Forestry and Land Scotland
Coilltearachd agus Fearann Alba

Lochar Mosses

Land Management Plan

2020 - 2029

V1.4

We manage Scotland's National Forest Estate to the United Kingdom Woodland Assurance Standard – the standard endorsed in the UK by the international Forest Stewardship Council® and the Programme for the Endorsement of Forest Certification. We are independently audited.

Our land management plans bring together key information, enable us to evaluate options and plan responsibly for the future. We welcome comments on these plans at any time.

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Property Details			
Property Name:	Lochar Mosses		
Grid Reference (main forest entrance):	NY 0339 7400	Nearest town or locality:	Dumfries
Local Authority:		Dumfries and Galloway	

Applicant's Details			
Title:	Dr	Forename:	Ed
Surname:	Turner		
Position:	Planning Forester		
Contact Number:	0131 370 5751		
Email:	ed.turner@forestryandland.gov.scot		
Address:	Forestry and Land Scotland, Ae Office, Ae Village, Parkgate, Dumfries		
Postcode:	DG1 1QB		

Owner's Details (if different from Applicant)	
Name:	
Address:	

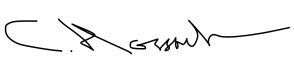
1. I apply for Land Management Plan approval for the property described above and in the enclosed Land Management Plan.

2. I apply for an opinion under the terms of the Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017 for afforestation / deforestation / roads / quarries as detailed in my application.

3. I confirm that the scoping, carried out and documented in the Consultation Record attached, incorporated those stakeholders which Scottish Forestry agreed must be included. Where it has not been possible to resolve specific issues associated with the plan to the satisfaction of the consultees, this is highlighted in the Consultation Record.

4. I confirm that the proposals contained in this plan comply with the UK Forestry Standard.

5. I undertake to obtain any permissions necessary for the implementation of the approved Plan.

Signed, Regional Manager		Signed, Conservator	
FLS Region	South	SF Conservancy	South
Date	2/12/2020	**Date of Approval**	
		Date Approval Ends	

Contents

1.0 Objectives and Summary

1.1 Plan overview and objectives

Plan name	Lochar Mosses
Forest blocks included	Racks Moss, Ironhirst Moss, Longbridge Muir, Blountfield
Size of plan area (ha)	1183 ha
Location	See **Map 1: Location**

Long Term Vision
The Lochar Mosses are returned to their former status as one of the most significant areas of lowland raised bog in Europe, through sensitive woodland removal and a programme of peatland restoration. Key peat-forming bog species, such as sphagnum mosses and cotton grass, become the dominant ground flora, and wildlife thrives in this priority habitat. Smaller areas of wet woodland increase the biodiversity value of the LMP area, and peatland edge woodland is established around site boundaries, providing additional landscape value and wildlife habitat, with continued local recreational access.
Management Objectives
1. Systematically restore former plantation on deep peat to functioning peatland systems for the benefit of carbon storage, biodiversity, and water quality; 2. Produce a range of timber products from current stock, balancing productivity of the forest with primary land management objectives; 3. Protect existing open bog habitat and SSSI area through control of invasive species including regenerating conifer species; 4. Continue silvicultural interventions in Blountfield block to realise future potential of high-quality softwood and hardwood timber products.
Critical Success Factors
• Appropriate harvesting techniques to minimise surface impact to the valuable carbon storage potential of lowland raised bog habitat. • Realise the biomass potential in harvesting waste, leaving as clean a site as possible following harvesting operations to help facilitate bog restoration. • Minimise road construction and utilise low impact forwarding track methods to minimise surface damage. • Apply current best practice and expertise to peatland restoration operations using suitably experienced contractors. • Maintain a level of browsing conducive to native broadleaf regeneration and supressing regenerating conifer.

1.2 Summary of planned operations

Table 1

Summary of Operations over the Plan Period	
Clear felling	355 ha
Thinning (potential area)	88 ha
Restocking	95 ha
Afforestation	0 ha
Deforestation	260 ha
Forest roads	1585 m
Forestry quarries	0 ha

The forest is managed to the UK Woodland Assurance Standard – the standard endorsed in the UK by the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). Forestry and Land Scotland is independently audited to ensure that we are delivering sustainable forest management.

2.0 Analysis and Concept

The planning process was informed by collecting information about the woodland and open ground within the Land Management Plan area, which is presented in **Appendix I** and on **Map 2: Key Features**. During the development of this plan we have consulted with the local community and other key stakeholders, and a Consultation Record is presented in **Appendix III**.

The plan's objectives were analysed against the constraints and opportunities identified during scoping and consultation. Preferred options were then chosen for delivering the objectives, and these proposals are summarised on **Map 3**: **Analysis and Concept**.

3.0 Management Proposals - regulatory requirements

3.1 Designations

The plan area forms part of, includes, or is covered by the following designations and significant features in Table 2:

Table 2

Designations and significant features		
Feature type	Yes / No	Note
Site of Special Scientific Interest (SSSI)	Yes	Longbridge Muir
National Nature Reserve (NNR)	No	
Special Protection Area (SPA)	No	
Special Area of Conservation (SAC)	Yes	Longbridge Muir
World Heritage Site (WHS)	No	
Scheduled Monument (SM)	No	
National Scenic Area (NSA)	No	
National Park (NP)	No	
Deep peat soil (>50 cm thickness)	Yes	Almost the entire plan area (excluding Blountfield) is on deep peat soils of type 10a and 9c
Tree Preservation Order (TPO)	No	
Biosphere reserve	No	
Local Landscape Area	No	
Ancient woodland	Yes	LEPO designations
Acid sensitive catchment	No	
Drinking Water Protected Area (Surface)	No	

Map 2: Key Features shows the location of all designated areas and significant features. Deep peat soils are indicated on **Map 9: Soils**.

3.2 Clear felling

Areas proposed for clear felling in the plan period are identified below (Tables 3 to 5) and as Phase 1 and Phase 2 coupes on **Map 4: Management**.

Table 3

Clearfell Summary by Phase and Coupe Number			
Phase	Coupe Number	Fell Year	**Gross Area** (ha)
1	16021	2020/21	50.0
1	16023	2022/23	42.1
1	16025	2020/21	51.0
1	16026	2023/24	40.1
1	16028	2023/24	31.2
2	16009	2025/26	79.0
2	16012	2024/25	109.2
		Total	**402.6**

Table 4

Clearfell by Species					
		Net Area (ha) by Main Species >20%			
Coupe Number	Fell Year	**LP**	**SP**	**SS**	Coupe Total **Net Area** (ha)
16021	2020/21	31.5	0	13.3	44.8
16023	2022/23	30.8	0	5.4	36.2
16025	2020/21	31.9	0	8.8	40.7
16026	2023/24	0.8	0	28.8	29.6
16028	2023/24	3.9	0	27.3	31.2
16009	2025/26	0.5	13.0	57.4	70.9
16012	2024/25	28.2	0	73.9	102.1
Plan Area Total		**127.6**	**13.0**	**214.9**	**355.5**

Table 5

Scale of Proposed Felling Areas										
Total Plan Area			1183		ha					
Felling	Phase 1	%	Phase 2	%	Phase 3	%	Phase 4	%	Long Term Retention	%
Net Area (ha)	**182.5**	15.4	**173.0**	14.6	**63.8**	5.4	**67.2**	5.7	**0**	0

3.3 Thinning

Potential sites for thinning in the Blountfield block and a single firewood coupe in Racks Moss over the plan period are identified on **Map 5: Thinning**. This covers an area of 88 ha.

Thinning will normally be carried out at, or below, the level of marginal thinning intensity (i.e. removing no more than 70% of the maximum MAI, or YC, per year). Higher intensities (no more than 140 % of maximum MAI, or YC, per year) may be applied where thinning has been delayed, larger tree sizes are being sought or as part of a LISS prescription. In all cases work plans will define the detailed thinning prescription before work is carried out and operations will be monitored by checking pre and post thinning basal areas for the key crop components.

3.4 Other tree felling in exceptional circumstances

FLS will normally seek to map and identify all planned tree felling in advance through the LMP process.

There are some circumstances requiring small scale tree felling where this may not be possible and where it may be impractical to apply for a separate felling permission due to the risks or impacts of delaying the felling.

Felling permission is therefore sought for the LMP approval period to cover the following circumstances: Individual trees, rows of trees or small groups of trees that are impacting on important infrastructure (as defined below*), either because they are now encroaching on or have been destabilised or made unsafe by wind, physical damage, or impeded drainage.

**Infrastructure includes forest roads, footpaths, access (vehicle, cycle, horse walking) routes, buildings, utilities and services, and drains.*

The maximum volume of felling in exceptional circumstances over the plan area covered by this approval is 40 cubic metres per calendar year. A record of the volume felled in this way will be maintained and will be considered during the five year Land Management Plan review.

[N.B. Trees may be felled without permission if they: are of less than 10 cm diameter at breast height (1.3 m); pose immediate danger to persons or property; are completely dead; or are part of Authorised Planning Permission works or wayleave agreements].

3.5 Restocking

Proposed restocking is shown in Table 7 and on **Map 6: Future Habitats & Species**.

Table 7

Restocking							
Phase	Coupe Number	Gross Area (ha)	Proposed Restock Year	Species	Method *	Minimum stocking Density (s/ha)	Note
1	16021	22.2	2021/22	NBL	NR	≥500**	(DBI, SBI, XWL)
1	16023	32.2	2023/24	NBL	NR	1600	(DBI, CAR, XWL)
1	16025	12.3	2021/22	NBL, MC	NR	≥500**	(DBI, SBI, CAR, LP, SS)
1	16026	12.2	2024/25	NBL	NR	≥500**	(DBI, SBI, XWL)
1	16028	16.1	2024/25	NBL	NR	≥500**	(DBI, SBI, XWL)
2	16009	-	-	-	None	-	
2	16012	3.4	2025/26	NBL	NR	≥500**	(DBI, SBI, XWL)
	Total	**95.1**					

* replant (R) / natural regeneration (NR) / plant alternative area (ALT) / no restocking (None)

**Peatland Edge Woodland (PEW). Refer to 'Deciding Future Management Options for Afforested Deep Peatland' (FCS, 2015) for definition.

Timescales for Natural Regeneration:

A natural regeneration 'flag' will be added to the sub-compartment database (SCDB) once felling has been completed to ensure monitoring for establishment begins from this point.

A formal site inspection will be carried out at year 4 (post-felling) to assess the success of natural regeneration and agree future management of the site. If natural regeneration is failing to meet the stocking requirements and some additional time is required, a further period of 2 years will be agreed. If natural regeneration has not reached the minimum stocking densities by the above time periods the site will be beaten-up to meet a planting density of 1600 stems per hectare (500 minimum for PEW as per FCS Guidance).

[N.B. Stocking density may include variable spacing throughout to achieve a minimum average stocking density of 500/1600 trees per hectare over the whole stocked area.]

3.6 Species diversity and age structure

The following tables (8 and 9) show how the proposed management changes the species composition and age-class structure of the existing forest over the LMP period and beyond (year 20).

Table 8

Plan area by Species						
Species	**Current**		**Year 10**		**Year 20**	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Sitka spruce	378.4	32.0	161.6	13.6	37.9	3.2
Other conifers	195.6	16.6	51.8	4.3	19.4	1.7
Native broadleaves	80.8	6.8	92.0	7.8	101.6	8.6
Non-native broadleaves	9.6	0.8	9.6	0.8	9.6	0.8
Open ground	519.5	43.8	868.9	73.5	1015.4	85.7
Total	**1183.9**	**100**	**1183.9**	**100**	**1183.9**	**100**

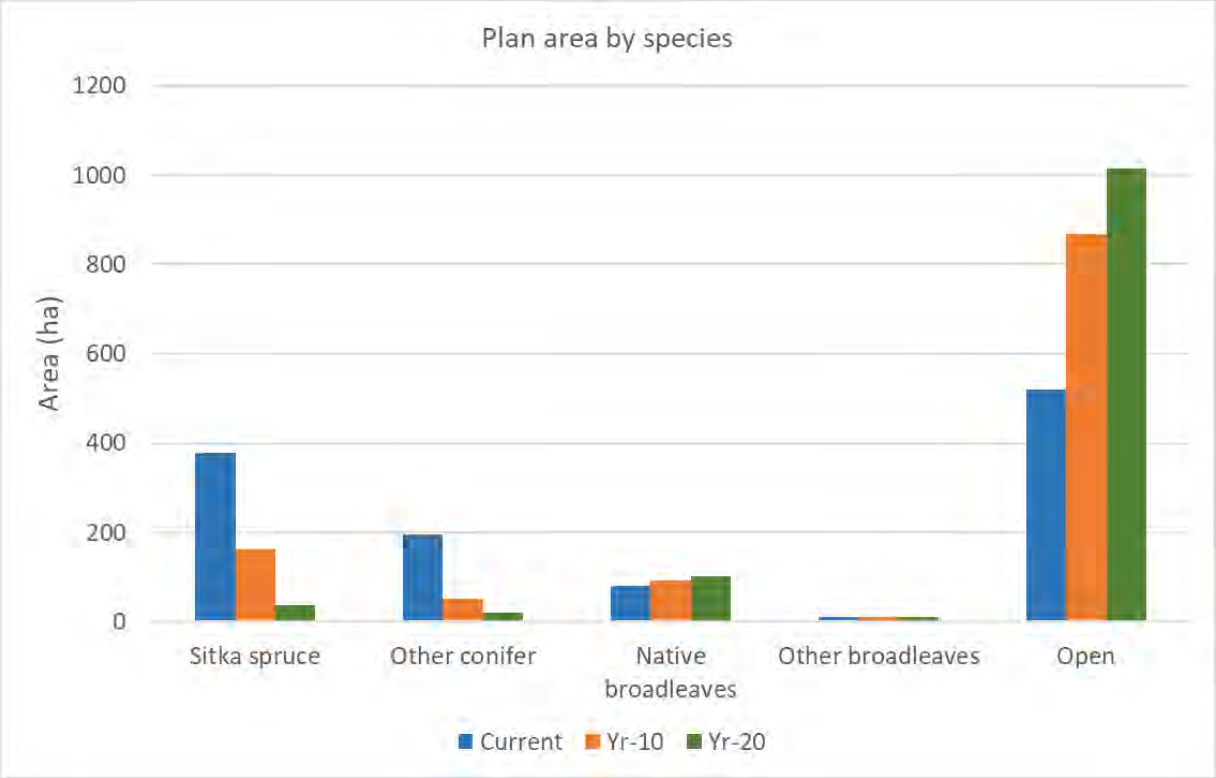


Table 9

Plan area by Age						
Age class (years)	**Current**		**Year 10**		**Year 20**	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
0 – 10	70.3	5.9	75.3	6.4	73.6	6.2
11 – 20	301.8	25.5	39.9	3.4	25.8	2.2
21 – 40	113.4	9.6	170.0	14.4	39.9	3.4
41 – 60	156.2	13.2	0.5	0.04	0	0
60+	21.7	1.8	21.7	1.8	45.4	3.8
Total	663.4	56.0	307.4	26.0	184.7	15.6

3.7 Road Operations and Quarries

Planned new roads, road realignments, road upgrades, new quarrying, and timber haulage routes are detailed below in Table 10, and shown on **Map 7: Timber Haulage**.

Table 10

Forest Road Upgrades, Realignments, New Roads and New Quarrying				
Phase	Name / Number	Length (m)	Year	Operation
1	Racks north	270	2021/22	New road
1	Racks south	1315	2021/22	New Road
1	Racks access	2500	2021/22	Upgrade

3.8 Environmental Impact Assessment (EIA)

Any operations requiring an EIA determination are shown in Table 11 below. If required, the screening opinion request form is presented in **Appendix II**.

Table 11

EIA projects in the plan area		
Type of project	Yes / No	Note
Afforestation	No	
Deforestation	Yes	Forest-to-bog restoration to priority open habitat
Forest roads	Yes	1585 m total length in Racks Moss
Forestry quarries	No	

3.9 Tolerance table

Working tolerances agreed with Scottish Forestry are shown in **Appendix IV**.

4.0 Management Proposals – guidance and context

Silviculture
Clear felling
The primary objective in this plan is to restore the Lochar Mosses to active lowland raised bog, therefore, clearfelling the current standing crop is the only appropriate management type for the majority of the plan area. Harvesting methods will seek to minimise ground damage through the use of low ground pressure machinery, whole tree removal where possible, and brash recovery where possible. Coupes for clearfelling during the plan period (refer to **Map 4: Management**): **16021** (2020/21) First rotation conifer, intruding in places into the broadleaf woodland surrounding Ironhirst lochan. Area to be restored to peatland, therefore sensitive low-impact felling and extraction required. **16023** (2022/23) First rotation conifer, very wet ground conditions with standing water pools in some areas. Area to become wet woodland through natural regeneration with minimal management, therefore sensitive low-impact felling and extraction required. Access to main ditch running through coupe taking water from neighbouring properties to be kept open for maintenance requirements. **16025** (2020/21) First rotation conifer, intruding in places into the broadleaf woodland surrounding Ironhirst lochan. Area to be restored to peatland, therefore sensitive low-impact felling and extraction required. **16026** (2023/24) First rotation conifer fringing the eastern edge of Racks Moss. Area to be restored to peatland, therefore sensitive low-impact felling and extraction required. New roads planned for Racks will provide access to both north and south ends of this coupe (and the adjoining coupe 16028).

16028 (2023/24)
First rotation conifer fringing the eastern edge of Racks Moss. Area to be restored to peatland, therefore sensitive low-impact felling and extraction required. New road construction required to access coupe.

16009 (2025/26)
Second rotation conifer (P2002-2004), checked and failed in places owing to poor growing conditions on deep peat. Early felling to prevent further deterioration to sensitive lowland raised bog habitat. Pockets of mature Scots pine to be left for habitat value. Area to be restored to peatland, therefore sensitive low-impact felling and extraction required.

16012 (2024/25)
Second rotation conifer (P2003-2005), checked and failed in places owing to poor growing conditions on deep peat. Felling early to prevent further deterioration to sensitive lowland raised bog habitat. Pockets of birch to be left for habitat value. Area to be restored to peatland, therefore sensitive low-impact felling and extraction required.

Thinning

As most of the Lochar Mosses will be returned to open bog habitat, no thinning is planned at Ironhirst or Racks Mosses (except the LISS-managed broadleaf firewood coupe **16018**).

There is good potential for thinning at Blountfield given the soil conditions and climate. Thinning interventions will be planned for all productive stands from around year 15-20, or 10-12 m height (some DF stands are exhibiting rapid growth) to clearfell age.

The approach to thinning will be influenced by each stand's species composition, structure and management objectives. Thinning regimes will be applied accordingly, and monitored through pre and post thinning basal area surveys. Thinning will normally be carried out at, or below, the level of marginal thinning intensity (i.e. removing no more than 70% of the Yield Class per year). Higher intensities (no more than 140 % of maximum MAI, or YC, per year) may be applied where thinning has been delayed, larger tree sizes are being sought or as part of a LISS prescription.

Low Impact Silvicultural Systems (LISS)
Refer to **Map 4: Management** A number of coupes in the Blountfield block will be managed under LISS to realise the potential of high-quality hardwoods and softwoods, and ultimately to provide a mixed age structure of the block. However, as the block was planted in 2015 it is unlikely that any interventions will take place over this plan period. **16037** The objective here is to develop a high-quality crop of sycamore hardwood, managed under a Group Selection system. This approach will be complimented by thinning when appropriate, and should create new marketing opportunities (e.g. fire wood). **16038** Douglas fir to be managed under a Group Selection system. It will be important to carry out the first thinning intervention at the correct time, as the crop currently has a rapid growth rate: this should be assessed from year 15 (2030 onwards). **16043** Douglas fir and native broadleaves to be managed under a Group Selection system. Again, timing of the first DF thinning intervention will be crucial. Oak 'nests' are scattered through the coupe with the aim of producing high-value oak timber in the future and these require regular management, with early identification of the final crop trees. **16046** Small coupe of native broadleaves managed under Group Selection to allow small gaps to be established and a more varied woodland structure to develop. The primary objectives of nature conservation and the development of native woodland in these areas will not be compromised by management interventions. LISS outwith the Blountfield block is limited to coupe 16018 in Racks Moss, which will be managed under a Group Selection prescription for firewood whilst maintaining a continuous cover of predominantly birch species.

Long term retentions (LTR) / minimum intervention (MI) / natural reserves (NR)
Minimum Intervention has been chosen as the most suitable management for the area around Ironhirst Loch (coupe **16030**) where low levels of disturbance will benefit wildlife, and maintain habitat diversity. This coupe will retain a proportion of mature conifer to provide red squirrel habitat. MI has also been selected for the isolated stands of mature Scots pine in Racks Moss that are valuable wildlife areas, and provide habitat for nesting raptors. (see **Map 4**). Once established, the areas of peatland edge woodland (PEW) and wet woodland (coupe **16023**) will be managed as MI areas.
Tree species choice
The objective of the plan is to return the majority of the plan area to lowland raised bog, therefore there will be comparatively little restocking. With reference to ESC (Forest Research Ecological Site Classification tool), there is very limited choice in terms of restock species in the Racks Moss and Ironhirst Moss blocks, as most of the deep peat areas have a Very Poor and Very Wet habitat classification. Peatland edge woodland will be established through natural regeneration, the expected species being predominantly birch and willow species.
Natural regeneration
Birch regeneration is already established in **coupe 16018** in Racks Moss following clearfell in 2008, and it is anticipated that most of the peatland edge woodland (PEW) in this plan will be established through natural regeneration. There will likely be some regeneration of non-native conifer species in this which will be monitored periodically (at 5 year review and near the plan expiry date) and cleared using motor manual methods if deemed excessive. Ultimately, over time, peatland restoration interventions should create hydrological conditions unsuited to regeneration of conifer species and remove any seed source into PEW areas, thus decreasing the need to clear conifer regen as time progresses.
New planting
There is no new planting in this LMP revision.

Protection
Deer management will be conducted in line with the expectations of a responsible land owner in terms of deer pressure on adjoining land; however, some level of browsing will be beneficial to the management objectives of this plan in keeping conifer regeneration under control on open ground undergoing peatland restoration. Browsing pressure on natural regeneration will be monitored by the regional wildlife team and assessed for control measures as required in line with the FLS Deer Management Strategy.
Road operations
A combination of road upgrading (2500 m) and road building (1315 m) in the Racks block is required to access coupes **16026**, **16028** and **16009** minimising timber forwarding distances as much as practicable on sensitive deep peat soils. New road construction will be designed to impact deep peat soils as little as possible, using the minimum specification to enable timber extraction but allow road material uplift once peatland restoration interventions have been completed.
Biodiversity
Designated sites
Longbridge Muir is a designated Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC). The SSSI citation was last assessed in August 2009 as 'Unfavourable Recovering'. The main negative pressures are listed by SNH as Forestry Operations, Invasive Species, Under Grazing, and Water Management (i.e. drainage). Deforestation and peatland restoration in the adjacent Ironhirst block will remove seed source for invasive regenerating non-native conifer on the SSSI, and *Rhododendron ponticum* will be dealt with as per the FLS INNS policy (see 'Invasive Species' section below). Further interventions to improve the hydrological functioning of the Longbridge Muir peatland will be carried out over the long-term restoration project plan for the entire area, for example, trench bunding to block subsurface peat macropores ('pipes') and raise the water table within the body of the raised bog area. This will also assist with the control of invasive species.
Native woodland
By the end of the plan period native woodland will occupy around 8% of the LMP unit. This will predominantly be low-density peatland edge woodland and wet woodland, consisting mainly of naturally regenerated silver and downy birch, with common alder and willow species. The area of Minimum Intervention around Ironhirst Loch contains mature birch species, and birch woodland has naturally regenerated to the northern end of Racks. Undoubtedly, conifer species will also be present in PEW and wet woodland, and an

element of this will be tolerated as described in the FCS guide "Deciding Future Management Options For Afforested Deep Peat" definition of PEW. Monitoring will be carried out to ensure conifer regen is not compromising the establishment and/or growth of native broadleaf species.

Ancient woodland / PAWS

There are two areas of LEPO (long-established of plantation origin) woodland within the plan area: 7.9 ha in the Minimum Intervention area (coupe 16033) in Ironhirst, and an area of 6.8 ha that partially intrudes the southern boundary of the Blountfield block, also to be managed as Minimum Intervention.

Protected and priority habitats and species

The Lochar Mosses are a lowland raised bog habitat, listed on the Scottish Biodiversity list and a UK BAP Priority Habitat. Afforestation is listed as one of the key threats to lowland raised bog habitat, having a significant impact on their conservation status at a National level. Restoration of lowland raised bogs is a key action from the Scottish Biodiversity Strategy: Government agencies have a duty to further the protection and enhancement of these under the Nature Conservation Scotland Act (2004).

The restoration potential of Racks Moss and Ironhirst Moss is considered to be high, due to the very wet ground conditions and abundant remnant bog vegetation that persists in rides and other isolated areas, especially where planted conifers have gone into check. FLS are committed to a long-term restoration programme of this priority habitat, and have already restored much of Longbridge Muir and a section of Ironhirst Moss. The key management objective in the Lochar Mosses LMP revision is the continued phased restoration of the mosses, utilising best practice techniques to achieve re-wetting of peat following tree removal (e.g. drain blocking, stump inversion, ground-smoothing, trench bunding – refer to Appendix VI).

Raptor species have been recorded across the Lochar Mosses, including osprey, goshawk, and hen harrier. Osprey return to the area each year to breed and nesting platforms have been established in several locations in the plan area. These areas will be protected from operations and stands of stable, mature Scots pine will be left as roost sites in Racks Moss. The restoration of lowland raised bog across the Lochar Mosses will be beneficial to a number of bird species including waders, hen harrier, and nightjar, and increase habitat biodiversity in the area to the benefit of numerous plant and invertebrate species. We will continue to manage edge habitats for the benefit of nightjar.

The remaining mature conifer cover in the Lochar Moss LMP unit represent locally important red squirrel habitat. The LMP unit closely borders (and Blountfield lies within) the Saving Scotland's Red Squirrels (SSRS) Annan Valley PARC (Priority area for red squirrel conservation). Consultation with the local SSRS officer concluded that, although the loss of conifer forest within the area will have an impact on the local red squirrel population, given the value of lowland raised bog habitat for biodiversity and carbon sequestration, the land would greatly benefit from the proposed peatland restoration project. The proposals are thus supported with the caveat that felling operations in this LMP will carefully account for any resident red squirrel population, with phased felling over a number of years, felling outwith the key breeding period (February to end June: local population are highly unlikely to breed twice in this area owing to limited food supplies) and avoiding isolating populations to allow squirrels to travel to adjoining or nearby habitat, such as the Comlongon forest blocks under private management. Coupe checks for environmental considerations, including priority or protected habitats and species surveys, will be conducted prior to felling works as per legal requirements and described in UKFS Requirements for Forestry and Biodiversity.
Open ground
Through the delivery of this plan FLS will manage natural regeneration in such a way as to ensure that, where practicable, it does not significantly impose a negative impact upon the objectives of the plan. Natural regeneration will be managed so that any negative impact upon designated, protected or promoted habitats, species, landscapes, historic environment features, and catchments within or adjacent to the LMP area is minimised and where possible mitigated.
Dead wood
Opportunities for retaining or creating deadwood will be identified during the planning of all operations, favouring areas with the highest deadwood ecological potential. Valuable deadwood and deadwood areas will be marked on contract maps. The highest potential deadwood areas are the Minimum Intervention management coupes, and the area of wet woodland at Holmhead Moss in Ironhirst (coupe **16023**).
Invasive species
FLS will continue to support the control of grey squirrels being co-ordinated by Saving Scotland's Red Squirrels.

We will endeavour to control known patches of invasive non-native plants under the FLS Invasive Non-Native Species (INNS) policy. *Rhododendron ponticum* is present in low densities across the three bog units (Longbridge Muir, Ironhirst and Racks) and treatment to remove this species will continue; however, it will be challenging to eradicate it entirely. The planned peatland restoration treatments will be instrumental in tackling the presence of *R. ponticum* through ground-smoothing and raising the water table in these areas.

Historic Environment

Designated sites

There are no designated historic environment sites.

Other features

There are remnants of former peat extraction works around the Ironhirst Loch, which whilst not designated, may retain some industrial archaeological interest. As this area is to be retained as a Minimum Intervention area, any industrial artefacts will remain undisturbed.

Landscape

No part of the Lochar Mosses LMP area is within a landscape designation. The majority of the plan lies within a large-scale, flat landscape, able to absorb relatively significant changes to forest cover. Ultimately, the goal is to return this area to its original (in this context, visual) condition of the mid-20th century.

The Blountfield block sits well within the topography and landscape to the north of the A75 trunk road. There are no operations planned during this plan period and therefore only incremental growth will alter the visual change to the block.

People

Neighbours and local community

There is a relatively low community interest in the management of the plantation blocks of the Lochar Mosses in their current form. It is hoped that the restoration of these areas to their former priority habitat will create a greater local interest in the Lochar Mosses.

Agricultural neighbours have expressed concern that restoration interventions will include the blocking of peripheral and through-forest ditches installed as part of the Land Drainage (Lochar Water) Improvement Order 1970. FLS will not block any ditch that accepts water from uphill neighbouring properties, and will continue to work in partnership with

neighbouring landowners and the Lochar Water Improvement Committee as per the requirements of the aforementioned Improvement Order.

Public access

There is little formal public access other than Core Path 74 leading from Mouswald into Ironhirst that runs through Coupe 16030 and is to be managed (and extended) as long-term mixed woodland. Informal recreational access around Racks Moss roads and tracks will not be impeded by any management operations in this plan, and it is hoped that, eventually, the restoration of the former lowland raised bogs will attract greater numbers of visitors.

Soils

Ground preparation

No restocking by planting is envisaged this LMP period; however, where enrichment planting is identified for PEW or wet woodland areas, straight planting will be employed with no ground preparation required.

Deep peats

Almost the entire plan area is classified as deep peat, excluding Blountfield. There will be no restocking of commercial conifer on deep peat, and specialist harvesting using low ground pressure machines and brash recovery will favour the extensive peatland restoration programme planned for the Lochar Mosses plan area.

Water

Drinking water

Scottish Water records indicate that there are no drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity.

There are no Scottish Water assets (including water supply and sewer pipes, water and waste water treatment works, reservoirs, etc.) in the area.

There are no records of private water supplies within the plan area.

Watercourse condition

All management operations will adhere to the 'Forests and Water' requirements and guidelines in the UKFS. The condition of the three watercourses running through the plan area (Lochar Water, Mouswald Burn, Black Grain) are impacted by *diffuse source [pollution] (rural sources)* causing reduced water quality. However, the Lochar Mosses LMP area

represents a small proportion of the catchment (8.7%). Extensive but phased peatland restoration operations will ultimately improve both the holding capacity, and water quality leaving the LMP area. Additionally, restoration should slow the release of water following high flow events.

The water courses around the Lochar Mosses have been heavily modified under the Land Drainage (Scotland) Act 1958 and the Land Drainage (Lochar Water) Improvement Order 1970. Maintenance of these (within the Lochar Mosses LMP area, these are the Lochar Water, the Black Grain, and the Mouswald Burn) is governed and executed by the Lochar Water Improvement Committee (the "authorised persons"). These watercourses will not be impacted by peatland restoration activities and will be buffered to at least 20 m as per SEPA requirements. Additionally, main in-forest and peripheral drains that accept water from adjoining upstream agricultural land will remain accessible, and be monitored and maintained as necessary.

Flooding

The plan area is downstream of the nearest SEPA Objective Target Area (Dumfries) and is thus outwith the sphere of influence of any OTA drainage area.

The village of Bankend is the only settlement downstream of the plan area. Bankend lies outwith the SEPA Potentially Vulnerable Areas map, but the Lochar Water that runs through Bankend is locally sensitive to flooding, also influenced by tidal extent. The drainage area that runs to the Bankend bridge is around 12,300 ha, therefore the total net felling during the 10 year period of this LMP is around 3.2% of the catchment area for Bankend, way below the threshold of 20% canopy removal in a drainage area (the level at which there may be a significant measurable negative effect at the flood point downstream). Given that the felled areas in the Lochar Mosses LMP will be re-wetted through peatland restoration techniques including drain blocking, the overall effect on flooding will be negligible.

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Appendix I: Description of Woodlands

Topography and Landscape	The blocks within the LMP unit fall into two distinct landscape types: The Lochar Mosses, being classed as lowland raised bogs, have little topographical variance located approximately 10-15 m above sea level throughout. The mosses sit within a large-scale landscape visible at an elevated position from the main Dumfries to Annan A75 road, and the surrounding B-class roads to the north-east and south-west. As such, quite significant management changes to the Lochar Mosses would have a respectively minimal impact. The Blountfield block is situated on a hillside setting, rising from around 135 m to a high point of 200 m asl. It is located around 700 m north-east of the A75 trunk road and relatively prominent in a landscape of agricultural land, pockets of broadleaf woodland, and small-scale plantation.
Geology and Soils	The Lochar Mosses blocks are underlain by sedimentary sandstones and mixed conglomerates of the Permian period. The break of slope toward the valley side (north-east of Racks and Ironhirst), marks the change in bedrock geology to wackes, silts and mudstones of the Silurian period underlying the Blountfield block. Superficial geology beneath the Lochar Mosses is Quaternary peat, bisected with alluvial sand, silt and clays around the location of watercourses. FLS soil survey data indicate that the three raised bog sites are predominantly of type 10a (lowland Sphagnum bog) which are edaphically unsuited for woodland. The edges of these blocks (termed 'laggs') change to type 9c soils (*Molinia – Eriophorum vaginatum* bog) indicating more flushed fen-type peat, hence suitable for peatland edge woodland. Soil types in the Blountfield block reflect the underlying geology, with a roughly equal coverage by area of brown earths and surface-water gleys. Soil types are shown on **Map 9.**
Climate	The climate is warm and moist throughout. The climate station at Dumfries has recorded average temperatures of 19.5°C (summer) and 6.8°C (winter) and average monthly rainfall ranging from 62 mm to 134

	mm. Accumulated temperature (day degrees above 5°C) ranges from ~1560 to ~1220. The moisture deficit (evaporation minus precipitation) ranges from 90 mm to 150 mm. Data from the UK Climate Projections 2009 (based on the central estimate for medium emissions) shows that by the 2080s this area may be up to 4°C warmer in the summer and up to 3°C warmer in the winter. It could also experience up to 30% less precipitation in the summer, but up to 30% more in the winter. This means there are likely to be warmer, wetter winters and warmer, drier summers.
Hydrology	**Map 2** shows all watercourses and open water (no recorded water supplies). The LMP area lies within the lower reaches of the Nith catchment. Three watercourses are located within the LMP area: **River:** Lochar Water/Park Burn **Condition:** Moderate **Impacted condition / Responsible pressures (and activity):** • Water quality due to diffuse source (rural sources) **River:** Mouswald Burn **Condition:** Moderate **Impacted condition / Responsible pressures (and activity):** • Physical condition due to modifications from urban and rural land uses. • Water quality due to diffuse source (rural sources). **River:** Black Grain **Condition:** Moderate **Impacted condition / Responsible pressures (and activity):** • Physical condition due to modifications from urban and rural land uses. • Water quality due to diffuse source (rural sources) As mentioned in the main text above, the water courses around the Lochar Mosses have been heavily modified under the Land Drainage (Scotland) Act 1958 and the Land Drainage (Lochar Water) Improvement Order 1970 prior to afforestation of the blocks. Main drainage ditches around the Lochar Moss blocks are directly connected to watercourses.

Windthrow	**Map 10** illustrates the DAMS measurements for the forest. The greatest exposure is on top of Blountfield Moor where DAMS reaches 17. The three Lochar Mosses blocks have lower scores of around 13-14.
Adjacent land use	All blocks within the LMP area are bordered in the main by agricultural grazing land. The eastern section of Longbridge Muir (also within the SSSI and SAC designated area) is privately owned and is currently being managed as open bog habitat. The southern edge of Longbridge Muir is adjacent to private forestry, which has been recently restocked with productive conifer.
Public access	The Lochar Mosses blocks support low level but regular public access (both walkers and horse riders), mainly limited to the forest roads and rides in Racks. Core Path 74 (Mouswald to Lochar Moss) leads into the area around the lochan in Ironhirst. There are also undesignated paths through the Blountfield block which are used by local walkers and dog walkers. Core Path 542 (Woodside to Rammerscales) lies close to the north-western edge of the block. **Map 2** shows the location of forest roads and the single Core Path.
Historic environment	There are no designated heritage features within the forest. There are a small number of undesignated HE features recorded on the FLS Heritage layer which are shown in **Appendix V** and on **Map 2.** Dumfries & Galloway Council Historic Environment Records (HER) note a number of undesignated assets within the forest blocks, of which the most significant is the remains of the peat extraction works extending into Ironhurst Moss. The HER has records for at least three bog bodies being recovered from Lochar Moss, the last one in 1943, though none of the bodies have been preserved. In addition, finds of prehistoric bronze axes and at least one Roman coin hoard are also noted.
Biodiversity	Despite the substantial modifications to the bog surface during ground preparations in the 1960s/70s and subsequent non-native conifer growth, the Lochar Mosses currently support and range of typical lowland raised bog species, highlighting the high potential of restoration success.

	Multiple sphagnum species have been recorded (including a historical record for Dumfries and Galloway's only occurrence of Baltic Bog Moss *Sphagnum balticum*). Other bog species include cotton grasses *Eriophorum vaginatum* and *E. angustifolium,* bog rosemary *Andromeda polifolia*, cranberry *Vaccinium oxycoccos*, and three species of sundew (including Dumfriesshires only current record for great sundew *Drosera anglica*). Notable faunal species recorded include otter, nightjar, osprey, goshawk, hen harrier, cuckoo, Lepidoptera including small copper and large heath, several species of Odanata, and reptiles such as adder and common lizard. Restoration interventions on the Longbridge Muir block have increased biodiversity of the area substantially, and continued restoration will increase the area of this nationally scarce priority habitat to the benefit of many species.
Invasive species	Grey squirrels may be present, and FLS will support any control measures co-ordinated by the Saving Scotland's Red Squirrels group. Areas of *Rhododendron ponticum* have been cut and treated in recent years in Longbridge Muir and are present in low densities across all three units of the Lochar Mosses. Himalayan balsam is widespread in watercourses throughout the region, and although it has not been recorded in the plan area, the species is likely to become established at some point in the future. All invasive plants are being monitored and controlled accordingly.
Woodland composition	The current species composition of the blocks within the Lochar Mosses LMP area is shown on **Map 8.** The remaining productive conifer stock on Racks and Ironhirst blocks is predominantly Sitka spruce and lodgepole pine. Much of the pine is of particularly poor form, and beyond roadlines, second rotation spruce is generally not growing well, with poor form and low yield class. Areas around the loch and southern border of Ironhirst have established mixed birch woodland, and new planting at Blountfield includes a wide diversity of tree species.

Plant health	*Phytophthora ramorum* is prevalent throughout south-west Scotland. Whilst it cannot be ruled out that larch is present within the plan area these would only be as individual isolated trees (there are none recorded in the sub-compartment database). Any larch found during operations would be felled regardless of infection. Dothistroma needle blight (DNB) has been identified at relatively low levels (stage 2) in lodgepole pine in Racks and Ironhirst, though is not yet widespread.

Appendix II: EIA screening opinion request form

Supplied separately with this document

Appendix III: Consultation record

Consultee	Date contacted	Date of response	Issues raised	FLS response
Scottish Forestry		27/11/2019 (meeting)	Woodland Officer D Zaoral attended the Lochar Mosses LMP scoping meeting at Ae.	Generally supportive of the plan objectives. No specific requirements at the scoping stage, but stated the need for robust EIA screening supporting information. This is supplied in Appendix VI of this document.
SEPA	06/12/2019	28/02/2020	"We support the work you are doing to restore the southern peatland blocks and to enhance the woodland management at Blountfield. These complement our own ambitions. SEPA has a new regulatory strategy, One Planet Prosperity, which when realised will result in Scotland living sustainably within its available resources. We are also a member of the National Peatland Group, and in this role want to support land managers and owners to carry out peatland conservation and restoration. The work you are proposing […] is a positive and significant contribution to the management of peatlands in southern Scotland.	FLS appreciate the support from SEPA in this large-scale habitat restoration focussed LMP. FLS will work closely with SEPA (and SNH) during the restoration phase of the plan in terms of water management and water quality.

			We welcome the opportunity to work with you on this project and the wider Land Management Plan when that is approved. This will allow us to provide early advice on any water management issues that might emerge."	
SNH	28/11/2019	17/12/2019	"SNH is of the opinion that the restoration of the Raised Mires within the Lochar Mosses Complex is a priority […] restoration is going to be an important factor in addressing Government priorities for Carbon Capture." Some specific comments on operations: Operational access infrastructure should be kept to a minimum, and removed as part of the restoration process wherever possible. Would be good to see a commitment to additional restoration of the SSSI. Support early harvesting of 2nd rotation conifer as "the damage of a delicate site by allowing trees to mature and root systems to further damage the hydrology could be significant."	The desire to restore the Lochar Mosses to lowland raised bog is mutual, and FLS appreciate the on-going support from SNH. The specific comments supplied are more relevant to operations once the plan is approved, and FLS will continue to work closely with SNH as the restoration of her mosses continues. Additional interventions at Longbridge Muir SSSI are planned to improve the hydrological functioning of the site.
HES	28/11/2019	-	No response received.	

Scottish Water	28/11/2019	03/12/2020	Confirmed there are no Drinking Water Protected Areas or Scottish Water Assets in the area that may be affected by the proposed activity.	No action required.
Confor	28/11/2019	-	No response received.	
WWT Caerlaverock	28/11/2019		Supportive of proposals in terms of habitat restoration and positive effects on wader populations, including nationally-threatened curlew, as well as benefits to many other species groups. Specific comments: Questioned whether timber produced from the Lochar Mosses could ever be a 'sustainably managed resource' as specified in the FLS Corporate Plan. Would like to see boundaries with open agricultural land, specifically to the west of Racks Moss kept free of PEW to minimise habitat for predatory species for the benefit of established breeding pairs of curlew and lapwing along the Lochar Water corridor between Racks and Craigs Moss.	The benefits of restoration of the Lochar Mosses are numerous, and FLS appreciate the support of WWT Caerlaverock as a neighbouring conservation-based land owner. FLS believe that restocking the Lochar Mosses would not constitute sustainable forestry as it would not be economically viable, therefore missing one of the three legs of sustainability. The western edge of Racks borders existing open peatland and this area will be kept as open ground as per the Future Habitats & Species map (Map 6).
River Nith District Salmon Fishery Board	28/11/2019	-	No response received.	

River Annan District Salmon Fishery Board	28/11/2019	-	No response received.	
RSPB	28/11/2019		"We welcome the overall concept of the plan and the proposals for peatland restoration and the retention and establishment of peatland edge woodland (PEW), native broadleaves (NBL) and existing mature scots pine." Proposals highly beneficial to nightjar, and the existing strong population would benefit by retaining willow scrub and heather in areas of Longbridgemuir.	FLS appreciate the support of RSPB in this plan. Peatland Edge Woodland will provide willow (and other native broadleaves) together with ground vegetation beneficial to nightjar (Map 6). We recognise that since we carried out forest-to-bog restoration in the Longbridge Muir and Ironhirst blocks, the site has become one of only two known regular breeding sites for nightjar in whole of Scotland (the other being the Galloway Forest Park) FLS will continue to work with the RSPB and we will support any monitoring programmes for nightjar through engagement between the FLS local Environment team and the RSPB. Restoration plans around the Cockpool Moss area will be discussed with the RSPB at the appropriate time to ensure we maximise potential nightjar habitat opportunities during operations.
Saving Scotland's Red Squirrels	28/11/2019	21/01/2020 *Meeting with FLS	The mature conifer within the Lochar Mosses do provide important red squirrel habitat, however SSRS do fully appreciate	FLS appreciate the support of SSRS in this large-scale habitat restoration focussed LMP.

		and SSRS held at Moffat Road office.	the value of lowland raised bog habitat for biodiversity and carbon sequestration. Can clearly see how the land would benefit greatly from the proposed peatland restoration project. The felling regime for the proposed plan should carefully account for the resident red squirrel population with felling staggered over years, the direction of felling allowing squirrels to travel to any adjoining or nearby habitat and the avoidance of the breeding season. The retention and expansion of the Natural Reserve Woodland is welcomed and the species retained and planted should ensure a diverse and stable food resource for red squirrels	Felling will be phased to allow for local squirrel populations to move to other areas with mature conifer including the adjacent Comlongon private forestry blocks. Felling will be directional so as not to isolate populations and will take place outwith the main breeding season. These commitments are made in Section 4.0 Management Proposals – guidance and context under 'Protected and priority habitats and species'
Butterfly Conservation Scotland	28/11/2019	13/01/2020	"We fully support the restoration of peatlands formerly planted up, and would be keen to see how we can assist."	FLS appreciate the full support of BCS in this LMP revision.
D&G Council - Timber Transport Officer	28/11/2019	-	No response received.	
D&G Council - Archaeologist	28/11/2019	16/01/2020	Records note a number of undesignated assets within the forest blocks, of which the most significant is the remains of the peat extraction plant extending into Ironhurst Moss. Areas of historic	All management proposals will adhere to the UKFS on the Historic Environment. Any features or objects of archaeological interest coming to light as a result of ground disturbance resulting from forestry

			environment interest should be checked both on FLS's internal historic environment records and with the Council's HER prior to the commencement of forestry activities. Any upstanding features should be clearly marked, both on the ground and on operational maps. Care should be taken to avoid any damage to surviving structural elements.	works will be notified to the Council Archaeologist.
D&G Council – Roads Officer	28/11/2019	-	No response received.	
D&G Council – Outdoor Access	28/11/2019	-	No response received.	
Caerlaverock Estate	06/12/2019	-	No response received.	
Mouswald CC	28/11/2019	-	No response received.	
Torthorwald CC	28/11/2019	28/11/2019	Initial response received acknowledging receipt of consultation. No further comments received.	
Caerlaverock CA	10/12/2019	-	No comments relating to the LMP	
Neighbours	10/01/2020	Various	A letter drop was carried out to neighbours adjacent to proposed operational areas. Responses were received from three farm businesses to the east of Ironhirst and Longbridge Muir. All were concerned that peatland	No peripheral drains or through-forest drains that accept water from higher adjacent landowners will be blocked during the restoration operations. Restoration of the former plantation should both reduce water availability to

			restoration would involve blocking of major drains carrying water from adjacent higher ground. Meeting held on 22/01/2020 with all respondees present to explain the plan fully and listen to concerns.	the drainage systems in place, and slow the flow, resulting in a net benefit to flooding issues in the surrounding area. The Lochar Water Improvement Committee manage the maintenance of a number of watercourses and ditches in the Lochar Water catchment area as per the Land Drainage (Lochar Water) Improvement Order 1970 and will continue to maintain the Black Grain, the primary area of concern. FLS will agree maintenance commitments with relevant parties going forward: this constitutes operational activities rather than a planning issue. It is not the intention of FLS to negatively impact surrounding land through these important habitat restoration prescriptions. Commitments to the management of water movement through the plan area are detailed in 4.0 Management Proposals under subsections 'Silviculture' (p.13), 'People' (p.20), and 'Water' (p.22).

Appendix IV: Tolerance table

	Maps Required (Y/N)	Adjustment to felling period *	Adjustment to felling coupe boundaries **	Timing of Restocking	Changes to Restocking species	Changes to road lines	Designed open ground ** ***	Windblow Clearance ****
FC Approval normally not required	N	• Fell date can be moved within 5 year period where separation or other constraints are met.	• Up to 10% of coupe area.	• Up to 3 planting seasons after felling.	• Change within species group e.g. evergreen conifers or broadleaves.		• Increase by up to 5% of coupe area	
Approval by exchange of letters and map	Y		• Up to 15% of coupe area	• Between 3 and 5 planting seasons after felling, subject to the wider forest and habitat structure not being significantly compromised.		• Additional felling of trees not agreed in plan. • Departures of > 60m in either direction from centre line of road	• Increase by up to 10% of coupe area • Any reduction in open space of coupe area by planting.	• Up to 5ha
Approval by formal plan amendment may be required	Y	• Felling delayed into second or later 5 year period. • Advance felling (phase 3 or beyond) into current or 2nd 5 year period.	• More than 15% of coupe area.	• More than 5 planting seasons after felling, subject to the wider forest and habitat structure not being significantly compromised.	• Change from specified native species. • Change Between species group.	• As above, depending on sensitivity.	• In excess of 10% of coupe area. • Colonisation of open space agreed as critical.	• More than 5ha.

NOTES:

* Felling sequence must not compromise UKFS, in particular felling coupe adjacency

** *No more than 1ha, without consultation with FCS, where the location is defined as 'sensitive' within the Environmental Impact Assessment (Forestry) 1999 Regulations (EIA)*

*** *Tolerance subject to an overriding maximum 20% open space*

**** *Where windblow occurs FCS should be informed of extent prior to clearance and consulted on where clearance of any standing trees is required*

Table of Working Tolerances Specific to Larch

	Adjustment to felling period	Adjustment to felling coupe boundaries	Timing of restocking	Changes to species	Changes to road lines
FC Approval not normally required	Fell date for all larch can be moved and also directly associated other species	Larch areas can be treated as approved coupes. Other conifers directly associated with larch being felled, may also be removed up to an equivalent of 20% of the area occupied by the larch or 5 ha, whichever is greater	To be undertaken within the overall plan approval period.	Replacement as per the agreed restock plan, but where this is not specified or is larch this may be replaced with either another diverse conifer (not SS) or Broadleaves.	
Approval normally by exchange of letters and map. **In some circumstances Approval by formal plan amendment may be required**		Removal of areas of other species in excess of the limits identified above.	Restocking proposals outwith the plan approval period.	Restocking proposals for other species which do not meet the tolerances identified above.	New road lines or tracks directly necessary to allow the extraction of larch material.

Appendix V: Historic Environment records

Designation	Name	Feature Description	Site Description	Grid Reference	Importance	Area (ha)
Undesignated	Horseholm	Farmstead	A farmstead comprising one partially roofed long building, two roofed buildings, one of which has an outshot, and two enclosures is depicted on the 1st edition of the OS 6-inch map (Dumfriesshire 1861, sheet lvi).	NY027706	Regional Importance	0.24
Undesignated	Unnamed	Barrow	A circular barrow is situated on a low knoll in an area of boggy ground. It measures 16.5m in diameter and 1.6m in height.	NY070761	Local Importance	0.08
Undesignated	Unnamed	Cairn (Bronze age)	A cairn, measuring 6.0m in diameter and 0.4m high. By 1995 it was reduced to a low swelling in the field.	NY069756	Local Importance	0.02
Undesignated	Unnamed	Structure	Located to a 100m square is a boat-shaped structure defining a scooped out hollow. Area has since been improved for farming.	NY069759	Uncategorised	1.0
Undesignated	Unnamed	Enclosure	Located to a 100m square is a large structure, comprising two concentric rubble rings from which large stones protrude.	NY069759	Uncategorised	1.0

Appendix VI: Supporting information for EIA screening (deforestation)

Summary
• The Lochar Mosses are a lowland raised bog habitat – listed on the Scottish Biodiversity list and a UK BAP Priority Habitat: **the site is a priority for habitat restoration on ecological grounds**. • Afforestation is listed as one of the key threats to lowland raised bog habitat, **having a significant impact on their conservation status at a National level** (*Control of Woodland Removal Policy –Annex 3: woodland removal without a requirement for compensatory planting*) • Restoration of lowland raised bogs is a key action from the Scottish Biodiversity Strategy: **Government agencies have a duty to further the protection and enhancement of these under the Nature Conservation Scotland Act (2004).** • **The Ironhirst Moss block is hydrologically connected to the former Longbridge Muir plantation block – a SSSI and SAC**, now deforested and mostly restored to bog habitat. • Remnant bog vegetation is abundant around rides and open areas within Ironhirst Moss and Racks Moss, indicating the **potential of the site to be restored is high**: the adjacent Longbridge Muir now has a mosaic of typical bog vegetation and higher water table following restoration and strongly indicates comparable or better results can be achieved at Ironhirst and Racks Mosses. • Forest-to-bog restoration techniques have improved greatly over the last few years, and **FLS is regarded as one of the leading organisations in developing best practice and delivering positive restoration programmes**: we would anticipate a more rapid recovery of water table (to suppress natural regen) and establishment of bog vegetation in restoration sites than experienced previously. • The FCS Practice Guide '*Deciding future management options for afforested deep peatland*' deals with afforested peatlands that are not going to be restored for biodiversity reasons, and **states that replanting must be justified** by considering if the crop will achieve YC8 or more for SS: the majority **of Ironhirst Moss and Racks Moss is deep peat of type 10a** – **edaphically unsuited to woodland**. Strategic ESC indicates the entire site is unsuitable for commercial conifer, with SS YC of 4.

1. Background

This purpose of this document is to provide supplementary information to support the EIA screening application for deforestation in the Lochar Mosses LMP submission for the purpose of continuing large-sclae peatland restoration in the Lochar Mosses LMP area, including:

1. A description of the conservation importance and the potential of the site to be restored, and;

2. A plan for the restoration operations and ongoing maintenance and monitoring.

This document also demonstrates alignment with the following key SG/SF policy & practice:

- The Scottish Government Control of Woodland Removal Policy – in particular guidance on woodland removal without a requirement for compensatory planting
- FCS Practice Guide - Deciding future management options for afforested deep peatland
- Forestry on Peatland Habitats (FCS, 2000)
- UK Forestry Standard

2. FLS approach to peatland management

Restoration of blanket bogs and lowland raised bogs is a key action from the Scottish Biodiversity Strategy, as both habitats are included on the Scottish Biodiversity List. Beyond their value as a carbon store, peatlands contain a huge diversity of organisms. Planting trees on peat leads to a fundamental change in the ecosystem[1].

FLS approaches peatland management slightly differently than the rest of the Forest industry because our objectives and legislative framework has an added dimension, simply because FLS being a Scottish Government agency, has an added 'Biodiversity Duty', as stated in the Nature Conservation Scotland Act (2004). Protection of conservation values is mentioned in UKWAS and principles of sustainability are outlined in UKFS. What this means

[1] Payne et al., 2018: The future of peatland forestry in Scotland : balancing economics, carbon and biodiversity. Scottish Forestry. pp. 34-40.

is that for afforested peatlands, restoration is considered first, before considering and justifying replanting.

This is set out in "Making future management decisions of afforested peatlands Practice Guide". It deals with afforested peatlands that are not going to be restored for biodiversity reasons, and **states that replanting must be justified** by considering if the crop will achieve YC8 or more for SS. The default is not to replant, unless there is evidence it will achieve a good growth rate of harvestable timber. If it doesn't, it is unsustainable, as the three legs of the sustainability stool are not there: Economic, environmental, social. A slow growing crop would not result in a profit, it would be acting as a carbon source and contributing to climate change, and society would be disadvantaged/threatened, based on current scientific information.

3. Conservation status and restoration of the Lochar Mosses

The Lochar Mosses are a lowland raised bog habitat – listed on the Scottish Biodiversity list and a UK BAP Priority Habitat, therefore the area is a high-priority peatland restoration target for FLS. Lindsay and Freeman (2006) suggest that even as it currently stands, Lochar Mosses is in the top 20 raised mire peat mosses in Britain and the top five in terms of quality. **Restoration would elevate this to European status**, due to its unique characteristics:

> ***Summary remarks from Lindsay RA & Freeman J (2006) The Lochar Mosses: Present Condition and Future Potential***
>
> *"The Lochar Mosses undoubtedly represent one of the great raised mire complexes surviving in Britain today. The persistence of raised mire vegetation, despite almost 35 years of plantation forestry, and the rapid response shown by these remnant patches of vegetation now that forest cover has been removed* [at Longbridge Muir]*, suggests that the hydrology of these areas remains fundamentally sound. There seems every reason to believe, on the basis of present evidence, that a thriving mire vegetation could be restored on the site within 30 years. As such, the Lochar Mosses would then represent one of the finest surviving raised mire complexes in western Europe."*

The above report also identifies the risks to this habitat in terms of continued degradation over time owing to the continued presence of conifer plantation on the Lochar Mosses lowland raised bog. Water supply to the bog surface is lost by evapotranspiration and further impeded by interception, reducing water availability by up to 40%. In addition, the

weight of the trees and the loss of water from the peat cause the peat surface to subside, with consequent hydrological effects on adjacent areas of peat bog[2]. Ironhirst Moss is hydrologically connected to Longbridge Muir and will thus continue to have a negative impact on a SSSI and SAC designated site.

The restoration potential of the entire site is considered to be high, due to the very wet ground conditions and abundant remnant bog vegetation that persists in rides and other isolated areas, especially where planted conifers have gone into check. FLS are committed to a long-term restoration programme of this priority habitat, and have already carried out restoration treatments to much of Longbridge Muir and a section of Ironhirst Moss (Figure 1).

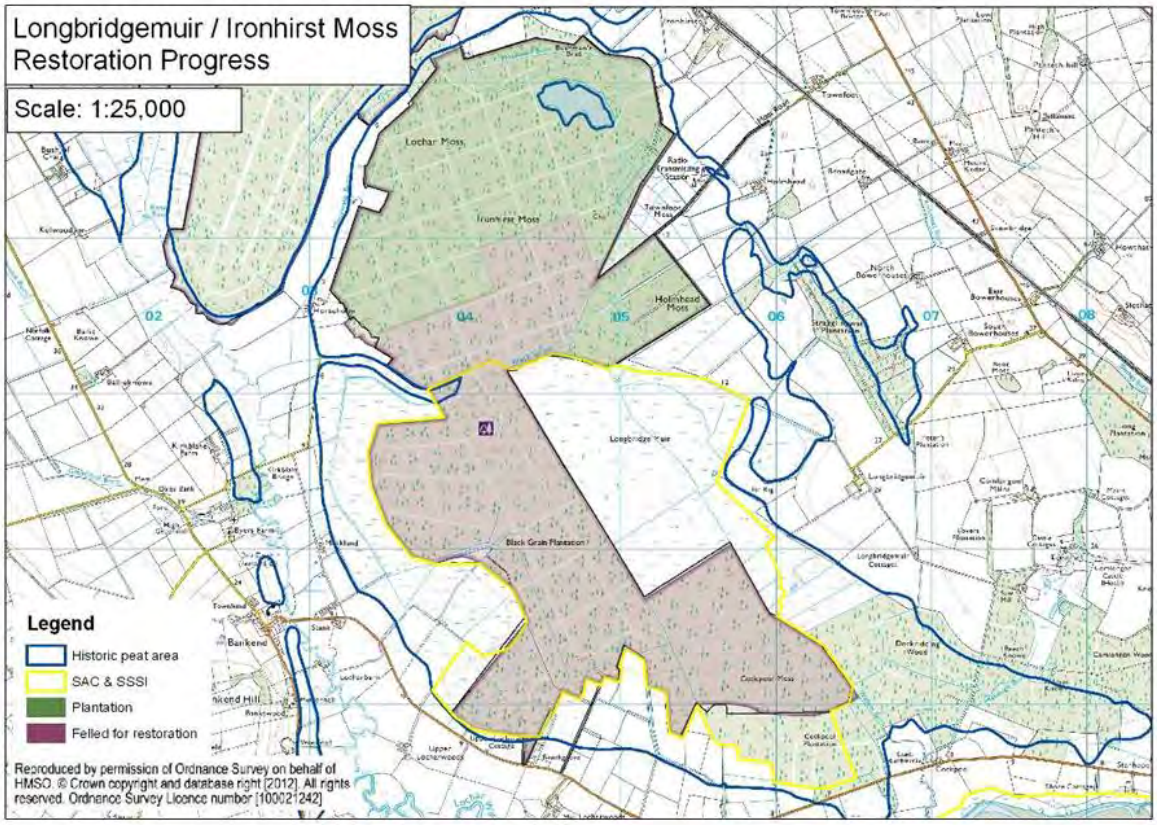


Figure 1: Current extent of deforestation for forest-to-bog restoration across Longbridge Muir and Ironhirst Moss.

Additional Scottish Government funding through Peatland Action has been secured to deliver a further c.70 ha of restoration in the south-eastern section of Longbridge Muir

[2] Lindsay et al., 2014: IUCN UK Committee Peatland Programme Briefing Note 4 – Ecological Impacts of Forestry on Peatlands

(Cockpool Moss) over 2020/21 and FLS are confident further funds will be secured to complete full restoration of the Lochar Mosses over the next c.10 years: FLS are considered a 'safe pair of hands' by Peatland Action, consistently able to deliver large-scale restoration projects within the time scales required.

Forest-to-bog restoration techniques are constantly evolving, and FLS have been prevalent in the implementation of novel methods to address the unique challenges these sites often present: drains, plough furrows, peat cracking, peat piping, harvesting brash, and stumps. Contemporary methods often utilise a combination of techniques, including ground smoothing, stump inversion, drain blocking and backfill trenching which results in a very high water table capable of resisting incursion by conifer regeneration. Further information on restoration methods is provided below.

4. Restoration plan for the Lochar Mosses

The primary long-term vision in this revision of the 10-year Lochar Mosses LMP, submitted for approval in 2020, is the restoration of priority lowland raised bog habitat for multiple benefits. As such, this falls under the category of 'Woodland removal without a requirement for compensatory planting', Annex 3 of the Scottish Government's policy on control of woodland removal: implementation guidance (February 2019), under the objective 'Enhancing priority habitats and their connectivity'.

Objectives within the LMP unit are:

1. Expand the area of designated peatland habitat by applying restoration treatments that encourage travel in the desired direction towards lowland raised bog priority habitat, restoring it to function as a peatland within 30 years;
2. Protect the storage of carbon in the soils (peats);
3. Maximise the sequestration of carbon by the peatland in the future;
4. Improve water quality and help regulate flow;
5. Monitor the impacts of treatments on water quality and establish if water quality has been improved over the long term.

Operational methodology

In many areas of the UK, large expanses of deep peat blanket bog have been historically drained and replaced with trees for commercial forestry. This afforestation has resulted in the degradation and loss of large areas of peat bog, however, with a greater interest in soil

carbon and realization that many of the trees on deep peat are vulnerable to growth check and wind-blow, there is a shift to restore these low return forests back to open bog.

'Traditional' methods of achieving hydrological restoration on peatlands, such as ditch-blocking with dams, can help on damaged open bog habitat, but on previously afforested sites intensive intervention is often required. The vast majority of these sites retain a legacy 'ridge' and 'furrow' pattern, with either single or double ploughed furrows varying from ~30 cm up to 1 m depth in extreme cases. These furrows act as drainage conduits, thereby lowering the natural water table and drying out the peatland.

FLS have been a key organisation in developing 'ground smoothing and stump flipping' methods, which aim to re-profile this uneven surface to restore the natural surface topography on previously afforested sites. This can be achieved by flattening any plough ridges and/or infilling furrows which allows a greater proportion of the planar surface to be closer to the water table, thereby promoting the development of peat-forming species (i.e. *Sphagnum* mosses) and reducing the opportunity for tree regeneration that occurs on uneven/drained sites. These improved techniques result in much better surface re-wetting in previously forested peatlands, and these will be applied across the Lochar Mosses restoration sites where appropriate. This is often used in conjunction with an element of drain blocking and backfill trenches (see later in this document) to achieve the best results.

The notable advantage of ground smoothing and stump flipping is that the vegetated surface of the peat is left upper-most, rather than inverted, which helps minimise the cover of bare, exposed peat. Where there are bigger and more solid wood stumps, the machine will invert the root plate into the furrow. The intact vegetation between the areas of the two plough ridges will assist with re-colonisation of bare peat where the ridges have been removed. Once the 'mining' aspect of the work has been completed, the machine then cross-tracks across the furrows to further flatten out any topography or brash that is still standing proud (Figure 2).

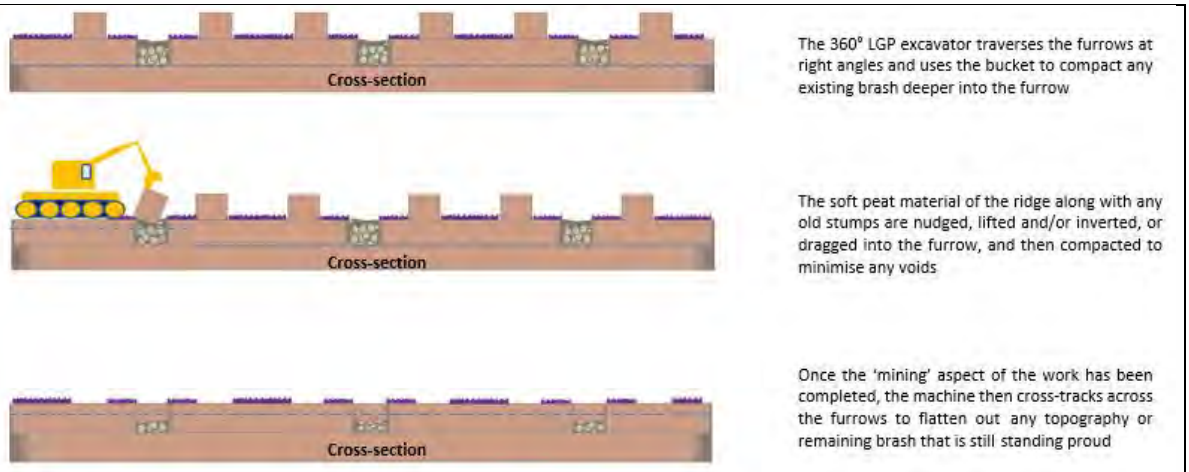


Figure 2. Representation of the 'ground smoothing & stump flipping' technique.

Environmental protection

Surface management techniques, such as stump-flipping and cross-tracking, can potentially create areas of bare peat prior to vegetation establishing, and thus pose a risk to the downstream water environment via runoff and erosion of bare peat surfaces.

Stringent Pollution Prevention Control (PPC) are integral to any ground-smoothing project, including intensive management of on-site drainage, and protection of watercourses within proximity to restoration sites. This includes robust sediment management measures, particularly in areas where stump-flipping is carried out, and SEPA are keen to ensure that appropriate design and siting of silt traps is implemented at these sites.

Generally, a cascade of silt traps made from plastic piling will be required on clear-felled sites, in addition to fabric dams to trap any sediment run-off. These may already be in place on recently felled sites, along with lengths of drain that have been dammed, as part of pre-felling mitigation. If drains are not blocked or silt traps installed in preparation for harvesting operations, then this will be addressed prior to ground-smoothing works commencing. Buffer zones of at least 20 m will be employed to mitigate against elevated levels of dissolved organic carbon, suspended solids, phosphates or nitrates from entering any river, burn, ditch, or wetland, towards which the land drains.

Machinery specification

Ground smoothing techniques require the use of suitably equipped, low ground pressure (LGP) tracked excavators to allow safe working practice on wet and unstable terrain. FLS

specify 360° LGP excavators on 1100 mm to 1400+ mm track pads, using wide toothed digging buckets, to achieve an average ground pressure of ≤3psi.

Backfill trenching

Some afforested peatlands have suffered from surface cracking of the peat due to water deprivation which, with root structures, can lead to underground 'pipes' forming. These act as a conduit to dissolved and particulate organic carbon loss, and hamper the rewetting process acting as 'hidden drains'. Forest Research have developed a method to tackle this problem, greatly improving restoration efforts. Barriers to prevent water flowing away through cracks are formed by digging trenches deeper than the cracks and repacking them with peat with or without a plastic membrane lining one side of the trench. The Lochar Mosses Longbridge Muir site was one of two sites selected by FR to conduct this trial, which saw a dramatic rise in the water table (i.e. the level the water is at underground) after applying the treatments (Figure 3[3]).

Backfill trenching is planned around the perimeter and at intervals perpendicular to plough furrows in the Cockpool Moss restoration area, Longbridge Muir (works commence 2020/21). This technique is likely to be included as part of the Ironhirst and Racks restoration process once peat condition has been assessed following the removal of trees. The Cockpool Moss restoration plan is shown below (p.50); the exact specification of other restoration areas will be along similar lines but cannot be finalised until harvesting operation have concluded.

Monitoring

Sites are monitored on a regular programme to assess the change in surface vegetation (also a proxy indicator of water table level) and for conifer regen. It is envisaged that more monitoring will be undertaken by drone-based aerial photography at least bi-yearly.

FLS continue to work with Forest Research on the effects of restoration on water quality, FR having monitored Flanders Moss for over 10 years, and currently have a monitoring programme in place for upcoming peatland restoration at the Tannylaggie forest block in Galloway. Best practice recommendations made in the recent publication by Shah and Nisbett[4] based on 10 years data from Flanders Moss will be followed.

[3] Russel Anderson, 2019. Online: https://www.forestresearch.gov.uk/research/peatland-ecosystem-services/rewetting-trials/

[4] Nadeem Shah, Thomas Nisbet. 2019. The effects of forest clearance for peatland restoration on water quality, Science of The Total Environment, Volume 693.

Where natural regen is considered to be problematic to the restoration trajectory, this will be removed with clearing saws in years 5-10; however, the restoration techniques FLS now use minimise the establishment potential of regen, and it is highly unlikely that more than a single intervention would be required, if at all.

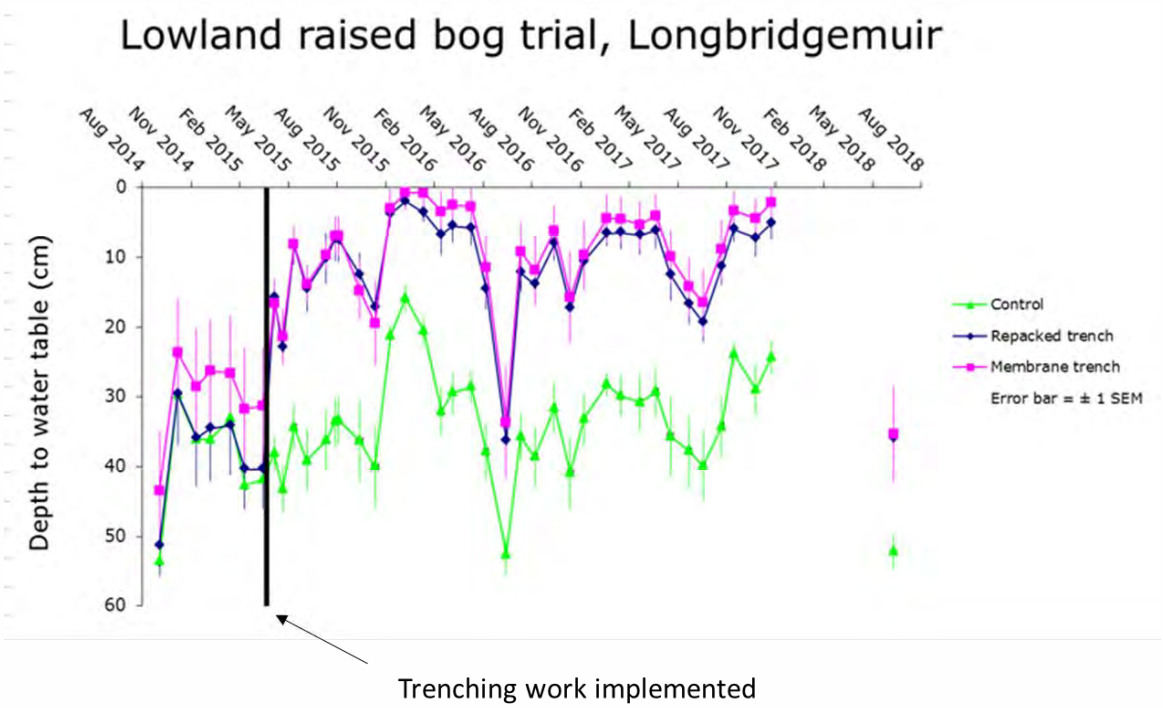
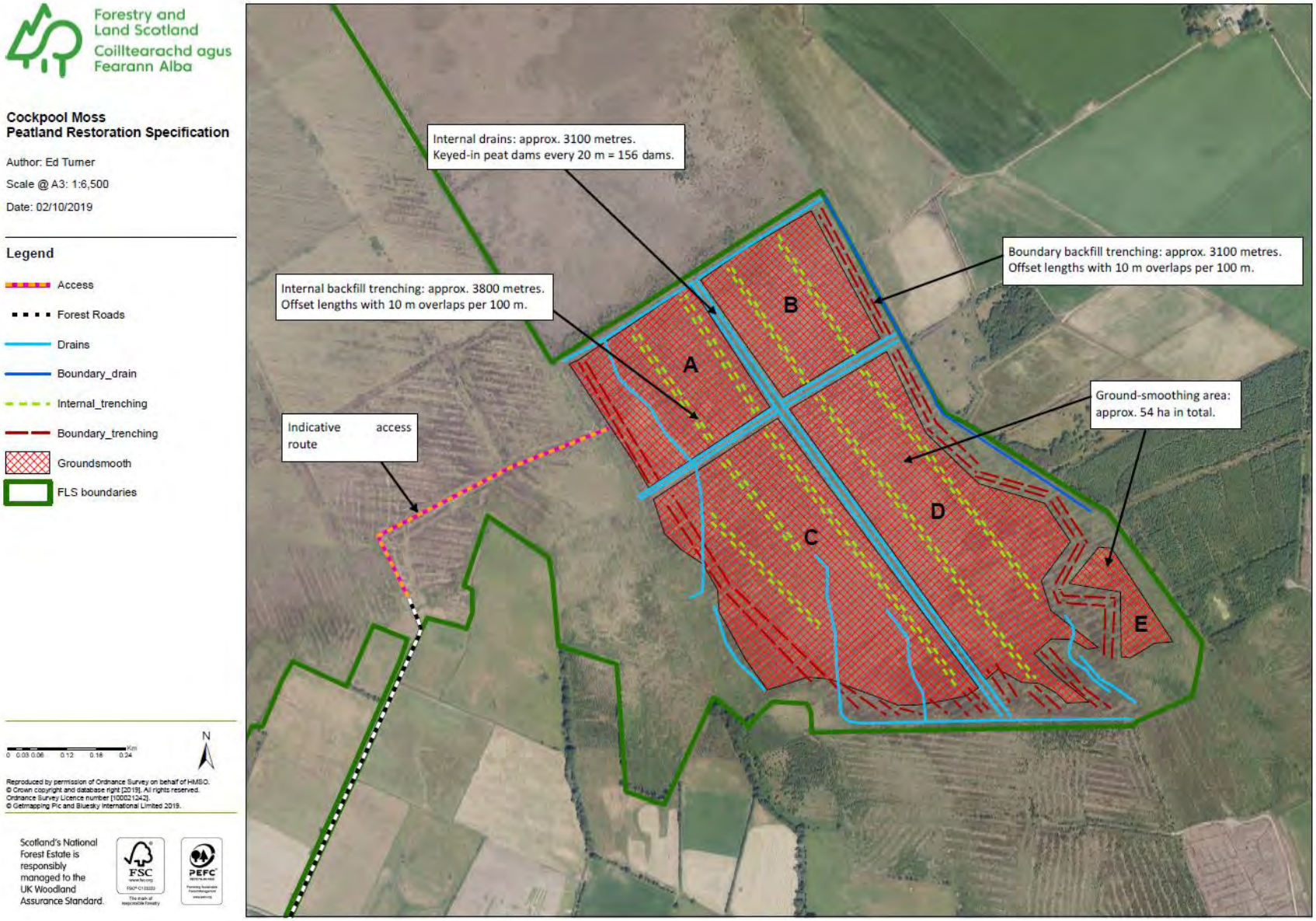


Figure 3. Results of backfill trenching trials at Longbridge Muir (Forest Research, 2019)


Forestry and Land Scotland
Coilltearachd agus Fearann Alba
Cockpool Moss
Peatland Restoration Specification
Author: Ed Turner
Scale @ A3: 1:6,500
Date: 02/10/2019
Legend
Access
Forest Roads
Drains
Boundary_drain
Internal_trenching
Boundary_trenching
Groundsmooth
FLS boundaries
Internal drains: approx. 3100 metres.
Keyed-in peat dams every 20 m = 156 dams.
Internal backfill trenching: approx. 3800 metres.
Offset lengths with 10 m overlaps per 100 m.
Boundary backfill trenching: approx. 3100 metres.
Offset lengths with 10 m overlaps per 100 m.
Indicative access route
Ground-smoothing area: approx. 54 ha in total.
A
B
C
D
E
N
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FSC
PEFC

Forestry and Land Scotland | Coilltearachd agus Fearann Alba

ESC suitability score

Author: Ed Turner

Scale @ A4: 1:40,000

Date: 19/09/2019

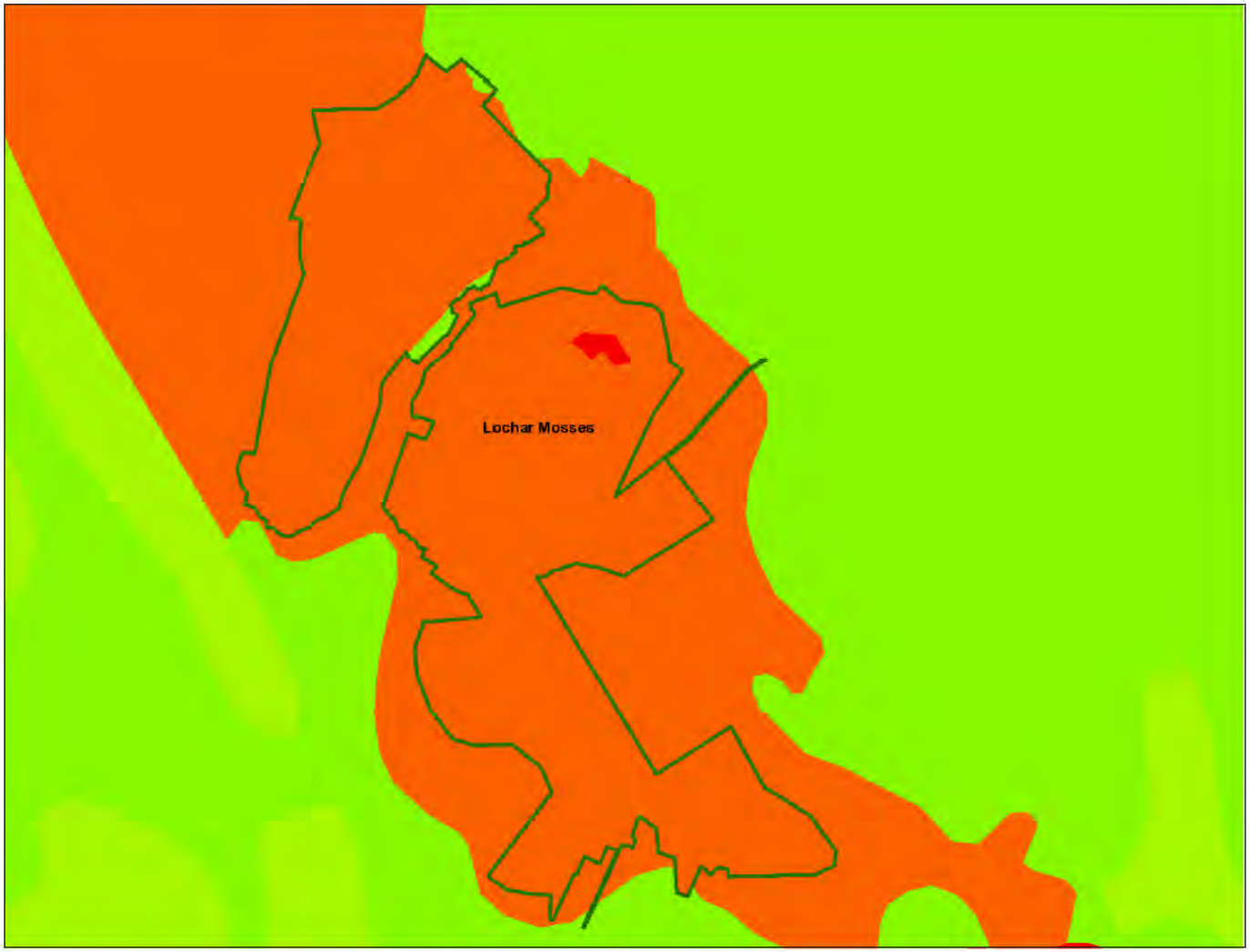
Legend

Blocks

Blocks

Strategic Level ESC (Sitka Spruce (YC))

0
2
4
6
8
10
12
14
16
18
20
22
24
26
28+



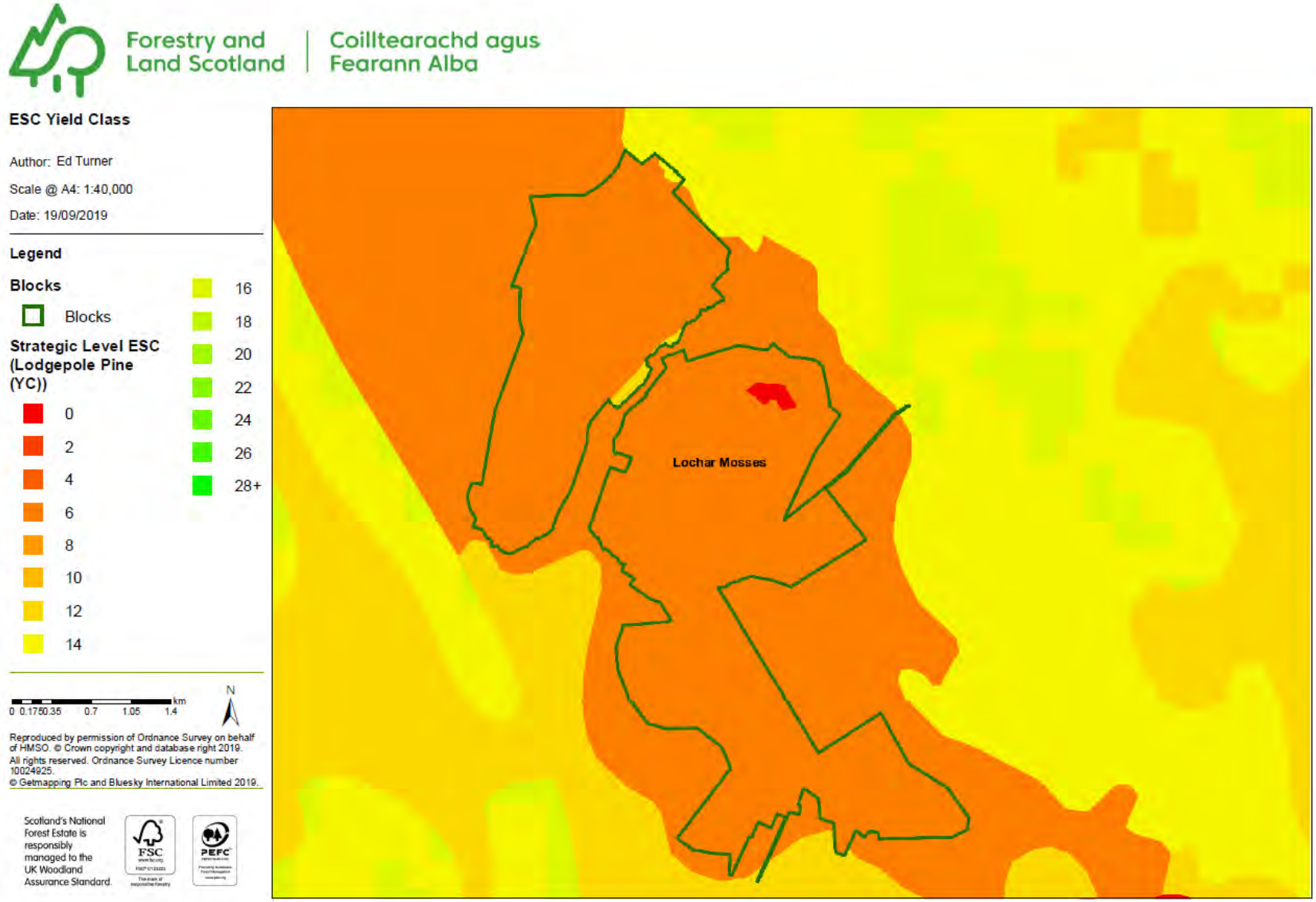
0 0.175 0.35 0.7 1.05 1.4 km

N

Scotland's National Forest Estate is responsibly managed to the UK Woodland Assurance Standard.

FSC

PEFC


Forestry and Land Scotland
Coilltearachd agus Fearann Alba
ESC Yield Class
Author: Ed Turner
Scale @ A4: 1:40,000
Date: 19/09/2019
Legend
Blocks
Blocks
Strategic Level ESC (Lodgepole Pine (YC))
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28+
0 0.175 0.35 0.7 1.05 1.4 km
N
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FSC
PEFC
Lochar Mosses