ScottishPower

Harestanes West Windfarm

Technical Appendix 8.9: Outline Habitat Management Plan

October 2024

Index

Figure List

Abbreviations

AWI	Ancient Woodland Inventory
EIA	Environmental Impact Assessment
FLS	Forestry and Land Scotland
Ha	Hectares
HMP	Habitat Management Plan
HMA(s)	Habitat Management Area(s)
Km	Kilometres
NPF4	National Planning Framework 4
SPR	ScottishPower Renewables
UK	United Kingdom

1. Introduction

1. ScottishPower Renewables (UK) ltd ('SPR') is leading the UK in the development and operation of renewable technologies and proposes to develop Harestanes West Windfarm (hereafter referred to as the 'proposed Development') in Dumfries and Galloway, Scotland.

2. The proposed Development comprises the installation of 12 turbines and associated infrastructure including hardstandings, substation and control building, and access tracks (see Figure 1).

3. This Outline Habitat Management Plan (hereafter referred to as 'HMP') has been prepared to support the Harestanes West Windfarm Environmental Impact Assessment (EIA) and should be read in conjunction with **Chapter 8: Ecology and Biodiversity** and its associated Technical Appendices.

4. As part of the EIA for the proposed Development an assessment has been made of the potential ecological impacts. As such, this HMP has been developed both to mitigate for adverse impacts on biodiversity but also to significantly enhance the biodiversity of the local area through habitat management measures.

5. SPR manages all HMP's internally and is currently delivering HMP's at 30 windfarm sites across the UK, encompassing a total land management area of approximately 10,000 ha.

2. Purpose of the HMP

6. The overall purpose of the HMP is to implement positive land management for the benefit of biodiversity and nature conservation to compensate any adverse impacts that the windfarm may have. In addition to purely compensating against any adverse impacts, SPR (hereafter, 'the Applicant') is committed to enhancing the ecological value of the windfarm site and has taken the opportunity to provide not only compensation, but larger scale enhancement to provide wider benefits for nature and biodiversity. This HMP defines the aims and objectives of the habitat management measures that will be implemented to achieve this overall purpose. The focus of these measures at the Site is the restoration of forested blanket bog habitat and native broadleaf planting.

3. Policy and Guidance

3.1. National Planning Framework 4 (NPF4)

7. The delivery of positive effects for biodiversity is enacted through multiple policies within the NPF4.

8. Policy 3 is biodiversity focused and sets out new requirements for development projects to deliver positive effects for biodiversity. For major development projects (including

Environmental Impact Assessments) it must be demonstrated that the project will leave biodiversity in a demonstrably better state than before the project.

9. A key criteria of Policy 3b that development proposals must meet is as follows:

"iv. significant biodiversity enhancements are provided, in addition to any proposed mitigation. This should include nature networks, linking to and strengthening habitat connectivity within and beyond the development, secured within a reasonable timescale and with reasonable certainty. Management arrangements for their long-term retention and monitoring should be included, wherever appropriate"[1].

10. The habitat management measures proposed in this HMP have been designed to meet the requirements of Policy 3 of NPF4.

3.2. Other Policy

11. Other policy that has been considered in the preparation of this HMP includes:

- Scottish Biodiversity Strategy (2022);
- Scottish Government Draft Planning Guidance: Biodiversity (2023);
- Dumfries and Galloway Local Development Plan 2 (October 2019); and
- Dumfries and Galloway Local Development Plan 2 – Trees and Development (February 2020).

3.3. Mitigation Hierarchy

12. It is important at this stage to confirm that the design of the proposed Development has followed the mitigation hierarchy. Mitigation has been built into the design process and great care has been taken to minimise impacts on ecological features through avoidance of high value habitats. Of the 18.88 ha of habitat that will be lost to the proposed Development, the vast majority (17.69 ha) is habitat of low ecological value (11.70 ha of 'artificial unvegetated unsealed surface', 5.49 ha of 'other coniferous woodland' (i.e. plantation forestry) and 0.50 ha of 'cereal crops'). Only 1.19 ha of higher value habitat (including 'other woodland mixed' (0.49 ha), 'other neutral grassland' (0.37 ha), and 'lowland mixed deciduous woodland' (0.15 ha) will be lost.

3.4. Habitat Management Proposals

13. The habitat management measures proposed in this HMP are blanket bog restoration and native broadleaf planting (including a large area of riparian planting), and will be delivered through two distinct Habitat Management Areas:

- Area A - located in the south-central area of the turbine area (see Figure 2); and
- Area B – located just east of the access track to the turbine area (see Figure 3).

[1] *Scottish Government. 2023. National Planning Framework 4. Available online: National Planning Framework 4.*

3.4.1. Area A

14. Blanket bog restoration proposals constitute the restoration of 2.82 ha of degraded blanket bog habitat. This area of restoration not only compensates for the 0.01 ha of degraded blanket bog that will be lost to the proposed Development but also provides significant enhancement by exceeding the required 1:10 compensation ratio and 10% enhancement threshold specified within the current NatureScot peatland guidance[2].

15. Habitat management measures include the removal of approximately 7.53 ha of commercial plantation forestry within Area A. It may be possible to undertake further bog restoration in this area however detailed peat survey data is not available for the whole area so further peat surveys will be undertaken, post-consent, to determine ground suitability for further peatland restoration works.

16. Where ground conditions are not suitable for bog restoration (i.e. peat depth <30 cm) native broadleaf planting will be undertaken. The area of planting will be approximately 15 ha, subject to post-consent peat surveys. Planting native broadleaf trees has significant biodiversity benefits particularly in providing a valuable food and shelter resource to native invertebrates, birds and mammals.

17. The habitat management measures proposed in Area A will create a habitat mosaic of restored functioning blanket bog and native broadleaf woodland which will significantly enhance the biodiversity of the site.

3.4.2. Area B

18. Native broadleaf tree planting is proposed across 13.33 ha of riparian habitat within the Application Boundary which will provide significant biodiversity enhancement. A key reason why this area has been selected is due to its connectivity with an area of Ancient Woodland Inventory (AWI) listed woodland to the south (see Figure 3). Additionally, the western side of the Garrel Water valley is covered with broadleaf trees and the aim is to create a similar habitat on the eastern valley side and along the tributaries. In time this riparian planting will create a strong nature network and in doing so enhance biodiversity in the local landscape.

19. In addition to the providing an increased resource of an ecologically valuable habitat in the local landscape, the riparian planting will have numerous other benefits such as:

- watercourse shading (helping to regulate water temperatures for aquatic species);
- soil stabilisation (reducing sediment run-off into the water environment); and
- flood alleviation (slowing and reducing the transfer of water from rainfall into the channel).

20. For these reasons it is considered that riparian native broadleaf planting in this area constitutes significant biodiversity enhancement in terms of NPF4.

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[2] *NatureScot. 2023. Advising on peatland, carbon-rich soils and priority peatland habitats in development management. Available online: Advising on peatland, carbon-rich soils and priority peatland habitats in development management | NatureScot.*

3.4.3. Summary

21. In summary, habitat management proposals will deliver habitat enhancements through blanket bog restoration and native broadleaf tree planting across approximately 31 ha. When these proposals are viewed in the context of the 18.88 ha of habitats being lost to the proposed Development (i.e. the majority of loss being of ecologically low value habitat) it is considered that the proposals will significantly enhance the biodiversity value of the site, and as such, meet the requirement of NPF4.

22. Post-consent, further surveys will be undertaken to develop and refine a more detailed blanket bog restoration scheme and broadleaved planting plan.

3.4.4. Assessment Methodology

23. It is important to note that due to the absence of a biodiversity metric in Scotland, it is appropriate to demonstrate that a project can deliver significant biodiversity enhancement using qualitative professional judgement, as Scottish Government Biodiversity Guidance states[3]:

"4.6. It will be for the applicant to demonstrate, through the planning application, those ways in which biodiversity will be left in a 'demonstrably better state' than before intervention. NPF4 does not specify or require a particular assessment approach or methodology to be used, though the policy makes clear best practice assessment methods should be utilised.

4.7. Assessment may be qualitative or quantitative (for example through use of a metric) and where relevant should align with existing statutory and other assessment requirements, taking an integrated approach to avoid duplication and ensure efficiency. …"

24. As such a qualitative assessment approach has been followed in this HMP.

4. Site Location and Habitat Management Areas

4.1. Site Location

25. The proposed Development is located approximately 1.3 km north-west of the village of Ae, Dumfries and Galloway. The Site (the area within the Application Boundary) is located within commercial forestry plantation managed by FLS. There are two proposed Habitat Management Areas (HMAs) within the Site (see Figure 1).

4.2. Land Ownership

26. Land within the Application Boundary is owned by two landowners: Forestry and Land Scotland (FLS) and a private individual, and will be leased to the Applicant for the duration

[3] *Scottish Government. 2023. Biodiversity draft planning guidance. Available online: Determining planning applications - Biodiversity: draft planning guidance - gov.scot (www.gov.scot)*

of the proposed Development. The lease agreements will include a provision to enable the Applicant to implement management works within the leased areas for the duration of the proposed Development.

4.3. Area A

27. Area A is located in the south-central area of the turbine area and is approximately 17.70 ha in size (see **Figure 2**). It is currently a mosaic of habitats including commercial forestry plantation (both standing crop and clear-felled areas), deforested blanket bog, rush pasture, mixed scrub, and a pond. Peat depth varies across the area with the deepest peat (*c.* 6 m) located in the centre with three other pockets between 2.5-3.5 m across the area.

28. The blanket bog habitat is the largest area of blanket bog recorded within the site (2.82 ha) and this was where the deepest peat in Area A was recorded (up to 6 m). The bog is in a degraded condition due to historic forestry activities. The ground has a ridge and furrow profile which is contributing to the degraded nature of this habitat. The furrows were partially infilled with vegetation including hare's-tail cotton-grass *Eriophorum vaginatum*, *sphagnum* mosses, rushes *Juncus sp.* and grasses. Heather *Calluna vulgaris* is dominant across the bog habitat, generally occupying the drier ridges. Sparse regenerating conifers were also present some of which were coning. (See **Photograph 1** below).

29. A small wetland area, including a pond was recorded adjacent to the blanket bog habitat. The area was dominated by rushes with some broadleaved shrubs (including willow *Salix* and birch *Betula* species) fringing the pond. (See **Photograph 2** below).

Photographs 1 and 2: Left - Blanket bog habitat with dominant heather cover and regenerating conifers; and, Right – boundary between the blanket bog and the rush dominated wetland habitat (the pond is located where the broadleaved are in the middle distance).

30. Commercial plantation forestry, largely comprising Sitka spruce *Piecea sitchensis*, (including both standing crop and clearfell) was the most abundant habitat (11.76 ha) within Area A. A stand of mature plantation forestry (approx. 7.53 ha), with coning trees, occupies the west of the area (see **Photograph 3**). This is likely to be draining the bog and providing the seed source for the regenerating conifers on the bog.

Photographs 3 and 4: Left – Mature Sitka spruce plantation forestry with blanket bog habitat in the foreground (looking east). Right – an example of clearfell plantation forestry showing a drainage channel (looking south-east).

4.3.1. Area A Habitat Management Proposals

31. Bog habitats in good condition provide a multitude of environmental benefits, particularly for biodiversity, ecology, hydrology and carbon storage, among others. Afforestation of blanket bog has many negative impacts on the underlying peat including altering the underlying hydrology, drying out the peat and ultimately leading to oxidation and loss of the peat mass. Removal of the trees and restoration of the underlying hydrology is key to restoring the overall habitat to a functioning bog for biodiversity, carbon storage and many other ecosystem services.

32. It is therefore proposed to restore the area (2.82 ha) of degraded blanket bog habitat within Area A to a functional bog habitat. Proposals include the mechanical restoration of the bog followed by management of regenerating conifers. The area suitable for blanket bog restoration may increase with the removal of the commercial plantation forestry however a post-felling assessment of the area and further peat surveys are required.

33. Native broadleaved planting is proposed on areas of clearfell (**Photograph 4**) where peat is shallow (<30 cm) or absent. The area of planting will be approximately 15 ha, subject to post-consent peat surveys.

4.4. Area B

34. Area B is an upland riparian area located just east of the access track to the turbine area. It covers 13.33 ha and lies within a larger land parcel of 53 ha. The area incorporates a section of the Garrel Water valley and two of its tributary watercourses which flow in from the north-east.

35. The Garrel Water flows through a steep sided valley in a broadly north-south direction. The eastern valley side has a sparse tree/scrub cover and an abundant ground cover of bracken *Pteridium aquilinum*. This is a stark contrast to the western valley side which is densely covered in broadleaf trees and scrub as shown in **Photograph 5** below.

Photograph 5: The Garrel Water valley (looking south) showing the difference in tree/scrub cover between the western (right) and eastern (left) valley sides.

36. The valleys of the tributary watercourses, whilst not as big, exhibit similar characteristics to the Garrel Water in that they are steep-sided, have limited tree cover and have an abundant ground cover of bracken (see **Photographs 6 and 7** below).

Photographs 6 & 7: Left - Tributary watercourse valley of the Garrel Water (looking south-west); Right - Garrel Water valley showing two main tributary watercourses (looking north).

37. The wider habitat within this area of the Site (i.e. outside of the watercourse valleys) is dominated by undulating upland acid grassland and rush pasture over which sheep are grazed (see **Photograph 7** above).

4.4.1. Area B Habitat Management Proposals

38. This area has been selected based on the opportunity it provides for native broadleaf riparian planting along the Garrel Water valley and two of its tributaries which flow in from the north-east. (See **Figure 3**).

39. Riparian broadleaf planting offers a multitude of biodiversity benefits such as providing habitat for a range of biological communities, providing organic inputs (e.g. woody debris) to the water environment and providing shading which can help reduce water temperatures which can benefit fish populations. Salmonoids such as Atlantic salmon *Salmo salar* and brown trout *Salmo trutta* were recorded during baseline aquatic surveys of watercourses in the local landscape therefore, riparian planting is likely to benefit these fish species. Full details of the aquatic surveys are presented in **Technical Appendix 8.4: Aquatic Ecology-Access Track**.

40. A key reason why this location has been selected is due to its connectivity with an area of ancient woodland to the south (see **Figure 3**) which will provide connectivity and allow species to move through the landscape and access new areas.

5. Aims and Objectives

5.1. Delivery Process

41. The delivery of a HMP is based on achieving the various aims, which are assessed by measuring the extent to which clearly defined objectives and their associated condition indicators have been met. The definition of each objective is therefore a key requirement for a HMP to allow progress to be assessed in a quantified, objective way which has clear implications for whether the overall aims are likely to be met and any management measures which need to be put in place or amended.

42. A summary of the stages is shown in **Diagram 1** which has been applied to each objective within this HMP. For objectives where the required management is not obvious, or the processes not well enough understood to allow them to be defined in detail, a programme of trials is advocated to allow the methods, costs, rates and effects of management measures to be assessed before being implemented more widely.

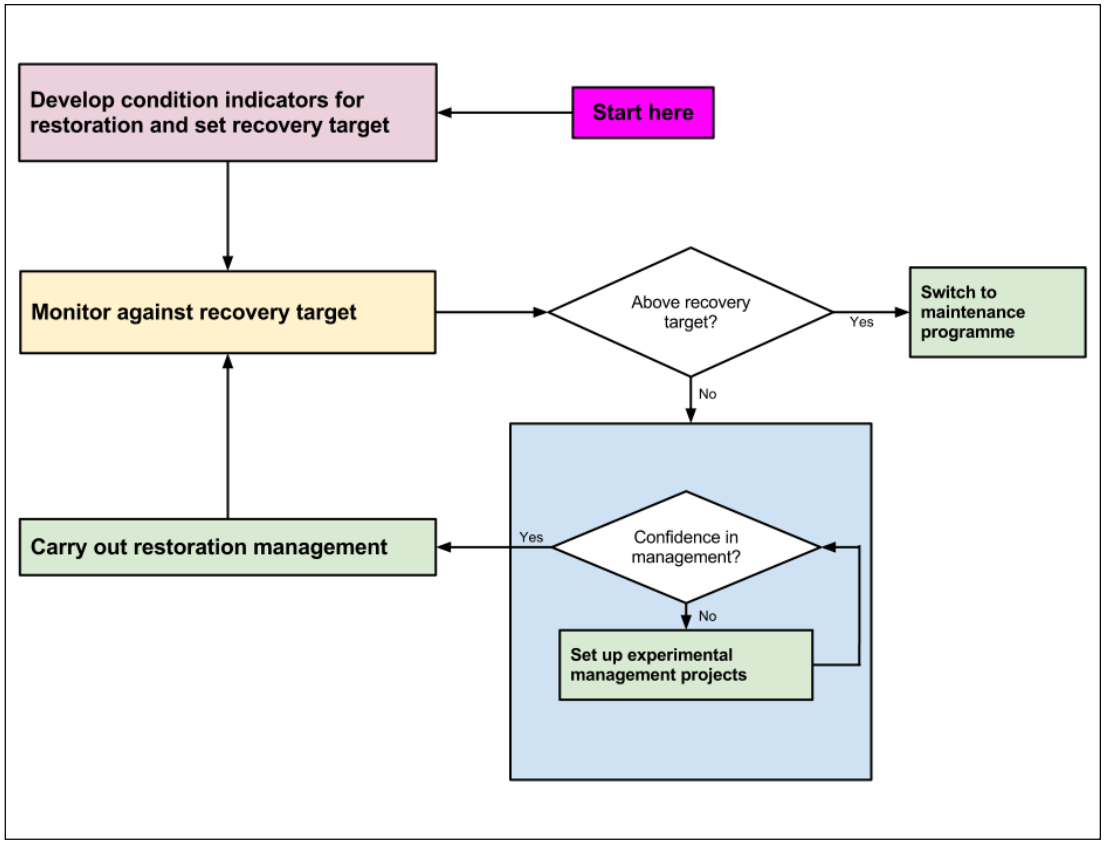


Diagram 1: Process for monitoring and management to achieve habitat restoration, redrawn from Hurford and Schneider (2007).

5.2. Quantifying Restoration Outcomes

5.2.1. Blanket Bog Habitats

43. Some objectives are considered to be more fundamental than others to achieve in order for blanket bog habitats to be restored and have therefore been weighted accordingly (see individual objectives within each Aim for the weighting). This allows an overall weighted average score for the entire site to be produced out of 100 and compared against with Table 2 below, with 100 demonstrating each objective is met at every sample location. This method allows an overall assessment of restoration progress to be made.

Table 1: Scoring system for HMP targets.

Condition Class	Weighted Average Score
Very poor	< 60.0
Poor	60.01-70.0
Acceptable	70.01-80.0
Good	80.01-90.0
Excellent	90.01-100

44. Table 2 shows an example of the breakdown of each individual objective together with the weighting which is based on the relative importance for bog functioning. The highest weighting is given to bog water table as good hydrology in critical to the function of a healthy bog habitat. Higher weighting is also given to the *Sphagnum* moss objectives as these are the constants of blanket bog habitat and also indicate the basic hydrology is intact.

Table 2: Weighted score given to each objective.

Overarching Aim	Group	Objective	Short Description	Weighting
Aim 1: Underlying Conditions	Bog Water Table	1.1	Water Table in drought: <20 cm	7.5%
		1.2	Water Table in drought: <10 cm	5%
		1.3	Water Table in drought: 0 cm	2.5%
	Tree regeneration	1.4	Trees absent	5%
		1.5	If present trees <1 m height	5%
Aim 2: Conservation Status	Sphagnum & Peat	2.1	Sphagnum present on plots	15%
		2.2	Thick Sphagnum present on plots	10%
		2.3	Sphagnum cover >30% on plots	10%
		2.4	Sphagnum trampling absent on plots	5%
		2.5	Bare peat cover <1% on plots	10%
	Higher Plants	2.6	Eriophorum present on plots	10%
		2.7	Calluna present on plots	7.5%
		2.8	Calluna >20 cm & <20% browsed	2.5%
		2.9	True grass cover <5% on plots	2.5%
		2.10	Key plant cover <75%	2.5%

45. The score for a treated area is therefore calculated as follows: Weighted Average Score = Sum (% Samples which meet Obj. 1.1 * 0.075, % Samples which meet Obj. 1.2 * 0.05..., % Samples which meet Obj. 2.10 * 0.025).

46. Aims and objectives are described for the for the habitat management proposals for Areas A and B. The management measures for each area are described in Section 7, and a description of the monitoring is included in Section 8.

Aim 1: Restore conditions for deforested blanket bog habitat (Area A)

Definition and Distribution

47. The definition of deforested blanket mire habitat covered by Aims 1 and 2 is defined as all deforested areas within the HMP boundary where peat depth is >0.5 m.

48. Area A has been identified as supporting degraded bog habitat (as a result of commercial forestry activities) which would benefit from positive management activities (Figure 2). The area of modified bog covers 2.82 ha and is located within the turbine area.

Background

49. The Applicant has undertaken comprehensive research and monitoring on deforested blanket bog sites to understand the underlying hydrology and have such developed techniques which demonstrably restore blanket bog conditions. The key issue arising from extensive afforestation of blanket bog is a disruption to the water table. With extensively elevated ground along ridges, as a result of ploughing, creating habitat that is above the water table level and therefore too dry for bog vegetation to recolonise outside the furrows (see Photograph 1). In addition, the presence of conifer regeneration from seed can cause additional drying pressure through evapo-transpiration as well as shading as the trees increase in size.

Photograph 8: An example of post-felling bog habitat showing elevated ridges with stumps visible and regenerating of conifers.

50. Whilst the baseline habitat surveys noted that the bog habitat within Area A may be active, the condition of the bog habitat is considered to be generally poor as a result of historical commercial forestry management. It has been heavily drained and whilst some specialist bog species were recorded it is considered that it would benefit from restoration and changes to adjacent habitats (i.e. removal of mature Sitka spruce plantation forestry).

51. In order to create the underlying conditions required for the establishment of typical bog species, works will need to be carried out to reverse the negative management activities and prevent further degradation (see **Section 7, Table 6**).

Condition Requirements

52. The conditions required for blanket bog within these areas are defined as follows:

- Water table depth must be close to the surface, including during the drought period April – July; and
- Regenerating trees must be absent.

53. Based on these requirements a set of objectives have been defined which will allow progress to be monitored.

Objectives

54. A number of indicators have been used to formulate objectives which reflect different aspects of blanket mire quality over time. These will be compared against suitable reference areas where possible to allow the quality of the restored blanket mire to be assessed in context. An objective is considered to be met when at least 70% of sample plots meet the criteria.

Table 3: Objectives for Aim 1.

Group	Objective	Description	Weighting
Bog water table	1.1	The water table should be no deeper than 20 cm from the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions' (defined as the time at which water table levels on site are considered to in the lowest 10% of their measured range, and rainfall has been negligible for at least 3 weeks; surveys undertaken any time between 1st April and 31st August).	7.5%
	1.2	The water table should be no deeper than 10 cm below the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions'.	5%
	1.3	The water table should be at or above the surface of the main peat mass on each sampled plot when assessed in summer 'drought conditions'.	2.5%
Tree regeneration	1.4	Conifer trees, broadleaf trees and exotic shrubs (e.g. Rhododendron) should be absent from each sampled plot.	5%
	1.5	Conifer trees, broadleaf trees and exotic shrubs (e.g. Rhododendron) should be < 1m in height if present.	5%

Aim 2: Improve quality of deforested (degraded) blanket bog habitat (Area A)

Definition and Distribution

55. Area A has been identified as supporting deforested (and therefore modified) bog habitat which would benefit from positive management activities (Figure 2). The area of bog covers 2.82 ha and is located within the turbine area.

Background

56. The long-term aspiration (>5 years) is to restore the blanket bog habitat to a high quality. However, the precise vegetation assemblage which would be expected is difficult to define and variation is expected. The response of certain indicators of blanket bog quality will be monitored as a long-term trend which will ultimately help to gauge success by making comparisons with other reference sites.

Objectives

57. A number of indicators have been used to formulate objectives which reflect different aspects of blanket bog quality over time. These will be compared against suitable reference areas where possible to allow the quality of the restored blanket bog to be assessed in context. An objective is considered to be met when at least 70% of sample plots meet the criteria.

Table 4: Objectives for Aim 2.

Group	Objective	Description	Weighting
Sphagnum and peat	2.1	At least one species of Sphagnum should be present (predicted community M17, 18 or 19) on each sampled plot.	15%
	2.2	Sphagnum papillosum or S. magellanicum should be present (where expected type is M17 & 18) on each sampled plot.	10%
	2.3	Sphagnum spp. should account for at least 30% of basal cover on each sampled plot.	10%
	2.4	Visible trampling or uprooting impacts of large grazing mammals on Sphagnum hummocks (or lawns) should be absent on each sampled plot.	5%
	2.5	Bare peat should comprise <1% of 'basal' cover on each sampled plot, in situations where it is arising due to trampling effects or disturbance by machinery	10%
Higher plants	2.6	Eriophorum spp. should be present on each sampled plot.	10%
	2.7	Calluna vulgaris should be present on each sampled plot.	7.5%
	2.8	Calluna vulgaris of at least 20 cm average canopy height and with < 20% leading shoots browsed by deer/sheep on average should be present on each sampled plot.	2.5%
	2.9	'True grasses' foliar cover should be less than 5% on each sampled plot.	2.5%
	2.10	The combined cover of Calluna vulgaris, Eriophorum spp. and Tricophorum cespitosum should account for no more than 75% of foliar cover on each sampled plot.	2.5%

Aim 3: Establishment of native broadleaf woodland (Areas A and B)

Definition and Distribution

58. Areas within both HMAs have been identified as suitable for native broadleaf planting, totalling approximately 28 ha. Approximately 15 ha will be created in Area A on formerly forested ground where peat depth is not deep enough to undertake bog restoration (generally <30 cm), or where there is no peat present. Native broadleaf riparian planting will be undertaken across approximately 13 ha of land within Area B (Figure 3). The planting will be along the eastern valley side of the Garrel Water and up two tributary watercourse valleys.

59. Final planting areas and species composition will be agreed in a finalised HMP following consent.

Background

60. Native broadleaf planting has been chosen as a measure to significantly enhance the biodiversity of Areas A and B in line with the requirements of NPF4.

61. Tree species will be selected taking into consideration species in the local landscape, the geographic location of the Site, altitude and soil type, however it is likely a mix of common, native broadleaf species, of local provenance (where possible) will be planted such as willow, rowan, hazel, aspen, hawthorn, blackthorn, cherry, oak and beech. Exact species/species composition and locations will be confirmed post-consent following a more detailed site survey.

Objectives

62. This Aim is to ensure that the trees are planted appropriately and maintained in such a manner that will maximise their establishment and meet the Objectives set out below (Table 5). An Objective is considered to be met when at least 70% of sample plots meet the criteria.

Table 5: Objectives for Aim 3.

	Objective	Description	Weighting
Native broadleaf planting	3.1	Achieve target density of 1600 stems/ha within planted areas after 5 years.	75%
	3.2	Achieve mean height >1m after 10 years.	25%

6. Habitat Management Measures

63. The habitat management approaches to be taken by the Applicant reflect the different requirements of the site conditions in the two HMAs.

6.1. Habitat Management Areas (Areas A and B)

64. Each HMA requires a different management approach due to the habitats present. Management measures within Area A will include forest-to-bog restoration, removal of regenerating conifers, felling of mature forestry plantation and native broadleaf planting. Measures within Area B will mainly constitute riparian native broadleaf planting with some grazing management.

6.2. Physical Interventions on degraded bog habitat (Area A)

65. Physical interventions are defined as measures which comprise mechanical treatment to an area of land.

6.2.1. Description

66. The Applicant is at the forefront of research and innovation into peatland restoration techniques and was appointed lead author by the International Union for Conservation of Nature (IUCN) of the chapter on deforested peatland restoration within the Commission of Inquiry on Peatlands Report[4].

67. The Applicant has undertaken several trial projects to investigate types of intervention and their associated costs, environmental risks and practical considerations relevant to forest-bog restoration as detailed in the IUCN report. A summary of tested techniques used by the Applicant in forestry to bog restoration is presented in Table 6 below.

Table 6: Description of forest-to-bog restoration methods.

Technique	Description	Drain/ Furrow Disruption	Conifer regeneration removal
Cross-tracking	Uses a tracked excavator to flatten plough ridges and disrupt drainage pathways and kill conifer regeneration	Yes	Yes
Ground smoothing	Uses an excavator bucket to upturn stumps, infill furrows and drains, and bury conifer regeneration.	Yes	Yes

[4] *Robson et. al., 2019. Commission of Inquiry on Peatlands Update 2017-20: Peatlands and Forestry. Available online: CoI Forestry and Peatlands.pdf.*

Wave damming	Hand felling of conifer regeneration using clearing saws or chainsaws	No	Yes (densities <2500/ha)
Raking	Creating dams approx. 4 m apart within existing drains and double ploughed furrows to stop water flow.	Yes	No

68. It is considered that a combination of cross-tracking, ground smoothing and wave damming techniques would likely be most effective in restoring the degraded bog habitat within Area A however final restoration methods will be determined post-consent. (See **Appendices A and B** for further details of bog restoration methods).

6.3. Native Broadleaf Planting (Areas A and B)

69. A final planting plan will be determined post-consent. As mentioned in **Section 6** (Aim 3) species will be of local provenance and selected based on geographic location of the Site and soil type.

70. The presence of bracken in the HMAs presents a challenge for tree planting and management, particularly in Area B where bracken in widespread on the valley side of the watercourses. Management will involve a concerted effort to address the risk of bracken 'crowding out' planted trees including planting larger trees and/or manual bracken control.

71. Planted trees will be routinely monitored until they become suitably established. Maintenance, such as replacing dead trees to maintain the desired planting density of 1,600 trees/ha, herbicide and fertiliser application will be undertaken as required.

6.4. Grazing Management (Area B)

72. Area B is part of a wider area of land that is used for upland sheep grazing. Prior to the commissioning of the windfarm, the Applicant will install stock fencing around the planting area(s) until the trees are established, to prevent them being browsed by sheep. However, given the planting is riparian planting (i.e. along watercourses) any fencing would need to allow the sheep access to water. Any proposal to install stock fencing would be discussed with the landowner in advance.

7. Monitoring Proposals

73. The Applicant has developed protocols to monitor vegetation in relation to the objectives set out within this HMP based on extensive experience monitoring similar habitats across Scotland.

7.1. Bog Monitoring

74. Monitoring will be undertaken on a set of permanent 1 m radial samples in Area A[5].

75. At each 1 m radial sample the following information is collected for species relevant to the objectives (target species):

- Presence/absence of target species;
- By eye cover targets of key metrics (see 2a below);
- Height and offtake of *Calluna;*
- Depth to water table (using fixed dipwell); and
- 3 pin hits of foliar and basal vegetation cover equally spaced along a 20m transect (long format only)

76. There are two monitoring methods used: a long monitoring protocol and short monitoring protocol. The short monitoring protocol only records items 1, 2, 3 and 4. The protocols will be applied according to the programme shown in **Table 7.**

Table 7: Monitoring programme.

Year	1	2	3	4	5	7	9	15	20
Method	Long	Short	Long	Short	Long	Short	Long	Long	Long

77. Following the initial monitoring programme which covers up to year 20, the long monitoring protocol will be carried out every 10 years for the duration of the operational life of the windfarm.

78. In addition to the vegetation and hydrological monitoring, the Applicant will undertake visual checks of the site on an annual basis to confirm compliance with the aforementioned management measures and to check the overall condition of the habitat management areas.

7.1.1. Field Protocol

Frequency Assessment

79. At each monitoring sample plot a rope demarcated at 0.25 m, 0.50 m and 1 m will be used to form a radial quadrat. Starting with the smallest distance and working up to 1 m, the presence of each target species is to be recorded, noting the smallest distance at which a species is recorded. This nested unit size allows different sizes of sampling units to be applied to species of differing abundances for trend monitoring i.e. common species are assessed in smaller units, rarer species are assessed in larger units.

General Cover Assessment

[5] *The number of sample points is yet to be determined due to the unknown habitat condition (notably peat depth) underneath the stand of mature plantation forestry within Area A that will be felled as part of the habitat management works.*

a) Record each by eye cover assessment within each frequency point (1 m radial quadrat):
   i) is *sphagnum* cover > 30% (if unsure record lower);
   ii) is bare peat cover < 1% (if unsure record higher);
   iii) is true grass cover (excluding *Molinia*) < 5% (if unsure record higher); and
   iv) is the combined cover of *Calluna*, *Eriophorum* and *Trichophorum* < 75% (if unsure record higher).

Calluna Height and Offtake

80. Record the height of a representative Calluna plant within each 1m radial quadrat. Record Calluna height from top of the basal layer the depth of the basal layer to peat surface separately. Record the percentage of Calluna long shoots browsed.

Dipwell Protocol

81. Permanent dipwells will be installed at each monitoring sample plot. During a drought period where there has been no significant rainfall in the preceding 14 days (typically between April and June, although can occur at other times), the dipwells will be measured by measuring from the top of the dipwell to the water table (termed "water depth"), and from the top of the dipwell to the main peat mass surface (termed "peat offset"). By subtracting the peat offset from the water depth it is possible to calculate the true value of the water table within the bog. On a good quality, healthy bog the water table should remain within 20 cm of the surface of the peat mass throughout the year.

Pin Hits

82. At each monitoring sample plot a rope demarcated at 1 m, 11 m and 19 m is set out to the east. At each marker point a laser pointer is stood on the north side of the rope and used to record any living plant species, litter or bare peat that it hits directly below. Both basal layer and higher vegetation species are to be recorded.

7.2. Native Broadleaf Tree Monitoring

83. Monitoring will be undertaken on 50 m x 50 m systematic grids in Areas A and B.

84. Within each grid there will be a set of permanent equally spaced radial sample plots of 100 m^2 (radius = 5.64 m).

85. There will be a minimum of 30 sample plots per grid where possible.

86. In each sample plot the following data will be collected:

- Number of trees in each plot;
- Species;
- Height; and
- Condition (see **Table 9**).

87. Monitoring will be undertaken between June and September in monitoring years.

88. Monitoring will be undertaken in years 1, 2, 3, 5, 10, 15, 20 and 25.

***Table 9**: Tree Condition Codes*

Tree Condition	Abbreviation
Healthy	H
Vole/hare damage	V
Deer browsing	B
Deer rubbing	R
Thrashing	Th
Leaning	L
Disease	Ds
Weevil	W
Fertilizer	F
Choked	C
Tubed	T
Dead	Dd

Appendix A: Wave Damming Summary

The Process

1. Identify the drain. The excavator has tracked down the drain, flattening the vegetation and exposing the oxidised peat slope either side of the cut channel. The excavator will straddle the drain, facing upslope. The operator will begin working at the top of the slope, building the dams as they move downhill.

2. The operator will start work on one side of the dam, on the oxidised peat slope. The operator uses the bucket to cut into the peat mass circa. 800 mm depth. The bucket is then used to pull the peat towards the excavator, thrusting material upwards. Care should be taken to ensure that the operator does not flip the peat during this process, and the vegetated surface remains on top.

3. Using the back of the bucket, the operator pushes the back of cut peat towards the machine so that it is compressed into place with a ramped face.

4. The operator will repeat this action a second time, in the middle of the drain.

5. The operator will then repeat this action a third time on the other side of the drain, on the oxidised peat slope. The dam is now three bucket widths wide, although additional width can be achieved using additional bucket widths.

6. The operator then uses the bucket to flatten and compress the top of the dam.

7. The operator then uses the bucket to flatten the edge of the cut face behind the dam. This will enable any livestock a way to climb out of the dam.

8. The finished process.

About Wave Damming

Timing

The time taken to build a wave dam is on average about 1 minute; significantly faster than traditional dams which take over ten minutes to build.

Spacing

The wave dams are installed close together, roughly every 3-4 m. This spacing was specified so that there was not more than a 10 cm drop in ground level between each dam location so that water stored behind the dam can re-wet the intermediate drain space and adjacent ground. The spacing of dams is also dependent on local gradient.

Width

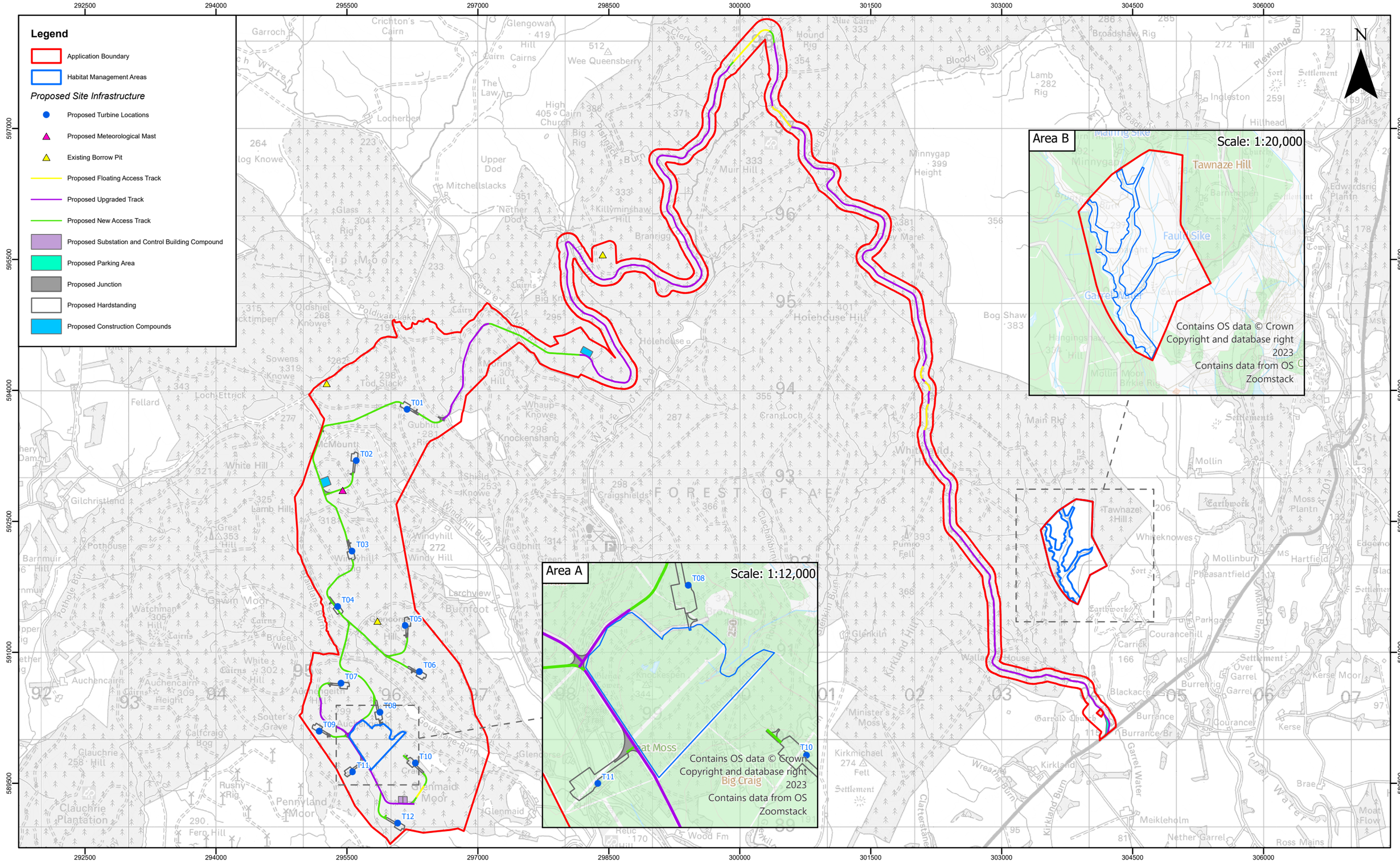
The width of the dam ensures that not only the ditch itself is blocked, but also the collapsed oxidised slopes on either side of the channel. This reduces the likelihood of a new hydrological flow around the side of the dam and encourages the water to spread out and rewet the wider bog.

Appendix B: Ground Smoothing Summary

This involves a low ground pressure excavator (hooked bucket) working along an old forestry ridge to carefully flip over each stump encountered (**Photo 1**). Care needs to be taken so that the stump is pried from the ground with as little excess material (peat and vegetation) as possible rather than being scooped up with a lot of material, the aim being to minimise mobilisation of the peat. After working along the ridges and flipping each stump, the excavator will then track across the area, perpendicular to the ridges to flatten the stumps into the underlying peat in a process call 'cross-tracking' (**Photo 2**). If conifer regeneration is present on the surface it tends to be buried or otherwise killed during the flipping and tracking processes. In previous trials the rate of ground smoothing was between 0.3 - 0.75 ha per day. Any drains encountered by the excavator during the ground smoothing process will be infilled. This involves raking forest residues, mainly brash, stumps and mats of needle litter found around the main forest drains and compacting this material into the drains (**Photos 3 and 4**). Additionally, 10 m wide untreated buffer strips will be left along watercourses.

Photographs 1 and 2: Left (1) – excavator flipping an excavated tree stump. Right (2) – finished area after cross-tracking to smooth the ground surface.

Photographs 3 and 4: Left (3) – excavator compacting material into a drain. Right (4) – drain infilled with forest brash.



ScottishPower Renewables

Rev	Date	By	Comment
B	11/11/24	BB	Development Review.
A	29/10/24	BB	First Issue.

1:40,000
Scale @ A3

0 1 2 km

Harestanes West Windfarm

Figure 1: Proposed Habitat Management Areas

Drg No	HSTW-I-041
Rev	B
Date	11/11/24
Figure	1

Datum: OSGB36
Projection: TM

ScottishPower Renewables

Rev	Date	By	Comment
C	11/11/24	BB	Development Review.
B	06/11/24	BB	Second Issue.
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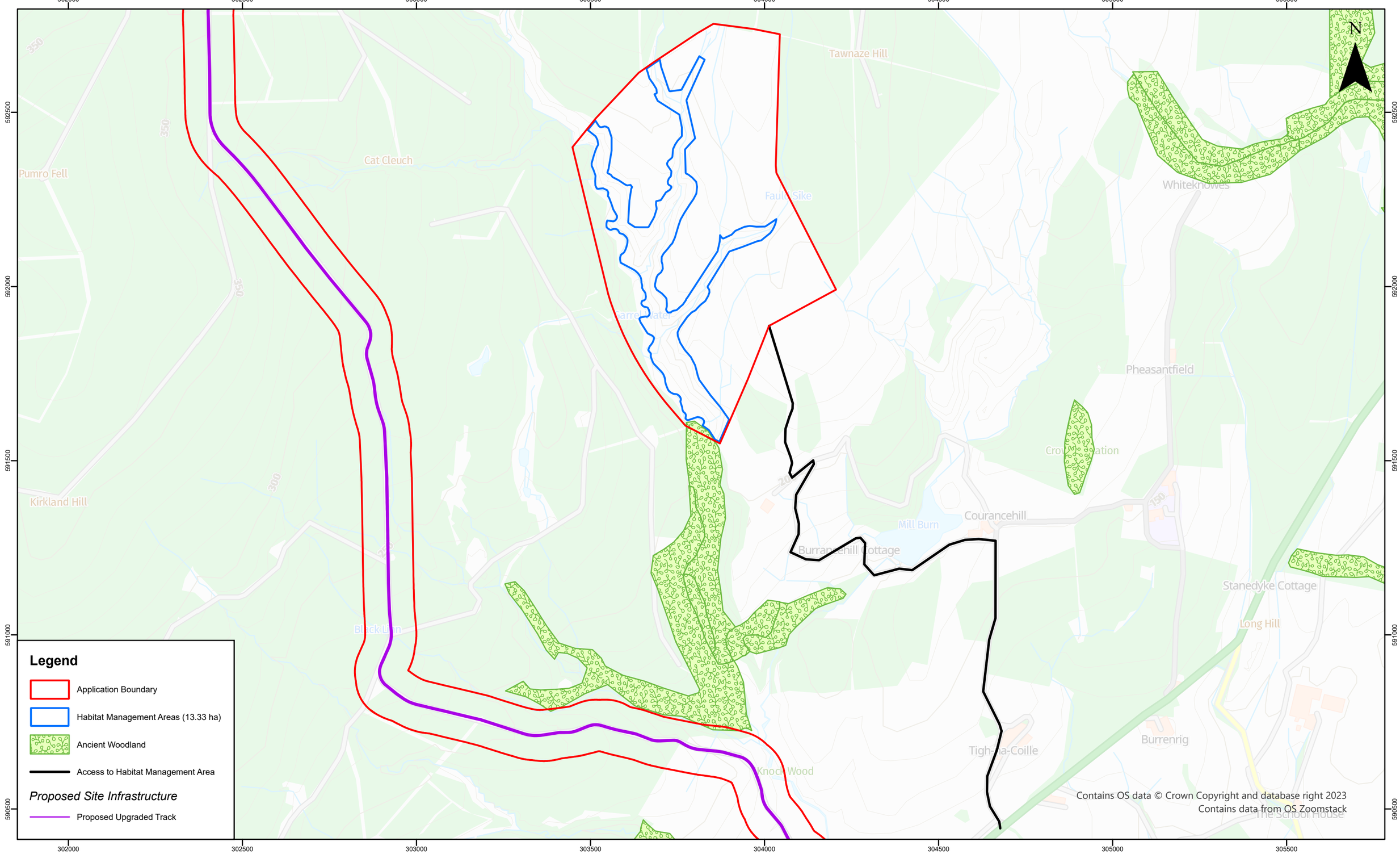
1:3,000
Scale @ A3

0 50 100 m

Harestanes West Windfarm

Figure 2: Habitat Management Area A

Drg No	HSTW-I-042	
Rev	C	Datum: OSGB36 Projection: TM
Date	11/11/24	
Figure	2	



Rev	Date	By	Comment
C	11/11/24	BB	Development Review.
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1:10,000 Scale @ A3

0 250 500 m

Harestanes West Windfarm

Figure 3: Habitat Management Area B

Drg No	HSTW-I-043
Rev	C
Date	11/11/24
Figure	3

Datum: OSGB36
Projection: TM