Appendix 6.2: oHMP

Introduction

1. This outline Habitat Management Plan (2024), hereafter referred to as the oHMP, has been produced to ensure overall net benefits for biodiversity in the form of reduced grazing across the site and restored peatland habitats, primarily blanket bog and wet heath with smaller areas of dry heath, within two Habitat Management Areas (HMAs) which cover a combined area of *c*.246.6 ha.

Aims and Objectives

2. The aim of this oHMP is to fulfil the requirement for an overall 'net gain' of biodiversity by outlining recommendations for compensatory habitat restoration and management to offset the loss of NI Priority Habitats that will result from the construction of the proposed Mullaghclogher Wind Farm.
3. The majority of the wind farm infrastructure footprint lies in within degraded blanket bog with lesser quantities of degraded wet heath and dry heath; despite being in a degraded condition, these peatland habitats are classified by NIEA as Northern Ireland Priority Habitats within the Northern Ireland Habitat Action Plan.
4. The focus of this oHMP is on both restoring vegetation around the construction footprint and on enhancing the condition of extensive areas of degraded heathland and degraded blanket bog habitats within two HMA areas – one consisting of two land parcels at the north-western corner of the site covering an area of *c*.22.7 ha, herein referred to as HMA1, and a larger and more extensive area encompassing *c*.223.9 ha in the eastern third of the site along the western margin of the Glengarrow River, herein referred to as HMA2. Habitat enhancement and management measures are detailed later within this document.
5. Good working practices will be implemented during construction of the Mullaghclogher Wind Farm which will prevent or minimise damage to peatland habitats of value. As a minimum, these will follow the guidelines provided in the Scottish Renewables *et al*. (2019) document: "Good Practice During Windfarm Construction".
6. In order to prevent leaks or spillages of fuels or other materials, such as cement/concrete onto peatland vegetation, and to prevent the laydown of excavated or construction materials on peatland vegetation or in areas of deeper peat (>1m) in order to minimise the potential for peat slide, a programme of good practices will be implemented throughout the pre-construction and construction phases of works.
7. In addition to good methods of construction and waste management, key good working practices will be implemented which will ensure the protection of valuable peatland habitats and the quality of water courses; these will include as a minimum:
    - An appropriately qualified Ecological Clerk of Works (ECoW) who is independent of the construction contractor will be appointed, who

understands both the ecological value of protected habitats and species as well as the importance of protecting the quality of water resources, and also has the responsibility and power within the construction team to influence decision making and implement protection and/or remediation practices as required during the entire pre-construction and construction phases of works. The ECoW will oversee and advise on all matters relating to ecology, particularly peatland habitats and the aquatic environment;

- The enforcing of strict access and egress routes as a 'working corridor' for all construction-related traffic, as well as marking out and implementation of strict exclusion zones around valuable areas of peatland habitat and watercourse buffers. This will ensure that site personnel and heavy plant do not adversely impact upon protected, vulnerable peatland habitats and that soft, peaty buffer zones along the margins of streams and other watercourses are not negatively impacted;
- The designation of re-fueling areas within controlled zones to ensure that there is no possibility that any hydrocarbon or oil spillages and leaks could affect vegetation, peat or watercourses;
- All temporarily stored materials to be located and contained in such a manner that they do not pose a risk to valuable peatland habitats or watercourse buffer zones; and the implementation of a well-designed temporary construction phase drainage system and a Sustainable Drainage System (SuDS) to prevent peat erosion from site and to encourage retention on site of as much rainfall runoff as possible, which will assist in the peatland re-wetting process. Regular inspections will be made of all SuDS elements and the construction phase drainage system throughout the construction period to ensure that they are fit for purpose and functional.

Summary of Existing Peatland Degradation

8. Although the site has been subject to peat cutting (particularly around the proposed site entrance near Carrickayne Road), the main land management practices which have damaged and are currently degrading both blanket bog and heathland habitats within the site are drainage; mowing; and livestock grazing, poaching and dunging.

Artificial Drainage

9. The most damaging of the three aforementioned land management practices has been drainage as there have been extensive artificial drainage ditches excavated across much of the site.

10. The effects that past and present drainage has had on large areas of the site are to (a) dry out the peat and (b) compress surface layers so that these areas of bog now have hard, compacted and dry surfaces which prevent infiltration of precipitation and thereby prevent natural re-wetting of the desiccated peat. As a result, many plant species typical of bog and wet heathland including *Sphagnum*

mosses and *Erica tetralix* (cross-leaved heath) have been lost.

11. The main proposal in this oHMP for habitat enhancement is to block, and in some places infill, active drainage ditches and to install leaky dams along selected minor waterways in order to hold water on-site, which will cause the water table to rise back to the levels which were present prior to the installation of artificial drainage. Re-wetting these areas of bog and wet heathland will provide optimum conditions for bog and wet heathland plant species, particularly *Sphagnum* mosses, to re-colonise and flourish.

Mowing

12. The second most damaging land management activity has been regular mowing. This activity compresses the surface peat layers through trafficking with heavy machinery, thereby altering the hydrological character of the underlying soil.

13. One aim of the HMP is to re-instate blanket bog and wet heath vegetation, primarily by overseeding with heather *Calluna vulgaris*, in areas where blanket bog and wet heathland has been previously mown.

Stock Grazing, Poaching and Dunging

14. Sheep grazing occurs across most of the site, and evidence of surface damage through poaching and cropping of vegetation is seen across the site. In addition, the effect of dunging on acidic peaty soils and associated peatland vegetation is eutrophication of the soil environment and neutralising the (formerly acidic) soil pH; more neutral soil conditions in turn allow for the invasion of grassland plant species at the expense of peatland plant species.

15. Evidence of blanket bog reverting to grazed acid grassland as a result of over-grazing by sheep can be seen in the area between turbines 3 and 5, as sheep prefer to graze areas dominated by grasses rather than heath or bog vegetation.

16. A key recommendation within this oHMP is to reduce the sheep stocking density to 0.075 livestock units (LU) per hectare over the lifetime of the development.

Conclusions on the current state of peatland

17. In many parts of the site a series of agricultural land management practices have led to degradation of the majority of blanket bog present within the site.

18. The main forms of damage can be summarized as:

    (a) a lowering of the water table level by drainage, causing the surface peat layer to dry out;

    (b) hardening and compaction of the surface peat layer, caused by drying out and vehicle trafficking across the surface for mowing of the sward and/or past peat cutting; and

    (c) grazing and dunging by sheep. Dry and hardened peat surfaces, and denser surface peat structure are indications that the normally spongy and wet surface acrotelm of the blanket bog is no longer functioning.

19. The above forms of damage have led to much slower and poorer growth of bog vegetation and in some places, the absence of the main peat-forming species –

Sphagnum mosses - which require wet acrotelm conditions to grow. When the acrotelm has been compromised in this way, blanket bog habitat is no longer active and this situation will persist as long as current agricultural land management practices continue. Cessation of the aforementioned land management practices would, over time, permit areas of blanket bog to become restored to active peatland.

Proposed Habitat Restoration and Habitat Enhancement

Introduction

20. Habitat restoration is used for restoring areas of vegetation that have been damaged by wind farm construction activities such as the restoration of vegetation along access track verges and hardstandings. Habitat enhancement is used for activities that are designed to improve the quality of existing degraded habitats on land that is within the control of the developer, and generally provides habitat benefit over and above that which would be considered as compensation. Habitat enhancement targets the blanket bog communities that have been degraded or damaged by agricultural land management activities. At Mullaghclogher these activities are drainage, mowing and stock grazing/trampling. Both habitat restoration and habitat enhancement measures are detailed within this Habitat Management Plan.

21. This section of the HMP is divided into seven sections:

(i) activities which will be prohibited to facilitate habitat restoration;
(ii) evidence of the success of peatland restoration and enhancement from around the UK;
(iii) methods of habitat restoration within the construction footprint;
(iv) habitat enhancement on lands within the control of the developer;
(v) working with landowners to improve land management;
(vi) assessment of overall habitat betterment and management; and
(vii) other ecological benefits of habitat enhancement.

Activities which will be prohibited to facilitate habitat restoration

22. Activities which have contributed to damaging existing habitats on Site will be prohibited to arrest further declines in habitat condition, particularly in relation to peatlands. These will include:

- Cessation of clearing ditches and gripps. Currently there appears to have been no recent clearance of drains or gripps, although the majority appear to still be actively moving water swiftly across the Site. As most drains are relatively shallow, the smaller examples will gradually become clogged with vegetation which will result in periodic minor blockages, thereby slowing down the speed of water flow through the drains;
- No additional drainage channels or gripps, or alternative methods of

drainage, will be installed within the Site;

- No widening, deepening of extending of drains or gripps will be undertaken;
- No manual or commercial peat cutting will be undertaken at any place within the Site, excepting where existing turbary plots exist near the site entrance close to Carrickayne Road;
- No mowing, flailing and/or screefing of heath or blanket bog habitats. This will allow ericaceous species such as Heather and Cross-leaved Heath to increase in height and, as the Site re-wets due to drain blocking measures, also improve the ability of surface peat layers to re-hydrate and expand through the absence of regular compaction by heavy machinery;
- No ploughing, cultivation and/or re-seeding will occur within any peatland habitats;
- No fertilisers, herbicides, fungicides and/or pesticides are to be applied to any peatland habitats;
- No applications of lime will be permitted on any peatland habitats;
- No applications of slurry, farm yard manure, sludge or other materials will be permitted on any peatland habitats;
- No dumping will be permitted on Site;
- No mineral extraction is permitted;
- No burning activities will be undertaken on or in close proximity to peatland habitats on Site;
- No supplementary feeding of livestock will be undertaken;
- No tree planting is to be undertaken on peatland habitats;
- No sheep grazing is to be undertaken within the period 1st November through to 28th/29th February;
- No livestock grazing to be undertaken within Habitat Management Areas A – F at any time during the initial 3 – 5 years following restoration works in these areas, to ensure that vegetation establishes strongly prior to reinstating grazing; and
- No cattle grazing is to be undertaken between 1st September through to 31st May.

Evidence of the success of blanket bog and heathland habitat restoration (example projects from around the UK including NI)

23. At Mullaghclogher the aim will be to restore and enhance areas of both degraded blanket bog and degraded wet heath habitats. This section therefore addresses both types of habitat. It is salient to note here that M19 communities are described as 'blanket bog' in the EU Habitats Directive. However, where these communities occur on peat deposits less than 0.5m depth they are, for the purposes of this HMP, considered to be wet heath. It is also helpful to point out that M19 communities are included in the NI Habitat Action Plan for Blanket Bog, where the peaty surface horizon is less than approximately 30cm these communities are much drier and are classified as dry heathland. There are several areas of the Mullaghclogher site that

are dry and shallow peaty versions of M19 and therefore are actually dry heathland and not blanket bog.

24. Many blanket bog restoration projects have been undertaken successfully across the UK including projects in Scotland, the North York Moors and the Peak District National Parks, on lands disturbed in order to bury pipelines or electricity cables as well as road construction, and the construction of power stations and oil terminals. A successful Northern Ireland example has been implemented at the Garron Plateau by the RSPB *et al*. (2012). The Northern Ireland Peatlands and Uplands Biodiversity Delivery Group (2010) has also produced excellent "Guidelines for Peatland Restoration" which are specifically suitable for Northern Ireland conditions.

25. Examples of successful peatland and blanket bog restoration programmes include: Department of the Environment for Northern Ireland (DoENI) (2010) for restored aggregate sites, wind farms, former commercial peat extraction and ex- forestry sites in Northern Ireland; and ADAS (2004) for restoration and conservation management of peatlands across the UK. In addition, Natural England has published "A review of techniques for monitoring the success of peatland restoration" (Bonnett *et al.*, 2009) which reviews a wide range of peatland restoration objectives (which include vegetation re-instatement and carbon sequestration) and appropriate ways to assess success (Bonnett *et al.*, 2011).

26. Ditch blocking to re-wet drained blanket bogs has been extensively examined and success reported (e.g. Penny Anderson; Adrian Armstrong *et al*. (2010)), particularly in relation to raising water table levels and improving carbon storage. Best practice has been assessed and cost-effective methods of ditch blocking recommended (Armstrong *et al*. 2009).

27. The techniques used for blanket bog restoration are well understood by botanists and regulators alike, have been demonstrated to succeed on a large number of projects to date, and are no longer considered controversial.

28. Across the UK there is also a wealth of experience and published evidence of the efficacy and success of a range of heathland restoration methods and programmes. The EAU (1988) "Heathland Restoration: A Handbook of Techniques" is the seminal text providing tested methodologies for restoring heathland habitats in many different kinds of situations. Scottish Natural Heritage (1996a) Information and Advisory Note Number 44: "Heather re- establishment on mechanically-disturbed areas" and Putwain and Rae (1988) also provide guidance on methods of heather restoration and re-establishment. Similar methods have been used successfully by The Moorland Association across the UK.

29. One of the most important parts of a successful habitat restoration/enhancement programme is to clearly state the objectives of the work; without a clear statement of the aims and objectives it is impossible to set up a monitoring protocol by which the success of the work can be determined. This HMP therefore starts by stating the aims and objectives of both restoration (around the construction footprint) and habitat enhancement elsewhere.

Mitigation: Restoration of vegetation around the development footprint after construction

30. In all areas where vegetation is stripped ahead of the construction of access tracks, turbine bases, crane pads, and cabling for the Mullaghclogher Wind Farm there is the need to restore vegetation after the construction activities have been completed. The prime aim of the restoration of vegetation within the wind farm footprint is to re-vegetate bare soil and peaty surface soils to stabilise them, prevent erosion and to reinstate peatland vegetation. A secondary aim is to restore the heather-dominated vegetation that was present prior to construction.

Methods of peatland vegetation restoration

31. There are five main methods of restoring the peatland vegetation cover, particularly heather (e.g. EAU, 1988; SNH, 1996a) around the construction footprint:

- Re-turfing with intact blocks of soil and plant cover, including whole heather plants, saved at the time of turf stripping;
- Using "topsoil" with its intact heather seedbank;
- Direct seeding with harvested heather capsules, litter or cut brash material;
- Nursery production of heather seedlings and planting-out; and
- Establishing grass cover and relying on natural colonisation of heather to follow.

32. The intention at Mullaghclogher will be twofold: (a) re-turfing with intact turves stripped ahead of construction, which will be a mixture of semi-improved grassland pasture, wet heath and blanket bog (see the Phase 2 vegetation and NVC map Figure 2) and, if required, (b) to enhance restored heathland areas by overseeding any bare peat areas and re-turved heathland areas with locally collected heather seed. The decision on where overseeding of re-turved heathland areas might provide useful enhancement will be made by the Ecological Clerk of Works (ECoW) once the initial turf replacement has been completed.

33. Removal and replacement of turf is usually the best option for restoring bare areas around construction developments. This method permits restoration of a near full range of plant community species and possibly also elements of the invertebrate fauna. It may also produce more rapid results as it largely involves vegetative re-growth of established plants. All the other aforementioned methods rely on seedling germination and establishment.

34. Four main activities will be carried out to ensure that restoration measures are effective and that vegetation is restored as quickly as possible. These are:

- Careful stripping of vegetation turves prior to the commencement of construction activities;
- Storage of intact turves close to their point of origin for as short a period of time as possible;
- Careful re-instatement of turves, with additional heather seeding where suitable, upon completion of construction works; and

- Monitoring of re-instated vegetation during Years 1, 2, 3, 5, 10, 15 and 25 post-construction.

35. Each activity is described in more detail below. Monitoring is described in the section entitled "Monitoring of restored / enhanced areas of peatland".

Careful stripping of vegetation turf

36. Ahead of the construction of turbine bases and cut sections of access tracks, the vegetation will be stripped in the form of intact turves, ideally in large sections using plant such as the bucket of a JCB or digger. The turves should be large in area (ideally around 0.5m x 0.5m) and as deep as the surface soil organic horizon, but not less than 30cm to ensure that the turves stay moist and intact during handling and storage. This will also assist their successful re-instatement. To ensure careful work, it is recommended that an experienced driver is used for this task and that all drivers are trained to meet this requirement.

37. For the excavation of cable trenches, a turf stripping and peat excavation technique should be agreed in advance with the contractor so that sections of cable trench (e.g. 400-500m sections) are excavated, laid and restored as quickly as possible and that the cable trench is not left open across the site and restored in one activity. This will allow the most rapid re-instatement of peatland (and other) vegetation and will prevent drying out of both the stored turves and areas of vegetation adjacent to the trench.

Storage of intact turves

38. Stripped turves should be stored as close to their point of origin and for as short a period of time as possible. In the case of turbine bases this is likely to be of the order of weeks, but for cable trenches it should be in the order of days.

39. Locations chosen for the storage of peaty vegetation turves should be located away from any areas of valuable peatland vegetation (NVC M19, M20, M25, H12 and H21 habitats within the Mullaghclogher Planning Application boundary) as agreed by the ECoW, and should be contained so that (a) turf stripped from areas of degraded blanket bog or degraded heathland is stored vegetation side up; (b) turves stripped from areas of semi-improved grassland or rush pasture are stored no greater than one layer high; and (c) no soil erosion can runoff the storage area. Turves from improved grassland areas can be stacked two layers high. Turf storage areas should be managed so that the turves can be deposited and lifted with minimal impact on underlying vegetation.

40. To ensure good conservation and to retain moisture status of turves during storage, particularly in dry weather when desiccation can occur rapidly, they will be covered or they may require periodic watering, as determined by the ECoW, if storage includes any longer spells of hot, sunny and/or windy weather.

Restoration using stored turves

41. The aim will be to restore all construction areas to their original vegetation type using stored turves initially stripped from these areas.

42. Where the access track is constructed as a 'cut' track, a methodology shall be agreed with the contractor to design the access track verges and the cable trench in such a way as to minimize the disturbance of stripped vegetation and excavated

peat. This could be a single vegetation stripping and storage exercise, or a two-stage process. The single stage approach would involve vegetation restoration on the road verge and over the cable trench as a single process after all the construction work has been completed. A two-stage approach would start by constructing the track, followed by restoration of the track verges, then a second process at a slight distance from, but parallel to, the track, would involve excavation of the cable trenches followed by rapid vegetation restoration. The latter two-step process, with the cable trench at an approximate 10m distance from the track, has been shown to speed up the process of vegetation restoration over cable trenches since vegetation re-colonises the restored trench from both sides.

43. Restoration around batters of turbine bases, crane hardstandings and sections of cut access track will be achieved by (a) ensuring sufficiently shallow batter gradients to prevent peat erosion, (b) careful levelling and firming of subsoil to the correct density to minimise the risk of uneven settlement, and (c) by the careful replacement of turves, butted close together and well tamped into place, so that they will not easily erode. Any unavoidable gaps should be filled with loose peat and well tamped. The quality of restored areas will be checked by the ECoW immediately after completion to confirm that turf re-instatement has been carried out correctly. Subsequent checks and monitoring of restored areas is described in the section entitled "Monitoring of restored / enhanced areas of peatland".

44. Should there be a requirement to dress batters with stored peat in addition to peat turves, the stored peat will be replaced first in a layer, typically of approximately 0.3-0.5m and well tamped into place and leveled in order to reduce the potential for peat erosion. Peat turves will then be carefully placed on top, closely butted, and further tamped into place. The peat and turf replacement process will be carried out as one activity and in no case will any replaced loose peat be left as an exposed layer without turf cover, unless under the guidance of the on-site ECoW. In such cases, re-vegetation of bare peat will be according to the methods to re-seed using heather brash or seed, outlined in paragraphs 46 to 55 below.

45. Restoration of cable trenches will be completed as soon as sections of trench, 400-500m long, are completed and back-filled. To ensure successful restoration of vegetation along cable trenches, and to ensure that trenches do not become routes of preferential flow for drainage waters, trenches will be designed with cross dams and back-filling and re-turfing will take place immediately after cables have been laid. Appropriate scale plant (such as a JCB) will be used for these activities to minimize as much as possible the trafficking of adjacent peat.

Restoring vegetation using heather seed

46. Heather seed is very small and can be produced in great abundance. Heather seed does not ripen until about October, depending on weather conditions. Germination requires light, warmth and moisture, so seed collected in the autumn is best sown in the spring. In the uplands most germination usually occurs in the second half of the summer. If conditions are unsuitable, seed will remain dormant and can persist in the seedbank for decades although viability varies greatly according to site conditions.

47. In order to use locally-sourced heather seed for re-vegetating areas of bare peat and enhancing re-turved areas the proposed wind farm development, a programme of heather mowing, ideally using a forage harvester, or alternatively a heather vacuuming technique (if appropriate equipment is available) will be conducted on suitable areas of heather moorland in the western part of the Site (to the west and north-west of T1). Where heather is cut to generate brash for seeding, this will have the dual benefits of (a) regenerating areas of old and leggy heather in the donor areas and (b) providing seed for the re-seeding restoration areas. This activity will require a number of component tasks, which will be developed further post- determination and will be managed by the ECoW. Likely tasks will include but will not necessarily be limited to:

- inspection of all areas of heather moorland in the south of the Site to identify and select suitable donor locations for heather seed. Likely areas suitable for cutting will be accessible and will display signs of mature and 'old age' heather stands in need of regeneration. Likely areas suitable for heather seed collection will be mature, healthy stands showing good flowering characteristics;
- plan a heather cutting programme according to the methods outlined in guidance provided by DARD (2005, 2010) and SNH (1996b). The programme will include designs for maximising edges of cut blocks, equipment to be used and timescales to be adopted, including justification. In addition, plan a heather seed collection programme;
- plan suitable storage facilities for both heather brash and heather seed so that harvested materials can be suitably conserved until it is deployed in restoration works; and
- if there are any bare patches in restored areas within the Planning Application Boundary, implement heather seed spreading on a location-by-location basis, as directed by the ECoW.

Methods of heather cutting and seeding

Heather cutting/mowing

48. A number of possible methods can be used for cutting/mowing heather including the use of a tractor drawn flail, heather swipe or a forage harvester. Choice of equipment will primarily depend on (a) the quality of the donor site (i.e. age and structure of the heather); (b) general topography and micro-topography of the site (particularly the gradient and the presence of rocks, hummocks, hollows, drains and/or pools); and (c) access. According to the guidance provided in DARD (2005) Section 12, heather flailing must not be carried out during the period 15 April to 31 August to protect ground-nesting birds.

49. Cutting/flailing heather will encourage regeneration of old heather stands and will generate brash which will be used to reseed areas of bare and restored peat. To ensure that areas of flailed heather look as natural as possible and to provide a useful habitat for ground nesting birds, the edges of cut areas will be left as irregular as possible. Cut heather brash will be removed, bailed/bagged (depending on method of cutting) and transported to predetermined locations which have been

designated for storage or seeding.

Season of heather cutting

50. Heather cutting can be carried out either in autumn/early winter or late winter/spring. At Mullaghclogher it is proposed that cutting in late autumn is likely to be best for collection of brash and seed which will be stored for future use in re-seeding peat restoration areas of the wind farm construction footprint. Seed bearing shoots cut during October to mid-January can be used for heather restoration (see SNH (1996a) Heather Re-establishment on Mechanically Disturbed Areas). A double-chop forage harvester probably produces the best material but a single-chop type is also suitable. Depending on the amount of seed carried by the donor stand there should be enough material to treat an area from one to three times the size of the donor area. This will allow pre-planning of the extent of heather cutting required for the anticipated restoration activities.

Vacuum seed collection

51. As an alternative to heather cutting, it may be possible (if suitable equipment is available) to use a vacuum seed harvesting technique.

52. A garden vacuum with a two-stroke engine or an industrial vacuum cleaner with a generator can permit the collection of around 100 - 250 kg of heather litter plus seed per day. The seed-litter material will be collected in winter and either stored or sown at once. Alternatively, it will be collected in early summer when, being vernalised, a proportion of the seed will germinate as soon as it is sown provided seedbed and germination conditions are suitable. If collected when dry the material can be safely stored in dry, airy conditions without need of further drying.

Seeding method

(a) Cut/flailed heather

53. Heather re-seeding using cut brash will take place in late spring (late April to May) to allow the warmth and moisture conditions of early summer to optimise germination. The cut heather should be spread thinly so that the soil surface is not obscured but adequate seed is available. Recommended application rates (EAU, 1988) of heather litter/brash are between 1000 -1500 kg/ha in order to supply a minimum of 300-500 germinable seeds per m^2. The size of the donor area to be cut will depend on the density and productivity of the donor heather. (Reported examples of coverage range from less than the size of the donor site up to three times larger (SNH, 1996a)). It is claimed that the stem material helps to stabilise small scale soil movement and improves humidity at the soil surface but an alternative view is that the litter becomes mobile in wind and can damage or bury seedlings. Laying sapling or mature heather brash over the re-seeded area may be used to reduce this risk.

(b) Heather seed/litter obtained by vacuuming

54. As above, heather reseeding will take place in late spring (late April to May) to allow the warmth and moisture conditions of early summer to optimise germination. The decision on application rates depends on seed abundance in the donor litter. Northern Ireland's Peatlands and Uplands Biodiversity Delivery Group (2010) recommends an application rate of 200 g/m^2.

Protection of restored areas

55. Restored areas require some degree of protection against livestock grazing, where present, for at least the first three years. Within priority habitat areas, the ECoW will determine which method of protection will be most suitable. Possible methods will include: (a) exclusion fencing (if permitted, such that it doesn't create predator posts), (b) use of heather brash or other brash to secure applied seed and protect seedling growth, or (c) a programme of restricted sheep grazing until restored vegetation has sufficiently established.

Habitat enhancement on lands within the control of the developer

Introduction

56. A number of typical agricultural land management practices have damaged and caused the degradation of both blanket bog and heath habitats at Mullaghclogher. In addition to preventing the occurrence of these damaging management practices in the future, there are a number of habitat enhancement activities that can be implemented as part of the HMP.

57. The proposed Mullaghclogher Wind Farm Development provides a good opportunity to work with the current landowners to manage areas of blanket bog and wet heathland within the Site to return it to good conservation status for at least the lifetime of the Proposed Wind Farm Development which is predicted to be 35 years.

58. Five main types of habitat enhancement are proposed:

- **Ditch blocking**. Areas of both degraded blanket bog habitat (M19 and M25) and areas of degraded wet heath (M19) are targeted for ditch blocking and in-filling of gripps to re-instate higher water table levels which would have been present before artificial drainage (within HMA1 and HMA2 in Figure 3);
- **Re-instatement of M19 blanket bog community**. Areas of degraded M19 that has been damaged through vegetation flailing together with compaction caused by heavy vehicle trafficking, is targeted for re-instatement of a *Calluna* sward and the recreation of an M19 community (Area B in Figure 3);
- **Rejuvenating and diversifying** over-mature heather swards across the site by patch mowing and diversifying valuable entomological and ornithological habitat (Area A in Figure 3);
- **Creation of M19 vegetation** in the form of heathland, in two areas that were converted to semi-improved grassland (Areas C & D in Figure 3); and
- **Control stock grazing**. Working with landowners to improve general land management and grazing regimes across the majority of the site, particularly within areas of NI priority habitat.

Ditch blocking and in-filling (Habitat enhancement)

59. There are many locations across the Mullaghclogher site, both within the Planning Application boundary and in adjacent land that is under the control of the developer, where drainage ditches and gripps have not recently been cleaned out but are still actively draining the surface peat layer. There is excellent scope to block and infill these ditches and gripps in order to raise water table levels back to

where they were before drainage.

60. Drainage has caused drying out the peat surface and has resulted in a dry and hard, crusted bog surface with an impoverished bog species community. All areas proposed for ditch blocking are shown in Figure 1 and occur within both HMA1 and HMA2.

61. The purpose of ditch blocking is to raise the water table level initially in the vicinity of each ditch or gripp but over time, across whole hydrological units of blanket bog. Ditches would first be blocked to pond back water and halt runoff, and then back- filled using the overturned furrow turf that still exists adjacent to each ditch to recreate the original, wetter bog surface. Where there is no overturned furrow, infilling of gripps and ditches will be achieved using excavated peat originating from the construction of turbine bases and crane pads.

62. Raising water table levels is the necessary first step to encourage the regeneration of bog species, such as *Sphagnum* mosses.

Methodology of ditch blocking within HMA1 and HMA2

63. Ditch blocking has been shown in numerous studies to be a highly effective method of raising water tables as a pre-cursor to blanket bog restoration. See, for example, Armstrong *et al* (2009) who review the results of 32 ditch blocking programmes in England and Scotland and also provide a drain-blocking best practice guide which advises on methodology. Typical methods for ditch blocking involve the use of plastic or wooden piling, often accompanied by infilling/backfilling the blocked ditch with peat or heather bales. In some places, for example areas where drainage ditches intercept mineral substrate below, stone dams have been used.

64. DoENI (2010) guidelines recommend using either highly decomposed peat or plastic sheet piling, however given the awareness around microplastics in the environment the latter should be replaced by corrugated tin piling. Peat turves are often the most widely used method for damming drainage ditches, since turves are available on site and the method is cheap. However, this type of dam has also resulted in the highest incidence of dam failure if not installed correctly. Where turves are used, an escape route for water should be created from the dam pool so that water can diffuse over the peat slope rather than flow around the dam and back into the drain.

65. At the proposed Mullaghclogher Wind Farm Development, corrugated tin sheet piling will be used in addition to backfilling ditches and gripps with peat turf. The spacing between dams will be determined by the slope of the land, the width of the ditch and the rate of water flow. Figure 1 shows indicative locations of ditch dams within HMA 1 and HMA 2. No general rule can be provided on whether dams should be regularly spaced or whether spacing should be determined by the gradient of the slope and its microtopography.

66. The exact location of dams in HMA 1 and HMA 2 will be assessed and determined by the ECoW, in consultation with the peat hydrology expert. In general, the spacing between dams should exhibit a ‘top to toe’ effect whereby the raised water table stretches from one dam up to the next one upslope.

67. There will be a number of key requirements of the construction contractor during

ditch blocking and dam construction, including:

- planning access and egress routes to minimise as much as possible the compaction of peat around drainage ditches;
- use of plant with low ground bearing tyres to reduce compaction around the construction areas;
- careful overturning of turf or overturned peat 'ribbons', so as to cause as little disturbance to the ditch banks as possible and to leave original underlying bankside vegetation intact; and
- peat must be tamped and keyed into the bottom and sides of the drain and dam to avoid undercutting or leakage.

68. A conservative estimate of the total area of bog in the two proposed HMA areas over which ditch blocking will raise water table levels is approximately 150.7ha.

69. The estimated length of drains being blocked within HMA 1 and HMA 2 is 28.22km.

70. It is important to monitor the success of ditch blocking to raise water table levels within the peat adjacent to the ditches; one of the simplest methods available for monitoring water table levels are WALRAGS (WAter Level RAnge GaugeS) which monitor the upper and lower (minimum and maximum) water table levels by means of a floating indicator which raises and lowers a magnet on a water level scale. These can be read manually at pre-determined intervals. The locations of insertion of WALRAGS must be carefully chosen to allow an understanding of the geographical extent to which the water table level has been raised. At Mullaghclogher, monthly reading of WALRAGS before dam insertion and afterwards for a period of at least one year will provide seasonal evidence of whether the dams are working to raise water table levels as well as the spatial extent of water level raising. Monitoring water table levels before ditch blocking is important in order to provide a baseline from which to measure the success of water table raising.

Heather mowing for habitat enhancement and collection of brash/seed (Area A)

71. Mature and old age heather within Area A will benefit from mowing to rejuvenate the sward. This area will also act as the donor area of heather brash and heather seed for re-seeding and over-seeding within other habitat enhancement areas on site. Each area is detailed within Figure 1.

72. Under the guidance of the ECoW, smaller pockets of habitat within Area A will be selected for mowing. This will involve an initial inspection of the area to select the best and most easily accessible areas as donor locations for collection of heather brash and/or heather seed for re-seeding elsewhere. These areas will display signs of mature and 'old age' heather stands in need of regeneration and displaying good seed production.

73. Ahead of peatland habitat restoration works elsewhere at Mullaghclogher, the ECoW will plan and supervise a heather cutting/mowing programme in the areas identified above according to the methods outlined in guidance provided by DARD (2005, 2010) and SNH (1996b). The programme will include details of equipment to be used and timescales to be adopted. In addition, the ECoW will plan a heather

brash/heather seed collection programme.

74. Suitable storage facilities for both heather brash and heather seed will also be planned so that harvested materials can be suitably conserved and protected from wet conditions until they are deployed in restoration works.

75. Since only patchy heather mowing will take place in the four aforementioned areas in order to create an uneven heather sward structure and to create uneven 'edges' for birds, a conservative estimate of the area of M19 habitat enhancement in this part of the site is 2.5% of HMA1 which equates to an area of 0.885ha; 4.3% of HMA2 which equates to an area of 9ha; 50% of Area A which equates to *c*.6.85ha; and 25% of Area B which equates to 3.38ha. Overall, sward enhancement through patchy heather mowing will occur over a total area of 20.12ha.

Habitat enhancement through Heather overseeding in area of poor M19 (selected parts of HMA 2)

76. At the northern end of HMA 2 a series of field units supports a mosaic of degraded blanket bog, marshy grassland and wet heath. This area is labeled Area B in Figure 3.

77. The aim of habitat enhancement in this part of the site is to over-seed degraded areas of blanket bog and wet heath with either heather seed or heather brash collected from within Area A. Prior to over-seeding, the ECoW will inspect the entirety of Area B and identify and mark out the areas to be enhanced. For the purposes of this HMP, the proportion of Area B assessed to require this treatment is estimated to be 30% of the 13.5ha area (i.e. 4ha). The surface of these peatland habitats will be slightly roughened manually with a rake, sufficient to expose areas of bare peat and ensure good seed to soil surface contact, but the vegetation turf will not be removed or over-turned.

78. Heather seed or brash will then be spread by hand to ensure that roughened areas of bare peat are adequately covered. The aim in this part of the site will be to encourage the regeneration of patchy heather with the anticipation that once established, *Calluna* will naturally spread through the sward to form either a heath or blanket bog community.

79. No livestock grazing will occur for 3 – 5 years in areas which have been over-seeded, to ensure that Heather re-establishes strongly prior to the re-introduction of grazing.

80. Monitoring of re-seeded areas will be required and is detailed within the section entitled "Monitoring of restored / enhanced areas of peatland".

Habitat enhancement through the recreation of a heather sward and M19 vegetation community in areas of semi-improved grassland (selected parts of HMA 2)

81. Two semi-improved grassland fields close to the northern boundary of HMA 2 are ideal locations for re-instating a heather-dominated sward and eventually the recreation of an M19 heathland-type community. These fields are labelled as Areas C & D in Figure 3. These areas will be re-created as heather sward and M19 community.

82. The substrate beneath the existing grass cover in these areas is peat, with surface

peaty horizon depths of at least 30cm. The intention in these four fields will be to screef the surface turf and turn it over, burying the surface grassland vegetation and surface soil seedbank, and exposing the peat surface. Note that screefing and turnover may not be required if these areas have been used for temporary peat storage during the construction phase, which may shade out surface vegetation; the ECoW will determine whether turf screefing and turnover is required after temporary peat storage, in order to break up and aerate the surface peat prior to seeding.

83. Once the inspected and, if required, the surface turf overturned and peat exposed, heather seed or heather brash will be sown by hand to prevent further compaction of the newly exposed peat surface and to ensure a good and complete cover across these two areas.

84. Heather re-seeding should take place in late spring (late April to May) to allow warmth and moisture conditions of early summer to optimise seed germination.

85. Assuming that sowing is carried out in spring, artificial watering may be required at sowing and throughout the first six months after sowing (during summer and possibly also autumn) to ensure that surface peat and vegetation conditions are suitably wet to enable seed germination and seedling establishment.

86. The decision on seed application rate will depend on seed abundance within the donor litter. Reported examples are in the range 10-120 g/m^2 (SNH, 1996a); an application rate near the upper end of this range would be advisable. If heather seeding is used, the ECoW will determine whether seeded areas need to be protected by cut brash or sapling brash to maintain humid conditions and to prevent disturbance of seed by wind and animals.

87. No livestock grazing will occur for 3 – 5 years in areas which have been over-seeded, to ensure that Heather re-establishes strongly prior to the re-introduction of grazing.

88. Whether seeding is carried out using heather brash or heather seed, the ECoW will inspect all re-seeded areas regularly to ensure that (a) heather seed and/or heather brash has not been eroded or removed and remains *in situ*, and (b) surface moisture conditions are adequate for seed germination and seedling establishment. Should warm and/or windy weather conditions dry out surface peat, the ECoW will prescribe adequate watering and will ensure that watering does not cause erosion or seed removal.

89. The total area of habitat enhancement of the two semi-improved grassland fields in Areas C & D is approximately 2.5ha.

90. The monitoring of these re-seeded areas is described in the section entitled “Monitoring of restored / enhanced areas of peatland”.

Protection of restored and enhanced areas of peatland

91. All restored and enhanced areas of habitat will be protected against sheep grazing for at least the first three years following restoration/enhancement works, and grazing restrictions will be agreed with the landowner until restored vegetation has sufficiently established. Proposed grazing regimes are indicated in Figure 4 which indicates stock grazing exclusion timescales and subsequent grazing levels across

the site post-construction.

Habitat enhancement - working with landowners to improve land management

92. On-going agricultural practices, which include the maintenance (cleaning out) of drainage ditches and gripps, mowing and flailing of heather swards and grazing of stock (primarily sheep), have dried out blanket bog and wet heath habitats, compacted and compressed surface peat layers and damaged or destroyed the acrotelm in many parts of the site.

93. Should the proposed Mullaghclogher Wind Farm Development be permitted, it will provide an excellent opportunity to work with landowners, both in the west of the site (within HMA 1) and in the east of the site (within HMA 2) to improve the status of areas of degraded peatland habitats. This will include agreements between the Applicant and landowners to include:

- ditch and gripp blocking and in-filling;
- patchwork mowing of old age and mature heather stands in more environmentally friendly ways and only when these stands are considered to be mature to old age; this will not be carried out annually. The purpose of this will be to (a) develop, over time, a greater variety of sward statures and diversities and to (b) generate heather brash and seed which will be used to re-seed and over-seed species-poor degraded areas of blanket bog and wet heathland;
- protecting areas of restored and enhanced habitat for the first 3 to 5 years after restoration works (to include no livestock grazing), until the swards are well established;
- implementing and maintaining appropriate grazing regimes for blanket bog and wet heathland, detailed below;
- a stocking rate restriction of 0.75 livestock units per hectare all year on rough moorland;
- a stocking rate of sheep at 0.25 livestock units per hectare from 1 March to 31 October, or cattle at 0.20 livestock units per hectare – 1 June to 31 August, on wet heathland; and
- a stocking rate of sheep at 0.075 livestock units per hectare from 1 March to 31 October, on blanket bog.

94. The proposed stocking rates which would be implemented as part of the HMP for the wind farm (taken from DARD (2005) CMS Table 2), would be the rate applicable for blanket bog which would be as much as ten times less than the current rate i.e. 0.075 livestock units per hectare, and only sheep will be grazed. Over the life span of the wind farm it is assessed that a reduction in grazing density would result in a very significant improvement of sward structure and biodiversity of currently degraded blanket bog and wet heath habitats.

95. The Developer will work with landowners over the lifetime of the proposed wind farm development, which will be 35 years, to provide long term continuity of these management practices.

96. Detailed records will be kept of initial habitat condition, and both current and historical stocking densities will be compiled and maintained throughout the operational life of these proposals. Grazing prescriptions for each habitat compartment will then be produced.

97. In addition, it is noted that many characteristic peatland fauna require a range of community structures (tall vegetation, short vegetation, bare ground) and grazing is the most effective tool for achieving this, therefore a variety of associated benefits arise. Birds (for which many peatland sites are protected under UK and European law) also benefit from a range of structural diversity and the increase in insect prey.

98. Sheep grazing will be completely excluded from the four peatland blocks that have been targeted for habitat enhancement (Areas A, B, C & D) during the construction phase and for the first three years after re-seeding/over-seeding. Elsewhere within the land control boundary, a programme of restricted sheep grazing will be agreed with landowners. The areas where sheep management will be implemented are indicated in Figure 4.

99. These proposals recognise that at much reduced stocking densities, grazing may control and reduce incidences of grasses that can out-compete more beneficial species such as heather. Well managed grazing can therefore help to increase species diversity.

Assessment of Habitat Betterment (habitat enhancement vs habitat loss)

100. Five different types of habitat enhancement/improvement are proposed in this HMP. These, and the areas proposed for habitat enhancement, are summarised in Table 1.

Table 1. Summary of types and areas of habitat enhancement

Area	Habitat Enhancement for the lifetime of the project	Area (ha)
C & D	Recreate *Calluna*-dominated heathland in area of semi-improved grassland.	2.5
HMA 1, HMA 2	Block and in-fill drainage ditches and gripps to raise water table levels.	246.6
B	Overseed with *Calluna* to improve degraded in species-poor area of former M19 blanket bog and wet heath (estimated to be 30% of the area).	13.5
A	Mow *patches* (estimated at 50% of the area) of over-mature *Calluna* to create a heterogeneous sward structure and to create edge diversity for birds.	13.7
Total habitat enhanced		**276.3**
Stock management - specified locations across the whole Site	Reduced and carefully managed stocking density of 0.075 livestock units (sheep only) per hectare, from 1 March to 31 October) over the majority of the site (illustrated in Figure 4).	516.3

101. The areas proposed for habitat enhancement are a mixture of degraded M19, M20 and M25 NVC communities; there are mosaics of these NVC communities within both the construction footprint and in areas proposed for enhancement. An attempt was made in Table 6.12 (within Chapter 6 of the Mullaghclogher Environmental Statement) to estimate the areas of each of these communities that would be lost, however it is difficult to estimate the areas of each NVC community that would be enhanced by proposed methods in this HMP so, for simplicity, the calculation of proposed habitat 'betterment' (i.e. the amount of enhanced habitat vs the amount of habitat lost to the development footprint over its lifetime) has been based on the *sum of all four NI priority habitats* (M19, M20, M23a and M25).

102. The area of NI priority habitat that will be lost for the lifetime of the development due to the footprint of the infrastructure is 6.45ha. The area of habitat enhancement (excluding that which would be improved through stock management) is approximately 276.6ha. The overall habitat betterment proposed is approximately 42 times more peatland habitat enhanced and restored than will be lost as a result of the development.

103. If, in relation to PPS2 NH5, it is helpful to separate out the area of habitat enhancement that 'compensates' for the area of habitat loss (i.e. 6.45ha), the area of proposed habitat enhancement that is *over and above direct compensation* amounts to 270.2ha.

104. In addition to the habitat 'betterment' calculation above, 516.3ha of degraded peatland habitats would benefit from reduced sheep grazing densities for the lifetime of the wind farm development. The main value of reduced sheep stocking densities will be reduced grazing of sensitive bog and heath species, less trampling and creation of paths through blanket bog (particularly in very wet winter conditions), reduced dunging and associated nutrient enrichment in sensitive areas of acidic and nutrient-poor blanket bog and heath, and reduced disturbance for ground-nesting bird species.

Habitat Management Over the Lifetime of the Development

105. The HMP for the Mullaghclogher Wind Farm, including habitat management agreements with landowners, will be applicable over a period of 35 years. Monitoring will be carried out by an independent, suitably qualified Ecologist. This HMP is an iterative document which will be revised after each phase of monitoring, with results being reported to both Derry City & Strabane District Council and NIEA. Monitoring is detailed within the section entitled "Monitoring of restored / enhanced areas of peatland".

Other Ecological Benefits of Habitat Enhancement & Management

106. Many characteristic peatland fauna require a range of community structures (e.g. tall vegetation, short vegetation, bare ground). Within a variety of peatland and grassland habitats, carefully controlled and managed grazing is the most effective tool for achieving a range of sward and ground cover types. Birds (for which many bog and heathland sites are protected under UK and European law) as well as invertebrates benefit from such a range of structural diversity.

Hydrological Benefits of Habitat Enhancement

107. The proposed habitat enhancement measures would be anticipated to have a beneficial effect in relation to site hydrology and water quality in the medium to long term. Blocking of drainage gripps and ditches that would otherwise accelerate runoff from the site would serve to reduce the peak rate of surface water runoff from the site, and contribute to flood management within the downstream catchment. Similarly, blocking of ditches and gripps will eliminate pathways for scoured sediments and suspended solids that would otherwise drain into the Burndennett River and other downstream catchments, resulting in a beneficial effect to water quality.

Indicative Schedule of Habitat Restoration and Enhancement Activities

108. The timing of many of the HMP activities is crucial for success. Table 2 provides indicative timings for implementation of the main elements of the habitat restoration and enhancement programme.

Table 2. Indicative schedule of habitat restoration and enhancement management activities and timescales

Phase of Development	Activity	Timescale
Pre-Construction or early Construction	Consult with the NIEA to agree suitable locations, within the lands under the control of the developer (e.g. Area A), for harvesting of local heather brash or seed.	April to October
	Harvesting local heather brash	Avoid mid-March to end August. Ideal time is October.
	Collect local heather seed	Ideally October
Construction	Peat/vegetation stripping and temporary storage in areas of wind farm construction	According to construction plan
On-going Construction and Post-Construction	Peat/vegetation restoration by replacing stripped turves in areas of wind farm construction	As soon after stripping as possible, ideally within a few days (cable trenches) or weeks (e.g. turbine bases and crane pads)
	Vegetation restoration by over-seeding turfed areas of any bare peat areas if required within the farm construction footprint.	Ideally late spring (late April to May)
	First inspection of restored vegetation on crane pad batters, road verges and cable trenches (confirmation of appropriate restoration conditions achieved)	Ideally August – September after construction has been completed.
	Heather re-seeding in areas identified for habitat enhancement (Areas B - D). The order of activities would be: • Area B: Lightly harrow & roughen hard, dry hummock surfaces and to reduce existing compaction and rutting • Areas C & D: (if necessary), turn over surface turf and expose bare peat surface. • Broadcast collected heather brash and/or seed	Ideally late spring (late April to May)
	Implement ditch blocking on selected ditches within HMP1 and HMP 2. The sequence of works will be: • Inspect indicated ditches for suitability • Insert plastic pile dams as per guidance (e.g. Armstrong *et al.*, 2009) • Backfill selected drains using overturned furrow turves.	Summer months when peat surfaces are drier and water table levels lowest.

Post-Construction and Operation	Monitoring of restored habitats and vegetation communities within the Site	Annually for the first four years, then in years 7 and 10.
Before and after construction	Monitoring of WALRAGS in areas of ditch blocking.	A minimum of one year before dam insertion and one to three years after.
Landowner grazing measures	Implement appropriate conservation grazing Regimes, including no grazing for the first 3 – 5 years on areas where habitat restoration measures have been undertaken.	Post-construction

Overall Assessment of the Impacts and Benefits of the Project

109. This section provides an overall assessment of the impacts and proposed benefits of the Mullaghclogher Farm Development.

110. It has been assessed that unless current agricultural practices cease, the degraded blanket bog habitats that are currently not active, as shown through

(a) statistical analysis of the vegetation present, and

(b) visual inspection of the dried out, hardened and compacted surface peat where the acrotelm is no longer functioning, will continue to be degraded.

111. Degraded areas of blanket bog are present across the entire site which is under the control of the applicant, not just within the proposed development footprint.

112. While it is assessed that excavation to construct the wind farm will cause an adverse effect on small areas of degraded blanket bog, counter-balancing this impact is the applicant's proposal to enhance and improve substantial areas of blanket bog outside the development footprint but within lands under the applicant's control. Part of this habitat enhancement provides direct compensation for the loss of peatland habitat within the construction footprint; the remaining habitat enhancement constitutes a net positive benefit as a result of the development.

113. Taking into account the initial degraded condition of the blanket bog and wet heath habitats at Mullaghclogher, it is assessed that the implementation of measures described in this HMP will, despite construction of the wind farm, result in a substantial net gain in terms of habitat quality when compared to the current condition of the site. The Mullaghclogher development will, through implementation of this HMP, improve the natural capital of the site and will provide a large area of substantially improved peatland habitats for local biodiversity.

Monitoring of restored / enhanced areas of peatland

Introduction

114. To confirm that habitat restoration (i.e. mitigation) and habitat enhancement has been successful, all areas of restored and enhanced vegetation should be

monitored post-restoration and post-enhancement, with monitoring results compiled into reports which also identify any failures and corrective actions which were then implemented. Each report will be submitted to both Strabane and Derry City Council and the NIEA within 6 months of the end of each reporting year in years 1, 2, 3, 5, 10, 15, 20, 25 and 30 following the completion of enhancement and restoration works.

115. The monitoring process emphasises the importance of stating clearly the objectives of habitat restoration or enhancement activities at the outset.

Monitoring of habitat restoration (mitigation) areas

116. The objective within restored areas of the application site is to re-vegetate bare soil and peat surfaces to stabilise them, prevent erosion and to re-instate peatland vegetation, with the opportunity of restoring better quality and more valuable peatland vegetation communities long term than were present before construction. Thus, the criteria by which the success of *habitat restoration* is judged will be threefold:

- Is the restored area stable? Criteria for assessment will include: presence of surface cracks in peat, evidence of peat slippage and percentage of bare soil/peat exposed;
- Has vegetation re-established and if so, what percentage vegetation cover is present and do any areas of bare soil/peat remain? The aim will be to achieve

  100% vegetation cover within 5 years of restoration; and
- Has a suitable vegetation composition been restored? This will be a longer-term aim and assessment criteria will include species diversity and species composition. The target will be to re-instate a better quality of the same NVC community that was present prior to construction.

Monitoring of habitat enhancement areas

117. In habitat enhanced areas within the application site, the objectives are a little different. Within HMA 1 and HMA2, where ditch blocking is proposed, the aims and objectives, as well as the inspections and monitoring are described in Table 2.

118. In habitat enhancement areas which will be re-seeded and overseeded (Areas B - D), the initial aim is to re-establish a peatland sward that is dominated by heather. A longer-term aim would be that these areas would eventually develop into an M19 NVC community, given suitable hydrological conditions within the peat layers. Over the lifetime of the proposed wind farm development, the aim will be to restore better quality and more valuable peatland vegetation communities in these areas than were present before construction.

119. The criteria by which the success of habitat enhancement in Area B is judged will be as follows:

- Has *Calluna* re-established and if so, what percentage *Calluna* cover is there and do any areas of bare soil/peat remain? This will be compared to % cover prior to habitat enhancement;
- What is the percentage cover of (a) bare peat, (b) *Calluna* and (c) other

heathland or blanket bog indicator species such as *Eriophorum vaginatum, E. angustifolium*, *Erica tetralix*, *Narthecium ossifragum* and species of *Sphagnum*; and

- Has a suitable vegetation composition been restored? This will be a longer-term aim and assessment criteria will include species diversity and species composition. The target will be to re-instate the NVC community M19.

120. The criteria by which the success of habitat re-creation in Areas C & D is judged will be as follows:

- Has *Calluna* re-established and if so, what percentage *Calluna* cover is there and do any areas of bare soil/peat remain? Has peat erosion occurred?;
- What is the % cover of other heathland or blanket bog indicator species such as *Eriophorum vaginatum, E. angustifolium, Molinia caerulea, Erica tetralix, Narthecium ossifragum* and species of *Sphagnum*?; and
- The overall aim will be to re-instate the NVC community M19 and so, the final criteria by which success will be judged will be to determine whether the vegetation surface is stable and whether a suitable vegetation composition been restored? This will be a longer-term aim and assessment criteria will include species diversity and species composition.

Timing of inspections/monitoring

121. Visual inspections of restored areas within the application site will be carried out bi-annually during the first two years after restoration to check for potential soil erosion or movement and any degradation of replaced turves. Vegetation monitoring will be carried out in years 1, 2, 3, 5, 10, 15, 20, 25 and 30 after restoration / enhancement. Monitoring will involve the following:

Soil/surface peat assessment

An assessment of the physical state of the topsoil/surface peat with regard to:

- Percentage bare soil or peat not covered by vegetation;
- Moisture status (qualitative);
- Intactness (e.g. presence of visible cracking in surface peat; and
- General stability (e.g. presence of peat erosion).

Vegetation assessment

An assessment of the composition and condition of the restored vegetation, including:

- Percentage of surface covered by vegetation;
- Full plant species list, using the DAFOR assessment of abundance;
- Photographs of a series of appropriately placed GPS-located 2m x 2m quadrats for each restored location monitored; and
- Estimated NVC class.

Monitoring/inspection of hydrological conditions

122. A combination of visual inspections and the use of regularly monitored WALRAGS will be used.

123. Bi-annually visual inspections will be made of blocked and infilled ditches and gripps for the first two years after construction (assuming that ditches are blocked at the time of construction or immediately after).

124. It is proposed that WALRAGS are inserted in three locations, all within Area B. These locations will be monitored bi-monthly for 12 months prior to ditch blocking, then bi-monthly for two years after blocking. These results will determine whether ditch and gripp blocking has been successful in raising the water table more generally across Area B.

125. It is proposed that detailed annual quadrat monitoring of vegetation is carried out in Areas C & D, listing all plant species present and their cover (using the DOMIN scale) as well as assigning and NVC category to each field area.

Monitoring reporting and action plan

126. The outcome of each visual inspection will be a brief note to confirm status of all restored areas and to indicate any locations where restoration requires further remedial action. If remedial action is required, activities and appropriate methods will be formulated and implemented. Monitoring reports will be sent to both Derry & Strabane District Council and to NIEA.

Personnel Roles and Responsibilities

Personnel roles and responsibilities during the construction phase

127. The implementation of this HMP will require certain key responsibilities to be assigned to defined roles. The following roles are key to the success of the HMP:

- Key roles in the effective delivery of the HMP lie with the Construction Contractor's Site Environmental Engineer who will be assisted by the ECoW for the Proposed Development;
- The Site Environmental Engineer and the ECoW will supervise and provide quality control on soil, peat and vegetation stripping, temporary stockpiling and vegetation restoration aspects of work. The Site Environmental Engineer and the ECoW will have a key role in ensuring that the control measure methodologies described in this HMP are correctly implemented;
- The ECoW will be responsible for carrying out in situ inspections of temporary turf storage/stockpiling areas and vegetation conditions in restored areas;
- The ECoW will be responsible for carrying out and reporting on monitoring after habitat restoration and vegetation enhancement activities have been completed; and
- The ECoW will provide the valuable link between the development team and liaison with the regulatory authorities with regard to compliance.

Training for construction personnel during the construction phase

128. To ensure that all site personnel understand the need for protection of valued habitats (blanket bog and wet heath), a series of toolbox talks will be provided by the ECoW for all construction personnel. These talks will include topics such as why the UK and Northern Ireland value these habitats, and how well-planned construction methods and carefully implemented vegetation stripping and re-instatement can be undertaken to assure the successful restoration of temporarily impacted habitats.

Conclusions

129. The proposed site of the Mullaghclogher Wind Farm Development consists of areas of degraded blanket bog, degraded wet (and dry) heathland, acid grassland, marshy grassland, and semi-improved and improved grasslands. Although degraded, the blanket bog and wet (and dry) heath habitats are still classified as NI priority habitats.

130. The land has been subject to a range of agricultural land management practices including artificial drainage to lower the water table, dry out the land and permit mowing and stock (primarily sheep) grazing.

131. This HMP has been produced to describe and quantify the proposed habitat restoration and enhancement measures which will accompany the wind farm development; its overall purpose is to ensure that identified impacts of the development are appropriately and sufficiently mitigated. In particular, the HMP aims to provide compensatory habitat improvement that sufficiently offsets the loss of degraded NI priority habitats.

132. Excluding stock management, four different types of habitat enhancement are proposed at Mullaghclogher:

- diversifying the structure of mature *Calluna* swards by mowing and creating irregular sward edges within Area A;
- raising water table levels in blanket bog and wet heath by ditch blocking within HMA1 and HMA2;
- diversifying degraded blanket bog by overseeding with heather within Area B; and
- creating more *Calluna*-dominated heathland habitat where there is currently semi-improved and marshy grasslands, within Areas C & D.

133. In addition to these activities, the developer will work with landowners to manage stock grazing densities and the timing of grazing to prevent further degradation of peatland habitats through grazing, trampling and dunging.

134. The total area which will be enhanced by the four activities above is 270.2ha.

135. Excluding the habitat betterment that will result from improved stock management and reduced grazing densities for the 35-year lifetime of the development, the proposed area of peatland enhancement is approximately 42 times greater than the area of NI priority habitat with will be lost to the development.

136. The additional management of sheep grazing and reduction of stocking to 0.075 LU/ha across the majority of the site, including the enhanced areas described above, over the 30-year lifetime of the development would represent a significant reduction in grazing pressure and will result in a very significant improvement of sward structure, sward quality and biodiversity of degraded blanket bog and wet heathland.

137. Should the Mullaghclogher Wind Farm Development be permitted, there will be the opportunity to work with the landowner to manage the land in a manner that promotes the re-instatement of improved blanket bog and wet heath habitat conditions, as preventing agricultural practices that have a deleterious effect on NI priority habitats is the first and most important step in restoring these peatland habitats to a favourable conservation status.

138. The Mullaghclogher Wind Farm Development will provide a valuable vehicle for delivering enhancement of degraded blanket bog and wet heath and thereby contributing to Northern Ireland's Habitat Action Plan (NIHAP) targets for these habitats. In the absence of other funding for habitat management outside of designated sites, cooperation between the NIEA and other partners, including wind farm developers, is likely to be one of the very few ways in which existing degraded and fragmented blanket bog and wet heath habitats in the uplands of Northern Ireland can be restored and enhanced, and therefore one of the few ways in which NIHAP targets can be achieved.

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Appendix 1. Figures

MULLAGHCLOGHER WIND FARM

FIGURE 1

WATERCOURSES & DRAINAGE DITCHES

KEY

- SITE ENTRANCE LOCATION
- LAND UNDER APPLICANT CONTROL
- PLANNING APPLICATION BOUNDARY
- DITCH BLOCKING
- WATERCOURSE & DITCHES
- TURBINE LOCATION
- WATERCOURSE CROSSING
- ACCESS TRACK
- CRANE HARDSTANDING (TEMPORARY)
- CRANE HARDSTANDING (PERMANENT)
- SUBSTATION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- BATTERY STORAGE COMPOUND

LAYOUT DWG	T-LAYOUT NO.
DRAWING NUMBER	

SCALE - 1: 12,000 @ A3

OUTLINE HABITAT MANAGEMENT PLAN

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MULLAGHCLOGHER WIND FARM

FIGURE 2

NVC PHASE 2 VEGETATION

KEY

- SITE ENTRANCE LOCATION
- LAND UNDER APPLICANT CONTROL
- PLANNING APPLICATION BOUNDARY
- TURBINE LOCATION
- WATERCOURSE CROSSING
- ACCESS TRACK
- CRANE HARDSTANDING (TEMPORARY)
- CRANE HARDSTANDING (PERMANENT)
- SUBSTATION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- BATTERY STORAGE COMPOUND
- H12 HEATH
- H21 HEATH
- H21 M20 MOSAIC
- M17 M19 MOSAIC
- M19 BLANKET MIRE
- M19 BLANKET MIRE M25 MOSAIC
- M19 M20 MOSAIC
- M19 U2 MOSAIC
- M20 BLANKET MIRE
- M20 H12 MOSAIC
- M20 M23a M23b MOSAIC
- M20 M25 MOSAIC
- M20 UNCLASSIFIED ACID GRASSLAND MOSAIC
- M20 UNCLASSIFIED WET HEATH MOSAIC
- M23a
- M23a ACID GRASSLAND MOSAIC
- M23a M23b MOSAIC
- M23a MG10 MOSAIC
- M23b
- M23b MG10 MOSAIC
- M25
- MG10
- MG7
- UNCLASSIFIED WET HEATH
- UNCLASSIFIED WET HEATH U4 MOSAIC
- WET HEATH U2 MOSAIC

LAYOUT DWG	T-LAYOUT NO.

DRAWING NUMBER

SCALE - 1: 12,000 @ A3

OUTLINE HABITAT MANAGEMENT PLAN

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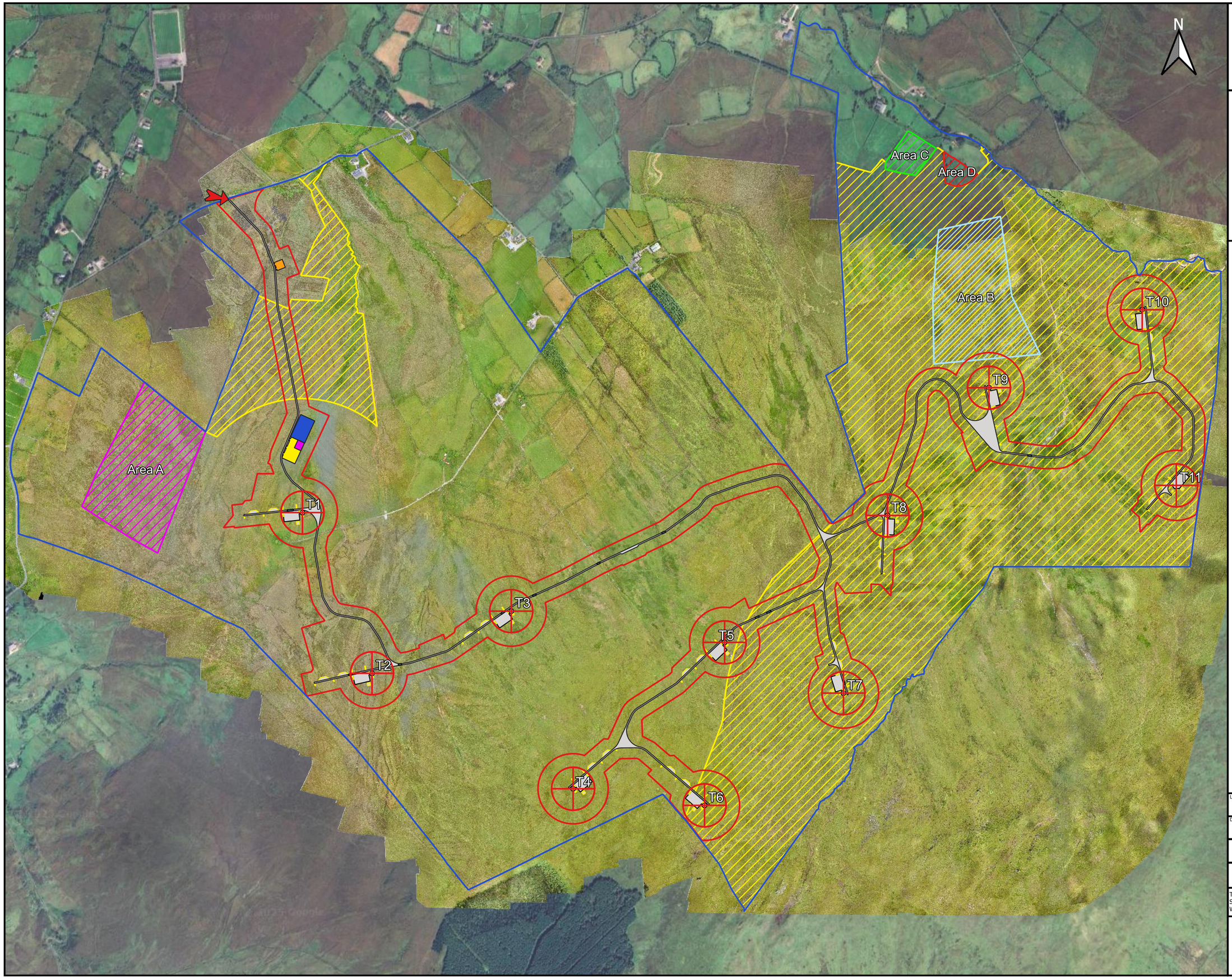

MULLAGHCLOGHER WIND FARM

FIGURE 3

HABITAT ENHANCEMENT AREAS

KEY

- SITE ENTRANCE LOCATION
- LAND UNDER APPLICANT CONTROL
- PLANNING APPLICATION BOUNDARY
- TURBINE LOCATION
- WATERCOURSE CROSSING
- ACCESS TRACK
- CRANE HARDSTANDING (TEMPORARY)
- CRANE HARDSTANDING (PERMANENT)
- SUBSTATION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- BATTERY STORAGE COMPOUND
- HABITAT MANAGEMENT AREA
- HABITAT MANAGEMENT AREA A (13.72ha)
- HABITAT MANAGEMENT AREA B (13.48ha)
- HABITAT MANAGEMENT AREA C (1.58ha)
- HABITAT MANAGEMENT AREA D (0.81ha)

LAYOUT DWG	T-LAYOUT NO.
DRAWING NUMBER	

SCALE - 1: 12,000 @ A3

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MULLAGHCLOGHER WIND FARM

FIGURE 4

GRAZING PRESCRIPTIONS

KEY

- SITE ENTRANCE LOCATION
- LAND UNDER APPLICANT CONTROL
- PLANNING APPLICATION BOUNDARY
- REDUCED GRAZING AREA
- TURBINE LOCATION
- WATERCOURSE CROSSING
- ACCESS TRACK
- CRANE HARDSTANDING (TEMPORARY)
- CRANE HARDSTANDING (PERMANENT)
- SUBSTATION COMPOUND
- TEMPORARY ENABLING WORKS COMPOUND
- TEMPORARY CONSTRUCTION COMPOUND
- BATTERY STORAGE COMPOUND

LAYOUT DWG	T-LAYOUT NO.
DRAWING NUMBER	

SCALE - 1: 12,000 @ A3

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Appendix 2. Areas of Habitats Impacted by the Development

Habitat Type	Total Loss (m^2)	Total Permanent Loss (m^2)	Total Temporary Loss (m^2)
H12 heath	6290	5916	373
H21 heath	1031	1031	0
H21 M20 mosaic	2342	2152	191
M17 M19 mosaic	0	0	0
M19 blanket mire	42794	38125	4669
M19 blanket mire M25 mosaic	1048	1048	0
M19 M20 mosaic	768	768	0
M19 U2 mosaic	546	546	0
M20	0	0	0
M20 blanket mire	9757	9022	735
M20 H12 mosaic	3915	3123	792
M20 M23a M23b mosaic	1185	1185	0
M20 M25 mosaic	6339	4100	2239
M20 U2 mosaic	0	0	0
M20 unclassified acid grassland mosaic	968	968	0
M20 unclassified wet heath mosaic	1970	1955	15
M23a	2310	2016	294
M23a acid grassland mosaic	4213	3345	868
M23a M23b mosaic	1631	1631	0
M23a MG10 mosaic	3629	3195	434
M23b	570	487	84
M23b MG10 mosaic	6960	5002	1958
M25	481	481	0
MG10	6845	6204	641
MG7	1076	607	470
Unclassified wet heath	6263	4482	1781
Unclassified wet heath U4 mosaic	671	671	0
Wet heath U2 mosaic	368	368	0
TOTAL	**113974**	**98429**	**15545**