Bute Energy
Aberedw Energy Park

Appendix 7.2:

Aberedw Energy Park Habitat Survey Report

Aberedw Energy Park Limited

Aberedw Energy Park Environmental Statement
Appendix 7.2: Habitat Survey Report

Project Number
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Contents

Chapter 1
Introduction

1.1 This appendix details the methods and results from habitat and vegetation surveys carried out at the Aberedw Energy Park Site, hereafter referred to as 'the Site'.

1.2 **Annex A** of this report comprises the Environment Systems Habitat Survey of Aberedw (May 2021, 'the 2021 Report'). LUC undertook habitat surveys of the Site in 2024 and 2025 to address new areas included in the red line boundary for the Site and to ground truth and update the 2021 Report. Only significant changes from the 2021 Report are discussed and set out below.

1.3 This data was completed to inform an Ecological Impact Assessment (EcIA) of the Site and has been written to support **Chapter 7: Ecology (non-avian)** of the Environmental Statement (ES). This Chapter should be read in conjunction with **Chapter 9: Hydrology, Hydrogeology and Geology.**

Supporting Documents

1.4 This Appendix supports the EcIA in addition to the following Appendices:

- **Appendix 7.1: Desk Study;**
- **Appendix 7.3: Protected Species Survey Report;**
- **Appendix 7.4: Bat Survey Report;**
- **Appendix 7.5: Outline Habitat Management Plan;**
- **Appendix 9.1: Geological and Ground Conditions Desk Study;** and

1.5 This Appendix is supported by the following figures which can be found in **Volume 2** of the ES:

- **Figure 7.2: Ecology Survey Area**;
- **Figure 7.3a: Phase 1 Habitat Survey Results;**
- **Figure 7.3b: National Vegetation Classification (NVC) Survey Results**;

Terminology and Survey Areas

1.6 The following terminology will be used throughout this Appendix:

- **Site**
  - All land within the red-line boundary, as shown in **Figure 7.2**, which totals 1323 hectares (ha);
- **Proposed Development**
  - The Proposed Development comprises the construction and operation of up to 18 wind turbines and associated infrastructure. The indicative output capacity at this stage is approximately 120MW and the operational lifespan is 40 years. In accordance with the Town and Country Planning Act 1990 (as amended) and the Developments of National Significance (Specified Criteria and Prescribed Secondary Consents) (Wales) Regulations 2016 (as amended), the Proposed Development is a 'Development of National Significance' (DNS) as it is anticipated that the turbines will have a combined installed capacity of greater than 10 megawatts (MW). As such, it would be a DNS, and consent will be required from the Welsh Ministers (via Planning and Environment Decisions Wales (PEDW)).
- **Ecology Survey Area (ESA)**

- The area within and adjacent to the red-line boundary in which all ecology surveys were undertaken in line with good practice guidelines for all ecological features surveyed (as shown in **Figure 7.2 Ecology Survey Area.**
- The ESA has been calculated to be 1323ha.

- **Access Road Area**
  - Part of the ESA comprising the proposed access road entering the northeast of the Site (as shown in **Figure 7.2**).
- **Northern Substation Area**
  - Part of the ESA comprising the proposed substation connection area in the far north of the Site (as shown in **Figure 7.2**).
- **Southern Fields Area**
  - An area of fields near the southern boundary, just west of Wylfre Hill, surveyed in May 2025 (as shown in **Figure 7.2**).

Chapter 2
Methods

Baseline Data Collection

Desk Study

2.1 A desk study (see **Appendix 7.1**) was completed in 2021 and updated in 2025 to determine potential impacts on statutory and non-statutory designated sites within a 5km buffer of the Site. Data was also obtained from the DEFRA Magic Map system and geological data of the Site was also recorded from the British Geology Map and Welsh Government Geology maps.

Environment Systems 2020 Habitat and Vegetation Surveys

2.2 Following the initial desk-based review, a Phase 1 Habitat Survey and NVC Surveys were completed by Environment Systems in 2020, to verify the habitat types and to target habitats that are potentially Important Ecological Features (e.g. potential Ground Water Dependent Terrestrial Ecosystems (GWDTE), peat producing habitats, Annex 1 habitats, habitats listed in Section 7 of the Environment (Wales) Act 2016, and uncommon or rare habitats).

2.3 Details of these surveys and the methodology are provided in the Environmental Systems report, in **Annex A** of this report.

LUC 2024 and 2025 habitat and Vegetation Surveys

2.4 The following walkover surveys were undertaken by LUC to update the 2020 baseline and to survey new areas of the Site that were added to the ESA:

- An updated walkover habitat and NVC survey of the upland parts of the Site in June and August 2024;
- An initial survey for the 'Access Road Area' in June 2024 and March 2025;
- An update survey of the 'Northern Substation Area' in March 2025; and
- An initial survey of the 'Southern Fields Area' to the south (see **Figure 7.2**) in May 2025.

2.5 There were two main components to the walkover survey, the Phase 1 Habitat Survey and the more detailed NVC, both of which were used to either to confirm the 2020 results, or, where differences were observed, to record changes. The methods are outlined below and follow best practice guidance produced by JNCC Phase 1 method[1], the Rodwell NVC method[2], the Chartered Institute of Ecology and Environmental Management (CIEEM)[3] and the British Standards Institute[4].

2.6 Phase 1 Habitat Surveys were undertaken across the whole Site, and NVC was applied to habitats of potential conservation concern (i.e., Annex 1 Habitats, Priority Habitats listed under Section 7 of the Environment (Wales) Act 2016 and potential GWDTEs).

2.7 All survey data was collected on GIS-enabled field tablets to increase accuracy and facilitate robust interpretation. Where field evidence was recorded, photographs (referred to as 'Images') were taken for later analysis.

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[1] Joint Nature Conservation Committee (2010) Handbook for Phase 1 Habitat Survey – A Technique for Environmental Audit. Peterborough.
[2] Rodwell, J.S. (2006) NVC Users' Handbook. Peterborough: JNCC.
[3] CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal and Marine. Winchester: Chartered Institute for Ecology and Environmental Management and CIEEM (2017). Guidelines for Preliminary Ecological Appraisal. 2nd Edition. Winchester: Chartered Institute for Ecology and Environmental Management.
[4] BSI (2013) BS 42020:2013: Biodiversity – code of practice for planning and development. Bristol: British Standards Institution.

Extended Phase 1 Habitat Survey

2.8 The Phase 1 Habitat Survey was undertaken, following standard methods[1], by experienced ecologists. The Phase 1 Habitat Survey method provides a means of rapidly classifying broad habitat types in any given terrestrial survey area.

2.9 During the survey, field surveyors walked across all parts of the ESA to map broad habitat types and their boundaries. Sufficient species identification was undertaken to accurately classify habitat types, using the DAFOR scale[5].

National Vegetation Classification (NVC)

2.10 NVC surveys were undertaken of all habitats identified as being of Important Ecological Features (as defined above) during the Phase 1 Habitat Survey. The NVC survey was completed following best practice guidelines[2] to map habitats based on the characteristics of the vegetation. Structure, condition and species composition were recorded (where changes from the 2020 baseline were identified) including detailed notes on the species present and abundance within stands of vegetation.

2.11 The Domin scale of cover/abundance (**Table 2.1**) was used in compliance with best practice guidelines[2]. Data collected in the field was assessed and NVC communities (and, where possible, sub-communities) were assigned to each assemblage.

2.12 Where vegetation communities weren't taken to NVC sub-community level, this does not constrain the assessment because the Annex I, Welsh Priority Habitats List and potential GWDTE habitats here are all identified based on their NVC communities and are unchanged by additional information on sub-communities.

2.13 Habitats that do not have an NVC code (for example improved grassland and some forms of poor semi-improved grassland), were left blank. Where habitat mosaics were present, NVC ratios were included to give the reader a sense of the abundances of each NVC code within the land parcels.

Table 2.1 Domin scale of cover/abundance

Cover	Domin
91-100%	10
76-90%	9
51-75%	8
34-50%	7
26-33%	6
11-25%	5
4-10%	4
<4% (many individuals)	3
<4% (several individuals)	2
<4% (few individuals)	1

Constraints and Limitations

2.14 All ecological surveys represent a snapshot in time. Habitats and species assemblages are dynamic and change over time in response to a range of variables. Data presented in this Appendix should not be considered a long-term interpretation of ecological data and should not be relied upon as such.

2.15 Surveys were completed during the optimal survey season for habitat and vegetation studies (April to September), and as such, the data gathered is considered robust for the purposes of informing the ES.

[5] DAFOR scale: D=Dominant, A=Abundant, F=Frequent, O=Occasional, R=Rare.

2.16 Some areas of the ESA were not fully accessible due to the boggy or steep terrain encountered. Where this was the case, areas were viewed from vantage points and binoculars were used to identify habitat types. This was sufficient for identification of the habitat and therefore, is not seen as a constraint to the robustness of the surveys.

2.17 Due to the complex topography and scale of the Site, it is not possible to record all habitats that occur as small extents or isolated features. However, particular attention was paid around proposed turbine locations to ensure the most detailed and robust data was gathered for the infrastructure locations.

2.18 Given the large and topographically challenging nature of the Site, local small-scale variation in vegetation communities, and time constraints, detailed mapping of NVC sub-communities would be particularly challenging and time-consuming. As such, NVC data was often mapped to community level only unless there was a specific reason to record the sub-community. This is not considered to be a significant constraint to the assessment because habitats of conservation concern are commonly identified on the basis of their NVC communities and are unchanged by additional information on sub-communities.

2.19 While care has been taken to collect and review habitat data, it is not possible to account for any changes that may occur in the intervening period between data collection and submission of the ES.

Chapter 3
Results

Background and Context

3.1 An initial habitat survey of the Site was undertaken by Environment Systems in October 2020, reported in May 2021 (see **Annex A**). LUC undertook an updated walkover habitat and NVC survey of the upland parts of the Site in June and August 2024 and the 'Northern Substation Area' (March 2025). Initial surveys were undertaken for areas which were not part of the 2020 baseline, which comprised the 'Access Road Area' (June 2024 and March 2025) and the 'Southern Fields Area' to the south (see **Figure 7.2**) in May 2025.

3.2 An updated Phase 1 Habitat map (**Figure 7.3a**) and an updated NVC map (**Figure 7.3b**) provide the Site's current baseline, which incorporates any identified changes and newly surveyed areas of the Site.

Habitat and Vegetation Survey (Environment Systems 2020, reported 2021)

3.3 The field and desk surveys carried out by Environment Systems in 2020 recorded 11 NVC communities present on the Site, including:

- Mires and flushes: M1, M6, M17, M23
- Dry Heath: H8, H12, H18
- Grasslands and Bracken: U5, U20, MG7

3.4 The report results can be found in **Annex A**.

3.5 The dominant vegetation community on Site was 'continuous bracken', which formed around 60% of the Site. Improved grassland comprised another 7.5% whilst 'dry dwarf shrub heath – acid' formed 11% and 'dry heath acid grassland mosaic' formed 10.8%. Smaller areas of acid grassland (semi-improved) represented 5% and small parcels of woodland habitats were also present.

3.6 The Environment Systems survey boundary did not include the Access Road Area or the Southern Fields Area.

Habitat and Vegetation Survey (LUC 2024 and 2025)

3.7 The 2024 LUC surveys of the main upland parts of the Site found that the habitats had remained the same as previously classified by Environment Systems in the 2021 Report with one main exception, set out below.

Changes to upland area since the 2021 Report

3.8 A wet habitat parcel around Grid Reference SO093523, to the north of the M17/M1 bog area (coloured cream on Figure 7.3b.b), was labelled in the 2021 Report as M25 in one map and M16 in another.

3.9 In the LUC 2024 survey, the area comprised dry heath/acid grassland mosaic with a central wet area (see **Figures 7.3a and 3b**). In the central wet area, Sphagnum mosses were abundant and diverse and there is an abundance of common cotton-grass *Eriophorum angustifolium*. *Sphagnum papillosum,* was present, though not in high abundance, and hare's-tail cotton grass *E. vaginatum* was absent. *S. rubellum* and *S.denticulatum* were also present, in addition to carnation sedge *Carex panicea,* and star sedge *C. echinata*. Matt grass *Nardus stricta,* was frequent. *S. compactum* was not noted. The vegetation community did not fit neatly into an NVC community, however, based on the species composition and topography, the closest fit was determined most likely to be M6b, which is a grassy/sedgey form of M6 acid flush, and can result from intensive grazing.

3.10 The remainder of the habitat parcel comprised a mosaic of H12/U5. The presence of H12/U5 further reduces the likelihood that the area was ever M16 or M25, because intensive grazing of those habitats would not usually result in H12/U5.

3.11 The M6b acid flush is in a slight depression and drains via a small stream that flows east-north-east. The peat survey did not find peat in this area (see **Chapter 9: Hydrology, Hydrogeology and Geology: of the ES**). While the habitat does not fit neatly into an NVC community, due to being heavily modified, the closest fit is M6 and it is therefore in line with a precautionary approach it is considered a potential GWDTE.

Northern Substation Area

3.12 The Northern Substation Area was resurveyed by LUC in March 2025. The 2020 Habitat Survey identified this area as primarily comprising improved grassland and woodland and this was confirmed by LUC in 2025, when all fields were improved except two fields on the eastern edge which were semi-improved. Other habitats present included:

- Three areas of ancient semi-natural broadleaved woodland;
- Ponds (A2, A4, A61, as detailed in Appendix 7.3: Protected Species Survey Report);
- A small quarry area;
- Individual mature trees including sessile oak *Quercus petraea*;
- Hedgerows;
- Disused shed buildings;
- Small watercourses/drains and streams.

Access Road Area

3.13 The Access Road area was not surveyed in 2020 but was surveyed by LUC in 2024 and 2025. The route follows an existing road which passes through areas of cattle and sheep grazed improved grassland and large patches of bracken (harvested every 2 years). A variety of hedgerows bordered some of the improved fields, some of these hedgerows were native and species rich.

3.14 A small stream ran along a tree line south-east to the south of the access track: the stream had minimal marginal vegetation. Farm buildings occurred to the north of the access track with some fruit trees/ small orchard. A small parcel of mixed woodland occurred to the west of the farm buildings, comprising mostly ash and field maple. A linear band of woodland occurred on the eastern side of the farm buildings comprising hawthorn, blackthorn, lime and coniferous species.

Southern Fields Area

3.15 A spur of farmland extended northwards into the Site just west of Wylfre Hill: this was not previously surveyed in 2020 but was surveyed by LUC in May 2025. The fields comprised improved grassland, with some acid grassland and bracken/gorse scrub (ffridd) on the western hillside sloping upwards. The Cwmblaenerw Brook ran along the valley floor here, cloaked in mixed and broadleaved woodland.

Chapter 4
Summary

4.1 The Site contained minor coverage of flush, mire and blanket bog plant communities which collectively occupied approximately 2.68ha, accounting for less than 0.2% of the total ESA. Blanket mire was present in the communities of M1 and M17, with soligenous mire communities M6 also present in small discrete areas. Rush pasture NVC community M23 is a rather ill-defined assemblage of vegetation (Rodwell et al., 1998) and accounted for 3.62ha across the ESA.

4.2 Dry heath/acid grassland mosaic accounted for 133ha of the ESA, collectively comprising approximately 10% of the Site's area. Dry dwarf shrub heath -acid covered 132ha and comprised around 10% of the Site. NVC communities H8, H12 and H18 were present, with the largest coverage being H18 *Vaccinium myrtillus – Deschampsia flexuosa*. Small patches of this community were a reasonably good fit to the NVC, but the large majority of all upland heathland had been grazed and impacted by anthropogenic disturbances, and were therefore rather degraded and of poor quality. A mosaic of these habitats and the U5 *Nardus stricta – Galium saxatile* grassland was prevalent across the higher plateaux of the ESA. Grasslands and bracken-dominated habitats were abundant, covering approximately 866ha and comprising 65% of the Site's area. NVC communities present included MG7, U5 and U20, the latter of which accounted for 56.5% of the ESA's area.

4.3 The ESA is largely covered by dense bracken, which was utilised by local farmers for livestock feed. Where the topography was advantageous, other floral communities such as mire, upland heathland and rush-pasture dominated, although these were minor in comparison with the bracken. The Site had historically been, and was still being, subjected to sheep and pony grazing, as well as being accessible to the public by walkers and off-road bikers.

4.4 A small amount of farmed improved grassland occurred in the Northern Substation Area, Access Road Area and Southern Fields Area.

4.5 Broadleaved woodlands were mostly restricted to adjacent land off site, although blocks of ancient broadleaved woodland occurred in the Northern Substation Area and along the valley floors in the south of the Site.

Nature conservation significance of habitats

4.6 The majority of the Site comprised habitats of low ecological value for nature conservation, in the form of managed bracken and improved grassland communities.

4.7 A small amount of wet mire and flush communities occurred on Site, covering less than 0.5%. The discrete area of M17 and M1 blanket bog within the survey area had been modified to some degree by anthropogenic activities such as livestock grazing and to some extent drainage. Despite this falling under the 'Blanket bog' habitat type, peat survey results found limited shallow peaty soils in this area of 12 to 14cm. These impacts are likely to have influenced the extent to which this bog can continue to form peat. The habitat is therefore considered to be a degraded form of blanket bog Annex 1 habitat.

4.8 The heathland communities on Site are common habitats across much of Welsh uplands. Nearly all dry heath is semi-natural, being derived from woodland through a long history of grazing and burning (JNCC). The most commonly found community within the study area was that of NVC H8, however, these were areas of species-poor heaths with much *Ulex gallii* but no *Calluna* or *E. cinerea*. The areas of H8 heath were therefore not considered Annex I habitat in this case in the Environmental Systems 2021 report. This conclusion is in line with guidance produced by Ben and Alison Averis[6], who note that this community is not well represented within the NVC, but widespread in Wales, having an affinity to H8, but more closely aligned to scrub than heathland.

[6] Ben and Alison Averis (June 2020). Plant Communities Found in Surveys by Ben and Alison Averis but Not Described in the UK National Vegetation Classification, pages 11 and 71.

4.9 The H12 community was infrequent within the Site, and also commonly supported a range of acid grassland species, which made a poor fit for the NVC. The grassland/heath mosaic is not represented in the NVC but is more closely affiliated with a heavily grazed version of H12 Calluna vulgaris-Vaccinium myrtillus heath. It was therefore concluded in the Environmental Systems 2021 report that the areas of H12 heath were not considered to be Annex I habitat in this case, due to their degraded quality. However, we consider that these H12 habitats have the potential to be restored back to good condition and therefore, in line with a precautionary approach, we have assessed them as being degraded examples of Annex 1 habitat.

4.10 The frequently-occurring community of H18 Vaccinium myrtillus – Deschampsia flexuosa was also often in a mosaic with the U5 Nardus stricta – Galium saxatile grassland community, which dominated the very tops of the Site's plateaux. On account of the grazing activity that has historically occurred and is still occurring, alongside other anthropogenic activity such as tourism, the habitat present on site was degraded and of poor-quality. It was therefore concluded in the Environmental Systems 2021 report that the areas of H18 heath were not considered to be Annex I habitat in this case. However, we consider that these H18 habitats have the potential to be restored back to good condition and therefore, in line with a precautionary approach, we have assessed them as being degraded examples of Annex 1 habitat.

4.11 Section 7 of the Environment (Wales) Act lists the habitats of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales. Some of these priority habitats are quite broad and can correlate to a large number of NVC types. The relevant priority habitat types and associated NVC types (where attributed) recorded within the ESA are as follows:

- Upland heathland: H8, H12, H18;
- Blanket bog: M1, M17, M25;
- Purple moor-grass and rush-pastures: M23;
- Upland flushes, fens and swamps: M6; and
- Ponds.

4.12 Finally, the Powys Nature Recovery Action Plan includes Habitat Action Plans for 7 Habitats, the following of which occur on Site:

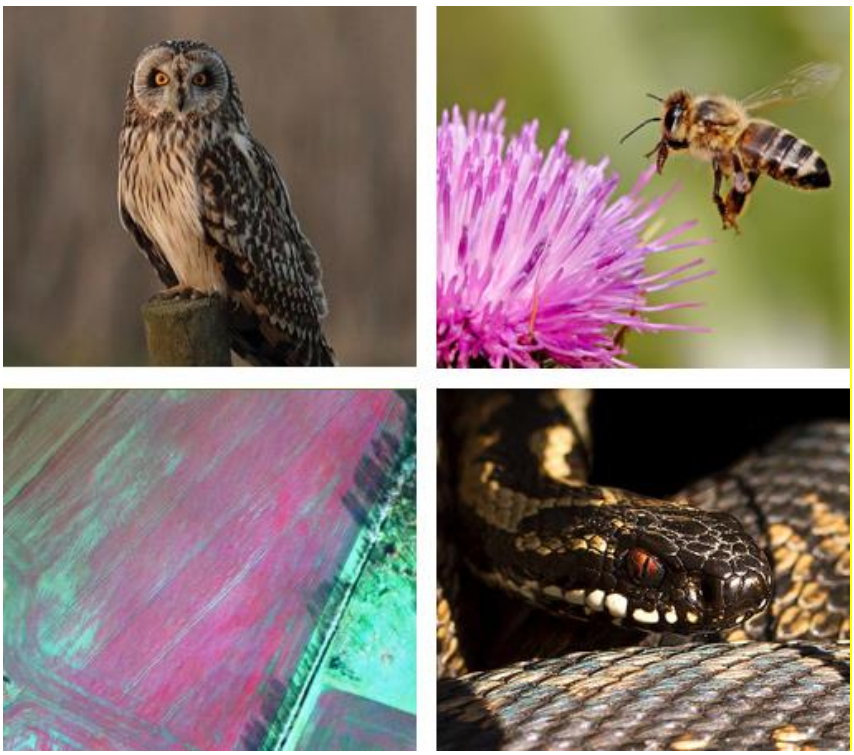
- Freshwater and wetlands: ponds and mire/flush communities.
- Grasslands: acid grassland
- Scrub and Ffridd: bracken and gorse scrub/Ffridd
- Upland and Heathlands: upland heathland communities
- Woodlands: broadleaved woodland in Substation area.

Annex A

Environment Systems 2021 Report

Builth Wells South Wind Farm

Habitat Survey



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Executive Summary

This report has been produced to provide a baseline assessment of the plant communities at the proposed Builth Wells South windfarm. The Application Site falls within the 1km Ordnance Survey Grid Reference (OSGR) SO 0951 and the local planning authority is Powys County Council (PCC).

The aim of the NVC survey is to identify and map the vegetation communities present within the site in order to identify those areas of greatest ecological interest (i.e., Annex I habitats; potential Groundwater Dependent Terrestrial Ecosystems (GWDTE), and Wales priority habitats. This information was used to inform the Proposed Development design process and the ecological assessment for the Ecological Impact Assessment (EcIA).

Surveys were conducted in 2020 by Environment Systems Ltd. In total 12 NVC communities were recorded, these did not make up the total area of the site due to the presence of habitats that are not able to be classified to the NVC, in particular conifer plantation, buildings and small areas of broadleaved woodland. In addition, due to anthropogenic pressures experienced by the site, habitats present have been degraded. Where a habitat partially resembles an NVC community it has been identified as such, despite not being a perfect match to the description. This was on account of the survey focussing on identification of Ground Water Dependent Terrestrial Ecosystems (GWDTE) and rapid classification of other habitat and floral communities.

The site contains minor coverage of mire plant communities which collectively occupy approximately 10ha, accounting for approximately 8.8% of the total site area. Blanket mire is present in the communities of M1 and M17, with soligenous mire communities M6 and M25 also present in small discrete areas. Some of these habitats correspond with habitats listed on Annex 1 of the Habitats Directive. Rush pasture NVC community M23 is a rather ill-defined assemblage of vegetation (Rodwell *et al.,* 1998) and accounts for 5.58 ha across the study area.

Heathland vegetation accounts for 131.5 ha of the site, collectively comprising approximately 9.87% of the site's area. Dry dwarf shrub heath of the communities H8, H12 and H18 are present, with the largest coverage being H18 *Vaccinium myrtillus – Deschampsia flexuosa.* Small patches of this community are a reasonably good fit to the NVC but the large majority of all upland heathland has been grazed and impacted by anthropogenic disturbances, and are therefore rather degraded and of poor quality. A mosaic of these habitats and the U5 *Nardus stricta – Galium saxatile* grassland is prevalent across the higher plateaux of the site. These communities do correspond with habitats listed on Annex 1 of the Habitats Directive.

Grasslands and bracken-dominated habitats are abundant, covering approximately 895ha and comprising 67.2% of the site's area. NVC communities present include MG7, U5 and U20, the latter of which accounts for 55.5% of the site's area.

The study area is largely covered by dense bracken, which is utilised by local farmers for livestock feed. Where the topography is advantageous, other floral communities such as mire, upland heathland and rush-pasture dominate, although these are minor in comparison with the bracken. The site has historically been, and is still being subjected to sheep and pony grazing, as well as being accessible to the public by walkers and off-road bikers.

Table of Contents

1. Introduction

Environment Systems Ltd ('Envsys') was commissioned by Bute Energy (the 'Applicant') to undertake habitat surveys to inform the Ecological Impact Assessment (EcIA) for the Builth Wells South Wind Farm, hereafter referred to as the 'Development'. The document presents the baseline habitat data prepared following surveys conducted in 2020.

1.1. Site Location

The site is located approximately 5km to the east of Builth Wells, Powys, and occupies an elevated area of upland ground on and surrounding Aberedw Hill. Land ranges in elevation from 220m Above Ordnance Datum (AOD) to 451 AOD covering approximately 1,260 ha. The study area in which habitat surveys were conducted encompasses the development boundary, henceforth referred to as the 'survey area'.

1.2. Policy and Legislation

Relevant wildlife and countryside legislation have been used along with planning policy guidance and a combination of local and national nature recovery action planning approaches to inform the habitat assessment.

The key articles of relevance are given in Table 1.

Table 1: Legislation and Policy Context Summary

Legislation/ Policy	Description
Habitats Directive (as amended)	In 1992 the then European Community adopted Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive'. The main aim of the 'Habitats Directive is to promote the maintenance of biodiversity by requiring member states to introduce protection for these habitats and species of European importance. The mechanism for protection is through designation of Special Areas of Conservation (SACs), both for habitats and for certain species listed within Annex II. In addition, the Habitats Directive provides specific protection of certain species.
The Bern Convention	The Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention) came into force in 1982. The principal aims of the Convention are to ensure conservation and protection of wild plant and animal species and their natural habitats (listed in Appendices I and II of the Convention), to increase cooperation between contracting parties, and to regulate the exploitation of species (including migratory species).
The Water Framework Directive	The Water Framework Directive (WFD) sets out the ecosystems dependent on groundwater and that are sensitive to the pressures that are potentially caused by development are protected. These are known as Ground Water Dependent Terrestrial Ecosystems (GWDTE) and correspond to wetland habitats that are often of nature conservation concern.
Wildlife and Countryside Act 1981 (as amended)	The WCA is the principal mechanism for the legislative protection of wildlife in Great Britain. However, it does not extend to Northern Ireland, the Channel Islands or the Isle of Man. This legislation is the means by which the Bern Convention and (partially) the Birds Directive and Habitats Directive are implemented in the UK.
Conservation of Habitats and	In the UK, the Habitats Directive was originally transposed into law by means of the Conservation (Natural Habitats, & c.) Regulations 1994 (as amended). The Regulations

Species Regulations 2017	came into force on 30 October 1994, and have been amended several times. Subsequently the Conservation of Habitats and Species Regulations 2017 was created which consolidates all the various amendments made to the 1994 Regulations in respect of England and Wales and is commonly known as the 'The Habitats Regulations'. The Regulations contain five Parts and four Schedules, and provide for the designation and protection of 'European sites', the protection of 'European protected species', and the adaptation of planning and other controls for the protection of European Sites. This legislation is the principle means by which the Habitats Directive and Birds Directive are implemented in the UK.
Environment (Wales) Act 2016	This act makes provision in respect of biodiversity, pesticides harmful to wildlife, protection of birds and invasive non-native species in Wales. Section 6 of this act introduces the biodiversity and resilience of ecosystems duty for which all public authorities in exercise of their functions must Section 7 of this act includes a duty on public bodies to have regard to the purpose of conserving biodiversity in the exercise of their functions. The list of habitats included in Section 7 defines those that are of principal importance in Wales and should be considered when public bodies exercise their duty.
Planning Policy Wales, Chapter 6	Planning Policy Wales (PPW) details measures to conserve landscape and biodiversity in the planning system. This national policy guidance details the features including statutory and non-statutory sites, protected species and trees and woodland and how they should be considered when making planning decisions.
Technical Advice Note 5	Technical Advice Note 5 (TAN5) outlines how the land use planning system in Wales should contribute to protecting and enhancing biodiversity and geological conservation. TAN5 details that when considering polices and proposals in planning applications at a local level the principles and material considerations are taken into account.
Powys Local Development Plan	The Powys Local Development Plan (LDP) includes Policy DM2 – The Natural Environment which require development proposals to demonstrate how they protect, positively manage and enhance biodiversity and geodiversity interests including improving the resilience of biodiversity through the enhanced connectivity of habitats within, and beyond the site.
Powys Nature Recovery Action Plan/ Local Biodiversity Action Plan	The national strategy for biodiversity is delivered at local level via Local Biodiversity Action Plans (LBAPs). The study area is covered by the Powys LBAP. It is understood the LBAP is currently in review and a new Powys Nature Recovery Action Plan (PNRAP) will focus on managing ecosystems to support wild flora and fauna with a list of species of Local Importance which will aid the assessment of species of local conservation concern.
The Hedgerow Regulations (1997) (as amended)	The Hedgerows Regulations make provision for the protection of important hedgerows in England and Wales. The regulations affect hedgerows which are 20m or more in length, or connected at both ends to another hedgerow of any length. They relate to hedgerows which are on, or adjoining land used for the following purposes: agriculture or forestry; the breeding or keeping of horses, ponies or donkeys; common land; village greens; Sites of Special Scientific Interest (which include all terrestrial SACs, NNRs, and SPAs) and Local Nature Reserves. They do not include hedges that are attached to, or marking the boundaries of a private house. It is an offence to intentionally or recklessly remove or cause or permit another person to remove a hedgerow or intentionally or recklessly remove, or cause or permit another person to remove, a hedgerow which is the subject of a hedgerow retention notice.

1.3. Rationale

In complex upland areas, habitat type can vary over short distances, the complexity of habitats and absence of features across the open moorland habitat means that accurately mapping habitat types in particular along the plateau is challenging within the field. Furthermore, with ongoing land improvement for more intensive livestock grazing across the area, it was deemed necessary to review the habitat surveys completed in previous years and update the habitat extents and boundaries based on the current survey data.

The Water Framework Directive includes requirements to prevent the derogation of waterbodies, including lakes, estuaries, coastal waters, rivers and aquifers. Implicit within these requirements is a need to protect wetlands, in particular where they are connected to waterbodies (e.g., fed by groundwater or dependent on river flooding) or form an integral part of a waterbody (e.g., the riparian zone of a river). Review of the historic habitat surveys confirmed the presence of Ground Water Dependent Terrestrial Ecosystems (GWTDE) and, as such, the areas of bog, flush and water bodies were considered as a potential 'Important Ecological Feature'. In terms of habitats, an Important Ecological Feature can be described as those that are listed on Annex 1 of the Habitats Directive, listed under Section 7 of the Environment (Wales) Act, or listed in the LBAP (or similar). The process to identify the Important Ecological Features of a potential Development site is an early-stage task in Ecological Impact Assessment (EcIA) which must be taken to determine the potential effects of the scheme when submitting a Development Consent Order or Planning Application for approval by the statutory authorities.

2. Habitat Survey Methodology

The approach taken in generating an up-to-date baseline of habitat information was completed by bringing together multiple techniques. These techniques included:

- Generating a baseline habitat boundary dataset using a GIS and remote sensing procedure
- Assessing whether the historic survey results are still accurate, using against the up-to-date boundary dataset (e.g., is it still a conifer plantation or has it been clear felled)
- Field survey to confirm habitat types, confirm species diversity and to target areas of the site likely to be considered as Important Ecological Features.

2.1. Delineating Habitat Boundaries

Earth observation (EO) is the use of data, from satellite and airborne sensors, for mapping and monitoring the Earth. It provides an accurate and repeatable methodology for ecological mapping particularly where vegetation is hard to survey or study areas are large and remote. EO has made progressive improvements in the spatial, temporal and spectral resolution of these sensors making them a valuable resource across a range of mapping scales for a variety of mapping requirements (Medcalf *et al*., 2014a, Medcalf *et al*., 2014b, and Medcalf *et al*., 2015). The Crick Framework (Medcalf *et al*., 2014a) provides a robust approach to defining what is possible to map using EO with imagery at different working scales and timings providing information from species level right through to the wider area perspective, as well as tracking cause, effect and change which are not directly possible with field methods. Given the historical survey effort of the site and the difficulties encountered during those surveys, it was considered that a combination of Object-Based Image Analysis (OBIA) (an EO technique) can be implemented to define the discrete boundaries of the habitats present within the survey area.

OBIA was used to group pixels from a Sentinel-2A satellite image from June 2017. Sentinel 2A is a 12-band optical satellite which includes Near Infrared (NIR) bands and Shortwave Infrared (SWIR) Bands. These bands are particularly useful for habitat mapping as they have a close relationship to vegetation. Figure 1 shows the reflectance curve for vegetation. The horizontal axis shows the electromagnetic spectrum with the Blue Green Red (RGB) visible part of the spectrum and then the longer wavelengths into the NIR and SWIR.

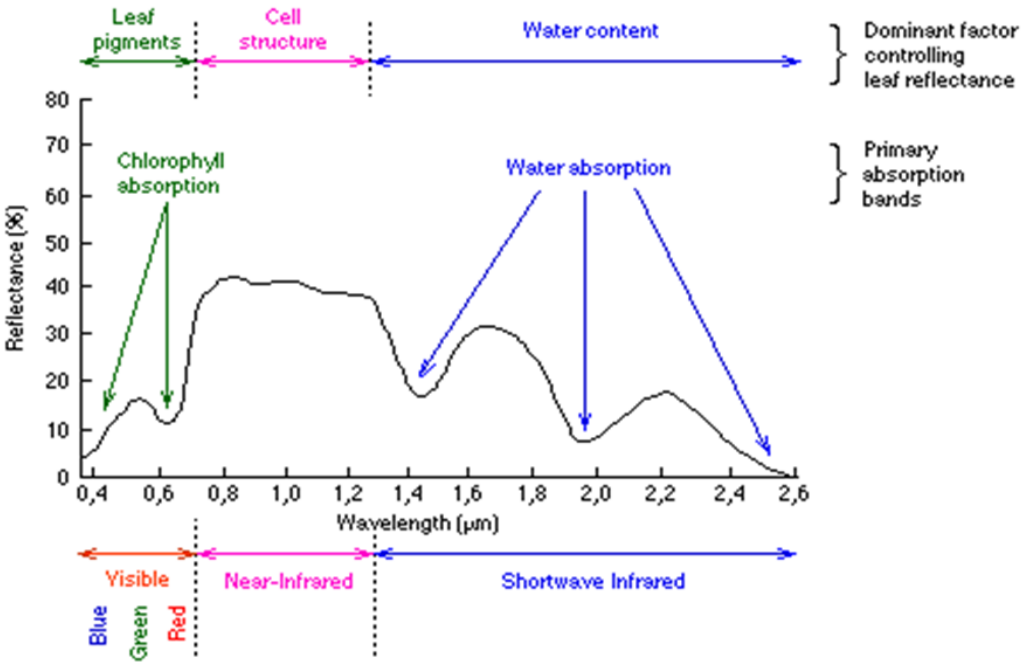

Figure 1: The spectral reflectance curve for vegetation

Green light is reflected from the top surface of the leaf, red and blue light are absorbed by the leaf and are used in photosynthesis, NIR light passes through the top surface for the leaf but is generally reflected from the lower surface, shown in Figure 2. The NIR signal is particularly useful for recording vegetation types as its strength is related to the leaf structure. Therefore, the more open and productive the vegetation the higher the NIR signal. Species such as agricultural grasses have a much stronger signal in the NIR band than scrub species for example, even though the RGB signal could be very similar.

Within the SWIR bands the signal is influenced by the water content of the vegetation and the soil and therefore can be useful for separating wet habitats such as blanket bog from those with similar species but on a drier mineral soil types such as gorse scrub and acid grassland and dwarf shrub heath.

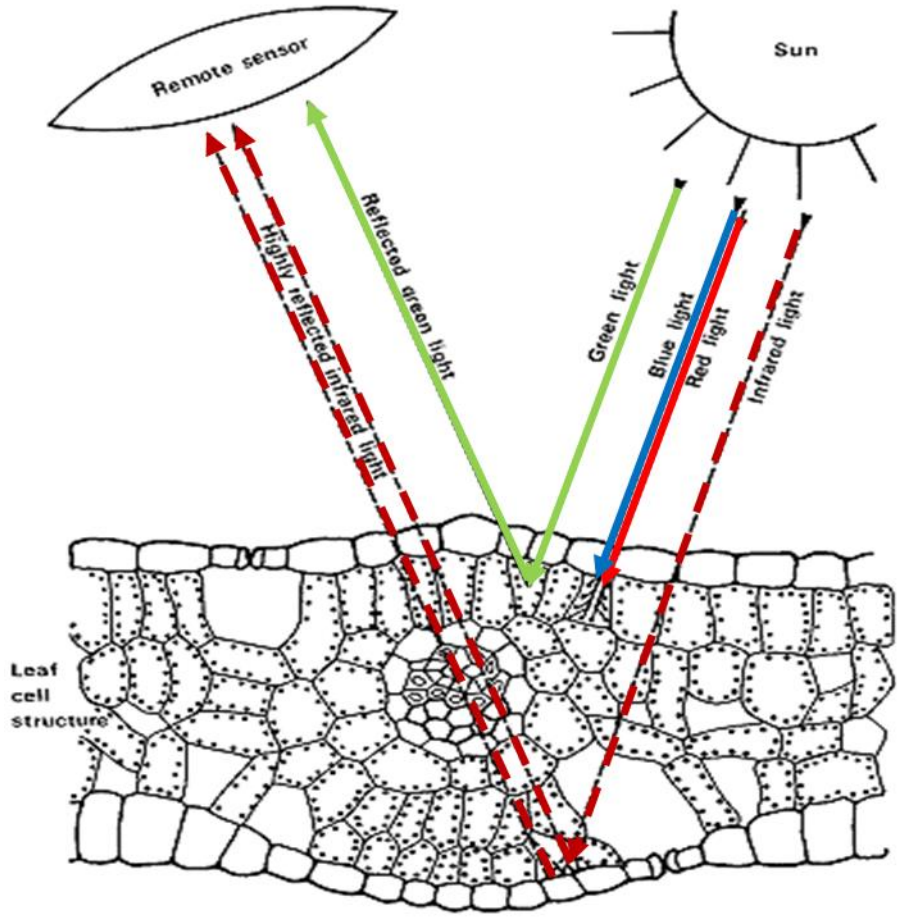

Figure 2: The profile through a leaf and how light is reflected and absorbed

EO images are gathered from above and therefore are best at identifying plant communities which have a distinctive appearance from above, either as an even cover of one or a range of canopy forming species. It struggles to find communities that are distinguished by the presence of small sized plants which occur in low frequency hidden by the over-storey canopy. The classification provided by remote sensing will therefore not completely equate to that which a botanist may record on the ground. However, as EO can quantify other bio-physical features of the vegetation such as productivity, it enables mapping of ecological functions which have a range of effects in terms of the ecosystem and their services than an area provides.

To ensure a high level of confidence in the updated habitat data, OBIA was completed by Dr Johanna Breyer FRGS and was only used to create the boundaries of habitats throughout the Development; this is known as image segmentation. This splits the image into objects of similar spectral characteristics based on size, colour and texture. The segmentation enables a rapid separation of the image pixels into a representative form of the real-world component they depict. Rephrased, the image segmentation process delineates the boundaries between habitat types using Geographical Information System (GIS) software.

In adopting this EO approach to delineating habitats within the survey area, it is possible for experienced field botanists to target habitats that are Important Ecological Features, confirm the boundaries of the habitats that make up the complex upland mosaics; and qualify species lists, in a timely and efficient manner in what can be difficult conditions to work in (e.g., inclement weather, livestock and dangerous areas of bog).

2.2. Field Survey

2.2.1. Verifying and Updating the Historical Habitat Survey Results

Following the desk-based review and the preparation of the habitat boundaries, field survey was completed to verify the habitat types and to target habitats that are potentially Important Ecological Features (i.e., GWDTE).

Areas of potential GWDTE such as bog, mire and flush were surveyed using a 'walkover' NVC approach. This has provided species lists that will be useful as a GIS layer for helping to design the wind farm layout. It is acknowledged that at the time of survey the layout of the wind farm, tracks and other associated infrastructure was not available (i.e. it had not been prepared). Once the layout has been prepared and is available, there may be a requirement to undertake further site visits to qualify any potential conflicts with GWDTE and other important habitats for micro-siting and designing mitigation.

The surveys were undertaken by Grace Dooley MSc ACIEEM between 25/09/2020 – 07/10/2020.

2.2.2. Phase 1 Habitat Survey

The Phase 1 Habitat Survey methodology (JNCC, 2010) is a technique for classifying and mapping habitats. Dominant plant species observed within each habitat type were recorded in accordance with plant species nomenclature in Stace (2010). Target Notes (TN) were used to identify potential for protected or priority species or habitats, and to provide more detailed site descriptions.

The Phase 1 Habitat Survey is sometimes synonymous with the 'Extended' Phase 1 Habitat Survey, where 'Extended' refers to assessment of habitat features that may support protected or priority species such as bats, great crested newts and birds. This type of survey was not conducted; habitat classification was the sole focus of the study.

2.2.3. National Vegetation Classification Survey Technique

National Vegetation Classification (NVC) is a detailed survey of various features of a habitat. Specifically Phase II NVC is intended to provide a detailed picture of the vegetation communities, their nature and distribution on the site at the present time. It will also provide an understanding of how the vegetation works in terms of how the particular plant communities relate to local climate, soil and human influences. The results provide detailed insight into the internal dynamics of the upland habitats and will provide a robust temporal baseline which follows from the original surveys through to present day and to future monitoring of construction and operational effects as a result of Development.

The methodology for NVC survey loosely followed that outlined in Rodwell (2006). The differences in plant communities were assessed mainly by eye by walking the site, and general communities identified by noting abundance of each floral species within sample 'quadrats' or pinpointed locations. Sampling concentrated on areas perceived to be Important Ecological Features and habitats whose vegetation is critically dependant on groundwater i.e., GWDTE.

Following analysis and interpretation of the field data, each vegetation community was subjectively appraised in respect of its relative intrinsic botanical value taking into account a number of criteria, including:

- The perceived nature conservation importance of the vegetation community e.g., uncommon or rare NVC communities and habitats of Principal Importance.
- Goodness of fit with 'type' NVC communities;
- Presence of notable plants or plant species with restricted ecological amplitude;
- Diversity.

Quadrat sampling was not used throughout the survey area, as experienced NVC surveyors do not necessarily need to record quadrats in order to reliably identify common NVC communities and sub-communities (Rodwell, 2006). Notes were made about the structure and flora of larger areas of vegetation in many places (such as the abundance and frequency of species, and in some cases condition and evident anthropogenic impacts). It can be better to record several larger scale qualitative samples than one or two smaller quantitative samples; furthermore, qualitative information from several sample locations can be vital for understanding the dynamics and trends in local (study area) vegetation patterns (Rodwell, 2006).

2.3. Limitations

The NVC system does not include all possible semi-natural vegetation or habitat types that may be found. Since the NVC was adopted for use in Britain in the 1980s further survey work and an increased knowledge of vegetation communities has led to additional communities being described that do not fall within the NVC system. Where such communities are found and recorded, they are given a non-NVC community code and are described.

Ecological surveys are limited by factors which affect the presence of plants such as the time of year and weather. The ecological surveys undertaken to support this project have not therefore produced a complete list of plants and the absence of evidence of any particular species should not be taken as conclusive proof that the species is not present or that it will not be present in the future. However, the results of these surveys have been reviewed and are considered to be sufficient to undertake the assessment.

The NVC category has been based on the species composition using a "best fit" method. Due to the lack of some species recorded in some of the quadrats it was often difficult to assign a definite category, as a number of different categories would fit. The NVC category has therefore been based on species, composition, peat depth and personal professional experience of mapping such habitats.

3. Results

3.1. Overview of the Habitats within the Development

The anthropogenic modification within the survey area, in combination with topographical and hydrological conditions, has given rise to the existence of a complex mosaic of habitats, which are variable in extent, structure and floristic composition. The boundaries between these habitats are often not particularly clear, and the habitats are often in a transitional state which do not readily sit within established classification categories.

The overview of the habitats is presented in the Phase 1 Habitat Survey style and where habitats of potential ecological importance identified these have been categorised using the NVC. A copy of the Phase 1 Habitat Map including NVC survey has been completed and features of interest are provided in Figure 3 and Figure 4. It should be noted that the site is large and the habitat map is best viewed in a GIS. Table 2 summarises the NVC communities and sub-communities found within the survey area which are discussed in the results text.

3.2. Summary of NVC Communities

The categories of vegetation within the study area include the following 11 NVC communities recorded during the survey:

- Mires and flushes: M1, M6, M17, M23, M25;
- Dry Heath: H8, H12, H18; and
- Grasslands and bracken: U5, U20, MG7.

Table 2 gives a summary of habitats recorded within the Development area

Table 2: Summary of habitats recorded within the Development area

Phase1 Habitat	NVC Community	Total Area Recorded (ha)	Approx. Percentage of Total Survey Area
A1.1.1 Semi-natural broadleaved woodland	N/A	26.637	2.06
A1.2.2 Coniferous woodland plantation	N/A	2.904	0.23
A3.1 Broadleaved parkland/scattered trees	N/A	67.517	5.23
B1.2 Acid grassland – semi-improved	U5	63.274	4.90
B4 Improved grassland	MG7	92.191	7.15
B5 Marshy grassland	M23, M25	8.049	0.62
C1.1 Continuous bracken	U20	739.613	57.33
D1.1 Dry dwarf shrub heath – acid	H8, H12, H18	134.863	10.45
D5 Dry heath/acid grassland mosaic	H18/U5; H12/U5	131.52	10.19
E1.6.1 Blanket bog	M17, M1	2.497	0.19
E2.1 Flush and spring – acid/neutral flush	M6	0.225	0.02
G1.2 Standing water	N/A	2.064	0.16
I2.1 Quarry	N/A	0.863	0.07
J1.1 Cultivated land	N/A	10.75	0.83
J1.3 Ephemeral / short perennial	N/A	2.357	0.18
J2.1.2 Species poor intact hedge	N/A	0.304	0.02
J3.6 Buildings	N/A	4.152	0.32
J5 Other habitat	N/A	0.268	0.02

	1223 ha (12,230,000 m^2)

3.3. Grassland Communities and Bracken-dominated Habitats

U5 Nardus stricta – Galium saxatile grassland community

The U5 grassland community is dominated by *Nardus stricta,* interspersed with *Agrostis capilliaris* and *Galium saxatile*. Moss species are scattered throughout at ground level, such as *Polytrichum commune* and *Pleurozium schreberi,* along with *Cladonia* lichen species. This habitat is present on the highest plateaux of the site, is well-grazed and is commonly associated with heavily-grazed examples of H18, with poorly-defined boundaries between the two.

U20 Pteridium aquilinum – Galium saxatile grassland community

The U20 *Pteridium aquilinum – Galium saxatile* community has vegetation dominated by *Pteridium aquilinum*, which can form extensive stands and was noted to be both standing, topped/laid over or had been harvested and baled. The community occupies the majority of the various land uses across the site, totalling 808.4 ha. It is most commonly present on the steeper slopes of the site where, along with scrub vegetation it forms 'ffridd' habitat, although it has been allowed to encroach over the top of lower hilltops for agricultural purposes. Within the community, species diversity is very limited due to the dense cover of *Pteridium aquilinum,* although around the edges where it is more easily grazed and along mown pathways *Galium saxatile* is present.

MG7 Lolium perenne leys and related grassland community

MG7 is present where the lowland slopes of the site are used for agricultural grazing. The habitat supports a low diversity of floral species which is dominated by *Lolium perenne, Holcus lanatus* and *Trifolium repens.*

3.4. Mire and Flush Communities

The discrete area of blanket bog within the survey area has been modified to some degree by anthropogenic activities such as live-stock grazing and to some extent drainage. The area marked as blanket bog contains significant amounts of *Sphagnum* mosses or cotton grasses that are bog-forming species that indicate active bog. The habitat is located primarily on the plateau area in the northern part of the survey area. The blanket bog is on level or very gently sloping ground. Within the survey area it is found in association with heath vegetation.

M1 Sphagnum auriculatum bog pool community

Instances of M1 are found only in association with the M17 blanket mire, and are present as shallow pools with floating and submerged *Sphagnum* moss species. The habitat is typical of bog pools commonly found in the west of Britain and are small in size, measuring on average 1.5-2m in length at 1m in width.

M6 Carex echinata - Sphagnum recurvum/denticulatum mire

M6 is found throughout the study area, present typically as small flushes or runnels, and around minor watercourses. It is noted that complex mosaics of grassland and flush are common in uplands (JNCC, 2007). All instances of M6 are of the species-poor M6c *Juncus effusus* sub-community although some *Juncus acutiflorus* is present.

M17 Scirpus cespitosus – Eriophorum vaginatum blanket mire

A discrete area of M17 is located in a largely central position within the site, measuring 2.5 ha. M1 community bog pools are found toward the western extent of the area, with visible patches of *Sphagnum* moss species and noticeable *Scirpus cespitosus*. Grazing and other anthropogenic activities, such as off-road biking have reduced the quality of the habitat and areas of *Juncus effusus* are also present on the edges.

M23 Juncus effusus/acutiflorus – Galium palustre rush-pasture

M23 accounts for 5.58ha within the study area, it is found to the northwest as a discrete stand. Overall, the rush-pasture vegetation comprises a fairly homogenous community in terms of species and structure, being typically rank. Most of it was not diverse, often with common marsh-bedstraw *Galium palustre* being the only fen species found.

M25b Molinia caerulea – Potentilla erecta mire: Anthoxanthum odoratum sub-community

M25 accounts for 2.5 ha within the study area and is found toward the centre of the site, in a small, shallow hollow at the bottom of a small hill. *Molinia caerulea* is the predominant species, with a more mixed sward of grass species including *Anthoxanthum odoratum, Agrostis canina* and *Nardus stricta.*

Table 3: NVC Communities of the Survey Area

NVC Code	Community
U5	*Nardus stricta – Galium saxatile* grassland
U20	*Pteridium aquilinum – Galium saxatile* community
M1	*Sphagnum auriculatum* bog pool community
M6	*Carex echinata – Sphagnum recurvum/denticulatum* mire
M17	*Scirpus cespitosus – Eriophorum vaginatum* blanket mire
M23	*Juncus effusus / acutiflorus – Galium palustre* rush-pasture
M25	*Molinia caerulea – Potentilla erecta* mire
H8	*Calluna vulgaris – Ulex gallii* heath
H12	*Calluna vulgaris – Vaccinum myrtillus* heath
H18	*Vaccinium myrtillus – Deschampsia flexuosa* heath
MG7	*Lolium perenne* leys and related grasslands

3.5. Heath Communities

H8 Calluna vulgaris – Ulex gallii heath

Heath vegetation is common within the survey area. There are several discrete areas of dry dwarf shrub heath present, the majority of these are patches of *Ulex gallii*, which are classified as heath. Within the Development this was characterized by species-poor H8 which was dominated by *U. gallii* but no *Calluna* or *E. cinerea*. The *U. gallii* was growing in a matrix with grasses. These heaths are not represented in the NVC, but clearly have a close affinity with H8 *Calluna-Ulex gallii* heath (JNCC, 2004) which is how it is represented in this report.

H12 Calluna vulgaris – Vaccinium myrtillus heath

Smaller areas of H12 are present toward the south and east of the site, and are generally located on the middle of slopes between the H18 communities at the top and the U20 communities toward the bottom. The vegetation is dominated by *Callun vulgaris* and *Vaccinium myrtillus* although at ground level, moss and lichen species such as *Pleurozium schreberi, Rhytidiadelphus loreus* and *Hylocomium splendens* occur. The occurances of this community are somewhat heavily grazed, and hint at the community being classified as the H12c where *Potentilla erecta, Galium saxatile* and *Nardus stricta* are also present throughout.

H18 Vaccinium myrtillus – Deschampsia flexuosa heath

H18 cloaks the upper slopes of the site, and is commonly rather degraded from anthropogenic activities. The heath community best fits with the H18 community identification, however, due to the high density of sheep grazing it is a poor fit to the NVC. Toward the top of the slopes, this degradation makes differentiation between this habitat and grazed U5 very difficult. The habitat occupies 63.35 ha of the site and is considered to be the typical presentation of the habitat.

3.6. Non-NVC Communities and Categories

3.6.1. Scrub and scattered scrub mosaic

Stands of gorse *Ulex sp.* are generally found on the steep hillsides and in association with unimproved acid grassland. Common gorse *Ulex europeus* was the main species recorded although western gorse *Ulex gallii* was also recorded. The hybrid between these two species is also likely to be present.

3.6.2. Broadleaved semi-natural woodland

Mature broadleaved woodland is largely absent from the survey area, apart from a discrete fragmented stand to the north of the site. Tree species include pedunculate oak *Quercus robur,* ash *Fraxinus excelsior,* hawthorn *Crataegus monogyna*, hazel *Corylus avellana*, alder *Alnus glutinosa*, blackthorn *Prunus spinosa* and silver birch *Betula pendula.* The ground flora is openly grazed by sheep and is typically synonymous with the surrounding grassland, therefore woodland indicator species are largely absent.

3.6.3. Coniferous Woodland Plantation

There are no large coniferous woodland plantations within the survey area. There are small coniferous tree lines within the area of agricultural land in the central southern area of the site, which act as wind breaks to livestock.

3.6.4. Hedgerows

Hedgerow networks are largely found within the central area of the survey area. They are associated with field boundaries and flanking the road. The ground flora is synonymous with the surrounding grassland, predominantly improved.

3.6.5. Watercourses and waterbodies

The Cwmblaenerw Brook begins on site, with its headwaters in the area of M17 / M1 floral community and bog pool. Other small watercourses forming the headwaters of the Milo Brook are present across the site.

3.6.6. Buildings, quarries, tracks, paths and bare ground

Limited to agricultural farmsteads to the north and central/south of the site, the buildings are outside the scope of this report. Instances of what appear to be old/defunct quarries or landslips are present infrequently across the site on steeply-sloping ground.

4. Nature Conservation Evaluation of Habitat Features

4.1. Overview

NVC communities can be compared with a number of habitat classifications in order to help in the assessment of the sensitivity and conservation interest of certain areas. The following sections compare the survey results and the NVC communities identified against the following classifications:

- SEPA guidance on GWDTEs;
- Habitats Directive (92/43/EEC) Annex I habitats; and
- Wales Environment Act Priority Habitats (Section 7).
- Powys Local Biodiversity Action Plan and Nature Recovery Action Plan.

4.2. Groundwater Dependent Terrestrial Ecosystems (GWDTE)

The results of the NVC surveyed identified six communities with potential for moderate or high groundwater dependency in accordance with SEPA guidance. These are summarized in Table 4 below.

Table 4: Wetland habitats with Potential Groundwater Dependency

NVC Code	NVC Community Name	Potential Groundwater Dependency
M23	Juncus effusus/acutiflorus – Galium palustre rush pasture	High*
M25	Molinia caerulea – Potentilla erecta mire	Moderate*
M6	Carex echinata – Sphagnum recurvum/denticulatum mire	High*

* Indicates dependance on hydrogeological setting

Wetlands or habitats containing these particular NVC communities are to be considered GWDTE unless further information can be provided to demonstrate this is not the case. NVC communities listed are very common habitat types across upland Wales, and some are otherwise generally of low ecological value. Also, NVC community M25 may only be considered GWDTE in specific hydrogeological settings.

Designation as a potential GWDTE does not therefore conclude an intrinsic biodiversity value, and GWDTE status has not been used as criteria to determine a habitats respective conservation importance. There is however a statutory requirement to consider GWDTEs and the data gathered during the NVC surveys has been used to inform this assessment.

GWDTE sensitivity has been assigned solely on the SEPA listings (SEPA, 2017). However, depending on a number of factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependant on groundwater at all.

These results are also provided visually in Figure 5. Where polygons comprised a mosaic of NVC communities which differ in their potential groundwater dependency, the dominant NVC community's groundwater dependency has been shown.

4.3. Annex I Habitats

A number of the NVC communities within the study area correlate to various Annex I habitat types. However, the fact that an NVC community can be attributed to an Annex I type does not automatically mean that the NVC community present constitutes Annex I habitat. Its Annex I status can depend on various factors such as quality, extent, species assemblages, geographical setting and substrates.

Using the Joint Nature Conservation Committee (JNCC) Annex I habitat listings and descriptions, which have then been compared with survey results and field observations, the following NVC communities within the study area which constitute Annex I habitat are shown in Table 5.

Table 5: Annex I habitat candidates

NVC Code and Community Name	Annex I Code and Title
M17 *Scirpus cespitosus – Eriophorum vaginatum* blanket mire	7130: Blanket Bog
M25 *Molinia caerulea – Potentilla erecta* mire	7130: Blanket Bog
H8 *Calluna vulgaris – Ulex gallii* heath	4030 European dry heaths
H12 *Calluna vulgaris – Vaccinium myrtillus* heath	4030 European dry heaths
H18 *Vaccinium myrtillus – Deschampsia flexuosa* heath	4030 European dry heaths

4.3.1. 7130: Blanket Bog

These extensive peatlands have formed in areas where there is a climate of high rainfall and a low level of evapotranspiration, allowing peat to develop not only in wet hollows but over large expanses of undulating ground (JNCC). The blanketing of the ground with a variable depth of peat gives the habitat type its name and results in the various morphological types according to their topographical position. 'Active' is defined as supporting a significant area of vegetation that is normally peat-forming. Typical species include the important peat-forming species, such as bog-mosses *Sphagnum spp.* and cottongrasses *Eriophorum spp*., or purple moor-grass *Molinia caerulea* in certain circumstances, together with heather *Calluna vulgaris* and other ericaceous species (JNCC).

Annex I type 7130 Blanket bog correlates with a number of NVC communities within the study area, such as M17 and M25 mires.

M17 is found in a small discrete patch within the site, located in a central/eastern position and interspersed with small examples of the M1 bog pool community. It is located within a shallow basin and surrounded by drier habitats. As a result of both communities being subject to grazing historically and currently, as well as historical drainage and other anthropogenic disturbance events, such as tourism, walkers and off-road motorbikers, the small area is deemed to be poor or degraded forms of the Annex 1 habitat.

M25 mire can also fall within the blanket bog Annex I type, usually where the underlying peat depth is greater than 0.5 m and the habitat is wet and contains peat forming species. M25 within the study area is for the most part species-poor and at the drier end of the scale, with the size of the habitat also somewhat limited.

The M25 mire community is generally noted to be rarely of notable conservation interest, at least in terms of habitats and plant species. The communities in the survey area are also degraded in character due to anthropogenic influences such as intensive grazing, and are therefore considered to

be of lower nature conservation interest. Given the character of the small area of M25 within the study area it has not been considered to be of Annex I habitat quality in this case.

4.3.2. 4030 European dry heaths

European dry heaths typically occur on freely-draining, acidic to circumneutral soils with generally low nutrient content. Ericaceous dwarf-shrubs dominate the vegetation. The most common is heather, which often occurs in combination with gorse *Ulex* spp., *Vaccinium* spp. or bell heather, though other dwarf-shrubs are important locally. Nearly all dry heath is semi-natural, being derived from woodland through a long history of grazing and burning (JNCC).

The most commonly found community within the study area was that of NVC H8, however, these were areas of species-poor heaths with much *U. gallii* but no *Calluna* or *E. cinerea*. The *U. gallii* was found to be growing in either dense swards or in a matrix of grasses. These heaths are not represented in the NVC, but clearly have a close affinity with *Calluna-Ulex gallii* heath. It is therefore concluded that the areas of H8 heath are not considered Annex I habitat in this case.

The H12 community was infrequent on site, and in similarity with the description of the H8 community above also commonly supports a range of acid grassland species, which makes a poor fit for the NVC. The grassland/heath mosaic is not represented in the NVC but is more closely affiliated with H12 *Calluna vulgaris-Vaccinium myrtillus* heath. It is therefore concluded that the areas of H12 heath are not considered Annex I habitat in this case.

The frequently-occurring community of H18 *Vaccinium myrtillus – Deschampsia flexuosa* was also often in a mosaic with the U5 *Nardus stricta – Galium saxatile* grassland community, which dominates the very tops of the site's plateaux. On account of the grazing activity that has historically occurred and is still occurring, alongside other anthropogenic activity such as tourism, the very few instances of good-quality habitat that are present on site are already degraded and of poor-quality. It is therefore concluded that the H18 heath is not considered Annex I habitat in this case.

4.4. Habitats of Principal Importance (Environment (Wales) Act, Section 7)

Section 7 of the Environment (Wales) Act lists the habitats of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales. Some of these priority habitats are quite broad and can correlate to a large number of NVC types. The relevant priority habitat types and associated NVC types (where attributed) recorded within the study area are as follows:

- Upland heathland: H8, H12, H18;
- Blanket bog: M1, M17, M25;
- Purple moor-grass and rush-pastures: M23;
- Upland flushes, fens and swamps: M6; and
- Ponds.

Section 7 provides statutory underpinning to the UK BAP. Thus, all habitats and species listed under the UK BAP are also Section 7 habitats and species.

4.5. Powys Local Biodiversity Action Plan (LBAP)

The Powys County Council LBAP was published in 2002 and outlines targets and actions considered necessary to protect the wildlife of Powys in the future (Powys Nature Partnership, 2002).

The adopted LBAP outlines 17 habitat action plans to target biodiversity conservation at a local level. The relevant habitat action plans associated with the habitat types recorded within the study area are as follows:

- Blanket bog
- Coniferous woodland
- Farmland
- Linear habitats
- Rhos pastures
- Rivers and Streams
- Scrub and ffridd
- Upland / Lowland heath

4.6. Summary

Table 6 provides a summary of all NVC communities found within the study area.

Table 6: Conservation Status of the NVC Communities

Phase 1 Habitat	NVC Community	Annex 1 Habitat	Environment (Wales) Act 2016	Powys LBAP/ NRAP	GWDTE	Area (ha)
Blanket Bog	M1 *Sphagnum auriculatum* bog pool communtiy	Overlaps with Blanket Bog (Active)	Blanket Bog	Blanket bog	No	0.0006
Acid flush	M6 *Carex echinata - Sphagnum recurvum/auriculatum* mire	No	Upland flushes, fens and swamps	No	High*	0.23
Blanket Bog	M17 *Scirpus cespitosus – Eriophorum vaginatum* mire	Overlaps with Blanket Bog (Active)	Bogs	Blanket bog	No	2.5
Marshy Grassland	M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture	No	Purple Moor-grass and Rush Pastures	Rhos Pasture	High*	5.58
Blanket Bog	M25 *Molinia caerulea – Potentilla erecta* Mire	Overlaps with Blanket Bog (Active)	Blanket Bog and Purple Moor-grass and Rush Pastures	Blanket bog and Rhos Pasture	Moderate*	2.47
Acid Grassland	U5 *Nardus stricta – Galium saxatile* grassland community	No	No	No	No	59.03
Dense Bracken	U20 *Pteridium aquilinum – Galium saxatile* community	No	No	Scrub & Ffridd (at bottom of slopes)	No	808.43
Improved Grassland	MG7 *Lolium perenne* leys and related grassland	No		No	No	93.22
Dry dwarf heath	H8 *Calluna vulgaris – Ulex gallii* heath	Overlaps with European Dry Heaths	Upland heathland	Upland and Lowland Heath	No	33.05
Dry dwarf heath	H12 *Calluna vulgaris – Vaccinium myrtillus* heath	Overlaps with European Dry Heaths	Upland heathland	Upland and Lowland Heath	No	19.88
Dry dwarf heath	H18 *Vaccinium myrtillus – Deschampsia flexuosa* heath	Overlaps with European Dry Heaths	Upland heathland	Upland and Lowland Heath	No	63.35
Dry dwarf heath/ acid grassland mosaic	U5 and H8 U5 and H12 U5 and H18	No	Upland heathland	Upland and Lowland Heath	No	137.37

5. Recommendations

5.1. Avoidance

Where possible, sensitive habitats must be avoided and protected from harm. As per the SEPA (2017) guidance on GWDTE, buffer zones of 100m and 250m are proposed where all groundwater abstractions need to be identified:

- within 100m radius: all excavations less than 1m in depth;
- within 250m radius: all excavations deeper than 1m.

If all development can be planned outside of these buffer zones, significant impacts in terms of Ecological Impact Assessment may be avoided.

5.2. Detailed and Site-Specific Survey

In order to identify potential GWDTE habitats, specific areas were targeted by the surveyor conducting the NVC with the help of Object-Based Image Analysis (OBIA). The proposed layout of the wind farm was not known at the time that the survey was conducted, and therefore a generalized approach was taken.

Results from surveys of this type are also generally only valid for two years from survey, due to environmental changes that may impact the habitats.

Once the final layout of the access track and turbines is available for dissemination and subject only to minor amendments, it is recommended that a detailed, targeted approach to identify GWDTE is undertaken to understand a truer impact from the proposed development and to identify any requirements for micro-siting and designing mitigation. This will also identify whether habitats have changed in character.

5.3. Habitat Monitoring

Using the EO technique, explained in section 2.1, it is possible to use the readily available satellite date combined with targeted field survey to provide an efficient, cost-effective and detailed method for monitoring of the Development's construction and operational effects. Principal Component Analysis[1] (PCA) uses the multi-spectral bands from various satellite images across several months and years. Where the PCA suggests the spectral objects (habitat polygons) are statistically different this indicates a change in habitat condition, diversity or even a complete change in the habitat type. Once the PCA is complete, the number of habitat polygons in the data set is calculated and provides targets for detailed field survey.

[1] Principal Component Analysis is a statistical method that is used to reduce the number of variables within a dataset and emphasise their variation, by grouping together those variables that highly correlate with one another

Using the targets identified in the PCA, field survey is to be undertaken to verify the real-world change in the habitat polygon. The technique used for field survey would vary depending on the type of change. For instance, where a temporary access track is built then it is a clear change, simple to understand and expected recovery of the vegetation can be readily monitored. Whereas, changes in the hydrological regime under GWDTE may occur over a longer period of time and only be noted in post-construction monitoring. It is therefore important that NVC control quadrats are completed in each year of monitoring to develop long-term trends in habitat condition and species diversity for the Development. Where the PCA completed during post-construction monitoring identifies habitat patches that appear to have statistically changed in the satellite (or other multi-spectral) data, targeted field survey can be undertaken. Where a PCA defined target is an Important Ecological Feature, as completed in the EcIA, NVC quadrat survey can be undertaken and an appropriate monitoring schedule applied.

Results of the control quadrats representing the various GWDTE and other habitats defined as Important Ecological Features can be scrutinised using Detrended Correspondence Analysis (DCA), as would usually be expected for NVC based vegetation monitoring. The outputs of the DCA can be combined with qualitative information from survey notes to interpret how and why the changes to the vegetation condition has occurred. These trends can be obvious trends and can fluctuate between season and years. Reasons can vary from different stocking densities, changes in availability of precipitation or as a result of a disturbed soils and geology.

Taking this approach to the ongoing monitoring of vegetation provides additional levels of control and understanding compared to that of field survey which is highly subjective based on where a surveyor targets their effort. It is quite possible at a large site such as that at Builth Wells South to unintentionally overlook habitat patches which may have changed in its extent, condition or diversity, and it is inherently difficult to map the boundaries of changing habitat patches in upland mire and heath. Using this approach can therefore substantially improve the quality and accuracy of monitoring outcomes giving confidence to decision makers. Furthermore, if undertaken by experienced and competent professionals it can reduce time and cost in completing each of the tasks.

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Appendix A: Habitat Maps

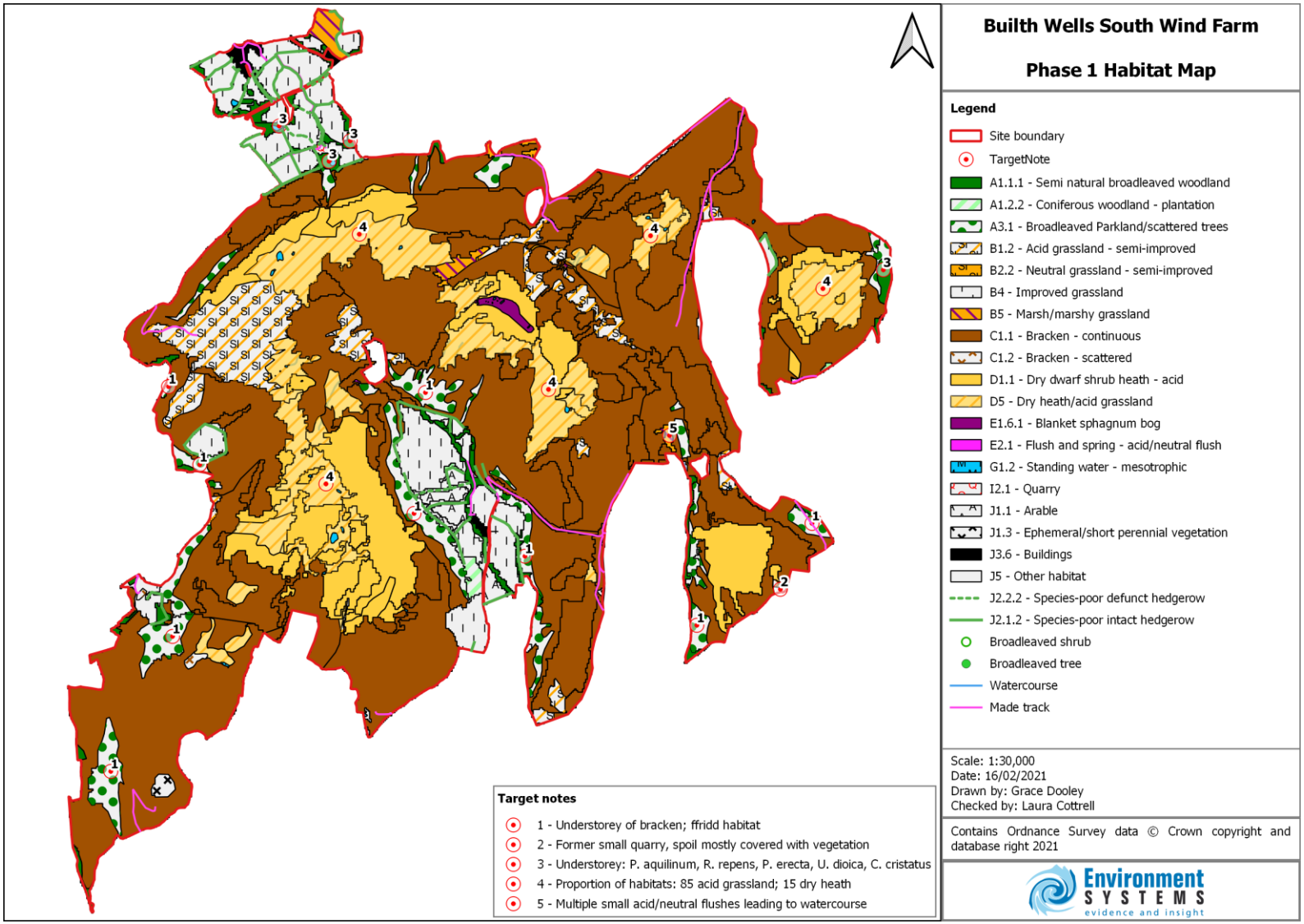

Figure 3: Phase 1 map

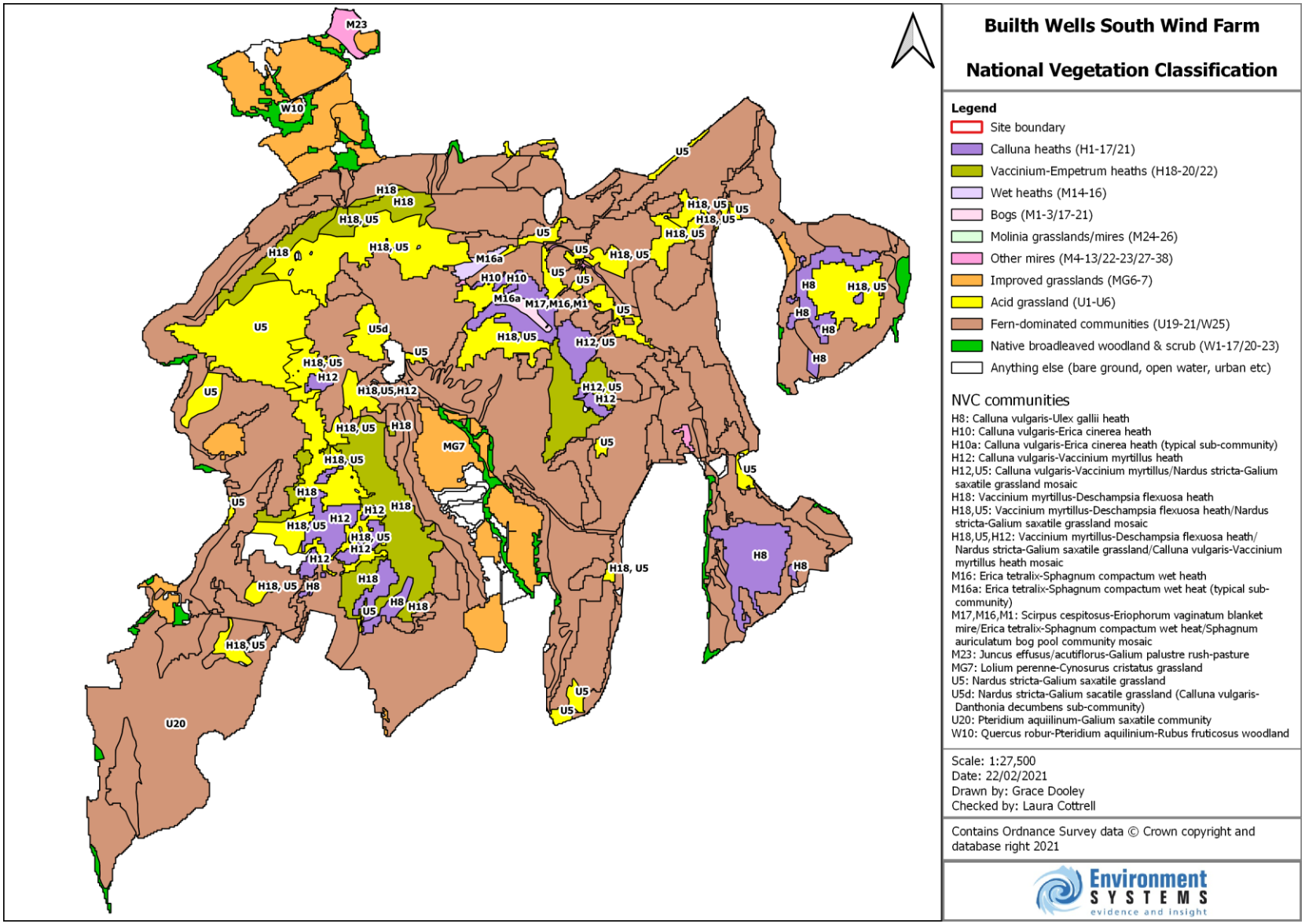

Figure 4: NVC map

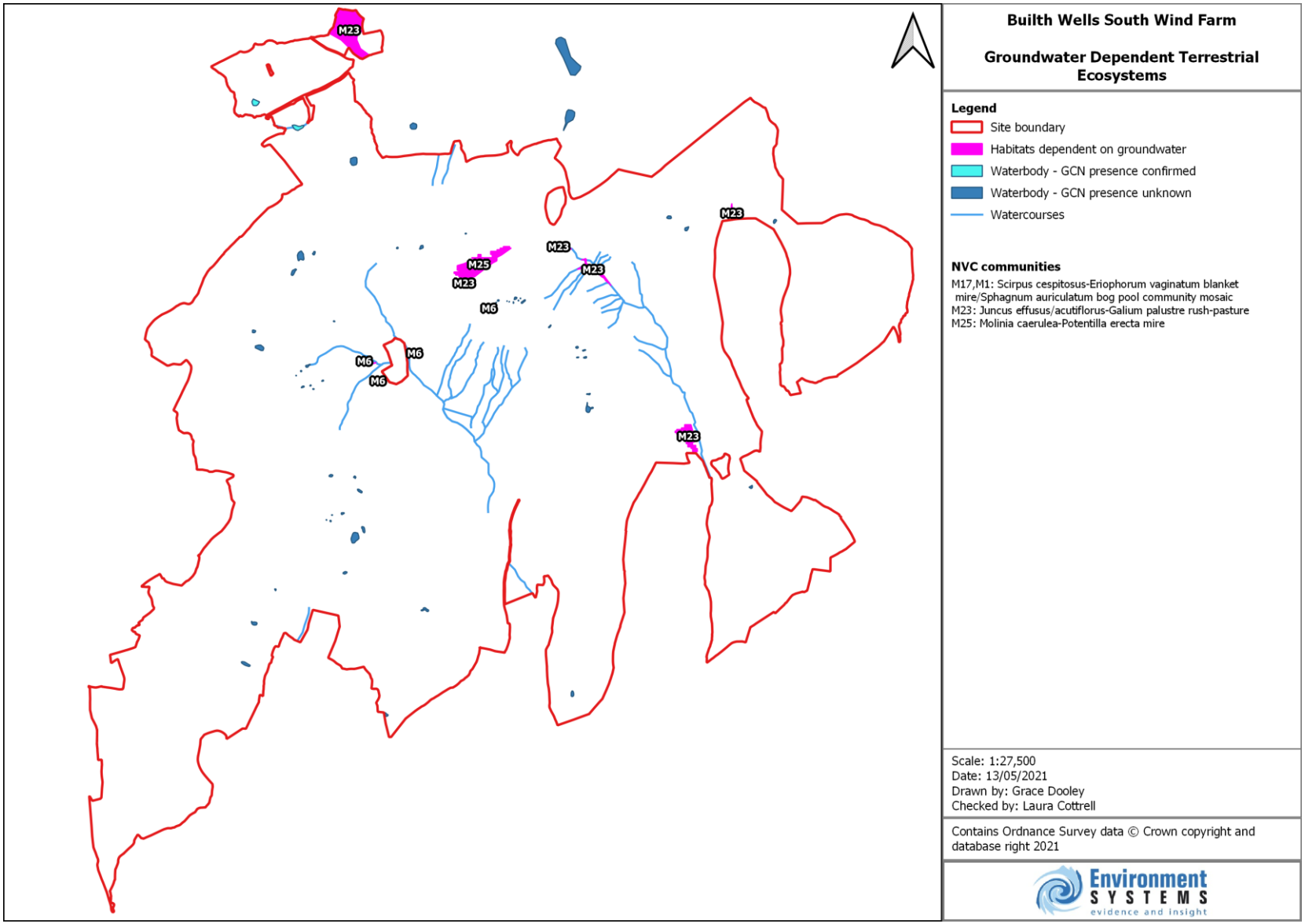

Figure 5: GWDTE, watercourses and waterbodies

Appendix B: NVC Quadrat Data

Walkover: M6 Quadrat 1

Species	Common Name	Percentage Cover %
Carex panicea		60
Carex nigra		10
Carex flacca		5
Carex echinata		5
Carex demissa		<5
Scirpus cespitosus		40
Polytrichum commune		30
Juncus effusus		25
Sphagnum palustre		40
Dicranium scoparium		5
Trifolium dubium		15
Agrostis stolonifera		20

Quadrat 2: M6 Quadrat 2

Species	Common Name	Percentage Cover %
Juncus effusus		80
Cirsium palustre		20
Polytrichum commune		40
Agrostis capilliaris		10
Galium saxatile		10
Nardus stricta		5
Potentilla erecta		5
Trifolium repens		5
Sphagnum palustre		30
Carex panicea		10
Trifolium dubium		5

Quadrat 3: M6 Quadrat 3

Species	Common Name	Percentage Cover
Dicranium scoparium		40
Potamogeton sp.		40
Nardus stricta		50
Juncus squarrosus		50
Carex echinata		20
Juncus acutiflorus		25
Pleurozium schreberi		20
Sphagnum palustre		25

Quadrat 1: M17 Quadrat 1

Species	Common Name	Percentage Cover
Calluna vulgaris		50
Erica tetralix		40
Juncus squarrosus		60
Vaccinium myrtillus		10
Pleurozium schreberi		10
Sphagnum papillosum		40
Sphagnum palustre		50
Dicranium scoparium		20
Potentilla erecta		15
Eriophorum vaginatum		10

Quadrat 2: M17 Quadrat 2

Species	Common Name	Percentage Cover
Juncus effusus		10
Polytrichum commune		80
Vaccinium myrtillus		15
Molinia caerulea		25
Calluna vulgaris		15
Erica tetralix		20
Sphagnum palustre		70
Potentilla erecta		15
Dicranium scoparium		10
Carex echinata	Star sedge	30

Quadrat 3: M17

Species	Common Name	Percentage Cover
Nardus stricta		30
Juncus effusus		10
Polytrichum commune		80
Vaccinium myrtillus		15
Molinia caerulea		20
Calluna vulgaris		40
Erica tetralix		30
Sphagnum papillosum		70
Potentilla erecta		15
Dicranium scoparium		10

Quadrat 1: H8

Species	Common Name	Percentage Cover
Ulex gallii		70
Galium saxatile		40
Pleurozium schreberi		30
Festuca ovina		10
Hypnum jutlandicum		10

Deschampsia flexuosa	10
Vaccinium myrtillus	5
Anthoxanthum odoratum	<5
Polytrichum commune	5
Potentilla erecta	10
Rhytidiadelphus squarrosus	15

Quadrat 2: H8

Species	Common Name	Percentage Cover
Calluna vulgaris		80
Cladonia arbuscula		20
Nardus stricta		20
Ulex gallii		25
Potentilla erecta		10
Vaccinium myrtillus		5

Quadrat 3: H8

Species	Common Name	Percentage Cover
Ulex gallii		50
Calluna vulgaris		50
Nardus stricta		10
Molinia caerulea		15
Vaccinium myrtillus		15
Dicranium scoparium		10
Potentilla erecta		5

Quadrat 1: H12

Species	Common Name	Percentage Cover
Calluna vulgaris		70
Vaccinium myrtillus		40
Erica tetralix		40
Nardus stricta		80
Cladonia sp.		30
Dicranium scoparium		10
Potentilla erecta		5
Polygala serpyllifolia		10

Quadrat 2: H12

Species	Common Name	Percentage Cover
Calluna vulgaris		80
Vaccinium myrtillus		10
Dicranium scoparium		5
Cladonia arbuscula		20
Hypnum jutlandicum		5

Pleurozium schreberi	30
Cladonia cristatella	1

Quadrat 1: H18

Species	Common Name	Percentage Cover
Calluna vulgaris		<5
Vaccinium myrtillus		80
Festuca ovina		10
Pleurozium schreberi		40
Rhytidiadelphus loreus		40
Rhytidiadelphus squarrosus		80
Galium saxatile		30
Hypogymnia sp.		5
Deschampsia flexuosa		25
Agrostis capilliaris		5
Cladonia sp.		<5

Quadrat 2: H18

Species	Common Name	Percentage Cover
Festuca ovina		10
Deschampsia flexuosa		10
Vaccinium myrtillus		60
Cladonia sp.		10
Agrostis capilliaris		5
Hypnum lacunosum		40
Galium saxatile		40

Quadrat 1: M25

Species	Common Name	Percentage Cover
Molinia caerulea		60
Nardus stricta		60
Polytrichum commune		30
Vaccinium myrtillus		20
Galium saxatile		10
Carex panicea	Carnation sedge	5
Sphagnum compactum		50
Dicranium scoparium		20
Pleurozium schreberi		5
Cladonia arbsulcula		5
Calluna vulgaris		5
Potentilla erecta		5
Agrostis canina		5