



FLS Peatland Restoration - Operational specifications

The following specifications and methods are those generally practiced for peatland restoration on the National Forest Estate, however methods and specifications may be amended or developed for any individual site.

1. Peatland Tree Removal Work- Specifications and Methods

- **Mechanical Mulching**

The purpose of this treatment is to mulch unharvestable or failed crops and natural regeneration that cannot be harvested by conventional means, such that it is reduced to fragmented material that functions as an impediment to drainage or evaporation, as a growing medium for early colonisation by sphagnum moss species and as an impediment to sward vigour. The aim is to create a level ground profile similar to active bog surfaces.

All woody vegetation whether actively growing, dead or dormant is to be reduced to ground level leaving a clean and open site. Vegetation includes all tree species (both broadleaf and conifer), and native & exotic weeds. Material is to be spread evenly over site, not in piles, with no large woody debris being left following the operation. If brush mats are required for access to the site these must be mulched as part of the completion of the operation.

All trees (other than any of those specifically identified by FLS) will be mulched by low ground pressure excavator (on Peatland) based rotary mulching head equipped with fixed teeth. All mulching will be to a level that will successfully prevent regrowth of trees, to below the lowest living whorl of branches with all stumps mulched down to the level of the original peat surface. Where indicated by FLS the organic plough ridge or associated growth will also be mulched to disperse material into plough furrows.

Where permitted by FLS larger stems (total height of 8m or otherwise agreed) may be mulched into plough furrows and all further branches and tops will then be mulched over the top of that material to cover it.

All debris to be kept clear from all natural watercourses and roadside drains in compliance with Forest and Water Guidelines (5th Ed.) All 'in forest' drains to be kept clear of debris unless agreed with the FLS Forestry Works Manager prior to commencement of operation.

- **Mechanical Felling**

The aim of this treatment is to fell and process trees too large or in too complex a wind blow to mulch safely and efficiently, and where possible recover merchantable timber .

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A standard forest industry mechanical harvesting system will be used, where the low ground pressure excavator, equipped with a tree harvesting head, creates a straight rack or drift by felling all trees and concentrating the brush into a mat for flotation purposes and to eliminate ground damage.

All trees felled under the contract will be cut as low to the ground as is practicable and to the satisfaction of the FLS Forestry Works Manager.

All un-measurable trees will be felled and cut into lengths no greater than 2 metres (unless planned restoration dictates otherwise, in which case the lengths will be agreed with the FLS Forestry Works manager or Site Works Supervisor), excess branches to be removed unless otherwise stated by the FLS representative.

All debris to be kept cleared from all natural watercourses and roadside drains in compliance with Forest and Water Guidelines (5th Ed.)

All reasonable steps to be taken to protect native broadleaved trees, broken or bent scrub trees to be tidied or felled and cut up, unless agreed otherwise with the FLS Forest Works Manager or Site Works Supervisor.

On windblown sites, uprooted stumps must be laid back in an inverted position and cut low, unless agreed otherwise with FLS.

Branch removal will be so that all branches are cut flush to the stem of the tree without damaging the timber in any way.

Crosscutting will be at right angles to the stem, with timber lengths and top diameter cut within the tolerances specified by FLS at pre commencement meeting.

Extraction racks will have the brush mat of width and depth specifications to support a forwarder during extraction of produce from the site. Brush mats will be such that both the harvester and forwarder and any debogging equipment will be able to work fully in accordance with the Forest & Water Guidelines (5th Edition)

The contractor must allow for normal secondary handling of brush and timber where this is required, with arrangements for potential excessive secondary handling being identified and agreed with FLS at the Pre-Commencement Meeting.

To permit restoration operations to be carried out effectively the distance between brush mats must be maximised and must not be less than 16m from the centre of the rack. Racks should not exceed 5m in width and material no greater than 2m in length should be contained within the brush mat. The practice of 'feeding' trees in to a central processing rack using a second harvester or excavator with shears (double or treble width harvesting) is encouraged and may be stipulated as the only method acceptable on some sites. Any deviation from this must be agreed with FLS Forest Works Manager prior to work commencing. Contractors are responsible for any marking associated with the layout of the racks. Racks will as far as practical cross the direction of

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planting unless agreed with the FLS Forestry Works Manager at pre-commencement.

Brash, lop and top will be concentrated in the brash mat, tops and dead trees cut up into appropriate lengths as agreed with, and to the satisfaction of the FLS Forestry Works Manager

Forest roads will be left in good condition; running tracked machinery on roads must be avoided and only be done where no alternative is available and after discussion with the FLS Forest Works Manager or Site Works Supervisor. These discussions will be on a site specific basis which will be agreed and recorded at pre-commencement meetings.

The removal of watercourse crossing points will be discussed at pre-commencement meeting and if requested by the Forestry Works Manager these must be removed and material spread away from the watercourse and laid flat. At all times the Forest & Water, Scotland; Know the Rules guidance must be followed - <http://www.confor.org.uk/media/246355/on-line-printable-know-the-rules-booklet.pdf>. In some circumstances, where FLS deem that retention of crossing points will improve habitat for fish then crossing points will be retained, with the brash only being removed and the bearer logs being retained in situ.

- **Mechanical Tree Shearing**

The aim of this treatment is to fell unharvestable trees or complex windblow areas. This can be to concentrate material in brash routes for the purpose of supporting other machinery or for the purpose of feeding trees into a central harvesting rack to be processed, or for removal to roadside. An additional requirement of this method is that stumps will be cut below the level of the plough ridge and equal to natural ground level, thereby encouraging a micro site profile similar to natural bog surfaces and suitable for rapid colonisation by sphagnum moss species once rewetted.

All trees will be felled by fixed hydraulic shears with a bunching facility and placed in piles facing the same direction such that they can be reached by harvester or flattened into furrows and drains to inhibit drainage of water from site and slow energy of water flow, as specified by FLS. The environmental practices and working standards will be the same as detailed above for mechanical felling.

- **Mechanical Fibre Relocation**

The aim of this operation is to provide a forwarder of suitable type to move brash and timber around site to assist in delivering the aims of peatland restoration and to minimise environmental damage by reinforcing brash routes for machinery to travel on.

Additionally where required by FLS, timber will be moved to construct semi-porous drain and furrow dams to reduce water flow energy and where directed

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by FLS temporary log bridges over watercourses or the placement of large woody debris within watercourses to improve habitat.

Eight or ten wheeled machines with driven bogeys will be required and tracks or chains of any type will only be used with the permission of FLS. Where fitting tracks is permitted by FLS the machine will not be permitted to run on the forest road.

- **Fibre Recovery**

The work to be delivered under this contract is the removal of wood fibre from peatland habitat coupes with the specific aim of improving restoration and direction from FLS will reflect this.

All timber and fibre will be presented at roadside suitable for lorry uplift or roadside chipping (as stipulated by FLS) with products separated as directed by FLS.

There is a presumption against the use of tracks and chains whilst forwarding. This is necessary as the financial penalty ensuing from road damage and the potential risk of water discoloration need to be minimised. There is recognition that the removal of tracks and chains is not always an option but discussion with FLS as to the individual circumstances prior to their use is a mandatory requirement.

Extraction racks will have the brush mat of width and depth specifications to support a forwarder during extraction of produce from the site. Brush mats will be such that both the harvester and forwarder and any debugging equipment will be able to work fully in accordance with the Forest & Water Guidelines (5th Edition)

In particular it will be normal practice for a double drift to be cut parallel to any permanent watercourse or permanent body of water with produce stacked so that the drift nearest to the watercourse has no brush and trees are processed on the inside drift. All lop and top must be cleared back 10m (as detailed on the site operations map) or at least to behind the first row of stumps at watercourses, roads, paths (however FLS may stipulate additional distance on sites where riparian areas can vary - this will be discussed and agreed at pre-commencement meetings).

The Contractor will be expected to modify practices on the advice of the Scottish Environmental Protection Agency (SEPA) or FLS.

The forwarder operator will maintain extraction routes so as not to cause any silt and/or pollution problems and to comply with UKFS Forest and Soils Guidelines. Where necessary, logs will be placed across pads in order to divert any water away from drains and watercourses into the compartment. Failure on the Contractor's part will make them liable for the cost of rectifying any damage. Additionally, the Contractor will be liable for any fines, legal costs, and/or court

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costs in the event that legal action is taken against FLS for any pollution caused due to the negligence of the Contractor.

The work should be planned so that in case of extreme wet weather the forwarder can move within the site to a drier area, if there is still danger of causing pollution/silt movement the driver must cease working and inform the FLS Forest Works Manager or Site Works Supervisor.

The contractor must allow for normal secondary handling of brash and timber where this is required, with arrangements for potential excessive secondary handling being identified and agreed with FLS at the pre-commencement meeting.

The presumption is for stacking from within the forest. The layout of extraction routes on the site should be designed to achieve this. Any additional provision of stacking areas, or felling of roadside trees to facilitate stacking from within the forest, must be pre-agreed with the FLS Forestry Works Manager. Any requirement for forwarders to run on and stack from forest roads, must be pre-agreed with the FLS Forest Works Manager.

To permit restoration operations to be carried out effectively the distance between brash mats must be maximised and must not be less than 16m from the centre of the rack. Racks should not exceed 5m in width and material no greater than 2m in length should be contained within the brash mat. The practice of 'feeding' trees in to a central processing rack using a second harvester or excavator with shears (double or treble width harvesting) is encouraged and may be stipulated as the only method acceptable on some sites. Any deviation from this must be agreed with the FLS Forestry Works Manager prior to work commencing.

Site Condition During and after Harvesting

Brash, lop and top will be concentrated in the brash mat, tops and dead trees cut up into appropriate lengths as agreed with, and to the satisfaction of FLS and in such ways as to enhance the restoration of the site by providing blockage to artificial drainage systems.

The removal of crossing points will be discussed at pre-commencement meeting and if requested by FLS these must be removed and material spread away from the watercourse and laid flat. At all times the Forest & Water, Scotland; Know the Rules guidance must be followed. In some circumstances, where FLS deem that retention of crossing points will improve habitat for fish then crossing points will be retained, with the brash only being removed and the bearer logs being retained in situ. All watercourse banks must be protected such that the vegetation remains undisturbed.

Small Trees

Some coupes may have areas of less productive material. Areas of check within the restoration coupe boundary must be felled, sned out and cut into 2m lengths with prior discussion with FLS. On extremely wet or challenging access sites FLS may specify preferred machinery weights and sizes to minimise ground damage, impact to the site and recovery of material.

2. Peatland Rewetting Work - Specifications and Methods

The following specifications and methods are those generally practiced for mire restoration on the National Forest Estate, however methods and specifications may be amended or developed for any individual site and if this is the case details will be given in mini competition specifications.

Hag Re-profiling

Re-vegetating and re-profiling eroded hags and gullies operations outcomes are to prevent the further collapse and widening of gullies and hags, reduce water flow and flow energy and trap sediment and to provide a vegetative surface to allow for the growth or re-colonisation of bog plants, particularly sphagnum moss.

The hags and erosion gullies are to be re-profiled to a more stable slope to enable re-vegetation. Vegetation on the top of the hag should be "rolled" backed (retaining the root structure) far enough to enable the underlying peat to be re-shaped to create a 30-40 degree sloping bank. The vegetation is replaced, stretched slightly and compacted to cover the profiled slope. Any remaining bare slope and the floors of the gullies or hags are to be carefully re-turfed by stretching and borrowing turves.

Where the vegetation does not completely cover the newly re-profiled slope and natural re-vegetation is deemed unlikely, the extent will be agreed with FLS.

Special care is to be taken with the borrow pits created in the re-turfing process of the hags and gullies. Vegetation surrounding the "borrow" pits is to be stretched to infill the bare peat and left in a tidy state. Contractors must ensure that there is sufficient vegetation adjacent to hags and gullies for re-turfing, without compromising the habitat that turfs are taken from.

Drain Blocking

The purpose of drain blocking operations is to reduce surface and ground water flow and flow energy and to retain the maximum amount of ground and surface water on site. An additional aim is to redistribute that water more evenly across

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the site by way of cut offlets running onto adjacent furrows and surfaces. Main drains and cross drains will be filled in systematically using peat dams.

Each drain will be blocked by creating a large peat dam at intervals that equate to a 25 cm drop in height but no greater than ten metres apart. Three pile dams at five metre centres must be created at the exit end of the drains, to act as sediment traps to prevent siltation of watercourses.

The drains will be blocked from the highest point working down slope. This will minimise the quantity of water in lower sections of the drain.

The material to form the blockage should be taken from the up-hill side of the drain, local "borrow pits" can be created but should be kept as small as possible, shallow and on flat ground for maximum water retention for the benefit of wading birds. They should be randomly located, not in a line as this can form a new drain. Surface vegetation can be removed, wet peat used and the vegetation placed back in the original position.

All dams should have un-oxidised peat built to a height 100mm above the original soil surface and then be capped with a further 200mm vegetated turf, or intact plough-throw material to reduce the impact of trampling by deer on the dam integrity. Peat is to be borrowed ideally from the original peat surface between the plough throws, but if this is likely to jeopardise other borrow pits or newly-created dams, or be composed of partly dried (oxidised) peat, it is permissible to take the peat from an adjacent ride. Surface turves, timber, brash, stumps and oxidised dry peat must not be included within the peat dam structure.

To comply with Water Guidelines and SEPA Controlled Activities Regulation, the contractor will provide and transport temporary water course crossings at their expense.

Furrow Blocking

Where the original pattern of plough furrows and ridges are visible and furrows are still carrying water from site it will be necessary to block these furrows using peat dams. The purpose of this operation is to reduce surface and ground water flow and flow energy across the site and to retain ground and surface water in a more evenly distributed pattern across the site.

Furrow dams will be created at intervals of no greater than 20 metre centres along the length of the furrows with the vertical drop between dams no greater than 30 centimetres unless agreed on site with FLS. Dams will be created in a staggered pattern to vary flow of water across the site so that no more than five adjacent furrows will be blocked before moving ten metres up the furrows to block the next row of furrows.

Furrows will be blocked by excavating to un-oxidised peat and pulling a wave of peat up the furrow until this is level with the original ground level (not the height of the ridge). Where plough ridges can simultaneously be knocked into the furrows around the dams this will be done. The depth of this excavation must be sufficient

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to include un-oxidised (wet) peat and disturb any peat cracking within the furrow. Stumps, brash and surface turves must not be included in the dam structure.

Ground Smoothing

The aim of this operation is to create a level ground profile similar to intact mire surfaces, reducing the variation created by forestry ground preparation techniques and to rapidly increase and consolidate the water table by virtually eliminating surface and ground water flow associated with any artificial modification or drainage feature. An additional benefit will be that the surface is more suitable for rapid vegetation regeneration.

This method will also treat tree regeneration by flipping it upside down and burying it beneath the peat surface entirely such that it will not regrow.

The technique involves using the excavator to travel along furrows; a toothed bucket is then used to flip any stumps and regeneration sideways into the adjacent furrow before cross-tracking the furrow, with the aim of levelling the ridged ground. This will flatten the whole surface, bringing the water table and surface peat up to the surface right across the site. The excavator will use its tracks and where necessary bucket to crush down the remaining brash into the furrow bottoms, pressing it below the original bog surface to help fill the void of the furrow. This will help to create a flatter, more natural peatland landscape. It is however considered important that no damage is done to the underlying peat structure during the operations so ground pressure has to be sufficient to flatten the ridge down by around 100mm. It is intended that reducing the brash height will have the additional benefit of allowing native plants to recover and where possible sphagnum vegetation can be spread in wetter hollows from adjacent areas to speed this process up.