the woodland will revert to the landowner.

16.10 Residual Effects

- 16.10.1 The Wind Farm Forest Plan would see minor changes to the Baseline Forest Plan in order to accommodate the turbines, infrastructure, bat protection buffer zones and open ground associated with the Proposed Development, as summarised below:
- 57.49 ha increase in Phase 2 Felling (2021-2025), a 13.1 % increase against the Baseline Forest Plan for the same period but only 2.8 % increase over the total forest area. Areas outside the infrastructure footprint and associated tree free areas will be replanted minimising the effect.
 - An additional 13,503 T of Phase 2 Felling (2021-2025), an increase of 9.4 % against Baseline Plans for the same period but an overall reduction of 7,253 T or 2 % over the twenty-year Forest Plan period.

- 540 additional loaded timber lorry movements in Phase 2 (2021-2025), a 9.4 % increase against Baseline during the same period but an overall reduction of 290 loaded lorry movements or 2 % over the twenty-year Forest Plan period.
- Reduction in productive conifer area over the twenty-year Forest Plan Period of 30.82ha against Baseline, representing a reduction of 2.6 % in conifer area or 1.5 % of the total forest area. The reduction in productive conifer area will be off-set by compensatory planting.
- Increase in open ground over the twenty-year Forest Plan Period of 33.08 ha against Baseline, representing an increase of 7.5 % in open ground or 1.6 % across the total forest area. The reduction in productive area will be off-set by compensatory planting.

16.11 Cumulative Assessment

16.11.1 Table 16.10 provides a summary of the forestry related cumulative impacts on Cumberhead Forest based on existing and proposed developments in the area, followed by a brief assessment.

Table 16.10 – Summary of Cumulative Forestry Impacts

Wind Farm	Turbines	Output (MW)	Woodland Removal Area (ha)	Proportion of Forest (%)	Woodland Loss (ha/MW)
Nutberry Wind Farm	6	15	27.30	1.4 %	1.82
Consented Cumberhead Wind Farm	11	50	23.29	1.2 %	0.47
Revised Cumberhead Wind Farm	14	50	48.68	2.4 %	0.97
Proposed Development	13	78	33.08	1.6 %	0.42

16.11.2 In order to assess cumulative forestry impacts on Cumberhead Forest, woodland removal has been used as the principle indicator. As can be seen in the table above, the Proposed Development seeks to install 13 six megawatt turbines into Cumberhead Forest, with an associated impact of 0.42 ha of woodland removal per megawatt, which is the lowest impact of any of the operational, consented or proposed wind farm developments within Cumberhead Forest.

16.11.3 The Proposed Development has adopted a similar approach to the other wind farms in relation to minimising woodland removal, however it has been able to take advantage of advances in accepted approaches to turbine tip heights and new 6 MW generators on the turbines. The use of 200 m tip heights, higher hub heights, longer rotor blades results in greater clearance between the rotor swept edge of the rotor and tree canopy heights, significantly reducing the need for woodland removal. When combined with 6 MW generators this significantly improves the ratio of woodland removal per megawatt and as such reduces the impact of the Proposed Development on Cumberhead Forest.

16.11.4 From a cumulative impact assessment perspective, the greatest potential cumulative impact on forestry would be for the Revised Cumberhead Wind Farm and the Proposed Development to be consented combined with the operational Nutberry Wind Farm. This would see a total of 33 turbines, generating 143 MW of renewable energy located across Cumberhead Forest at a loss of 109.06 ha of Sitka spruce dominated woodland within the forest, representing 5.4 % of the total forest area.

16.11.5 It is important to note, both the Revised Cumberhead Wind Farm and the Proposed Development will deliver compensatory planting to mitigate the loss of productive conifers and as such the actual loss of woodland related benefit is limited to the areas previously removed for Nutberry Wind Farm.

- 16.11.6 The cumulative loss of 5.4 % of Cumberhead Forest is considered a **minor** effect in the context of the property, especially when the losses come from generally lower yield class crops in the higher altitude locations, reducing the impact of loss of production. The Wind Farm Forest Plan demonstrates that Cumberhead Forest will remain a largescale, productive commercial forest, capable of longer-term sustainable production of good quality commercial timber. The positive renewable energy and carbon reduction benefits that would accrue from the wind farms within the forest are also noteworthy in this regard.

16.12 Summary

- 16.12.1 Following best practice detailed in the *Guidance to FCS staff on implementing the Scottish Government's Policy on Control of Woodland Removal (FCS, 2015)*, this chapter has focused on Cumberhead Forest as a single forestry management unit, even though the majority of the property is outwith the Proposed Development site. Cumberhead Forest will continue to be managed as a commercial forest under UKFS and UKWAS in the event the Proposed Development is consented with felling and replanting authorised under the *Forestry Act 1967* overseen by FCS as the Competent Authority.

- 16.12.2 The following is a summary of the areas of felling and replanting required to construct and operate the Proposed Development and for which permission is being sought from the Energy Consents Unit:

- Felling approval for 32.25 ha of commercial forest to accommodate construction of the Proposed Development as detailed in the Wind Farm Felling Plan and detailed in Figure 16.4;
- Delivery of compensatory planting extending to a minimum of 35.08 ha as detailed in the Compensatory Planting Plan and shown on Figure 16.6; and
- On consent of the Proposed Development, a Forest Plan Amendment will be sought through the standard FCS process to implement the Wind Farm Forest Plan.

Table 16.11 – Summary Table

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
<i>During Construction & Decommissioning</i>					
Social Benefits of the Wind Farm Forest Plan	Negligible	Adverse	Implementation of Wind Farm Forest Plan – public access, archaeological and landscape considerations are materially changed from the baseline	Neutral	
Economic Benefits of the Wind Farm Forest Plan	Minor	Beneficial	Implementation of Wind Farm Forest Plan and Compensatory Planting to address reduced production – the loss of 33.08ha of commercial woodland does not effect the economic viability of the forest or the wider industry and is being mitigated through compensatory planting.	Minor	Beneficial
Environmental Benefits of the Wind Farm Forest Plan	Minor	Beneficial	Implementation of Wind Farm Forest Plan and Compensatory Planting to address woodland loss – minimal loss of woodland cover (33.08ha) which is mitigated through compensatory planting and the generation of 78 MW of renewable energy.	Minor	Beneficial
<i>During Operation</i>					
None					
<i>Cumulative Effects</i>					
Potential cumulative reduction of 5.4% of Cumberhead Forest area	Minor	Adverse	Delivery of Compensatory Planting and Implementation of Wind Farm Forest Plan	Neutral	

16.13 References

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