# Appendix 7B

NVC Survey Report

Ove Arup and Partners Ltd

# Proposed Global Centre for Rail Excellence Nant Helen open cast mine and Onllwyn washery

## Vegetation surveys

Version 4 June 2020

Sturgess Ecology

# Contents



**This report has been updated to exclude the recommendations detailed in the original report. Since the production of the initial report, the design has evolved, and specific up to date recommendations have been incorporated into the Ecology Chapter of the Environmental Statement, to be submitted for the proposed Global Centre for Rail Excellence scheme.**

Document reference: C253/D1/V3

Cover photographs: Left: acid grassland on former spoil heaps at Nant Helen; Right: sparse grassland and ruderals on railway sidings at Onllwyn washery.

This document has been produced for Ove Arup and Partners by:

**Sturgess Ecology**
**12 Lon Ysgubor, Rhiwbina, Cardiff, CF14 6SG**
**e-mail: peter@sturgess-ecology.co.uk**
**Web: www.sturgess-ecology.co.uk**

# 1. Introduction

Ove Arup and Partners Ltd ('Arup') have commissioned Sturgess Ecology to undertake vegetation surveys for the proposed Global Centre for Rail Excellence (GCRE) (hereafter referred to as the 'Project'), located on the Nant Helen opencast mine and Onllwyn washery, between Seven Sisters and Abercraf (approximate grid reference SN826110). The survey is required to support the design and assessment process for the Project.

The survey is intended to add botanical detail to the Phase 1 habitat survey, and describe the range of variation within the main habitats of nature conservation significance by categorising them in terms of the National Vegetation Classification (NVC) (Rodwell *et al*, 1991 etc.). Due to the large size of the site and high proportion of transitional habitats and small-scale vegetation mosaics resulting from the mining activities an NVC mapping survey was not considered appropriate to inform the design process and assessment at this point in time.

The fieldwork and assessment were undertaken by Dr Peter Sturgess CEnv MCIEEM. He is an experienced botanist and familiar with the NVC. He has carried out many botanical surveys on former mining sites and quarries in South Wales over more than 20 years.

# 2. Survey method

The objective was to describe the plant communities in habitats judged to be of highest value for nature conservation using NVC methods. The vegetation types initially selected for study were identified from a Phase 1 Habitat Survey plan produced by Arup. This confirmed the following habitats potentially worthy of investigation were present within the site

- Semi-natural broadleaved woodland
- Acid grassland
- Semi-improved acid grassland
- Neutral grassland
- Marshy grassland
- Flush
- Mire/Fen
- Dry heath
- Wet heath
- Swamp/ standing water/ ponds
- Ephemeral/ short perennial.

The following habitats were also present but considered less likely to be of nature conservation significance:

- Coniferous plantation
- Broad-leaved plantation
- Dense/ continuous scrub
- Improved grassland
- Species-poor semi-improved grassland
- Continuous Bracken
- Bare, recently disturbed ground, or other man-made habitats.

In practice, some of the habitats considered unlikely to be of nature conservation value were more diverse than expected, so were included in the study.

The survey was generally limited to land within the ownership of Celtic Energy. Some information from beyond this was gathered from public rights of way, but it was not possible to access all of the area that was included within the initial Phase 1 Habitat Survey.

The fieldwork was carried out by a walk-through method, using a combination of the habitat survey map and direct observation of habitats to identify vegetation stands for description and quadrat sampling.

A total of 127 quadrats were recorded. The quadrat areas were generally selected as being representative samples of the stand in which they occurred. The survey aimed to collect a minimum of 5 quadrats from each of the main plant communities, aiming to provide a reasonable representation of the vegetation type. Some unusual or poorly represented communities were sometimes described by just one or two quadrats.

Quadrat recording involved recording every species within square 2x2m sample areas (or 4x4m for woodlands). The cover of every species within each quadrat was assessed using the Domin scale, as shown in Table 1. An estimate was also made of the percentage cover by vegetation and the approximate vegetation height (as a rough average through the quadrat). Habitats that are less readily recorded using quadrats were described using a target note approach (e.g. ponds, rock faces), noting the main species present. A total of 23 target notes were collected.

**Table 1. Domin scale for recording vegetation cover**

| Percentage cover | Domin score |
|---|---|
| 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 |
| Associate species (within 1m of a quadrat) | A |

The quadrats recorded from each broadly similar plant community were grouped together into floristic tables, giving each distinct community its own table. Following NVC methodology, the occurrence of each species within the group of quadrats was assigned a constancy score as indicated in Table 2. The species within each table were then listed in order of their constancy score. Once the tables were completed, they were compared with the communities within the published NVC classification. Comparisons have mostly been made on the basis of the author's experience, rather than use of analytical software. However, TABLEFIT version 2.0 (Hill, 2015) was used to assist in interpreting some of the communities.

**Table 2. Constancy scores for quadrat data**

| Frequency within quadrats | Constancy Score |
|---|---|
| 81 - 100% | V |
| 61 - 80% | IV |
| 41 - 60% | III |
| 21 - 40% | II |
| 1 - 20% | I |
| Associate species (A) only | |

The survey work was carried out during June and July 2019. This is the optimal time of year for this type of vegetation survey because most species of plants are visible and many are in flower. Even so, it is possible that some species might have been overlooked by the survey because they had finished flowering early in the spring (e.g. some woodland or 'winter-annual' species) or species that are only present at very low density.

*This single young frond of Royal Fern was the only one found during the survey (near Q48). It is a species that is only present at a very low density and could have easily been overlooked.*

# 3. Survey findings

A list of the plant species recorded during the survey is presented in Appendix 1. This includes the scientific and common names for each species. The list includes every species encountered during the quadrat surveys and target notes. It also includes a number of others that were seen while walking through the site. However, those not recorded in the quadrats are mostly only present at a low density.

The locations of the quadrats and target notes are presented in Appendix 2. They are shown on an aerial photograph background rather than the habitat survey plan to avoid possible confusion resulting from the scale used in habitat plan e.g. some of the quadrats for acid grassland and heath are within areas that were mapped as marshy grassland, because that was the predominant habitat in the wider area. Many of the vegetation types found within the study area are part of habitat mosaics or gradual transitions between two or more habitats.

The vegetation descriptions and constancy tables are presented below (set out in in the approximate order of habitat categories listed in the Handbook for Phase 1 habitat survey, JNCC, 2010). They attempt to describe the vegetation in terms of the Phase 1 habitat types and also the published NVC communities. In some cases it has not been possible to match the vegetation with the published types very precisely, particularly where the plant communities have been subject to disturbance or where they are in a state of transition. The community descriptions are presented together with the quadrat data collected, arranged as NVC vegetation tables. The species in the tables are arranged in order of frequency, as denoted by the constancy score in the right-hand column.

### *Semi-natural broad-leaved Woodland*

Semi-natural broad-leaved woodland is mostly located on steeply sloping ground. The largest areas are dominated by mature Sessile Oak, with a sparse understorey of Rowan, Holly, Hazel and Hawthorn. This is mostly attributable to the NVC category W11 *Quercus petraea – Betula pubescens – Oxalis acetosella* woodland. Quadrats 70, 81 and 82 are from typical examples of this habitat. Frequent ground flora species include Creeping Soft-grass, Bluebell and Wood Sorrel. Q2 is an example of Oak woodland on a damp valley-side where Alder is also prominent. Q5 is an example of Sessile Oak woodland with a very species-poor ground flora, due to grazing by sheep.

On lower valley-sides to the south there is semi-natural Ash-dominated woodland with a relatively diverse ground flora that includes a number of old woodland indicator species such as Bluebell, Yellow Pimpernel, Wood Speedwell and Tutsan. Only one quadrat was recorded from this woodland (Q18) as it is outside the likely works area. This is best classed as W9 *Fraxinus excelsior – Sorbus aucuparia – Mercurialis perennis* woodland.

*W11 Sessile Oak woodland (Q82). This particular woodland is included in the Natural Resources Wales Ancient Woodland Inventory.*

*W9 Ash woodland (Q18).*

## Table 3. Quadrat data for semi-natural broadleaved woodland (4x4m quadrats)

| Species | 2 | 5 | 18 | 70 | 81 | 82 | Frequency |
|---|---|---|---|---|---|---|---|
| *Holcus mollis* | | 2 | 1 | 6 | 2 | 9 | V |
| *Kindbergia praelonga* | 4 | 3 | 3 | 5 | 7 | 6 | V |
| *Polytrichastrum formosum* | 2 | 3 | 2 | 7 | 4 | 2 | V |
| *Quercus petraea* | 9 | 10 | | 8 | 10 | 10 | V |
| *Rubus fruticosus* | 5 | | 5 | 4 | 5 | 2 | V |
| *Dryopteris dilatata* | 2 | | 1 | 2 | 4 | A | IV |
| *Dryopteris filix-mas* | 1 | | 2 | 1 | 2 | | IV |
| *Juncus effusus* | 1 | 1 | | | 2 | 2 | IV |
| *Rhytidiadelphus squarrosus* | | 2 | | 7 | 5 | 2 | IV |
| *Agrostis capillaris* | 8 | 9 | A | | 2 | | III |
| *Crataegus monogyna* | 1 | 1 | 1 | A | | A | III |
| *Hedera helix sl* | 2 | | 4 | 2 | | | III |
| *Sorbus aucuparia* | | | 5 | 2 | A | 1 | III |
| *Alnus glutinosa* | 10 | | | 5 | | | II |
| *Anthoxanthum odoratum* | 2 | 2 | | | | A | II |
| *Athyrium filix-femina* | | | 2 | 1 | | | II |
| *Atrichum undulatum* | | | | 2 | 2 | A | II |
| *Betula pubescens* | A | | | 4 | 5 | | II |
| *Corylus avellana* | 5 | | 8 | | A | | II |
| *Dactylis glomerata* | A | 1 | 1 | | | A | II |
| *Eurhynchium striatum* | | | 5 | | | 3 | II |
| *Fraxinus excelsior* | 1 | | 9 | | | | II |
| *Hyacinthoides non-scripta* | | | 5 | A | A | 4 | II |
| *Hypnum cupressiforme* | | | | | 3 | 3 | II |
| *Hypnum jutlandicum* | 2 | 2 | | | | | II |
| *Ilex aquifolium* | 1 | | 1 | A | | A | II |
| *Oxalis acetosella* | | | 1 | 5 | | | II |
| *Thuidium tamariscinum* | 2 | 2 | | | | | II |
| *Blechnum spicant* | | | 1 | | | | I |
| *Brachythecium rutabulum* | | 2 | | | | | I |
| *Chamerion angustifolium* | | | | | 2 | | I |
| *Deschampsia cespitosa* | | 2 | A | A | | | I |
| *Deschampsia flexuosa* | | | | A | A | 3 | I |
| *Dicranum majus* | | | | | | 2 | I |
| *Digitalis purpurea* | 1 | | | A | | | I |
| *Diplophyllum albicans* | | | | | 2 | | I |
| *Dryopteris affinis* | A | | 1 | | | | I |
| *Epilobium montanum* | | | | | 2 | | I |
| *Festuca rubra* | | 3 | | | | | I |
| *Fragaria vesca* | | | 2 | | | | I |
| *Galium palustre* | | | | 1 | | | I |
| *Geranium robertianum* | | | 2 | A | | | I |
| *Isothecium myosuroides* | 2 | | A | | | | I |
| *Lysimachia nemorum* | | | 2 | | | | I |
| *Mnium hornum* | 3 | | | | | A | I |
| *Peltigera sp.* | | | 1 | | | | I |
| *Poa trivialis* | | 2 | | | | | I |
| *Potentilla erecta* | 1 | | | | | | I |
| *Potentilla sterilis* | | | 2 | | | | I |
| *Pseudoscleropodium purum* | A | 2 | | | | | I |
| *Veronica montana* | | | 2 | | | | I |
| *Viola riviniana* | | | 2 | | | | I |
| *Cardamine cf flexuosa* | | | | A | | | |
| *Chiloscyphus polyanthos* | | | | A | | | |
| *Circaea lutetiana* | A | A | | | | | |
| *Epilobium ciliatum* | A | | | | | | |

| Species | 2 | 5 | 18 | 70 | 81 | 82 | Frequency |
|---|---|---|---|---|---|---|---|
| *Festuca ovina* | | | | | | A | |
| *Galium aparine* | | | | A | | | |
| *Geum urbanum* | | | A | | | | |
| *Holcus lanatus* | A | | | | A | A | |
| *Lophocolea bidentata* | | | | A | | | |
| *Luzula pilosa* | | | A | | | | |
| *Pellia sp.* | | | A | A | | | |
| *Plagiothecium undulatum* | | | | | A | | |
| *Platyhypnidium riparioides* | | | | A | | | |
| *Polypodium vulgare* | | | | | | A | |
| *Prunella vulgaris* | | | A | | | | |
| *Rhizomnium punctatum* | | | | A | | | |
| *Taraxacum* sp. | | | A | | | | |
| *Urtica dioica* | | A | | | | | |
| *Vaccinium myrtillus* | | | | A | | | |
| *Veronica serpyllifolia* | | | A | | | | |
| **Species total** | **21** | **17** | **26** | **16** | **16** | **13** | |
| **Ground flora (cm)** | **40** | **30** | **50** | **40** | **60** | **40** | |
| **Canopy (m approx.)** | **15m** | **20m** | **20m** | **10m** | **10m** | **10m** | |
| **Ground cover (%)** | **100** | **100** | **100** | **100** | **50** | **100** | |

### *Plantation and scrub woodland*

Some of the broad-leaved woodland shown on the habitat map comprises plantation woodland, planted as part of coal spoil restoration projects. Canopy species including Field Maple and Grey Alder are frequent in the plantations but would not be expected to occur in these situations naturally. Other relatively new woodland appears to have established from scrub on damp ground. For the purposes of this study these younger woodlands have been grouped together. Quadrats 53, 68 and 83 appear to have been established as plantations. Quadrats 20 and 86 are examples of scrub woodland (which may have been planted) and Quadrat 1 is an example of young Alder woodland.

These woodlands are all characterised by a high proportion of Bramble in their understorey, and there are often remnants of grassland flora persisting in the shade (e.g. Red Fescue, Soft Rush, Common Bent, Common Spotted Orchid). They mostly lack old-woodland indicator species, although a few, such as Wood Sedge, Enchanter's Nightshade and Wood Avens occur locally. Broad-leaved Helleborine orchids are present in many of the young woodlands on coal spoil; often in large numbers.

These young woodlands are difficult to place within the NVC because they are in a transitional state between scrub and woodland. The plantations have a man-made canopy composition and most of the young woodlands have grassland elements in the ground flora. W21 *Crataegus monogyna – Hedera helix* scrub is a reasonable match for much of the plantation woodland, while some damper scrub woodland has elements of W6 *Alnus glutinosa – Urtica dioica* woodland (e.g. Q11).

There were relatively few noteworthy plant species in the young woodlands, but a large plant of Sherard's Downy Rose (or a possible hybrid of it) was seen at a track-side scrub margin south of Quadrat 68. Several non-native invasive Cotoneaster species, particularly Hollyberry Cotoneaster, were also seen in young woodlands.

## Table 4. Quadrat data for broadleaved plantation and scrub woodland (4x4m quadrats)

| Species | 1 | 20 | 53 | 68 | 83 | 86 | Frequency |
|---|---|---|---|---|---|---|---|
| *Hedera helix sl* | | 9 | 2 | 2 | 2 | 2 | V |
| *Kindbergia praelonga* | 5 | 4 | 3 | 6 | 4 | 8 | V |
| *Rubus fruticosus* | 10 | 4 | 10 | 5 | 4 | 8 | V |
| *Geranium robertianum* | | 1 | | 2 | 2 | 1 | IV |
| *Salix cinerea* | | 8 | 4 | | 4 | 10 | IV |
| *Agrostis capillaris* | 4 | | 2 | 2 | | | III |
| *Cardamine cf flexuosa* | 2 | | 4 | | | 2 | III |
| *Deschampsia cespitosa* | 2 | | | 3 | 1 | | III |
| *Epilobium montanum* | | | 3 | | 3 | 1 | III |
| *Poa trivialis* | | | | 4 | 2 | 4 | III |
| *Acer pseudoplatanus* | | | | 2 | 1 | | II |
| *Alnus glutinosa* | 10 | | 7 | | | | II |
| *Alnus incana* | | | | 4 | 2 | | II |
| *Athyrium filix-femina* | | 1 | | | | 2 | II |
| *Betula pubescens* | 1 | 8 | | | | | II |
| *Brachythecium rutabulum* | A | | A | 2 | | 3 | II |
| *Crataegus monogyna* | | A | A | 1 | | 2 | II |
| *Digitalis purpurea* | 1 | | 2 | | | | II |
| *Dryopteris dilatata* | | 1 | A | 1 | A | | II |
| *Dryopteris filix-mas* | 1 | A | | A | | 2 | II |
| *Epipactis helleborine* | | 1 | | 1 | A | A | II |
| *Equisetum arvense* | | | | 2 | 1 | | II |
| *Eurhynchium striatum* | | | | 2 | 2 | | II |
| *Festuca rubra* | | 1 | A | | | 2 | II |
| *Fragaria vesca* | | 1 | 1 | | | | II |
| *Fraxinus excelsior* | | 1 | | | A | 1 | II |
| *Peltigera sp.* | | 1 | | | | 1 | II |
| *Polytrichastrum formosum* | 2 | | 3 | | | | II |
| *Quercus petraea* | | | 7 | | 5 | | II |
| *Ranunculus repens* | 2 | | | 2 | | | II |
| *Urtica dioica* | 5 | | | | | 2 | II |
| *Acer campestre* | | | | 10 | | | I |
| *Atrichum undulatum* | 2 | | | A | | | I |
| *Carex remota* | 4 | | | | | | I |
| *Circaea lutetiana* | 2 | | | | A | | I |
| *Corylus avellana* | | 4 | | | | | I |
| *Dactylis glomerata* | | 1 | | | | | I |
| *Epilobium palustre* | | | | 2 | | | I |
| *Fissidens bryoides* | | | | 2 | | | I |
| *Fissidens taxifolius* | 2 | | | | | | I |
| *Galium aparine* | | | | 3 | | | I |
| *Galium palustre* | 1 | | | | | A | I |
| *Geum urbanum* | 2 | | | | | | I |
| *Holcus lanatus* | | | A | | 1 | | I |
| *Juncus bufonius* | | | | 3 | | | I |
| *Lophocolea bidentata* | | 1 | | | | | I |
| *Mnium hornum* | | | | | | 2 | I |
| *Plagiomnium undulatum* | | | | | | 1 | I |
| *Polystichum setiferum* | | | | 1 | | | I |
| *Prunella vulgaris* | 2 | | | | | | I |
| *Prunus avium* | | | | | 9 | | I |
| *Prunus spinosa* | | | | 2 | | | I |
| *Ranunculus acris* | | | | | | 1 | I |
| *Rhytidiadelphus triquetrus* | | | | | 7 | | I |
| *Rumex sanguineus* | 2 | | | | | | I |
| *Salix caprea* | | | 6 | | | | I |

| Species | 1 | 20 | 53 | 68 | 83 | 86 | Frequency |
|---|---|---|---|---|---|---|---|
| *Solanum dulcamara* | 2 | | | | | | I |
| *Solidago virgaurea* | | 1 | | | | | I |
| *Sorbus aucuparia* | | 2 | A | | A | A | I |
| *Stellaria alsine* | | | | 1 | | | I |
| *Stellaria media* | | | | 2 | | | I |
| *Taraxacum* sp. | | | | | 1 | | I |
| *Trifolium repens* | | | | 2 | | | I |
| *Veronica chamaedrys* | 1 | | | | | | I |
| *Viola riviniana* | | 1 | | | | | I |
| *Arrhenatherum elatius* | | | | | A | | |
| *Asplenium scolopendrium* | A | | | | | A | |
| *Brachypodium sylvaticum* | A | | | | | | |
| *Carex sylvatica* | | | | | A | | |
| *Chamerion angustifolium* | | | A | | | | |
| *Cotoneaster bullatus* | | | | A | | | |
| *Dactylorhiza fuchsii* | | | | | | A | |
| *Epilobium ciliatum* | | A | | | | | |
| *Filipendula ulmaria* | A | | | | | | |
| *Fissidens adianthoides* | | | | | A | | |
| *Heracleum sphondylium* | | | | | A | | |
| *Ilex aquifolium* | | | | | A | | |
| *Isothecium myosuroides* | | | | | | A | |
| *Juncus effusus* | | | A | | | | |
| *Plagiothecium undulatum* | | | | | A | | |
| *Polytrichum commune* | | | A | | | | |
| *Rosa arvensis* | | A | | | | | |
| *Ulex europaeus* | A | | | A | | | |
| *Viburnum opulus* | | | | | A | | |
| **Canopy (m)** | **10m** | **7m** | **10m** | **10m** | **8m** | **8m** | |
| **Height (cm)** | **80** | **30** | **80** | **40** | **5** | **80** | |
| **Cover (%)** | **100** | **100** | **100** | **100** | **100** | **100** | |
| **Species total** | **22** | **19** | **13** | **26** | **17** | **19** | |

*Broad-leaved plantation (Q53)*

### *Conifer plantation*

Conifer plantations were not sampled using quadrats, because the dense tree canopy only supports a sparse ground flora and the plant community was not expected to have much value for nature conservation value. A walk-through of the plantation at the north-west of the study area found that although the vegetation beneath the canopy of Lodgepole Pine, Larch and Sitka Spruce was sparse it was of at least local value due to a very large population of Common Wintergreen (with many thousands of plants present). The moderately diverse range of other species in the ground flora was dominated by mosses and liverworts. Frequent seedlings of Sessile Oak and Downy Birch may give an indication of the type of woodland that might develop in this area naturally.

**Table 5. Species-list for coniferous plantation (TN12)**

*Betula pubescens*
*Campylopus introflexus*
*Chamerion angustifolium*
*Cirsium palustre*
*Cladonia rangiformis*
*Deschampsia flexuosa*
*Dicranum scoparium*
*Diplophyllum albicans*
*Epilobium brunnescens*
*Fragaria vesca*
*Hypericum androsaemum*
*Hypnum jutlandicum*
*Juncus effusus*
*Juncus tenuis*
*Kindbergia praelonga*
*Larix sp.*
*Lotus pedunculatus*
*Picea sitchensis*
*Pinus contorta*
*Pleurozium schreberi*
*Polytrichastrum formosum*
*Prunella vulgaris*
*Pseudoscleropodium purum*
*Ptilidium ciliare*
*Pyrola minor*
*Quercus petraea*
*Racomitrium lanuginosum*
*Rhytidiadelphus loreus*
*Rumex acetosa*
*Sanicula europaea*
*Sorbus aucuparia*
*Thuidium tamariscinum*
*Trifolium repens*
*Ulex europaeus*
*Vaccinium myrtillus*

*Coniferous plantation (TN12), showing large numbers of Common Wintergreen plants in otherwise sparse ground flora.*

### *Acid grassland*

At this site acid grassland typically exists as part of a mosaic with marshy grassland and heath vegetation. It tends to occur patchily, especially on well-drained sloping ground, where succession to heath is limited by grazing. Much of it also varies in the openness of the sward, depending on slope and grazing intensity. In some cases, where it is developing on relatively young coal spoil it may also be a transitional stage that might eventually become heath. Much of the acid grassland within the site would be best classified semi-improved acid grassland (which is discussed later) due to the heavy grazing of sheep and likely past influences of reprofiling and soil conditioning work carried out to restore coal spoil.

In terms of the NVC the acid grassland forming relatively open swards on dry, stony slopes and spoil heaps is best assigned to U1 *Festuca ovina – Agrostis capillaris – Rumex acetosella* grassland. It supports a relatively high proportion of annuals, bryophytes and lichens. However, it differs from the typical published U1 community as Sheep's Sorrel is relatively scarce.

**Table 6. Quadrat data for U1 *Festuca ovina – Agrostis capillaris – Rumex acetosella* dry acid grassland.**

| Species | 4 | 27 | 29 | 33 | 34 | 57 | 59 | 74 | 96 | 101 | 111 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Festuca ovina* | | 2 | 8 | 5 | 2 | 6 | 5 | 1 | 4 | | 3 | V |
| *Rhytidiadelphus* | 2 | 1 | 3 | 4 | 2 | | | 4 | 4 | 2 | 4 | V |
| *Cirsium palustre* | 1 | | 1 | 1 | 1 | 1 | 1 | | 1 | | A | IV |
| *Dicranum scoparium* | | | 2 | 4 | | 3 | 4 | 3 | 2 | 1 | 4 | IV |
| *Galium saxatile* | | 2 | 2 | 4 | | 3 | 3 | 2 | 4 | | 2 | IV |
| *Hypochaeris radicata* | | 2 | 4 | 1 | 2 | 2 | A | 3 | A | 2 | | IV |
| *Peltigera sp.* | | | 2 | 1 | | 2 | 2 | A | 2 | 1 | 2 | IV |
| *Cladonia pyxidata* | | | 2 | 2 | 1 | 2 | | 1 | | 1 | | III |
| *Cladonia rangiformis* | | A | | 5 | | 3 | 2 | 2 | | 1 | | III |
| *Danthonia decumbens* | 2 | 6 | | | 4 | 1 | 4 | A | 2 | | | III |
| *Holcus lanatus* | 4 | | | | | 2 | 2 | | 5 | 4 | 4 | III |
| *Hypnum jutlandicum* | | 4 | 4 | 7 | 6 | | | | 2 | | 2 | III |
| *Luzula campestris* | 1 | | 2 | | | 2 | 1 | | 2 | 2 | | III |
| *Pilosella officinarum* | | | 2 | | | 5 | 4 | | | 2 | 1 | III |
| *Polytrichum commune* | A | 2 | | 4 | 1 | | 4 | 3 | | | | III |
| *Polytrichum juniperinum* | 1 | | 7 | | A | | | 4 | 2 | 2 | | III |
| *Potentilla erecta* | 4 | 2 | | | 1 | | A | 2 | A | | 2 | III |
| *Agrostis canina* | | 8 | 2 | 2 | | | | | 3 | | | II |
| *Agrostis capillaris* | 8 | | | A | | 2 | 7 | | | | 6 | II |
| *Anthoxanthum odoratum* | 2 | | | | | 4 | 2 | | 8 | | | II |
| *Calluna vulgaris* | | | 4 | | 1 | | | 2 | A | | 4 | II |
| *Cladonia furcata* | | | 2 | 2 | 1 | A | | 1 | | A | | II |
| *Festuca rubra* | 4 | | | | | | | | 6 | 7 | 4 | II |
| *Juncus effusus* | 2 | | | | 1 | | 1 | | | | | II |
| *Lotus corniculatus* | | | A | | | | 2 | | 4 | 3 | | II |
| *Luzula multiflora* | | | | | 1 | | | | A | 3 | 2 | II |
| *Plantago lanceolata* | | | | | | | | | 4 | 3 | 2 | II |
| *Pleurozium schreberi* | | | | | | 4 | 6 | 4 | 2 | A | | II |
| *Pseudoscleropodium* | 2 | A | 1 | | | 4 | 3 | | | | | II |
| *Taraxacum* sp. | | | 1 | | | | | | 1 | | 2 | II |
| *Vicia sativa* | | | | | | | | | 2 | 4 | 2 | II |
| *Aira caryophyllea* | | | | | | 2 | A | | | 3 | | I |
| *Aira praecox* | | | | | | 2 | | | | A | | I |
| *Anaphalis margaritacea* | | | 4 | | | | | | | 2 | | I |
| *Arrhenatherum elatius* | | | | | | | | | | | 1 | I |
| *Atrichum undulatum* | 1 | | | | | | | | | 1 | | I |
| *Betula pubescens* | 1 | | | | | | | | | A | | I |

| Species | 4 | 27 | 29 | 33 | 34 | 57 | 59 | 74 | 96 | 101 | 111 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Blechnum spicant* | | | | | 1 | | | | | | | I |
| *Calliergonella cuspidata* | | | | | | | | | | | 2 | I |
| *Campylopus introflexus* | | | | | | | | | | 1 | | I |
| *Carex binervis* | | | | | | | | | 1 | | | I |
| *Cerastium fontanum* | | | | | | A | | | | 2 | | I |
| *Chamerion angustifolium* | | | | | | | | | | 2 | 4 | I |
| *Cirsium vulgare* | | | | | | | | | | 1 | | I |
| *Cladonia crispata* | | | | | | | | 1 | | | | I |
| *Cladonia foliacea* | | | | | | 2 | | | | | | I |
| *Dactylorhiza praetermissa* | | | | | | | | | | 1 | | I |
| *Deschampsia flexuosa* | | | | | | | | 8 | 4 | | | I |
| *Diplophyllum albicans* | | | | | A | | 1 | 2 | | | | I |
| *Equisetum arvense* | | | | | | | | | | A | 1 | I |
| *Erica tetralix* | | | | | 1 | | | | | | | I |
| *Fragaria vesca* | | | | | | | | | | 3 | 4 | I |
| *Geranium dissectum* | | | | | | | | | | | 2 | I |
| *Hieracium sp.* | | | | | | | | | | 2 | | I |
| *Hylocomium splendens* | | | | | | | 1 | 1 | | | A | I |
| *Juncus conglomeratus* | 2 | | | | | | | | | | | I |
| *Juncus squarrosus* | | 1 | | | 4 | | | | | | | I |
| *Lophocolea bidentata* | | | | | | | | | 2 | | 2 | I |
| *Lotus pedunculatus* | 1 | | | | | | | | | | | I |
| *Molinia caerulea* | A | | A | | 6 | | | | A | | | I |
| *Nardus stricta* | 2 | | | A | 6 | | A | A | | | | I |
| *Poa pratensis* | | | | | | | | | | | 5 | I |
| *Pogonatum urnigerum* | | | | | | | | | | 3 | | I |
| *Polytrichum piliferum* | | | 3 | | | 2 | | | | | | I |
| *Potentilla reptans* | | | | | | | | | | 1 | | I |
| *Prunella vulgaris* | | | | | | | | | | 1 | | I |
| *Ptilidium ciliare* | | | | | | 2 | | | | | | I |
| *Quercus petraea* | 1 | | | | | | | | | | | I |
| *Racomitrium cf fasciculare* | | | | 2 | | | | | | | | I |
| *Rumex acetosa* | | | | | | | | | | 2 | | I |
| *Trifolium dubium* | | | | | | 2 | | | | 2 | | I |
| *Trifolium pratense* | | | | | | | | | | 2 | | I |
| *Trifolium repens* | | | 2 | | | 2 | | | | | | I |
| *Tussilago farfara* | | | | | | | | | | 1 | | I |
| *Vaccinium myrtillus* | | | | 2 | | | A | 1 | | | | I |
| *Veronica officinalis* | | | 2 | | | 3 | | | | | A | I |
| *Vicia hirsuta* | | | | | | | | | 1 | | 3 | I |
| *Viola riviniana* | | | | | | | | | | | 2 | I |
| *Carex panicea* | A | | | | | | | | | | | |
| *Centaurea nigra* | | | | | | | | | A | | | |
| *Ceratodon purpureus* | A | | | | | | | | | | | |
| *Cladonia floerkeana* | | | A | | | | | | | | | |
| *Crataegus monogyna* | | | | | | | A | | | | | |
| *Digitalis purpurea* | | | | | | | | A | | | | |
| *Epilobium palustre* | | | | | | | | | | A | | |
| *Picea sitchensis* | | | | | | | | | | A | | |
| *Ranunculus repens* | | | | | | | | | | | A | |
| *Salix cinerea* | | | | | | | | | A | A | | |
| *Senecio jacobaea* | | | | | | A | | | | | | |
| *Sorbus aucuparia* | | | | | | | | | A | | A | |
| *Ulex europaeus* | A | A | A | | | | | | | | | |
| **Height (cm)** | **50** | **25** | **15** | **10** | **40** | **15** | **15** | **30** | **30** | **20** | **30** | |
| **Cover (%)** | **100** | **95** | **95** | **100** | **95** | **85** | **95** | **95** | **100** | **95** | **100** | |
| **Species total** | **18** | **10** | **21** | **15** | **18** | **24** | **19** | **18** | **23** | **32** | **26** | |

*Dry U1 acid grassland on a former railway embankment (Q57)*

### *Neutral grassland*

Neutral and semi-improved neutral grassland at this site is mostly limited to small patches and road-side strips, where there is more base-enrichment in soils than the more prevalent acid grassland communities. In this case it is likely that the base minerals have originated from shale in coal waste or limestone associated with road building, and this is especially likely with the developing grasslands at the washery (Quadrats 98, 99 and 100). Most are probably best classified as 'unimproved' neutral grassland because it is unlikely that there has been any intentional grassland improvement in most of these areas, except occasional grass cutting. There is a wide range of species in these rather fragmented habitats, reflecting the mix of acid and base minerals in the soils derived from coal spoil. In terms of the NVC the neutral grassland communities are probably closest to MG5 *Centaurea nigra - Cynosurus cristatus* grassland, although some patches of rougher, unmanaged grassland are closer to MG1 *Arrhenatherum elatius* grassland (which was more species-poor and not sampled). In addition to the species recorded in the quadrats, the neutral grassland also included small amounts of Restharrow, Cowslip and Hairy Tare.

*MG5 neutral grassland beside access track (Q87)*

## Table 7. Quadrat data for MG5 neutral grassland.

| Species | 19 | 85 | 87 | 95 | 98 | 99 | 100 | Frequency |
|---|---|---|---|---|---|---|---|---|
| *Calliergonella cuspidata* | | 4 | 2 | 2 | 2 | 4 | 4 | V |
| *Cynosurus cristatus* | 3 | 4 | 3 | 2 | A | 2 | 3 | V |
| *Festuca rubra* | 7 | 4 | 5 | 5 | 6 | 3 | | V |
| *Holcus lanatus* | 7 | 4 | 2 | 1 | A | 2 | 4 | V |
| *Anthoxanthum odoratum* | 8 | 5 | 4 | | 2 | | 4 | IV |
| *Rhytidiadelphus squarrosus* | | 3 | 4 | | 4 | 6 | 2 | IV |
| *Trifolium repens* | 2 | 2 | 2 | 1 | | | 4 | IV |
| *Carex flacca* | | | 5 | 3 | 4 | | 4 | III |
| *Carex leporina* | 2 | | 2 | | A | 1 | 2 | III |
| *Cerastium fontanum* | 1 | 1 | 1 | A | | | 1 | III |
| *Juncus effusus* | 2 | | 2 | | 1 | 2 | A | III |
| *Lotus corniculatus* | | 1 | | 3 | 7 | | | III |
| *Lotus pedunculatus* | 4 | | 2 | | | | 2 | III |
| *Luzula campestris* | | 2 | 2 | | 2 | | | III |
| *Plantago lanceolata* | 4 | 2 | 2 | 2 | | | | III |
| *Prunella vulgaris* | A | | | 1 | A | 2 | 3 | III |
| *Ranunculus acris* | 2 | 3 | 3 | | A | | 2 | III |
| *Ranunculus repens* | 5 | | | 1 | | 2 | 3 | III |
| *Trifolium pratense* | 6 | | 6 | A | 1 | | A | III |
| *Vicia sativa* | | 3 | 1 | 1 | | 1 | A | III |
| *Achillea millefolium* | | | | 4 | | | 2 | II |
| *Agrostis capillaris* | 5 | | | | 2 | | | II |
| *Agrostis stolonifera* | | | | | | 3 | 1 | II |
| *Arrhenatherum elatius* | | 6 | | | | 2 | | II |
| *Brachythecium rutabulum* | | 2 | | | | 2 | | II |
| *Cardamine pratensis* | | | 1 | | | 1 | | II |
| *Centaurea nigra* | | | | | 1 | | 2 | II |
| *Cirsium arvense* | | 1 | | | | 1 | | II |
| *Cirsium palustre* | A | | A | 1 | | | 1 | II |
| *Cladonia rangiformis* | | | | 1 | 2 | | | II |
| *Cratoneuron filicinum* | | | | 2 | | | 2 | II |
| *Dactylis glomerata* | | 4 | A | 1 | | A | | II |
| *Dactylorhiza praetermissa* | | | 1 | | A | 1 | A | II |
| *Equisetum arvense* | 2 | | A | | | | 2 | II |
| *Galium palustre* | A | | | | | 3 | 1 | II |
| *Holcus mollis* | | | | | | 4 | 1 | II |
| *Hypochaeris radicata* | | | | 1 | 4 | A | | II |
| *Kindbergia praelonga* | 2 | 2 | | | | | | II |
| *Linum catharticum* | | | | 2 | 1 | | | II |
| *Peltigera sp.* | | | | 2 | | 1 | | II |
| *Pilosella officinarum* | | | | 4 | 2 | | | II |
| *Poa pratensis* | | 2 | A | | | 3 | | II |
| *Potentilla anserina* | | | | 2 | | 7 | | II |
| *Racomitrium ericoides* | | | | 2 | 4 | | | II |
| *Sagina procumbens* | | | | | | 1 | 3 | II |
| *Silene flos-cuculi* | | | 1 | | | | 1 | II |
| *Trifolium dubium* | | | | 3 | 3 | | | II |
| *Agrostis canina* | | | | | 2 | | | I |
| *Aira caryophyllea* | | | | | 2 | | | I |
| *Alopecurus pratensis* | 2 | | | | | | | I |
| *Bellis perennis* | | | | 1 | A | | A | I |
| *Betula pubescens* | | | | 1 | | | | I |
| *Bromus hordeaceus* | | | | 3 | | | | I |
| *Carex hirta* | | | | | A | A | 5 | I |
| *Carex nigra* | | | | | | | 4 | I |
| *Carex pallescens* | | | | | | | 2 | I |
| *Carex spicata* | | | | | | | 1 | I |
| *Centaurium erythraea* | | | | | A | | 1 | I |

| Species | 19 | 85 | 87 | 95 | 98 | 99 | 100 | Frequency |
|---|---|---|---|---|---|---|---|---|
| *Chamerion angustifolium* | | 2 | | A | | | | I |
| *Cirsium vulgare* | | | | | | 1 | | I |
| *Daucus carota* | | | | 1 | | | | I |
| *Deschampsia cespitosa* | | | 2 | | | | | I |
| *Equisetum palustre* | | | | | | | 1 | I |
| *Festuca ovina* | | | | | 2 | | | I |
| *Fragaria vesca* | | | | 2 | | | | I |
| *Geranium dissectum* | | | | | | 2 | A | I |
| *Hypericum perforatum* | | | | 2 | A | | | I |
| *Hypnum lacunosum* | | | | 2 | A | | | I |
| *Juncus acutiflorus* | | | | | | 2 | | I |
| *Lathyrus pratensis* | | | | | A | | 2 | I |
| *Leontodon hispidus* | | | 4 | | | | | I |
| *Leucanthemum vulgare* | | | | A | 3 | | | I |
| *Lolium perenne* | 1 | A | | | | | | I |
| *Medicago lupulina* | | | 4 | | | | | I |
| *Mentha aquatica* | | | | | | 1 | | I |
| *Odontites vernus* | 2 | | | | | | | I |
| *Oenothera sp.* | | | | 2 | | | | I |
| *Plagiomnium undulatum* | | | | | | 2 | | I |
| *Poa compressa* | | | | | | | 1 | I |
| *Quercus robur* | | | | 1 | | | | I |
| *Ranunculus flammula* | 1 | | | | | | | I |
| *Rhinanthus minor* | | A | 2 | | | | | I |
| *Rosa canina* | | | | 1 | | | | I |
| *Rumex acetosa* | A | 2 | | | A | | | I |
| *Rumex conglomeratus* | | | | | | 1 | | I |
| *Salix cinerea* | | A | A | A | | | 1 | I |
| *Scorzoneroides autumnalis* | | | | | | | 1 | I |
| *Senecio aquaticus* | | | | | | 1 | | I |
| *Senecio jacobaea* | | | | | 2 | | | I |
| *Stachys palustris* | | | | | | 2 | | I |
| *Taraxacum* sp. | | 1 | | | | | | I |
| *Torilis japonica* | | 1 | | | | | | I |
| *Vicia cracca* | | | | | | | 1 | I |
| *Anaphalis margaritacea* | | | | A | | | | |
| *Cladonia sp.* | | | | A | | | | |
| *Crataegus monogyna* | | A | | | | | | |
| *Dactylorhiza fuchsii* | | | | | A | | | |
| *Encalypta streptocarpa* | | | | A | | | | |
| *Epilobium palustre* | A | | | | | | | |
| *Euphrasia sp.* | A | | | | | | | |
| *Filago minima* | | | | A | | | | |
| *Fraxinus excelsior* | | | A | | | | | |
| *Juncus articulatus* | | | | | | | A | |
| *Luzula multiflora* | | A | | | | | | |
| *Melilotus cf officinalis* | | | | A | | | | |
| *Molinia caerulea* | | | | | | | A | |
| *Nardus stricta* | | | A | | | | | |
| *Potentilla reptans* | | | A | | | | | |
| *Quercus petraea* | | A | | | | | | |
| *Reynoutria japonica* | | | | | | A | | |
| *Rubus fruticosus* | A | | | | A | A | | |
| *Rumex crispus* | A | | | | | | | |
| *Sonchus oleraceus* | | | | | | | A | |
| *Tussilago farfara* | | | | A | | A | | |
| *Urtica dioica* | | | | | | A | | |
| **Species total** | **20** | **23** | **24** | **33** | **22** | **30** | **34** | |
| **Height (cm)** | **60** | **40** | **40** | **10** | **20** | **30** | **30** | |
| **Cover (%)** | **100** | **100** | **100** | **90** | **95** | **100** | **95** | |

### *Semi-improved acid grassland*

A high proportion of the heavily grazed, short grassland on the site is best classified as semi-improved acid grassland. Most is grazed by sheep and cattle, but a few fields near the washery (represented by Quadrats 119, 124, 126 and 127) are grazed by horses. One of the features of the older semi-improved grassland is the abundance of ant-hills. For the purposes of this study the 'ant-hill grassland' was sampled separately from the other semi-improved acid grassland, because of its very distinct appearance. This fits the NVC community U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland.

**Table 8. Quadrat data for semi-improved acid 'ant-hill' grassland.**

| Species | 6 | 14 | 17 | 44 | 56 | 89 | 119 | 124 | 126 | 127 | Freq |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Agrostis capillaris* | 8 | 9 | 4 | 6 | 8 | 2 | 2 | 8 | 2 | 2 | V |
| *Holcus lanatus* | 1 | | 5 | 4 | 3 | 4 | 2 | 2 | 1 | 2 | V |
| *Luzula campestris* | A | 2 | 3 | 4 | 4 | 1 | 2 | 4 | 1 | 3 | V |
| *Festuca rubra* | | | 2 | 5 | | 8 | 2 | 6 | 2 | 4 | IV |
| *Galium saxatile* | 4 | 5 | 4 | A | 3 | 6 | 2 | 3 | | 4 | IV |
| *Polytrichum juniperinum* | 3 | | 2 | | 2 | | 2 | 2 | 2 | 2 | IV |
| *Rhytidiadelphus squarrosus* | 4 | 4 | 2 | 4 | | 2 | 4 | 4 | | 2 | IV |
| *Anthoxanthum odoratum* | | | 8 | 4 | 4 | | | | 7 | 6 | III |
| *Festuca ovina* | 4 | 4 | | 7 | 5 | | 2 | | | A | III |
| *Nardus stricta* | 2 | 4 | | | 5 | | 2 | 2 | | 2 | III |
| *Plantago lanceolata* | | | 5 | 3 | 2 | | | 1 | 2 | 4 | III |
| *Potentilla erecta* | A | | 4 | 1 | 6 | | 4 | 4 | | A | III |
| *Agrostis canina* | 2 | | | 4 | 2 | | | | | | II |
| *Ceratodon purpureus* | | 2 | A | | 2 | | | | 2 | 3 | II |
| *Cynosurus cristatus* | | | 2 | 4 | | | | | 3 | 4 | II |
| *Danthonia decumbens* | 2 | A | | | 2 | | 1 | 3 | | | II |
| *Deschampsia flexuosa* | 3 | | | | | | 4 | 3 | | | II |
| *Epilobium ciliatum* | | | | | | 1 | 2 | 1 | | | II |
| *Juncus effusus* | 1 | | | 4 | A | A | 1 | 2 | | | II |
| *Juncus squarrosus* | | 1 | | | | | 2 | 3 | A | A | II |
| *Prunella vulgaris* | | | | 2 | 2 | | | | A | 1 | II |
| *Pseudoscleropodium purum* | 2 | | | | 2 | | 2 | | | | II |
| *Rumex acetosa* | | | 1 | | | | | 2 | A | 1 | II |
| *Rumex acetosella* | 2 | | | | | | | | 4 | 5 | II |
| *Senecio jacobaea* | | | | | | | | 1 | 2 | 2 | II |
| *Taraxacum* sp. | | | 2 | 1 | | | | | 2 | | II |
| *Trifolium repens* | | | | 4 | 2 | | | | A | 2 | II |
| *Acer pseudoplatanus* | | | | | | | | | | 1 | I |
| *Achillea millefolium* | | | | | | 1 | | | A | | I |
| *Aira caryophyllea* | | | | | 2 | | | | | | I |
| *Aira praecox* | 5 | | | | | | | | | | I |
| *Calluna vulgaris* | | | | | | | 2 | 1 | | | I |
| *Carex binervis* | | | | 1 | | | | | | | I |
| *Cerastium fontanum* | | | | 2 | | | | | A | 1 | I |
| *Cirsium arvense* | | | | 1 | | A | | | | | I |
| *Cirsium palustre* | | | | 2 | 2 | | | | | | I |
| *Cirsium vulgare* | | | | | | 1 | | | | | I |
| *Dicranum scoparium* | | | | | A | | 2 | | | | I |
| *Filago germanica* | | | | | | | | | 1 | | I |
| *Hypnum jutlandicum* | | | | | 2 | | 2 | | | | I |
| *Hypochaeris radicata* | | | 2 | | | | | | | | I |
| *Juncus acutiflorus* | | | 1 | | | | | | | | I |
| *Juncus conglomeratus* | | | 1 | | | 1 | | | | | I |
| *Kindbergia praelonga* | | | | | | | | 2 | | | I |
| *Lolium perenne* | | | | 2 | | | | | | | I |
| *Lotus corniculatus* | | | 3 | | | | | | A | 1 | I |
| *Luzula multiflora* | | | | | | | A | 1 | | | I |

| Species | 6 | 14 | 17 | 44 | 56 | 89 | 119 | 124 | 126 | 127 | Freq |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Molinia caerulea* | | | A | | | | 6 | 2 | | | I |
| *Narcissus sp.* | | | | 4 | | | | | | | I |
| *Pedicularis sylvatica* | | | | | | | 6 | | | | I |
| *Peltigera sp.* | | | | | 1 | | | A | | A | I |
| *Pilosella aurantiaca* | | | | | | | | | | 1 | I |
| *Pilosella officinarum* | | | | | A | | | | 2 | | I |
| *Pleurozium schreberi* | 5 | | | | A | | 3 | | | | I |
| *Poa annua* | | | | | | | | | 3 | A | I |
| *Poa pratensis* | | | | | | 4 | | 2 | | | I |
| *Polygala serpyllifolia* | | | | | A | | 2 | | | | I |
| *Ranunculus repens* | | | | | | A | | | 1 | 2 | I |
| *Sagina procumbens* | | | | 2 | | | | | | A | I |
| *Scorzoneroides autumnalis* | | | | | | | | | 2 | 2 | I |
| *Succisa pratensis* | | | | | | | | | | 1 | I |
| *Trifolium dubium* | | | | | | | | | A | 1 | I |
| *Vaccinium myrtillus* | | | | | | | 4 | 4 | | | I |
| *Valeriana officinalis* | | | | | | | | 2 | | | I |
| *Veronica arvensis* | | | | 1 | | | | | | 1 | I |
| *Veronica serpyllifolia* | | | | 2 | | | | 1 | | | I |
| *Vicia sativa* | | | | | | 1 | | 2 | | | I |
| *Vulpia bromoides* | | | | 3 | 1 | | | | | | I |
| *Arrhenatherum elatius* | | | | | | A | | | | | |
| *Atrichum undulatum* | | | | | | | | | | | |
| *Bellis perennis* | | | | | | | | | A | A | |
| *Betula pubescens* | | | | | | | | A | | | |
| *Bromus hordeaceus* | | | | A | A | | | | | | |
| *Carex demissa* | | | | | A | | | | | | |
| *Carex leporina* | | | | | | | | | | A | |
| *Chamerion angustifolium* | | | | | | | | A | | A | |
| *Cladonia rangiformis* | | | | | A | | | | | | |
| *Crataegus monogyna* | | | | | | | | A | | | |
| *Dactylorhiza fuchsii* | | | | | | | | | | A | |
| *Deschampsia cespitosa* | | | | | | A | | | | | |
| *Digitalis purpurea* | A | | A | | | | | | A | | |
| *Erica tetralix* | | | | | | | A | | | | |
| *Galeopsis cf tetrahit* | | | | | | | | | | A | |
| *Heracleum sphondylium* | | | | | | A | | | | | |
| *Homalothecium sericeum* | | | | A | | | | | | | |
| *Juncus bulbosus* | | | | | | | A | | | | |
| *Juncus tenuis* | | | | | | | | | x | | |
| *Lotus pedunculatus* | | | | | | | | | x | | |
| *Odontites vernus* | | | | | | | | | x | | |
| *Poa trivialis* | | | | | | | | | | A | |
| *Polytrichastrum formosum* | | | | | | | A | | | | |
| *Quercus x rosacea* | | | | | | | | A | | | |
| *Racomitrium aciculare* | | | | A | | | | | | | |
| *Ranunculus acris* | | | | | | | | | A | | |
| *Rumex obtusifolius* | | | | | | | | | A | | |
| *Sphagnum capillifolium* | | | | | | | A | | | | |
| *Sphagnum inundatum* | | | | | | | A | | | | |
| *Tilia cordata* | | | | | | A | | | | | |
| *Ulex europaeus* | | | | A | | | | | | A | |
| *Veronica officinalis* | | | | | | | | | A | | |
| *Viola riviniana* | | | | | | A | | | | | |
| **Species total** | **15** | **8** | **17** | **25** | **21** | **12** | **24** | **26** | **17** | **26** | |
| **Height (cm)** | **5** | **10** | **40** | **20** | **10** | **30** | **10** | **10** | **10** | **10** | |
| **Cover (%)** | **95** | **100** | **95** | **100** | **95** | **100** | **95** | **100** | **70** | **95** | |

*U4 semi-improved acid grassland with abundant ant-hills (Q6)*

Other semi-improved acid grassland is present that also has a closed sward but does not support the same frequency of ant-hills. Some of this is of relatively recent origin (the large spoil heap where Q30 and 37 were recorded is only about 30 years old). Some appears to be on natural clay soil rather than coal spoil, and with a high proportion of Sweet Vernal-grass, Red Fescue and Crested Dog's-tail is close to MG5 semi-improved neutral grassland (e.g. Q69, 79 and 80). Much of the semi-improved grassland has patchy rushes (especially Soft Rush), and some is transitional with damp grassland (e.g. Q35, which has a high frequency of Purple Moor-grass and has affinity with M25 mire). A few areas with more prominent Mat Grass resemble U5 *Nardus stricta – Galium saxatile* grassland. However, the majority of this close-sward acid grassland still broadly conforms to the NVC community U4 *Festuca ovina – Agrostis capillaris – Galium saxatile* grassland.

*Low-diversity U4 semi-improved acid grassland (Q23)*

## Table 9. Quadrat data for other U4 semi-improved acid grassland.

| Species | 7 | 23 | 30 | 35 | 37 | 69 | 79 | 80 | Freq. |
|---|---|---|---|---|---|---|---|---|---|
| *Agrostis capillaris* | 9 | 7 | 6 | | 6 | 8 | 4 | 4 | V |
| *Galium saxatile* | 2 | 2 | 3 | 1 | | 2 | 2 | 2 | V |
| *Holcus lanatus* | 6 | 4 | 4 | | 7 | 6 | 4 | 5 | V |
| *Rhytidiadelphus squarrosus* | 2 | 5 | 8 | 2 | 7 | 4 | 4 | 2 | V |
| *Cirsium palustre* | A | 1 | 1 | A | 1 | A | 1 | 1 | IV |
| *Cynosurus cristatus* | | | 1 | | 5 | 1 | 2 | 3 | IV |
| *Festuca rubra* | 2 | | 2 | | 5 | 4 | 4 | 7 | IV |
| *Luzula campestris* | 3 | 1 | | | 2 | 2 | 5 | 7 | IV |
| *Nardus stricta* | 2 | 6 | | 2 | 4 | | 2 | | IV |
| *Potentilla erecta* | 4 | 2 | | | 2 | 5 | 7 | 8 | IV |
| *Trifolium repens* | 4 | 1 | 1 | | 2 | | 3 | 2 | IV |
| *Anthoxanthum odoratum* | 2 | A | | | | 5 | 8 | 5 | III |
| *Cerastium fontanum* | 1 | | 1 | | 2 | | A | | II |
| *Danthonia decumbens* | 2 | | | 1 | A | | | | II |
| *Festuca ovina* | | 7 | 4 | 1 | | | | | II |
| *Juncus conglomeratus* | | | | 2 | 4 | | | A | II |
| *Juncus effusus* | A | 1 | | A | 1 | A | A | | II |
| *Juncus squarrosus* | 2 | | | 2 | | | | | II |
| *Luzula multiflora* | | | | 3 | 3 | | | | II |
| *Molinia caerulea* | | | | 8 | 1 | | | | II |
| *Plantago lanceolata* | | | | | | 2 | | 3 | II |
| *Poa pratensis* | 2 | A | A | | | | 1 | | II |
| *Rumex acetosa* | | | | | | 4 | 3 | 2 | II |
| *Senecio jacobaea* | | | | | 1 | | 2 | | II |
| *Veronica officinalis* | | | 1 | | 2 | | | | II |
| *Veronica serpyllifolia* | | | | | 1 | 1 | | | II |
| *Vicia sativa* | | | 1 | | | 2 | | | II |
| *Agrostis canina* | | | 3 | | | | | | I |
| *Carex binervis* | | | | | | | | 2 | I |
| *Carex leporina* | | | | | 1 | | | | I |
| *Chamerion angustifolium* | | | A | | | 2 | | | I |
| *Cirsium arvense* | | | | | 2 | | | | I |
| *Deschampsia flexuosa* | | 2 | | | | | | | I |
| *Dicranum scoparium* | | | 1 | | | | | | I |
| *Epilobium ciliatum* | | | | | 2 | | | | I |
| *Epilobium palustre* | | | 1 | | | | | | I |
| *Erica tetralix* | | | | 2 | | | | | I |
| *Fragaria vesca* | | | A | | 1 | | | | I |
| *Hyacinthoides non-scripta* | | | | | | | 1 | | I |
| *Hylocomium splendens* | | | 2 | | | | | | I |
| *Hypericum tetrapterum* | | | | | | 1 | | | I |
| *Hypnum jutlandicum* | | | | 4 | | | | | I |
| *Lotus corniculatus* | | | A | | | 1 | | A | I |
| *Peltigera sp.* | | | 4 | | | | | | I |
| *Persicaria maculosa* | | | | | | 1 | | | I |
| *Pilosella officinarum* | | | 1 | | | | | | I |
| *Polytrichum juniperinum* | | | | 2 | | | | | I |
| *Pseudoscleropodium purum* | | | | | | 1 | | | I |
| *Quercus petraea* | | | | | | | | 1 | I |
| *Rumex acetosella* | | | 1 | | | | | | I |
| *Thuidium tamariscinum* | | | | | 2 | | | | I |
| *Vaccinium myrtillus* | | | | 1 | | | | | I |
| *Aira caryophyllea* | | | A | | | | | | |
| *Aira praecox* | | | A | | | | | | |
| *Calluna vulgaris* | | | | | | A | | | |
| *Carex panicea* | | | | | A | | | | |
| *Carex pilulifera* | | | | A | | | | | |
| *Crataegus monogyna* | | | | | | | | A | |

| Species | 7 | 23 | 30 | 35 | 37 | 69 | 79 | 80 | Freq. |
|---|---|---|---|---|---|---|---|---|---|
| *Deschampsia cespitosa* | | | | | | A | | | |
| *Geranium dissectum* | | | A | | | | | | |
| *Polytrichum commune* | | | | A | | | | | |
| *Polytrichum piliferum* | | | A | | | | | | |
| *Sagina procumbens* | A | | | | | | | | |
| *Salix cinerea* | | | | | | A | | | |
| *Taraxacum* sp. | | | | | A | | | | |
| *Trifolium dubium* | | | | | A | | | | |
| *Ulex europaeus* | | | | | | A | | | |
| **Species total** | **14** | **12** | **19** | **13** | **23** | **18** | **16** | **14** | |
| **Height (cm)** | **10** | **10** | **20** | **60** | **40** | **40** | **20** | **15** | |
| **Cover (%)** | **100** | **100** | **100** | **100** | **98** | **90** | **100** | **95** | |

### *Sparse grassland on coal spoil and washery sidings*

Much of the study area supports sparse vegetation on recently disturbed coal spoil. Similarly, the railway sidings at the washery support sparse vegetation on the limestone ballast forming the tracks, which is also mixed with fine material from the coal. The flora supports a high proportion of annual and low-growing ruderal species, as well as early colonists more typical of heath and grassland vegetation, and seedlings of trees and scrub. Bryophytes and lichens are also locally prominent. The flora supports many species indicative of acid soils, but there are many base-loving species too. This mix is typical of coal spoil and results in a very variable, flower-rich and often high diversity flora. In Phase 1 habitat classification this would usually be classified as 'ephemeral/ short perennial vegetation', although it is often not freely draining as the shale in the coal spoil breaks down into clays. It is not easy to define in terms of the NVC, probably because of the wide variation in the range of species that co-exist on the coal spoil and the presence of so many base-loving plants. The closest matches are probably U1 *Festuca ovina – Agrostis capillaris – Rumex acetosella* grassland community (Quadrats 38 and 72 are good examples of a typical U1 flora on coal spoil), but much of the spoil flora bears little resemblance to U1 and is probably best left unclassified.

*Sparse vegetation on coal spoil (Q38).*

## Table 10. Quadrat data for sparse grassland on coal spoil and washery sidings.

| Species | 25 | 38 | 62 | 63 | 72 | 91 | 92 | 94 | 97 | 115 | 116 | 118 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Aira caryophyllea* | 2 | 2 | 3 | 3 | 3 | 2 | A | | 3 | 2 | 2 | 1 | V |
| *Lotus corniculatus* | | | 8 | 9 | 2 | 3 | 2 | 2 | 4 | 4 | 2 | 3 | V |
| *Pilosella officinarum* | 5 | 3 | 1 | 2 | 2 | 4 | 2 | 2 | 5 | 5 | 6 | 6 | V |
| *Taraxacum* sp. | 2 | | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 3 | 1 | V |
| *Trifolium dubium* | 2 | 4 | 4 | 3 | 2 | 7 | 4 | 3 | 4 | 3 | 6 | | V |
| *Festuca rubra* | 5 | | 4 | 6 | 1 | 2 | | 2 | | 5 | 4 | 2 | IV |
| *Hypochaeris radicata* | | | 1 | 3 | 3 | | 1 | | 1 | 4 | 4 | 1 | IV |
| *Linum catharticum* | 2 | 2 | 3 | | 2 | 1 | | 3 | 2 | 3 | | A | IV |
| *Agrostis stolonifera* | 1 | | | | | 3 | 4 | 4 | | | 2 | 1 | III |
| *Calliergonella cuspidata* | | | 2 | 3 | | A | 6 | 2 | | | 3 | | III |
| *Campylopus introflexus* | 4 | 5 | | | 4 | | | | 5 | | | 1 | III |
| *Cerastium fontanum* | | | 2 | 2 | | 2 | 2 | 2 | A | | 2 | A | III |
| *Cynosurus cristatus* | | | 3 | 4 | 1 | 1 | 4 | 2 | | A | 4 | | III |
| *Festuca ovina* | | 3 | 2 | A | 4 | 1 | A | | 2 | | | 3 | III |
| *Fragaria vesca* | 2 | 7 | 2 | A | 4 | 2 | | 1 | A | | | 4 | III |
| *Holcus lanatus* | | | 3 | 6 | | | | | 1 | 2 | 3 | A | III |
| *Plantago lanceolata* | | | | 2 | | 4 | 2 | 2 | 2 | 3 | 3 | A | III |
| *Polytrichum juniperinum* | 3 | 4 | | | 4 | | | | | | 1 | 2 | III |
| *Prunella vulgaris* | | | 2 | | 1 | 3 | 2 | 3 | | | | | III |
| *Rhytidiadelphus squarrosus* | | | | 2 | | 2 | 2 | | 3 | | 4 | | III |
| *Sagina procumbens* | 1 | 1 | | | 2 | 2 | | | 1 | | | | III |
| *Senecio jacobaea* | A | 1 | | | | 3 | 2 | 2 | 2 | | | | III |
| *Trifolium repens* | 2 | A | 3 | | A | 2 | 5 | 2 | A | | 2 | | III |
| *Agrostis capillaris* | | 2 | | | 2 | | | 2 | | 2 | | | II |
| *Aira praecox* | 2 | 2 | | | 3 | | 1 | | | | | A | II |
| *Anaphalis margaritacea* | | 2 | | A | 2 | | | A | | | | 2 | II |
| *Anthoxanthum odoratum* | | | | | | | | | 2 | 2 | 4 | | II |
| *Carex flacca* | | | | | | 2 | | | 2 | 5 | 2 | | II |
| *Cirsium palustre* | | | A | | 1 | | 1 | | | | 1 | A | II |
| *Cirsium vulgare* | 1 | | | | 1 | A | | | | | | 2 | II |
| *Cladonia furcata* | 4 | 1 | | | 2 | | | | 2 | | | | II |
| *Cladonia pyxidata* | | 1 | | | 2 | | | | | | 1 | | II |
| *Dactylis glomerata* | | | | | | 4 | 4 | 2 | 1 | | | | II |
| *Dicranum scoparium* | 2 | 2 | | | | | | | | | 2 | | II |
| *Filago minima* | 1 | 1 | | | 3 | | | | | | | | II |
| *Geranium dissectum* | | | | | | 4 | 3 | | A | | 3 | | II |
| *Hypnum lacunosum* | 2 | | | | 1 | 4 | | | | | | | II |
| *Leontodon saxatilis* | | | 2 | | | | | | | 1 | 3 | | II |
| *Luzula campestris* | | 1 | | 1 | | | | | | | 1 | 1 | II |
| *Peltigera sp.* | 2 | 1 | | A | 1 | | | | | | 3 | | II |
| *Poa pratensis* | 1 | | | 1 | | | | | | | | 1 | II |
| *Rumex acetosella* | | 3 | | | 5 | | | | 3 | | | A | II |
| *Scorzoneroides autumnalis* | | | 1 | 2 | | | | | | | 2 | | II |
| *Vicia sativa* | | | | 1 | | 2 | 3 | | | | | 1 | II |
| *Achillea millefolium* | | | | | | 2 | | 3 | | | | | I |
| *Achillea ptarmica* | | | | | | 2 | | | | | | | I |
| *Agrostis canina* | | | | 2 | | | | | | | | | I |
| *Angelica sylvestris* | | | | | | 2 | | | | | | | I |
| *Anthyllis vulneraria* | | | | | | | | 5 | | | | | I |
| *Arrhenatherum elatius* | | | | | | 2 | | A | | | A | | I |
| *Atrichum undulatum* | | | | | | | | | | | 1 | | I |
| *Bellis perennis* | | | | | | | 1 | 2 | | | | | I |
| *Brachythecium rutabulum* | | | | | | | | 2 | | | | | I |
| *Bromus hordeaceus* | | | | | | 3 | | 3 | A | | | | I |
| *Calluna vulgaris* | A | A | | | | 1 | | | 2 | | | | I |
| *Carlina vulgaris* | A | 1 | | | | | | | | | | | I |
| *Centaurea nigra* | | | | | | | | | | | 4 | | I |
| *Centaurium erythraea* | | | | A | | | | | | 2 | | A | I |

| Species | 25 | 38 | 62 | 63 | 72 | 91 | 92 | 94 | 97 | 115 | 116 | 118 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ceratodon purpureus* | 1 | | | | | | | | | | | | I |
| *Chamerion angustifolium* | | | | | | | | A | | | | 2 | I |
| *Cirsium arvense* | | | | | | | | | | 1 | A | 1 | I |
| *Cladonia floerkeana* | | | | | 1 | | | | | | | | I |
| *Cladonia foliacea* | 4 | 1 | | | | | | | | | | | I |
| *Cladonia rangiformis* | 2 | | | | | | | | 3 | A | | A | I |
| *Cladonia sp.* | | | 1 | | | | | | | 2 | | | I |
| *Climacium dendroides* | | | | | | 3 | | | | | | | I |
| *Crataegus monogyna* | | | | | | | | | A | | 1 | | I |
| *Crepis capillaris* | | | | | | | 2 | | | | | | I |
| *Danthonia decumbens* | | | | | | | | | 3 | | | | I |
| *Daucus carota* | | | | | | A | | 2 | | 3 | | A | I |
| *Deschampsia cespitosa* | | | | | | A | | 1 | | | | | I |
| *Deschampsia flexuosa* | | 2 | | | 4 | | | | | | | | I |
| *Didymodon insulanus* | | | | | | | | 2 | | | | | I |
| *Digitalis purpurea* | | 1 | | | A | | | | | | | | I |
| *Equisetum arvense* | | | | | | 1 | | | 2 | | | | I |
| *Erigeron acris* | | | | | | | | | | | | 1 | I |
| *Euphrasia cf nemorosa* | | | | | | A | | | 1 | | | | I |
| *Euphrasia sp.* | | | 2 | | | | | | | A | | | I |
| *Fissidens adianthoides* | | | | | | 2 | | | | 4 | | | I |
| *Galium saxatile* | | | | | 4 | | | | | | | | I |
| *Hieracium sp.* | | | | | | | | | | | | 3 | I |
| *Homalothecium lutescens* | | | | | | | | 2 | | | | | I |
| *Hypericum maculatum* | | | | | | 2 | | 1 | | | | | I |
| *Hypericum perforatum* | | | | | | A | 3 | | | 1 | A | A | I |
| *Hypnum jutlandicum* | | 2 | | A | 2 | | | | | | | | I |
| *Kindbergia praelonga* | | | | 2 | | | | | | | | | I |
| *Leucanthemum vulgare* | | | | | | | | | | 7 | A | | I |
| *Lolium perenne* | | | 3 | | | | | | | | | | I |
| *Medicago lupulina* | | | | | | | 4 | A | 2 | | | | I |
| *Melilotus cf officinalis* | | | | | | | | 2 | | | | | I |
| *Mentha aquatica* | | | | | | | | | 1 | | | | I |
| *Nardus stricta* | A | A | | | | 2 | | | 2 | | | | I |
| *Oenothera sp.* | | | | | | A | 1 | | | | | A | I |
| *Ophrys apifera* | | | | | | | | | | A | 1 | | I |
| *Pilosella aurantiaca* | | | | | | | | | | | 4 | | I |
| *Plagiomnium undulatum* | | | | | | | | | | | 1 | | I |
| *Plantago major* | | | | | | | 1 | | | | | | I |
| *Poa compressa* | | | | | | | | | | | | 2 | I |
| *Pogonatum urnigerum* | 2 | | | | | | | | | | A | | I |
| *Polytrichastrum formosum* | | | | | | | | | | | 1 | | I |
| *Polytrichum piliferum* | 2 | | | | 2 | | | | | A | | A | I |
| *Potentilla reptans* | | | | | | 2 | | 1 | A | | | | I |
| *Pseudoscleropodium purum* | | | | | | | | | 2 | | | | I |
| *Racomitrium ericoides* | 4 | A | | | | A | | | 3 | | | A | I |
| *Ranunculus acris* | | | | | | | | | | | 2 | | I |
| *Rubus fruticosus* | | | | | | 1 | | | | | | 1 | I |
| *Rumex acetosa* | | | | | | | | | 1 | | 2 | | I |
| *Rumex obtusifolius* | | | | | | | | | | | | 1 | I |
| *Salix cinerea* | | A | | | A | | | | A | 1 | | A | I |
| *Silene flos-cuculi* | | | | | | | | | 1 | | | | I |
| *Thuidium tamariscinum* | | | | 1 | | | | | | | | | I |
| *Trifolium pratense* | | | | | | A | 2 | 4 | | | | | I |
| *Tussilago farfara* | | | 4 | | | | | 1 | A | | | | I |
| *Veronica arvensis* | 2 | | | | | | | | | | | | I |
| *Veronica officinalis* | A | 2 | A | | 2 | | | | A | | | | I |
| *Viola riviniana* | | | | | | 2 | | | 2 | | | | I |
| *Vulpia bromoides* | | | | | | | 4 | | | | | A | I |
| *Arenaria serpyllifolia* | | | | | | A | | | | | | | |

| Species | 25 | 38 | 62 | 63 | 72 | 91 | 92 | 94 | 97 | 115 | 116 | 118 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Buddleja davidii* | | | | | | | A | | A | | | | |
| *Cardamine pratensis* | | | | | | A | | | | | | | |
| *Cytisus scoparius* | | | | | | | | | | | | A | |
| *Dactylorhiza praetermissa* | | | | | | | A | | A | | | | |
| *Epilobium montanum* | | | | | | | | | | | | A | |
| *Eupatorium cannabinum* | | | | | | | | A | A | | | | |
| *Galium palustre* | | | A | | | | | | | | | | |
| *Geranium robertianum* | | | | | | | | | A | | | | |
| *Heracleum sphondylium* | | | | | | A | | | | | | | |
| *Juncus effusus* | | | A | | A | | | | | | | | |
| *Larix sp.* | A | A | | | | | | | | | | | |
| *Molinia caerulea* | A | A | | | | | | | A | | | | |
| *Phleum pratense* | | | | | | | | | | | A | | |
| *Pinus contorta* | | | | A | | | | | | | | | |
| *Potentilla anglica* | | | | | | | | | | | A | | |
| *Potentilla erecta* | A | | | | | A | | | | | | | |
| *Primula veris* | | | | | | | | | | | A | | |
| *Quercus petraea* | | | | A | | | | | | | | | |
| *Rumex crispus* | | | | | | A | A | | | | | | |
| *Sagina filicaulis* | | | | | | | A | | | | | | |
| *Samolus valerandi* | | | | | | | | | A | | | | |
| *Sonchus oleraceus* | | | | | A | | | | | | | A | |
| *Sorbus aucuparia* | | | | | | A | | | | | | | |
| *Ulex europaeus* | | A | A | | | | | | | | | | |
| *Vaccinium myrtillus* | | A | | | | | | | | | | | |
| *Valeriana officinalis* | | | | | | | | | A | | | | |
| *Verbascum thapsus* | | | | | | | | | | | | A | |
| **Species total** | **27** | **26** | **22** | **20** | **32** | **37** | **26** | **31** | **32** | **22** | **35** | **23** | |
| **Height (cm)** | **5** | **10** | **30** | **30** | **10** | **25** | **20** | **30** | **15** | **15** | **20** | **15** | |
| **Cover (%)** | **90** | **70** | **90** | **100** | **60** | **90** | **95** | **80** | **90** | **85** | **95** | **60** | |

*Flower-rich sward on recently colonised coal spoil at the washery, with abundant Bee Orchids (near Q115).*

While the Onllwyn sidings and washery spoil support a diverse ephemeral / short perennial community on the drier ground, there are damper areas within this area that support a higher proportion of wetland plants. Two quadrats from this vegetation are presented separately from the others because they are clearly developing towards a damp grassland flora rather than acid grassland or heath. Southern Marsh-orchids, Ragged Robin and a variety of sedges are a prominent feature of most of the damp areas of developing grassland at the washery. The locally rare plant Brookweed is associated with several damp areas by the sidings.

This damp, base-enriched grassland has similarities to some sand dune slack vegetation (e.g. SD15 or SD17), or forms of the M22 mire community. However, it is not a close match for any of the published NVC communities.

*Developing damp grassland at the washery, with Ragged Robin and Southern Marsh-orchids (near Q112)*

**Table 11. Quadrat data for sparse damp grassland on coal spoil and washery sidings.**

| Quadrat | 102 | 112 | Frequency |
|---|---|---|---|
| *Anthoxanthum odoratum* | 2 | 2 | V |
| *Calliergonella cuspidata* | 7 | 4 | V |
| *Carex demissa* | 1 | 2 | V |
| *Cirsium palustre* | 1 | 2 | V |
| *Holcus lanatus* | 4 | 2 | V |
| *Mentha aquatica* | 2 | 2 | V |
| *Prunella vulgaris* | 2 | 2 | V |
| *Ranunculus acris* | 2 | 2 | V |
| *Salix cinerea* | 1 | 2 | V |
| *Silene flos-cuculi* | 4 | 5 | V |
| *Taraxacum* sp. | 1 | 2 | V |
| *Trifolium dubium* | 2 | 4 | V |
| *Agrostis stolonifera* | 4 | | III |
| *Aira caryophyllea* | | 2 | III |
| *Aneura pinguis* | | 2 | III |
| *Bryum pseudotriquetrum* | 1 | | III |
| *Centaurium erythraea* | | 1 | III |
| *Cladonia pyxidata* | | 2 | III |
| *Cratoneuron filicinum* | 2 | | III |
| *Dicranum scoparium* | | 2 | III |
| *Eleocharis palustris* | 2 | | III |
| *Epilobium hirsutum* | A | 1 | III |
| *Epilobium palustre* | 2 | | III |
| *Equisetum arvense* | | 4 | III |

| Quadrat | 102 | 112 | Frequency |
|---|---|---|---|
| *Equisetum fluviatile* | 1 | | III |
| *Equisetum palustre* | 3 | | III |
| *Euphrasia sp.* | 1 | | III |
| *Festuca rubra* | | 2 | III |
| *Fissidens adianthoides* | | 4 | III |
| *Fragaria vesca* | A | 2 | III |
| *Galium palustre* | 2 | | III |
| *Hylocomium splendens* | | 2 | III |
| *Hypericum tetrapterum* | 1 | | III |
| *Hypochaeris radicata* | | 2 | III |
| *Juncus articulatus* | 1 | | III |
| *Juncus effusus* | | 3 | III |
| *Juncus inflexus* | 4 | | III |
| *Linum catharticum* | | 1 | III |
| *Luzula campestris* | | 2 | III |
| *Luzula multiflora* | A | 3 | III |
| *Melilotus cf officinalis* | 4 | | III |
| *Nardus stricta* | | 2 | III |
| *Peltigera sp.* | | 2 | III |
| *Phleum pratense* | | 2 | III |
| *Plantago lanceolata* | 2 | | III |
| *Poa pratensis* | | 2 | III |
| *Polytrichastrum formosum* | | 2 | III |
| *Polytrichum juniperinum* | | 4 | III |
| *Potamogeton polygonifolius* | 1 | | III |
| *Potentilla reptans* | | 2 | III |
| *Rhytidiadelphus squarrosus* | | 3 | III |
| *Rumex acetosa* | | 1 | III |
| *Sagina procumbens* | | 2 | III |
| *Samolus valerandi* | 5 | | III |
| *Senecio jacobaea* | | 1 | III |
| *Trifolium repens* | | 3 | III |
| *Valeriana officinalis* | 1 | | III |
| *Angelica sylvestris* | A | | |
| *Athyrium filix-femina* | A | | |
| *Betula pubescens* | | A | |
| *Carex echinata* | A | | |
| *Carex flacca* | | A | |
| *Cerastium fontanum* | A | A | |
| *Cladonia rangiformis* | | A | |
| *Dactylorhiza praetermissa* | | A | |
| *Galium aparine* | A | | |
| *Juncus conglomeratus* | | A | |
| *Oenothera sp.* | A | | |
| *Poa palustris* | A | | |
| *Rubus fruticosus* | A | | |
| *Typha latifolia* | A | | |
| *Veronica serpyllifolia* | | A | |
| *Vicia sativa* | A | | |
| **Species total** | **29** | **40** | |
| **Height (cm)** | **40** | **20** | |
| **Cover (%)** | **95** | **95** | |

### *Dry heath*

Heath is a feature of several areas on older coal spoil, especially where it has not been limited by grazing or shaded by scrub. The largest stands of heath are in the centre of the site which supports a mix of dry heath, wet heath and marshy grassland. Dry heath is also found on steeper slopes of coal spoil, often forming a mosaic with acid grassland (e.g. in Quadrats40, 60, 73 and 113). Most stands of dry heath are dominated by Common Heather and readily conform to the published NVC community H1 *Calluna vulgaris – Festuca ovina* heath.

*Ungrazed H1 dry heath, with patchy scrub (Quadrat 52).*

**Table 12. Quadrat data for dry heath.**

| Species | 40 | 47 | 51 | 52 | 60 | 67 | 73 | 76 | 77 | 113 | 117 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Calluna vulgaris* | 5 | 9 | 8 | 9 | 6 | 8 | 5 | 9 | 7 | 7 | 5 | V |
| *Dicranum scoparium* | 4 | 3 | 2 | 4 | 2 | 2 | | A | 4 | 5 | 4 | V |
| *Cladonia rangiformis* | 4 | A | 5 | 2 | 2 | A | | A | 2 | 3 | 7 | IV |
| *Deschampsia flexuosa* | | 3 | 4 | 4 | | 3 | 6 | 3 | 4 | | | IV |
| *Festuca ovina* | 4 | 1 | 1 | | 7 | 3 | | 2 | | 3 | 2 | IV |
| *Galium saxatile* | 2 | | | 4 | 4 | 1 | 3 | A | 2 | 1 | 2 | IV |
| *Hypnum jutlandicum* | 2 | 6 | 2 | 7 | 7 | 4 | | | A | 5 | 2 | IV |
| *Hypochaeris radicata* | 1 | A | A | | 1 | 3 | 2 | A | 1 | 1 | 1 | IV |
| *Rhytidiadelphus squarrosus* | | 2 | 2 | 3 | A | 3 | 3 | | 2 | 6 | 2 | IV |
| *Anthoxanthum odoratum* | 4 | | | | A | 2 | 4 | | | 4 | 1 | III |
| *Peltigera sp.* | 2 | | | | 1 | 2 | | | 2 | 1 | 4 | III |
| *Pilosella officinarum* | 4 | | | | A | 3 | A | | 1 | 3 | 4 | III |
| *Pleurozium schreberi* | | | 2 | 6 | | | | | 4 | 1 | 2 | III |
| *Polytrichum juniperinum* | | | | | 4 | | 2 | 4 | 6 | 2 | 1 | III |
| *Vaccinium myrtillus* | | 1 | 8 | 5 | 1 | 4 | | | A | | | III |
| *Agrostis canina* | | | 2 | 2 | | | 4 | | | | | II |
| *Agrostis capillaris* | 4 | | | | 2 | 2 | A | | | 4 | | II |
| *Campylopus introflexus* | | 2 | | | | | | 1 | 4 | | | II |
| *Cladonia furcata* | 2 | A | | | 1 | | A | | 2 | | 2 | II |
| *Cladonia pyxidata* | 2 | 1 | | | | 1 | | | | | | II |
| *Danthonia decumbens* | 4 | | | | 1 | A | A | A | | 2 | 1 | II |
| *Lotus corniculatus* | | | | | 2 | | 5 | | | 2 | 2 | II |
| *Luzula multiflora* | | 1 | 1 | | | A | A | | | 3 | | II |
| *Molinia caerulea* | A | 1 | 4 | 5 | | A | 5 | | | | | II |
| *Polytrichum commune* | | A | 2 | | 3 | 4 | | | | | | II |
| *Potentilla erecta* | | | 1 | 4 | | 3 | A | | A | | | II |
| *Aira caryophyllea* | | | | | | | | | | 2 | | I |
| *Aira praecox* | 2 | | | | A | | | | | | A | I |
| *Anaphalis margaritacea* | | | | | 2 | | | | | | | I |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Aulacomnium palustre* | | | | | | 2 | | | | | | I |
| *Carex flacca* | | | | | | | | | | 2 | | I |
| *Ceratodon purpureus* | | 2 | | | | | | | | | | I |
| *Chamerion angustifolium* | | | 2 | | | | | | | A | A | I |
| *Cirsium palustre* | | | | A | | | 1 | | | 1 | | I |
| *Cladonia cervicornis ssp* | | | | | | | | 2 | | | | I |
| *Cladonia gracilis* | | | 2 | | | | | | | | | I |
| *Cladonia sp.* | | | | | | | | 2 | 2 | | | I |
| *Cladonia uncinata* | | | 2 | | | | | 2 | | | | I |
| *Dicranum majus* | | | | | | | | | 2 | | | I |
| *Digitalis purpurea* | | | | 1 | | | | | A | | | I |
| *Diplophyllum albicans* | | | | | | | | 2 | 2 | | | I |
| *Equisetum arvense* | | | | | | | 1 | | | 1 | | I |
| *Euphrasia sp.* | | | | | | | | | | 1 | | I |
| *Festuca rubra* | | | | | | | 3 | | | | 2 | I |
| *Fragaria vesca* | 1 | | | | | | | | | A | | I |
| *Hieracium sp.* | | | | | A | | | | | | 3 | I |
| *Holcus lanatus* | | | | | | | 3 | | | 1 | | I |
| *Hylocomium splendens* | | | | | | | | | | 2 | | I |
| *Hypnum lacunosum* | | | | | | | | | | | 2 | I |
| *Hypogymnia physodes* | | A | 1 | | | | | | A | | | I |
| *Lophocolea bidentata* | | | | | | | | | | 2 | | I |
| *Lophozia ventricosa* | | 1 | | | | | | | | | | I |
| *Luzula campestris* | | | | | | | 3 | | | | A | I |
| *Nardus stricta* | 3 | | | | | | 1 | | | | | I |
| *Plantago lanceolata* | | | | | | | | | | 2 | | I |
| *Polygala serpyllifolia* | 1 | | | | | | | | | | | I |
| *Polytrichum piliferum* | 2 | 2 | | | | | | | | | | I |
| *Potentilla anglica* | | | | | | | 2 | | | 2 | | I |
| *Potentilla reptans* | | | | | | | | | | 2 | | I |
| *Pseudoscleropodium purum* | | | | | | | | | | 2 | 1 | I |
| *Rubus fruticosus* | 1 | | | 1 | | | | | | | | I |
| *Rumex acetosella* | 3 | | A | | | | | | | | 2 | I |
| *Sorbus aucuparia* | | | | | 1 | 1 | | A | | A | | I |
| *Taraxacum* sp. | | | | | | | | | | 2 | A | I |
| *Veronica officinalis* | 3 | | | | | | | | | 1 | | I |
| *Vicia hirsuta* | | | | | | | | | | | 2 | I |
| *Vicia sativa* | | | | | | | 1 | | | 2 | A | I |
| *Achillea millefolium* | | | | | | | | | | | A | |
| *Betula pubescens* | | | | | | | | | A | | | |
| *Carex binervis* | | | | | | | | A | A | | | |
| *Cladonia cf coccifera* | A | | | | | | | | | | | |
| *Cytisus scoparius* | | | | | | | | | | | A | |
| *Dactylorhiza praetermissa* | | | | | | | | | | | | |
| *Erica tetralix* | | | A | A | | | | | | | | |
| *Juncus squarrosus* | | | | | A | | | | | | | |
| *Leucanthemum vulgare* | | | | | | | | | | | A | |
| *Narcissus sp.* | | | | | | | A | | | | | |
| *Quercus petraea* | | | A | | | | | | | A | | |
| *Quercus robur* | | | | | | | | | | A | | |
| *Racomitrium lanuginosum* | | | | | | | | | | | A | |
| *Salix cinerea* | | A | | A | | | | | | | | |
| *Thuidium tamariscinum* | | | | A | | | | | | | | |
| *Trifolium pratense* | | | | | | | | | | | A | |
| *Trifolium repens* | | | | | | | A | | | | | |
| *Ulex europaeus* | A | | | A | | A | | | | | | |
| **Height (cm)** | **20** | **40** | **35** | **40** | **30** | **10** | **30** | **45** | **20** | **15** | **25** | |
| **Cover (%)** | **95** | **100** | **100** | **100** | **100** | **90** | **100** | **85** | **90** | **100** | **95** | |
| **Species total** | **22** | **14** | **18** | **14** | **17** | **18** | **18** | **9** | **16** | **32** | **22** | |

### *Wet heath/ marshy grassland mosaic*

Wet heath is not a common feature within the site, and where it occurs it is generally a fragmentary form within a mosaic of marshy grassland and mire vegetation. The examples sampled are all dominated by Purple Moor-grass, and the shrubs are a relatively minor element. In terms of the NVC this type of vegetation is best classified as M25 *Molinia caerulea – Potentilla erecta* mire (possibly close to the M25a *Erica tetralix* sub-community)

*Wet heath/ marshy grassland mosaic (Quadrat 81).*

**Table 13. Quadrat data for wet heath/ marshy grassland mosaic.**

| Species | 36 | 49 | 50 | 58 | 64 | Frequency |
|---|---|---|---|---|---|---|
| *Erica tetralix* | 4 | 6 | 5 | 5 | 2 | V |
| *Hypnum jutlandicum* | 1 | 3 | 4 | 2 | 3 | V |
| *Molinia caerulea* | 9 | 8 | 9 | 8 | 9 | V |
| *Calluna vulgaris* | 5 | 1 | | 2 | 4 | IV |
| *Polytrichum commune* | 4 | 3 | 4 | 2 | | IV |
| *Cladonia pyxidata* | 1 | 1 | | | | II |
| *Eriophorum vaginatum* | | 4 | 6 | | | II |
| *Holcus lanatus* | 1 | | | | 4 | II |
| *Hypochaeris radicata* | A | A | | 1 | 1 | II |
| *Juncus squarrosus* | 1 | | | 1 | | II |
| *Luzula multiflora* | | | | 2 | 1 | II |
| *Potentilla erecta* | | | | 2 | 2 | II |
| *Rhytidiadelphus squarrosus* | | | 2 | | 3 | II |
| *Sphagnum capillifolium* | | 2 | 2 | | | II |
| *Sphagnum denticulatum* | | 2 | 2 | | | II |
| *Trichophorum cespitosum* | | 6 | 4 | | | II |
| *Vaccinium myrtillus* | A | | 2 | 2 | | II |
| *Achillea millefolium* | | | | | 2 | I |
| *Agrostis canina* | 1 | | | | | I |
| *Agrostis capillaris* | | | | | 2 | I |
| *Anaphalis margaritacea* | | | | | 2 | I |
| *Anthoxanthum odoratum* | | | | A | 2 | I |
| *Betula pubescens* | | | 1 | | | I |
| *Calliergonella cuspidata* | | | | | 2 | I |
| *Carex demissa* | 1 | | | A | | I |
| *Centaurea nigra* | | | | | 1 | I |
| *Cirsium arvense* | | | | | 2 | I |

| Species | 36 | 49 | 50 | 58 | 64 | Frequency |
|---|---|---|---|---|---|---|
| *Cirsium palustre* | A | | | 1 | | I |
| *Cladonia rangiformis* | | 1 | | | | I |
| *Dryopteris carthusiana* | | | 1 | | | I |
| *Eriophorum angustifolium* | | 2 | | | | I |
| *Festuca ovina* | 2 | | | | | I |
| *Galium saxatile* | | | | | 1 | I |
| *Hieracium sp.* | | | | | 1 | I |
| *Hylocomium splendens* | | | | 4 | | I |
| *Juncus conglomeratus* | A | | | 1 | | I |
| *Juncus effusus* | 2 | | A | | | I |
| *Kindbergia praelonga* | | | | | 2 | I |
| *Lotus corniculatus* | | | | | 3 | I |
| *Mnium hornum* | | 1 | | | | I |
| *Peltigera sp.* | 1 | | | | A | I |
| *Plantago lanceolata* | | | | | 2 | I |
| *Polygala serpyllifolia* | | | | 2 | | I |
| *Rubus fruticosus* | | | | | 1 | I |
| *Sphagnum inundatum* | | | 2 | | | I |
| *Sphagnum subnitens* | | | 2 | | | I |
| *Trifolium repens* | | | | | 1 | I |
| *Vicia sativa* | | | | | 2 | I |
| *Aira caryophyllea* | A | | | | | |
| *Blechnum spicant* | | A | A | A | | |
| *Bromus hordeaceus* | A | | | | | |
| *Carex binervis* | | | A | | | |
| *Carex nigra* | | | A | | | |
| *Dicranum scoparium* | | A | A | | | |
| *Digitalis purpurea* | A | | | A | | |
| *Epilobium ciliatum* | A | | | | | |
| *Fragaria vesca* | A | | | | | |
| *Hedera helix sl* | | | | A | | |
| *Hookeria lucens* | | | A | | | |
| *Hypericum pulchrum* | | | | | A | |
| *Leucanthemum vulgare* | | | | | A | |
| *Pinus contorta* | | | | | A | |
| *Sagina procumbens* | A | | | | | |
| *Salix cinerea* | | | A | | | |
| *Salix repens* | | | | | A | |
| *Taraxacum* sp. | | | | | A | |
| *Veronica officinalis* | A | | | | | |
| **Height (cm)** | **30** | **45** | **50** | **30** | **40** | |
| **Cover (%)** | **80** | **100** | **100** | **95** | **100** | |
| **Species total** | **13** | **13** | **14** | **14** | **24** | |

### *Sphagnum-rich bog vegetation*

Several wet areas with Cotton-grasses and *Sphagnum* mosses are present around the margins of the restored coal workings, typically only in small quantity and/or filling ditches. The peaty substratum supports a number of species typical of upland peat bogs, including Common Cotton-grass, Hare's-tail Cotton-grass, Star Sedge, White Sedge, Round-leaved Sundew and a good number of *Sphagnum* species, locally with standing water and Bog Pondweed in wetter parts. A young plant of Royal Fern was also found in this habitat. Only two quadrats were collected from this vegetation. Quadrat 48 is from a bog pool and Quadrat 42 is from a ditch. Both are probably forms of the published NVC community M6 *Carex echinata - Sphagnum fallax/ S.denticulatum* mire.

**Table 14. Quadrat data for M6 bog pool mire vegetation.**

| Species | 42 | 48 | Frequency |
|---|---|---|---|
| *Eriophorum angustifolium* | 4 | 9 | V |
| *Sphagnum fallax* | 4 | 6 | V |
| *Agrostis canina* | 1 | A | III |
| *Athyrium filix-femina* | 1 | | III |
| *Aulacomnium palustre* | 4 | | III |
| *Cardamine pratensis* | 1 | | III |
| *Carex echinata* | 3 | | III |
| *Carex leporina* | 1 | | III |
| *Eleocharis palustris* | | 2 | III |
| *Epilobium palustre* | 1 | | III |
| *Galium palustre* | 3 | | III |
| *Juncus effusus* | 8 | | III |
| *Molinia caerulea* | 5 | | III |
| *Polytrichum commune* | 6 | A | III |
| *Potentilla erecta* | 2 | | III |
| *Salix cinerea* | A | 1 | III |
| *Scutellaria minor* | 2 | | III |
| *Sphagnum capillifolium* | 4 | A | III |
| *Sphagnum denticulatum* | 4 | | III |
| *Sphagnum tenellum* | | 3 | III |
| *Warnstorffia exannulata* | 2 | | III |
| *Calluna vulgaris* | A | | |
| *Carex curta* | A | | |
| *Deschampsia flexuosa* | A | | |
| *Drosera rotundifolia* | A | | |
| *Dryopteris affinis* | A | | |
| *Dryopteris carthusiana* | | A | |
| *Erica tetralix* | A | | |
| *Eriophorum vaginatum* | | A | |
| *Holcus lanatus* | A | | |
| *Juncus acutiflorus* | | A | |
| *Juncus bulbosus* | | A | |
| *Juncus squarrosus* | A | | |
| *Lophocolea bidentata* | | A | |
| *Nardus stricta* | A | | |
| *Rhytidiadelphus squarrosus* | A | | |
| *Sphagnum cuspidatum* | | A | |
| *Sphagnum squarrosum* | A | | |
| *Sphagnum subnitens* | A | | |
| *Trichophorum cespitosum* | | A | |
| **Species total** | **18** | **5** | |
| **Height (cm)** | **50** | **40** | |
| **Cover (%)** | **90** | **100** | |

*Sphagnum-rich ditch with Cotton-grass and sundews (near Q42)*

*Sphagnum-rich vegetation with Sundews (near Q42).*

### *Marshy grassland*

The most frequent type of marshy grassland on the site is dominated by Purple Moor-grass and subject to sheep-grazing. It tends to form a mosaic with species-poor semi-improved acid grassland and rush-dominated areas over large areas in the south and west of the site. The associated species are mostly grasses, sedges and rushes, with a very low proportion of flowering herbs.

Within the NVC this mosaic probably represents a wide spectrum of transitional stages between M25 *Molinia caerulea – Potentilla erecta* mire, M23 *Juncus effusus/ acutiflorus – Galium palustre* rush pasture, and *U4 Festuca ovina – Agrostis capillaris – Galium saxatile* grassland.

*Sheep-grazed marshy grassland dominated by Purple Moor-grass (Q78)*

**Table 15. Quadrat data for grazed grassland dominated by Purple Moor-grass.**

| Species | 8 | 11 | 13 | 22 | 24 | 31 | 41 | 43 | 45 | 54 | 78 | 110 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Molinia caerulea* | 9 | 8 | 10 | 8 | 7 | 8 | 8 | 9 | 8 | 6 | 9 | 6 | V |
| *Anthoxanthum odoratum* | 1 | 2 | 2 | | 1 | | 4 | A | 4 | 4 | 2 | | IV |
| *Holcus lanatus* | 3 | | | | 5 | 4 | 2 | 3 | 4 | 4 | 4 | 5 | IV |
| *Rhytidiadelphus squarrosus* | | 2 | 4 | A | 2 | 4 | 3 | A | 2 | | 4 | 2 | IV |
| *Agrostis canina* | | | | | | | 4 | 2 | 4 | 5 | 2 | 4 | III |
| *Agrostis capillaris* | 4 | 4 | 4 | 6 | 4 | | | | | | 4 | 7 | III |
| *Carex echinata* | 1 | | 4 | | | | 2 | | 2 | 4 | | | III |
| *Cirsium palustre* | 1 | | | | 1 | 1 | A | 1 | A | 2 | | | III |
| *Juncus conglomeratus* | 1 | | A | A | | | 5 | | 4 | 4 | 2 | | III |
| *Juncus effusus* | 1 | A | 4 | A | 6 | 4 | A | 5 | A | A | A | 2 | III |
| *Juncus squarrosus* | | | 1 | 4 | | 2 | | | 2 | | | 3 | III |
| *Polytrichum commune* | 5 | | 5 | 4 | | 4 | | | 4 | | | 2 | III |
| *Potentilla erecta* | | 3 | | | | | | 3 | 1 | 3 | 5 | 4 | III |
| *Aulacomnium palustre* | 2 | | | A | | A | 4 | | 2 | 2 | | | II |
| *Calliergonella cuspidata* | | | | | 2 | | | A | | 1 | | 3 | II |
| *Deschampsia flexuosa* | 2 | 3 | | 2 | | | | | | | 4 | | II |
| *Epilobium palustre* | | | | | | | 1 | 1 | | 2 | | | II |
| *Eriophorum angustifolium* | | | | 4 | | | 4 | | | 2 | | | II |
| *Festuca ovina* | 3 | 4 | | A | | | | A | 4 | | | A | II |
| *Galium palustre* | | | A | | 2 | | 2 | 4 | A | 2 | | | II |
| *Galium saxatile* | | 2 | | | | | | | | | 1 | 2 | II |
| *Hypnum jutlandicum* | | | | 3 | | 3 | | | | | A | 1 | II |
| *Juncus acutiflorus* | | | | | 6 | | 4 | 4 | | 5 | | | II |
| *Luzula campestris* | | 2 | | | | | 1 | A | | | 3 | | II |
| *Luzula multiflora* | 1 | | 1 | | | | 1 | | | A | | 2 | II |
| *Pleurozium schreberi* | | | | | | | | | 2 | 2 | 2 | | II |
| *Sphagnum capillifolium* | A | | | | | | 4 | | 2 | 4 | | | II |
| *Agrostis stolonifera* | | | 2 | | 4 | | | | | | | | I |
| *Anagallis tenella* | | | | | | | | | | 3 | | | I |
| *Athyrium filix-femina* | | | | | | 1 | | 2 | | | A | | I |
| *Brachythecium rutabulum* | | | | | | | | 2 | | | | | I |
| *Campylopus introflexus* | | | | 4 | | | | | | | A | 2 | I |
| *Carex binervis* | | | | | | | | | | | 2 | | I |
| *Carex flacca* | | | | | | | | | | 2 | | | I |
| *Carex leporina* | | | | | 2 | | | | | | | | I |
| *Carex panicea* | 1 | | | A | | | | | | | | | I |

| Species | 8 | 11 | 13 | 22 | 24 | 31 | 41 | 43 | 45 | 54 | 78 | 110 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ceratodon purpureus* | | | | | | | | | | | | 2 | I |
| *Danthonia decumbens* | | | 1 | | | | | | | | | | I |
| *Dicranum scoparium* | 2 | | | 2 | | | | | | | | | I |
| *Dryopteris dilatata* | 1 | | | | | A | | | | | | | I |
| *Epilobium ciliatum* | | | | | | 2 | | 1 | | | | | I |
| *Equisetum palustre* | | | | | | | | | | 3 | | | I |
| *Erica tetralix* | | | | | | A | 1 | | 4 | | | | I |
| *Kindbergia praelonga* | | | | | | | | 3 | | | | | I |
| *Lotus pedunculatus* | 1 | | | | | | | | | | | | I |
| *Myosotis laxa* | | | | | | | | 2 | | | | | I |
| *Nardus stricta* | | 4 | | | | | | | | | A | | I |
| *Peltigera sp.* | | | | | | 1 | | | | | | | I |
| *Persicaria hydropiper* | | | | | | | | 2 | | | | | I |
| *Polytrichum juniperinum* | | | | | | | | | | | | 2 | I |
| *Rumex acetosa* | 1 | | | | | | | | | 2 | | | I |
| *Salix cinerea* | | | | | | 1 | | | | | | | I |
| *Scapania irrigua* | | | | 2 | | | | | | | | | I |
| *Scutellaria minor* | | | | | A | | | | A | 1 | | | I |
| *Sphagnum denticulatum* | A | | | | | 4 | | | | | | | I |
| *Sphagnum fimbriatum* | | | 4 | | | | | | | | | | I |
| *Sphagnum inundatum* | | | | | | | 2 | | | | | | I |
| *Sphagnum papillosum* | | | | | | | | | 2 | | | | I |
| *Stellaria alsine* | | | | | | | | 2 | | | | | I |
| *Trichophorum cespitosum* | A | | | 4 | | | | | | | | | I |
| *Angelica sylvestris* | | | | | | | | | | A | | | |
| *Calluna vulgaris* | | | | | | | | | | | | A | |
| *Cladonia pyxidata* | | | | | | | | | | | | A | |
| *Cynosurus cristatus* | | | | | | | | A | | | | | |
| *Deschampsia cespitosa* | | | | | | | | | | | A | | |
| *Digitalis purpurea* | A | | | | | | | | A | | | | |
| *Sagina procumbens* | | | | | A | | | | | | | | |
| *Trifolium repens* | | | | | A | | | | | | | | |
| *Vaccinium myrtillus* | | A | | | | A | | | | | | A | |
| **Species total** | **18** | **10** | **12** | **11** | **12** | **13** | **17** | **16** | **16** | **21** | **13** | **16** | |
| **Height (cm)** | **50** | **30** | **80** | **30** | **90** | **80** | **50** | **90** | **70** | **60** | **50** | **30** | |
| **Cover (%)** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **10** | **100** | |

Some of the marshy grassland within the site is species-poor and dominated by rank Purple Moor-grass, and this is particularly found in areas where sheep have been excluded. The following examples were all ungrazed at the time of the survey, and supported tall, tussocky Purple Moor-grass. In terms of the NVC they are probably best described as a very species-poor M25 *Molinia caerulea – Potentilla erecta* mire, although the amount of Tormentil and other associated species is much lower than the typical form of this community due to the dominance of the Purple Moor-grass. NB The presence of the Sweet Chestnut, Pedunculate Oak and Rowan in association with Quadrat 90 is due to the area being used for tree planting, which is presumably why sheep have been excluded.

*Species-poor marshy grassland dominated by Purple Moor-grass and Soft Rush (Quadrat 90)*

**Table 16. Quadrat data for ungrazed marshy grassland with Purple Moor-grass.**

| Species | 26 | 61 | 71 | 90 | Frequency |
|---|---|---|---|---|---|
| *Molinia caerulea* | 9 | 10 | 9 | 9 | V |
| *Kindbergia praelonga* | | 2 | 3 | 3 | IV |
| *Galium saxatile* | | 1 | 1 | | III |
| *Juncus effusus* | | A | A | 7 | II |
| *Galium palustre* | A | 1 | | | II |
| *Juncus acutiflorus* | | 2 | | | II |
| *Hypnum jutlandicum* | 4 | A | | | II |
| *Sphagnum capillifolium* | 4 | | | | II |
| *Erica tetralix* | 2 | | | | II |
| *Deschampsia cespitosa* | | | 4 | | II |
| *Lophocolea bidentata* | | | 2 | | II |
| *Digitalis purpurea* | | 2 | A | | II |
| *Dryopteris filix-mas* | | 1 | | | II |
| *Sphagnum denticulatum* | 2 | | | | II |
| *Trichophorum cespitosum* | 2 | | | | II |
| *Holcus mollis* | | | 2 | | II |
| *Eriophorum vaginatum* | 4 | | | | II |
| *Potentilla erecta* | | | A | | |
| *Juncus conglomeratus* | | | A | | |
| *Dryopteris dilatata* | | | | A | |
| *Campylopus introflexus* | A | | | | |
| *Sphagnum fimbriatum* | A | | | | |
| *Carex binervis* | | | A | | |
| *Sphagnum papillosum* | A | | | | |
| *Sorbus aucuparia* | | | | A | |
| *Dryopteris affinis* | | A | | | |
| *Dryopteris carthusiana* | | | | A | |
| *Quercus robur* | | | | A | |
| *Castanea sativa* | | | | A | |
| *Fagus sylvatica* | | | | A | |
| *Pinus contorta* | | A | | | |
| *Sphagnum cuspidatum* | A | | | | |
| *Ulex europaeus* | | A | | | |
| *Species total* | 7 | 7 | 6 | 3 | |
| *Height (cm)* | 70 | 80 | 90 | 120 | |
| *Cover (%)* | 100 | 100 | 100 | 100 | |

A high proportion of the extensively sheep-grazed marshy grassland in the south west of the site, and beside many of the damp ditch margins, is dominated by tall rushes, particularly Sharp-flowered Rush and Soft Rush. Purple Moor-grass is present but not dominant. These damp grassland habitats sometimes support a moderate number of flowering herbs such as Greater Bird's-foot Trefoil, Lesser Skullcap, Bog Stitchwort and Marsh Thistle, and occasional ferns. Within the NVC this grassland is best categorised with M23 *Juncus effusus/ acutiflorus – Galium palustre* rush pasture.

**Table 17. Quadrat data for M23 marshy grassland with dominant rushes.**

| Species | 3 | 12 | 32 | 39 | 46 | 55 | 65 | 109 | 120 | 122 | 123 | 125 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Galium palustre* | 2 | | | 2 | 7 | 2 | 4 | 2 | 3 | 2 | 3 | 3 | V |
| *Holcus lanatus* | 2 | 2 | 6 | 4 | 4 | 7 | 4 | 4 | 4 | A | 5 | 1 | V |
| *Juncus effusus* | 2 | 2 | 6 | | 4 | | 8 | 2 | 6 | 4 | 7 | 6 | V |
| *Epilobium palustre* | A | | | | 1 | 1 | 3 | 2 | 1 | 1 | | 3 | IV |
| *Juncus acutiflorus* | 9 | | | 9 | 9 | 9 | | 7 | | 5 | | 8 | IV |
| *Molinia caerulea* | | 8 | 2 | 4 | 2 | 5 | | A | 5 | A | 4 | 5 | IV |
| *Athyrium filix-femina* | 1 | | | 4 | | | | | A | 1 | 1 | 2 | III |
| *Calliergonella cuspidata* | | | | 2 | | 4 | | 2 | 4 | 4 | 4 | | III |
| *Cirsium palustre* | 1 | | 2 | | A | 2 | | 1 | A | | 2 | 2 | III |
| *Kindbergia praelonga* | 2 | | | | 2 | | | | 2 | | 1 | 2 | III |
| *Lotus pedunculatus* | 2 | | | | A | 2 | 4 | 3 | | 3 | 2 | | III |
| *Rhytidiadelphus squarrosus* | 2 | 2 | 7 | | 2 | | 7 | | 2 | | | | III |
| *Rumex acetosa* | 2 | | | | | 2 | 2 | | 2 | A | 2 | 2 | III |
| *Stellaria alsine* | 2 | | | | 2 | | | | 2 | 1 | 2 | | III |
| *Agrostis canina* | 2 | | | | 4 | 4 | | | | | | 3 | II |
| *Brachythecium rivulare* | | | | | | | | | 2 | | 2 | 1 | II |
| *Carex echinata* | | 3 | | | A | 2 | | | 2 | 1 | | | II |
| *Carex flacca* | | | | | | 1 | A | | 2 | | 1 | | II |
| *Carex leporina* | | | | | | | 2 | 2 | | 1 | 2 | | II |
| *Carex nigra* | | | 5 | | | 4 | | | | 4 | | | II |
| *Cerastium fontanum* | 1 | | | | | A | | 2 | 1 | | 1 | | II |
| *Epilobium ciliatum* | 2 | | 1 | | | | | | | | 1 | 1 | II |
| *Equisetum fluviatile* | | | | | | 2 | | | 1 | 4 | | | II |
| *Juncus conglomeratus* | | 8 | | | | 1 | 4 | | A | | | | II |
| *Myosotis laxa* | | | | | 1 | | | A | 1 | 1 | 2 | | II |
| *Peltigera sp.* | | | 2 | 1 | | | | | | | 2 | | II |
| *Poa trivialis* | | | | | | | | 4 | 2 | 2 | 1 | A | II |
| *Potentilla erecta* | 2 | | A | | | 2 | | | 2 | | | | II |
| *Ranunculus acris* | | | | | | 1 | | 2 | 2 | | | | II |
| *Ranunculus flammula* | | | | | | A | | 2 | 2 | 2 | 2 | A | II |
| *Ranunculus repens* | | | | | A | | | 4 | 5 | 8 | 4 | A | II |
| *Salix cinerea* | | | A | 1 | | | 3 | | A | A | 2 | 2 | II |
| *Scutellaria minor* | A | | | 2 | 2 | | 3 | | | | | | II |
| *Silene flos-cuculi* | | | | | | | | 3 | 3 | | 5 | A | II |
| *Agrostis capillaris* | | 7 | | | | | | | | | | | I |
| *Anthoxanthum odoratum* | | 5 | 4 | | | | A | | | | | | I |
| *Caltha palustris* | | | | | | | | 1 | | | | | I |
| *Cardamine pratensis* | | | | A | 1 | | 2 | A | | A | | | I |
| *Carex demissa* | | 1 | | | | | | | | | | | I |
| *Carex panicea* | | 2 | | | | | | 2 | | | | | I |
| *Carex paniculata* | | | | 4 | | | | | | | | | I |
| *Ceratodon purpureus* | | | | | | | | | | | | 1 | I |
| *Chamerion angustifolium* | | | 1 | A | | | | | | | | 1 | I |
| *Cratoneuron filicinum* | | | | | | | | | | | | 2 | I |
| *Dactylorhiza praetermissa* | | | | 2 | | | | A | | | | | I |
| *Deschampsia cespitosa* | | | 4 | | A | A | | | | | | | I |
| *Digitalis purpurea* | 1 | | | | A | | | | | | A | | I |

| Species | 3 | 12 | 32 | 39 | 46 | 55 | 65 | 109 | 120 | 122 | 123 | 125 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Dryopteris dilatata* | | | A | | | | | | | | 1 | 1 | I |
| *Dryopteris filix-mas* | 1 | | | | | | | | | | | | I |
| *Epilobium brunnescens* | | | 1 | | | | | | | | | | I |
| *Epilobium tetragonum* | | | | | A | | | | 1 | | | | I |
| *Equisetum palustre* | | | | | | 3 | | | 2 | | | | I |
| *Eriophorum angustifolium* | | | | 4 | | | | | | | | | I |
| *Festuca ovina* | | 3 | | | | | | | | | | | I |
| *Festuca rubra* | | | 2 | | | | 2 | | | | | | I |
| *Hydrocotyle vulgaris* | | | | 8 | | 4 | | | | | | | I |
| *Hypnum jutlandicum* | | | 3 | | | | | | | | | | I |
| *Juncus articulatus* | | | | | | | 4 | | | | | | I |
| *Juncus bufonius* | | | | | | | | | 1 | | | | I |
| *Juncus bulbosus* | | 1 | | | | | | | | | | | I |
| *Lophocolea bidentata* | | | | | 2 | 2 | | | | | | | I |
| *Luzula campestris* | | | 2 | | | | | | | | | | I |
| *Luzula multiflora* | | 1 | | | | | A | | | | | | I |
| *Mentha aquatica* | | | | | | | | 8 | A | 5 | | | I |
| *Myosotis secunda* | | | | | | | 1 | | | | | | I |
| *Nardus stricta* | | A | 2 | | | | | | | | | | I |
| *Odontites vernus* | | | | | | | | 2 | | | | | I |
| *Oreopteris limbosperma* | 1 | | A | | | | | | | | | | I |
| *Plagiomnium undulatum* | 1 | | | | | 1 | | | | | | | I |
| *Polytrichum commune* | 2 | | 2 | | | | | | | | | A | I |
| *Pulicaria dysenterica* | | | 6 | A | | | | | | | | | I |
| *Rumex obtusifolius* | | | | | | | | | | | 1 | | I |
| *Sagina procumbens* | | | | | | | | 1 | 2 | | A | | I |
| *Scapania irrigua* | | 1 | | | | | | | | | | | I |
| *Senecio jacobaea* | | | | | | | 1 | | | | | | I |
| *Sphagnum sp.* | | 2 | | | | | | | | | | | I |
| *Succisa pratensis* | | | | | | | | | 4 | | | | I |
| *Taraxacum* sp. | | | 1 | | | | | | | | | | I |
| *Trifolium repens* | | | | | | | | 2 | | | | | I |
| *Trocdaris verticillatum* | | | | | | | | | | 3 | | | I |
| *Urtica dioica* | | | | | | | | | | | 1 | | I |
| *Veronica scutellata* | | | | | 2 | | | | | 3 | | | I |
| *Veronica serpyllifolia* | | | 2 | | | | | | | | | | I |
| *Vicia sativa* | | | 2 | | | | | 2 | | | | | I |
| *Viola palustris* | | | | | 2 | | | | | | | | I |
| *Wahlenbergia hederacea* | | | | | | 2 | | | | | | | I |
| *Agrostis stolonifera* | | | | | | | A | | | | | | |
| *Anagallis tenella* | | | | | | A | | | | | | | |
| *Arrhenatherum elatius* | | | | | | | A | | | | | | |
| *Atrichum undulatum* | | | | | | | | | | | | A | |
| *Aulacomnium palustre* | | A | | | | | | | | | | | |
| *Blechnum spicant* | A | | | | | | | | | | | | |
| *Carex pilulifera* | | | A | | | | | | | | | | |
| *Dryopteris affinis* | | | A | | | | | | | | | | |
| *Dryopteris carthusiana* | | | | | | | | | | A | | | |
| *Erica tetralix* | | A | A | | | | | | | | | | |
| *Eupatorium cannabinum* | | | | A | | | | | | | | | |
| *Filago minima* | | | A | | | | | | | | | | |
| *Juncus inflexus* | | | | | | | | A | | | | | |
| *Juncus squarrosus* | | A | | | | | | | | | | | |
| *Lolium perenne* | | | | | | | | | | | | x | |
| *Philonotis fontana* | | | | | | | | A | | | | | |
| *Phleum pratense* | | | | | | | A | | | | | | |
| *Poa pratensis* | | | | | | | | A | | | | | |
| *Potentilla palustris* | | | | | | | | | | A | | | |
| *Prunella vulgaris* | | | A | | | | | | | | | | |
| *Rubus fruticosus* | | | | | | | | | A | | A | | |

| Species | 3 | 12 | 32 | 39 | 46 | 55 | 65 | 109 | 120 | 122 | 123 | 125 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Sphagnum inundatum* | | | | | | | | | | | | A | |
| *Sphagnum squarrosum* | | | | | A | | | | | | | | |
| *Trifolium dubium* | | | A | | | | | | | | | | |
| *Typha latifolia* | | | | A | | | | | | A | | | |
| *Valeriana officinalis* | | | | | | | | A | | | | | |
| **Species total** | **20** | **15** | **21** | **13** | **16** | **22** | **16** | **22** | **27** | **19** | **26** | **18** | |
| **Height (cm)** | **70** | **50** | **50** | **90** | **90** | **70** | **80** | **35** | **95** | **40** | **95** | **50** | |
| **Cover (%)** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **100** | **40** | **100** | **40** | **100** | |

*M23 rush pasture dominated by Sharp-flowered Rush (Q3).*

Rush-dominated marshy grassland on the recently restored parts of the site tend to be heavily sheep-grazed and form a mosaic with species-poor semi-improved grassland. The vegetation has a very low proportion of flowering herbs and is generally not of nature conservation significance. However, it covers a relatively large area, so several quadrats were recorded from it to describe it and help to illustrate the variation within the range of marshy grassland types on the site. It is best classified as the NVC community MG10 *Holcus lanatus – Juncus effusus* rush pasture. It differs slightly from the published community as it has a lower proportion of Creeping Bent and Creeping Buttercup, but both species are present and the difference may just be due to the young age of the grassland, the intensity of the sheep grazing or some other local factor.

*Species-poor MG10 rush pasture on the recently restored parts of the site (near Q88)*

**Table 18. Quadrat data for MG10 marshy grassland with dominant Soft Rush.**

| Species | 28 | 75 | 84 | 88 | Frequency |
|---|---|---|---|---|---|
| *Holcus lanatus* | 5 | 2 | 4 | 7 | V |
| *Juncus effusus* | 9 | 10 | 8 | 9 | V |
| *Agrostis capillaris* | 2 | | 2 | 2 | IV |
| *Cirsium palustre* | 2 | 1 | 1 | A | IV |
| *Epilobium ciliatum* | 2 | 1 | 1 | | IV |
| *Cerastium fontanum* | | | 2 | 1 | III |
| *Cynosurus cristatus* | | | 2 | 4 | III |
| *Kindbergia praelonga* | 2 | 2 | | | III |
| *Poa trivialis* | | 2 | 5 | A | III |
| *Trifolium repens* | | | 2 | 1 | III |
| *Agrostis stolonifera* | | | 2 | | II |
| *Anthoxanthum odoratum* | | | A | 2 | II |
| *Athyrium filix-femina* | A | 1 | | | II |
| *Calliergonella cuspidata* | 4 | | | | II |
| *Cardamine pratensis* | | A | 2 | | II |
| *Epilobium palustre* | 1 | | | | II |
| *Equisetum palustre* | | 1 | | | II |
| *Galium palustre* | | 3 | | | II |
| *Galium saxatile* | 2 | | | | II |
| *Rumex acetosa* | | 1 | | | II |
| *Rumex acetosella* | 2 | | | | II |
| *Stellaria alsine* | | 1 | | | II |
| *Urtica dioica* | | 2 | | | II |
| *Veronica serpyllifolia* | 1 | | | | II |
| *Alopecurus geniculatus* | | | A | | |
| *Cirsium arvense* | A | | | | |
| *Deschampsia cespitosa* | | | | A | |
| *Digitalis purpurea* | | A | | | |
| *Dryopteris affinis* | A | | | | |
| *Dryopteris filix-mas* | | A | | | |
| *Festuca rubra* | | | | A | |
| *Potentilla erecta* | A | | | | |
| *Ranunculus repens* | | | A | | |
| *Rhytidiadelphus squarrosus* | A | | | | |
| **Species total** | **11** | **12** | **11** | **7** | |
| **Height (cm)** | **100** | **100** | **80** | **70** | |
| **Cover (%)** | **100** | **100** | **100** | **100** | |

The marshy grassland flora in and around the washery has a very different character to the other marshy grassland within the study area. This is partly because it is grazed by horses rather than sheep, and also probably because the substratum is base-rich but acidic coal waste rather than natural soil. This marshy grassland has a very diverse sward, characterised by a high proportion of sedges and wetland herbs. Rushes are prominent, but they are represented by several different dominant species. The flower-rich sward includes a number of locally uncommon species, such as Marsh Lousewort and Brookweed. In terms of the NVC this is probably best classified as M23 *Juncus effusus/ acutiflorus – Galium palustre* mire. The base enrichment of the washery soils also adds elements of M22 *Juncus subnodulosus – Cirsium palustre* fen-meadow, although there was no sign of any Blunt-flowered Rush during the survey. Much of the vegetation appears to form transitions between the two communities, and also with swamp vegetation in wetter areas.

**Table 19. Quadrat data for flower-rich marshy grassland at the washery.**

| Species | 93 | 103 | 104 | 106 | 107 | 108 | Frequency |
|---|---|---|---|---|---|---|---|
| *Calliergonella cuspidata* | | 4 | 7 | 9 | 2 | 8 | V |
| *Galium palustre* | 2 | 2 | 3 | 2 | | 4 | V |
| *Juncus effusus* | 2 | 4 | | 2 | 4 | 6 | V |
| *Mentha aquatica* | 2 | 1 | 1 | | 4 | 4 | V |
| *Valeriana officinalis* | 3 | 1 | 3 | 4 | | 1 | V |
| *Epilobium palustre* | | 2 | 2 | 2 | A | 2 | IV |
| *Equisetum palustre* | 1 | 3 | 4 | | 4 | | IV |
| *Holcus lanatus* | 2 | | 2 | 2 | | 2 | IV |
| *Caltha palustris* | | 2 | A | 3 | 2 | | III |
| *Carex nigra* | 2 | | 2 | 2 | | | III |
| *Juncus acutiflorus* | | | | 8 | 2 | 3 | III |
| *Lotus pedunculatus* | 2 | | 2 | 6 | | | III |
| *Rhytidiadelphus squarrosus* | 2 | | 4 | 4 | | | III |
| *Salix cinerea* | | 2 | 2 | | | 2 | III |
| *Scutellaria minor* | | | 2 | 2 | | 1 | III |
| *Silene flos-cuculi* | | | 2 | 2 | A | 3 | III |
| *Angelica sylvestris* | 2 | | 1 | | | | II |
| *Carex demissa* | | | 2 | | 2 | | II |
| *Carex flacca* | | | 2 | | 2 | | II |
| *Carex panicea* | | A | 2 | | | 2 | II |
| *Cirsium palustre* | | | A | 1 | | 2 | II |
| *Dactylorhiza praetermissa* | 1 | | A | A | 1 | A | II |
| *Equisetum fluviatile* | | | 1 | | 2 | | II |
| *Eriophorum angustifolium* | | 8 | 4 | | | | II |
| *Hydrocotyle vulgaris* | | 1 | 4 | | | A | II |
| *Juncus inflexus* | 5 | | | | 8 | | II |
| *Pedicularis palustris* | | A | 1 | | 2 | | II |
| *Ranunculus flammula* | | | | | 3 | 1 | II |
| *Rumex acetosa* | 1 | | | 1 | | | II |
| *Achillea ptarmica* | 2 | | | | | | I |
| *Agrostis canina* | | | | | | 2 | I |
| *Aulacomnium palustre* | | | A | | | 3 | I |
| *Brachythecium rivulare* | | 2 | | | | | I |
| *Brachythecium rutabulum* | 2 | | | | | | I |
| *Bryum pseudotriquetrum* | | | | | 2 | | I |
| *Cardamine cf flexuosa* | 2 | | | | | | I |
| *Cardamine pratensis* | | A | | | | 1 | I |
| *Carex echinata* | | | A | | | 3 | I |
| *Carex leporina* | | | | | | 1 | I |
| *Carex paniculata* | | | | 4 | | | I |
| *Carex pulicaris* | | | 2 | A | | | I |

| Species | 93 | 103 | 104 | 106 | 107 | 108 | Frequency |
|---|---|---|---|---|---|---|---|
| *Carex rostrata* | | 4 | | | | | I |
| *Cirsium arvense* | 1 | | | | | | I |
| *Cynosurus cristatus* | | | 2 | | | | I |
| *Dactylorhiza fuchsii* | | | | 1 | | | I |
| *Deschampsia cespitosa* | 9 | | | | | | I |
| *Eleocharis palustris* | | | | | 4 | | I |
| *Epilobium ciliatum* | 1 | | | | | | I |
| *Epilobium parviflorum* | | | | 3 | | A | I |
| *Eupatorium cannabinum* | | | | | | 1 | I |
| *Festuca rubra* | | | 2 | | | | I |
| *Lathyrus pratensis* | 2 | | | | | | I |
| *Luzula multiflora* | 2 | | | | | A | I |
| *Lycopus europaeus* | | | | | 1 | | I |
| *Lythrum salicaria* | | 1 | | | | | I |
| *Molinia caerulea* | | | | A | | 2 | I |
| *Myosotis laxa* | | | | | | 4 | I |
| *Peltigera sp.* | | | 2 | | | | I |
| *Plantago lanceolata* | 1 | | | | | | I |
| *Poa trivialis* | 3 | | | A | | | I |
| *Potentilla palustris* | | 8 | | | | | I |
| *Prunella vulgaris* | 1 | | | | | | I |
| *Ranunculus repens* | A | | 2 | | | A | I |
| *Samolus valerandi* | | | | | 7 | | I |
| *Sphagnum fimbriatum* | | | | | | 2 | I |
| *Stellaria alsine* | | | | | | 2 | I |
| *Typha latifolia* | | | | | | 2 | I |
| *Valeriana dioica* | | | 8 | | | | I |
| *Veronica scutellata* | | | | | | 3 | I |
| *Vicia sativa* | 1 | | | | | | I |
| *Anthoxanthum odoratum* | | | A | | | | |
| *Betula pubescens* | | | A | | | | |
| *Briza media* | A | | | | | | |
| *Daucus carota* | A | | | | | | |
| *Dryopteris dilatata* | | | | A | | | |
| *Eriophorum vaginatum* | | | | | | A | |
| *Heracleum sphondylium* | A | | | | | | |
| *Nardus stricta* | A | | | | | | |
| *Plagiomnium cf rostratum* | | A | | | | | |
| *Polytrichum juniperinum* | | | | | | A | |
| *Potentilla anserina* | A | | | | | | |
| *Potentilla erecta* | | | | | | A | |
| *Rumex conglomeratus* | | | | | | A | |
| *Salix aurita* | | A | A | A | | | |
| *Sphagnum squarrosum* | | | A | | | | |
| **Species total** | **25** | **15** | **27** | **18** | **17** | **26** | |
| **Height (cm)** | **50** | **90** | **35** | **100** | **90** | **80** | |
| **Cover (%)** | **100** | **100** | **100** | **100** | **95** | **95** | |

*Flower-rich marshy grassland north of the washery, with prominent Greater Tussock-sedges and Ragged Robin (near Q108).*

*Marsh Lousewort and Brookweed in flower-rich marshy grassland north of the washery (Q119).*

### *Flush vegetation*

There are several areas of flush vegetation on gently sloping ground at the lower edges of the site, particularly at the south and west margins. In most cases the flushes are very small and the vegetation is not very different from other rush-dominated marshy grassland. The plant community probably conforms most closesly to the NVC category M23 *Juncus effusus/ acutiflorus – Galium palustre* mire. However, the flushes tend to be relatively diverse examples of this. An area of seepage from coal spoil at the washery (Q114) appears to fit more closely with sand dune slack vegetation but this is probably just an anomaly of the unusual man-made nature of the habitat. Several locally uncommon species were found in association with flushes, including Ivy-leaved Bellflower, Whorled Caraway and Bog Pimpernel (although no quadrats included the Ivy-leaved Bellflower).

*Heavily trampled flush vegetation, with Whorled Caraway (Q121)*

**Table 20. Quadrat data for flush vegetation.**

| Species | 9 | 10 | 16 | 21 | 66 | 114 | 121 | Frequency |
|---|---|---|---|---|---|---|---|---|
| *Calliergonella cuspidata* | 3 | 3 | 2 | | 5 | 4 | 4 | V |
| *Epilobium palustre* | 3 | 2 | 1 | | 3 | 3 | 1 | V |
| *Galium palustre* | 3 | 3 | 2 | | 2 | 2 | 2 | V |
| *Holcus lanatus* | 5 | 4 | 4 | | 4 | | 2 | IV |
| *Juncus acutiflorus* | 9 | 9 | 9 | 2 | | | 8 | IV |
| *Molinia caerulea* | 5 | 6 | 2 | 8 | 2 | | | IV |
| *Rhytidiadelphus squarrosus* | 2 | 2 | | 4 | 2 | 2 | | IV |
| *Scutellaria minor* | 2 | 1 | 2 | | 2 | | 2 | IV |
| *Agrostis canina* | | 2 | A | 4 | 2 | | | III |
| *Anthoxanthum odoratum* | 2 | | 4 | 4 | | 2 | | III |
| *Carex echinata* | 3 | 3 | 4 | | | | 2 | III |
| *Carex panicea* | 1 | 1 | | 4 | | | | III |
| *Cirsium palustre* | 3 | 1 | | | | 2 | 2 | III |
| *Festuca rubra* | 2 | 1 | | 2 | | A | | III |
| *Lotus pedunculatus* | 5 | A | 2 | | | | 2 | III |
| *Luzula multiflora* | 1 | 1 | | 2 | | 1 | | III |
| *Pellia sp.* | | 2 | 1 | | 1 | | | III |
| *Potentilla erecta* | 2 | 3 | | 2 | | | | III |
| *Ranunculus flammula* | 1 | | 1 | | | | 1 | III |
| *Anagallis tenella* | 1 | A | | | 1 | | | II |
| *Athyrium filix-femina* | 2 | | A | | 2 | | A | II |
| *Carex demissa* | 1 | | 2 | | | | | II |
| *Carex nigra* | | | | | | 5 | 5 | II |
| *Dactylorhiza praetermissa* | | | | | | 1 | 2 | II |
| *Digitalis purpurea* | 1 | | | | 2 | | | II |
| *Equisetum fluviatile* | 2 | | | | | | 7 | II |
| *Juncus bulbosus* | | A | 2 | A | | | 3 | II |
| *Ranunculus repens* | 2 | | A | | | | 2 | II |
| *Rubus fruticosus* | | | 1 | A | 4 | | | II |
| *Sphagnum denticulatum* | | | 6 | 2 | | | | II |
| *Trocdaris verticillatum* | | 1 | | | | | 1 | II |
| *Achillea ptarmica* | | 2 | | | | | | I |
| *Agrostis stolonifera* | 2 | | | | | | A | I |
| *Aulacomnium palustre* | | | | | 4 | | | I |
| *Betula pubescens* | | | | | 2 | | | I |
| *Bryum alpinum* | | | | | | 2 | | I |
| *Bryum pseudotriquetrum* | | | | | | 5 | | I |
| *Calluna vulgaris* | | | | 2 | | | | I |

| Species | 9 | 10 | 16 | 21 | 66 | 114 | 121 | Frequency |
|---|---|---|---|---|---|---|---|---|
| *Cardamine cf flexuosa* | | | | | | 1 | | I |
| *Carex disticha* | | | | | | 8 | | I |
| *Carex flacca* | | 2 | | | | | | I |
| *Carex pulicaris* | | 3 | | | | | | I |
| *Cerastium fontanum* | 2 | | | | | | | I |
| *Cratoneuron filicinum* | | | | | | 4 | | I |
| *Cynosurus cristatus* | 1 | | | | | | | I |
| *Dactylis glomerata* | | | | | | 1 | | I |
| *Dactylorhiza maculata* | | | | | 1 | | | I |
| *Danthonia decumbens* | | | | 2 | | | | I |
| *Dichodontium palustre* | | | 2 | | | | | I |
| *Dicranum scoparium* | | | | 2 | | | | I |
| *Didymodon insulanus* | | | | | | 2 | | I |
| *Dryopteris filix-mas* | | 1 | | | A | | | I |
| *Erica tetralix* | | 1 | | | | | | I |
| *Eriophorum angustifolium* | | | | | | | 4 | I |
| *Festuca ovina* | | | | 2 | | | | I |
| *Fragaria vesca* | | | | | | 1 | | I |
| *Hypericum tetrapterum* | | | 3 | | | | | I |
| *Juncus conglomeratus* | | 3 | A | | | | | I |
| *Juncus squarrosus* | | | | 2 | | | | I |
| *Myosotis secunda* | | | 1 | | | | | I |
| *Pedicularis sylvatica* | | | | 4 | | | | I |
| *Philonotis fontana* | A | A | | | 2 | | | I |
| *Plantago lanceolata* | A | | | | | 2 | | I |
| *Pleurozium schreberi* | | A | A | 4 | | | | I |
| *Polytrichum commune* | | A | | | 4 | | | I |
| *Prunella vulgaris* | A | | | | | 2 | | I |
| *Ranunculus omiophyllus* | | | | | | | 1 | I |
| *Rumex acetosa* | 2 | | | | | | A | I |
| *Rumex crispus* | | 1 | | | | | | I |
| *Salix cinerea* | | | A | | A | | 1 | I |
| *Senecio jacobaea* | | | 1 | | | A | | I |
| *Silene flos-cuculi* | | | | | | 4 | A | I |
| *Sphagnum fimbriatum* | | | | | 4 | | | I |
| *Stellaria alsine* | | | | | | | 1 | I |
| *Taraxacum* sp. | | | | | | 3 | | I |
| *Veronica officinalis* | | | | | | 1 | | I |
| *Vicia hirsuta* | | | | | | 1 | | I |
| *Vicia sativa* | | | | | | 1 | | I |
| *Warnstorffia exannulata* | | | 1 | | | | | I |
| *Brachythecium rutabulum* | | | | | A | | | |
| *Cardamine pratensis* | | A | | | | | | |
| *Carex binervis* | | | | A | | | | |
| *Chamerion angustifolium* | | | | | | A | | |
| *Eupatorium cannabinum* | | | | | | A | | |
| *Isolepis setacea* | A | | | | | | | |
| *Juncus effusus* | | | | A | | | | |
| *Lotus corniculatus* | | | | | | A | | |
| *Lysimachia nemorum* | A | | | | | | | |
| *Mentha aquatica* | | A | A | | | | | |
| *Montia fontana* | A | | | | | | | |
| *Myosotis laxa* | A | A | | | | | | |
| *Oreopteris limbosperma* | A | | | | | | | |
| *Peltigera sp.* | | | | | A | | | |
| *Plagiomnium undulatum* | | A | | | | | | |
| *Poa trivialis* | | | | | | | A | |
| *Primula veris* | | | | | | A | | |
| *Pseudoscleropodium purum* | A | A | | | A | | | |
| *Sphagnum capillifolium* | | | | | A | | | |

| Species | 9 | 10 | 16 | 21 | 66 | 114 | 121 | Frequency |
|---|---|---|---|---|---|---|---|---|
| *Succisa pratensis* | | | | A | | | | |
| *Tussilago farfara* | | | | | | | A | |
| *Ulex europaeus* | A | | | | | | | |
| *Veronica serpyllifolia* | | | | | | A | | |
| **Species total** | **27** | **24** | **21** | **17** | **19** | **24** | **20** | |
| **Height (cm)** | **80** | **90** | **60** | **50** | **60** | **20** | **80** | |
| **Cover (%)** | **100** | **100** | **95** | **100** | **1100** | **100** | **90** | |

### *Swamp vegetation*

Dense stands of tall emergent plants forming swamp vegetation tend to be very localised within the site, and they are mostly low diversity plant communities. Greater Tussock-sedge forms one rather uniform stand beside a small stream, and this has been sampled in Quadrat 15. Tall sedges, Common Reed and Reed Canary-grass are patchily dominant in parts of the wet grassland north of the washery, and a stand of Lesser Pond-sedge has been sampled to represent this (Q105). Bulrush was also present as small stands in several ponds (this was not sampled because it generally exists in deeper water as single-species stands). There is also a small Common Reed reedbed near the centre of the site. NVC classification for these very low-diversity swamp communities in this case is straightforward; the Greater Tussock-sedge swamp is S3 *Carex paniculata* swamp, the Lesser Pond-sedge stand is S7 *Carex acutiformis* swamp, the Bulrush stands are S12 *Typha latifolia* swamp, and the reedbed is S4 *Phragmites australis* swamp.

Common Reed was generally present as a single-species stand in the reedbed, but a list of associated species was obtained from the whole reed bed as a target Note (TN7).

*Small reed-bed between coal spoil tips (TN7)*

### Table 21. Species-list for reed bed (TN7)

*Phragmites australis*
*Agrostis stolonifera*
*Athyrium filix-femina*
*Carex paniculata*
*Cirsium arvense*
*Cirsium palustre*
*Digitalis purpurea*
*Eleocharis palustris*
*Epilobium brunnescens*
*Epilobium hirsutum*
*Holcus lanatus*
*Molinia caerulea*
*Potamogeton polygonifolius*
*Pulicaria dysenterica*
*Salix cinerea*
*Salix viminalis*
*Tussilago farfara*
*Typha latifolia*

### Table22. Quadrat data for swamp vegetation.

| Species | 15 | 105 | Frequency |
|---|---|---|---|
| *Carex paniculata* | 10 | 1 | V |
| *Agrostis canina* | 1 | | III |
| *Caltha palustris* | | 2 | III |
| *Carex acutiformis* | | 10 | III |
| *Epilobium palustre* | 1 | | III |
| *Equisetum fluviatile* | | 2 | III |
| *Equisetum palustre* | | 1 | III |
| *Galium palustre* | 1 | A | III |
| *Juncus effusus* | 2 | | III |
| *Mentha aquatica* | | 1 | III |
| *Molinia caerulea* | 1 | | III |
| *Phragmites australis* | | 2 | III |
| *Scutellaria minor* | 1 | | III |
| *Sphagnum sp.* | 2 | | III |
| *Veronica officinalis* | | 2 | III |
| *Alnus glutinosa* | | A | |
| *Holcus lanatus* | A | | |
| *Hydrocotyle vulgaris* | | A | |
| *Persicaria hydropiper* | A | | |
| *Salix cinerea* | | A | |
| *Silene flos-cuculi* | | A | |
| **Species total** | **8** | **8** | |
| **Height (cm)** | **150** | **100** | |
| **Cover (%)** | **100** | **100** | |

*Greater Tussock-sedge swamp (Q15)*

*Lesser Pond-sedge swamp (Q105) with Alder scrub and sparse Common Reed.*

*Bulrush swamp vegetation in a pond at the washery (TN22).*

### *Ponds*

The study area supports a high density of ponds; many of these are relatively recent in origin, created for silt control, attenuating high flows and providing water for the mine operations. Some ponds are still very functional, with steep sides and little vegetation, but others are less intensively maintained and support a fringe of wetland plants. These typically include Common Spike-rush, Soft Rush, Sharp-flowered Rush, Bulbous Rush, Lesser Spearwort and *Sphagnum* mosses. Some of the older ponds have a well-developed submerged plant community. The acidic, silty water from the coal spoil that feeds the ponds allows species typically associated with upland pools to grow, such as Bog Pondweed, Cotton-grasses, Star-sedge and the locally rare Floating Bur-reed.

It is difficult to place the pond communities in terms of the NVC as any more than a rough approximation, particularly as each pond had a slightly different character, and elements of several different communities might be present in any pond. The fringing vegetation often has strong elements of M23 *Juncus effusus/ acutiflorus – Galium palustre* mire, which is

similar to much of the nearby marshy grassland. Ponds fringed by Common Spike Rush could be considered to support a narrow band of S19 *Eleocharis palustris* swamp. The boggier margins of some ponds have some similarities with M29 *Hypericum elodes – Potamogeton polygonifolius* soakway vegetation (although there was no sign of Marsh St.John's-wort), M6 *Carex echinata – Sphagnum denticulatum* mire, and the OV35 *Lythrum portula – Ranunculus flammula* community. The aquatic plants could feasibly be described as a species-poor version of the A24 *Juncus bulbosus* community.

*Pond at TN10 showing several different plant communities. A wide belt of emergent Common Spike-rush (S19) grades to a zone of abundant Lesser Spearwort and Water Purslane (OV35) at the water's edge, and then into rush-dominated vegetation (M23) further up the bank.*

*Stoneworts, such as this* Nitella *species were present in a pond (TN10).*

## Table 23. Species list data for ponds.

| Species | TN4 | TN5 | TN6 | TN8 | TN9 | TN10 | TN13 | TN14 | TN15 | TN22 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Eleocharis palustris* | X | X | X | X | | X | X | X | | X | V |
| *Juncus effusus* | | X | X | X | X | X | X | X | X | X | V |
| *Callitriche sp.* | | X | | X | | X | X | X | X | X | IV |
| *Molinia caerulea* | X | X | | | X | X | X | X | | | IV |
| *Potamogeton polygonifolius* | X | X | X | X | | X | X | | | | IV |
| *Ranunculus flammula* | X | X | | X | | X | X | X | | X | IV |
| *Salix cinerea* | X | X | X | | | X | X | | X | X | IV |
| *Typha latifolia* | X | | X | X | | X | X | | X | X | IV |
| *Agrostis stolonifera* | X | X | | | | | X | X | | X | III |
| *Carex nigra* | | X | X | | X | X | | | X | | III |
| *Eriophorum angustifolium* | X | X | | X | X | X | | | | | III |
| *Juncus acutiflorus* | X | | X | X | | X | | | | X | III |
| *Juncus bulbosus* | | X | | | X | X | | X | | | III |
| *Polytrichum commune* | | X | | | | X | | X | | X | III |
| *Agrostis canina* | | X | | | | X | | | | | II |
| *Athyrium filix-femina* | X | | X | | | | | X | | | II |
| *Aulacomnium palustre* | | | | | X | X | | | | | II |
| *Calliergonella cuspidata* | X | | | | | X | X | | | | II |
| *Carex echinata* | | X | | | X | X | | | | | II |
| *Epilobium ciliatum* | | | | | | | | X | X | X | II |
| *Epilobium palustre* | X | | | | | X | | X | | | II |
| *Equisetum fluviatile* | | | X | | X | | | | | | II |
| *Galium palustre* | | | | | | | | | X | X | II |
| *Holcus lanatus* | | X | | | | | X | X | | | II |
| *Juncus articulatus* | X | | | | | | X | | | | II |
| *Juncus conglomeratus* | | X | X | | | | | | | | II |
| *Lemna minor* | X | | | | | | X | | | | II |
| *Lythrum portula* | | X | | X | | X | | | | | II |
| *Persicaria hydropiper* | | | | | | | X | | | X | II |
| *Potamogeton natans* | X | | X | | | | | | | | II |
| *Rubus fruticosus* | | | X | | | | | | X | | II |
| *Rumex conglomeratus* | | | | | | | | | X | X | II |
| *Scutellaria minor* | X | | X | | | | | X | | | II |
| *Sparganium cf angustifolium* | | X | | X | | X | | | | | II |
| *Sphagnum denticulatum* | | | | | | X | | X | | | II |
| *Sphagnum fallax* | | X | | | | X | | | | | II |
| *Acer pseudoplatanus* | | | | | | | | | X | | I |
| *Alopecurus geniculatus* | | X | | | | | | | | | I |
| *Anagallis tenella* | X | | | | | | | | | | I |
| *Anthoxanthum odoratum* | | | | | | | | | | X | I |
| *Betula pubescens* | | | | | | | | | | X | I |
| *Calluna vulgaris* | | | | | | | | | | X | I |
| *Cardamine pratensis* | | | | | | X | | | | | I |
| *Carex demissa* | | X | | | | | | | | | I |
| *Carex paniculata* | | | X | | | | | | | | I |
| *Chamerion angustifolium* | | | | | | | | | X | | I |
| *Chara sp.* | | | X | | | | | | | | I |
| *Cirsium palustre* | | | | | | | | X | | | I |
| *Dryopteris dilatata* | | | | | | | | | X | | I |
| *Dryopteris filix-mas* | | | | | | | | | X | | I |
| *Equisetum palustre* | | | | | | | | | X | | I |
| *Erica tetralix* | | | | | X | | | | | | I |
| *Eupatorium cannabinum* | | | X | | | | | | | | I |
| *Euphrasia sp.* | | | X | | | | | | | | I |
| *Festuca vivipara* | | | X | | | | | | | | I |
| *Glyceria fluitans* | | | | | X | | | | | | I |
| *Holcus mollis* | | | | | | | | X | | | I |
| *Juncus squarrosus* | | X | | | | | | | | | I |

| Species | TN4 | TN5 | TN6 | TN8 | TN9 | TN10 | TN13 | TN14 | TN15 | TN22 | Freq. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Lotus pedunculatus* | | | | | | X | | | | | I |
| *Luzula multiflora* | | | | | | | | | | X | I |
| *Mentha aquatica* | | | | | | | | | X | | I |
| *Myosotis laxa* | | | | | | | | | X | | I |
| *Myriophyllum spicatum* | X | | | | | | | | | | I |
| *Nitella sp.* | | | | | | X | | | | | |
| *Philonotis fontana* | X | | | | | | | | | | I |
| *Picea sitchensis* | | | | | | | | | X | | I |
| *Potentilla palustris* | | | | | | X | | | | | I |
| *Pulicaria dysenterica* | X | | | | | | | | | | I |
| *Ranunculus omiophyllus* | | X | | | | | | | | | I |
| *Rumex acetosa* | | | | | | | | X | | | I |
| *Salix aurita* | | | | | | | | | | X | I |
| *Salix caprea* | | | | | | | | | X | | I |
| *Silene flos-cuculi* | | | | | | | | | | X | I |
| *Sphagnum cuspidatum* | | | | | | | | X | | | I |
| *Sphagnum fimbriatum* | | | | | | | | | X | | I |
| *Sphagnum sp.* | | | | | X | | | | | | I |
| *Typha angustifolia* | | | X | | | | | | | | I |
| *Ulex europaeus* | | | | | | | | | | X | I |
| *Vaccinium myrtillus* | | | | | | | | | | X | I |
| *Warnstorffia fluitans* | | | | | | X | | | | | I |
| **Species total** | **20** | **23** | **19** | **10** | **11** | **26** | **14** | **18** | **19** | **21** | |

### *Ditches*

There are numerous shallow ditches within the study area, but many of them appear to be almost dry most of the time and only support a species-poor rush-dominated flora. A few of the deeper, wetter ditches have a greater proportion of wetland plants, such as Bulrush, Angelica, Water Mint and Common Spike Rush, and the flora resembles that of the pond margins. In most cases the ditches support variations of the NVC community M23 *Juncus effusus/ acutiflorus – Galium palustre* mire. Some ditches support a high proportion of Bulrush or Common Spike-rush and are closer to S12 Typha latifolia swamp and S19 *Eleocharis palustris* swamp respectively. Some ditches which are subject to disturbance or regular management, such as around the washery, support open vegetation communities resembling the OV28 *Agrostis stolonifera – Ranunculus repens* community.

The ditches with greatest botanical conservation significance tend to be those that are permanently wet. Some these support a high proportion of mosses (e.g. Q42, described under *Sphagnum*-rich bog vegetation). Some have a very high proportion of sedges and flowering herbs (e.g. TN20, which has a diverse flora including Common Sedge, Star Sedge, Remote Sedge, Common Yellow Sedge and White Sedge).

*The wide, shallow ditch at TN20, dominated by Common Spike-rush and Water Horsetail, but with a high diversity of flowering herbs and sedges.*

*A wet ditch beside a retaining wall at the washery supports a sparse wetland flora dominated by Creeping Buttercup and Creeping Bent (TN18).*

*Montbretia (near TN18), an invasive species seen at the washery.*

## Table 24. Species list data for ditches.

| Species | TN16 | TN17 | TN18 | TN19 | TN20 | TN21 | TN23 | Frequency |
|---|---|---|---|---|---|---|---|---|
| *Galium palustre* | X | X | X | X | X | | X | V |
| *Juncus effusus* | X | X | X | X | X | X | X | V |
| *Agrostis stolonifera* | X | | X | | | | X | III |
| *Angelica sylvestris* | | X | | X | X | | | III |
| *Athyrium filix-femina* | | | X | X | X | | | III |
| *Eleocharis palustris* | X | | | | X | | X | III |
| *Epilobium hirsutum* | | X | X | | X | | | III |
| *Epilobium palustre* | X | | | | X | | X | III |
| *Potentilla anserina* | | X | X | | | X | | III |
| *Ranunculus repens* | | | X | X | | X | X | III |
| *Rumex crispus* | X | | | | | X | X | III |
| *Salix cinerea* | | | X | | X | | X | III |
| *Silene flos-cuculi* | | | | X | X | X | | III |
| *Typha latifolia* | | | X | | X | X | X | III |
| *Alopecurus geniculatus* | X | | | | | X | | II |
| *Calliergonella cuspidata* | X | | | | | X | | II |
| *Callitriche sp.* | X | | | | | X | | II |
| *Carex leporina* | X | | | | | X | | II |
| *Carex nigra* | | | | X | X | | | II |
| *Cirsium palustre* | | | X | | | X | | II |
| *Dryopteris filix-mas* | | | X | X | | | | II |
| *Equisetum fluviatile* | | | | X | X | | | II |
| *Holcus lanatus* | X | | X | | | | | II |
| *Juncus acutiflorus* | | | | | X | X | | II |
| *Juncus inflexus* | | X | | | X | | | II |
| *Mentha aquatica* | | | | X | X | | | II |
| *Poa trivialis* | | X | | | | | X | II |
| *Ranunculus flammula* | X | | | | X | | | II |
| *Tussilago farfara* | | | X | | | X | | II |
| *Urtica dioica* | | X | | | | | X | II |
| *Valeriana officinalis* | | X | | X | | | | II |
| *Alnus glutinosa* | | | X | | | | | I |
| *Calliergon cordifolium* | | | | | | | X | I |
| *Cardamine pratensis* | | | X | | | | | I |
| *Carex curta* | | | | | X | | | I |
| *Carex demissa* | | | | | X | | | I |
| *Carex echinata* | | | | | X | | | I |

| Species | TN16 | TN17 | TN18 | TN19 | TN20 | TN21 | TN23 | Frequency |
|---|---|---|---|---|---|---|---|---|
| *Carex remota* | | | | | | X | | I |
| *Carex rostrata* | | | | X | | | | I |
| *Chamerion angustifolium* | | | X | | | | | I |
| *Cratoneuron filicinum* | | | X | | | | | I |
| *Cynosurus cristatus* | X | | | | | | | I |
| *Dactylorhiza fuchsii* | | | | X | | | | I |
| *Dactylorhiza sp.* | | | X | | | | | I |
| *Deschampsia cespitosa* | | X | | | | | | I |
| *Dryopteris affinis* | | | X | | | | | I |
| *Dryopteris carthusiana* | | | | X | | | | I |
| *Epilobium brunnescens* | | | X | | | | | I |
| *Epilobium ciliatum* | X | | | | | | | I |
| *Equisetum palustre* | | | X | | | | | I |
| *Eriophorum angustifolium* | | | | X | | | | I |
| *Fissidens adianthoides* | | | | | X | | | I |
| *Glyceria fluitans* | | X | | | | | | I |
| *Heracleum sphondylium* | | X | | | | | | I |
| *Holcus mollis* | | X | | | | | | I |
| *Hydrocotyle vulgaris* | | | | | X | | | I |
| *Hylocomium splendens* | | | | | X | | | I |
| *Hypericum tetrapterum* | | | | | | | X | I |
| *Iris pseudacorus* | | | | | | | X | I |
| *Juncus articulatus* | | | X | | | | | I |
| *Juncus bulbosus* | X | | | | | | | I |
| *Lythrum portula* | | | | | | | X | I |
| *Molinia caerulea* | | | | | X | | | I |
| *Myosotis laxa* | | X | | | | | | I |
| *Pellia sp.* | | | X | | | | | I |
| *Persicaria hydropiper* | | | | | | | X | I |
| *Pohlia melanodon* | X | | | | | | | I |
| *Pohlia wahlenbergii* | | | | | X | | | I |
| *Pulicaria dysenterica* | | | | | X | | | I |
| *Ranunculus acris* | | | | | | X | | I |
| *Ribes nigrum* | | | | | | | X | I |
| *Rumex acetosa* | | | | X | | | | I |
| *Rumex conglomeratus* | | X | | | | | | I |
| *Sagina procumbens* | X | | | | | | | I |
| *Salix alba* | | | | | X | | | I |
| *Scutellaria minor* | | | | | X | | | I |
| *Stellaria alsine* | | X | | | | | | I |
| *Taraxacum* sp. | | | | | | X | | I |
| *Trifolium repens* | X | | | | | | | I |
| *Valeriana dioica* | | | | X | | | | I |
| *Veronica beccabunga* | | X | | | | | | I |
| *Veronica scutellata* | | | | | X | | | I |
| **Species total** | **18** | **17** | **23** | **17** | **28** | **16** | **17** | **136** |

### *Stream*

The largest stream within the study area is the Afon Dulais which flows past the southern boundary. It flows just outside the Celtic Energy land ownership boundary so could only be examined from beside the adjacent fence (TN11). The stream is approximately 2-3m wide and flows in a meandering channel. The stream bed is stony and has localised ochre deposits. The channel is bordered by marshy grassland and flush vegetation, which is lightly grazed by sheep. Much of it appears to conform to the NVC category M23 *Juncus effusus/ acutiflorus – Galium palustre* mire, but it locally grades into tall, dense stands of Meadowsweet which are classified as M27 *Filipendula ulmaria – Angelica sylvestris* mire.

*Afon Dulais stream at TN11, fringed by marshy grassland and Meadowsweet mire.*

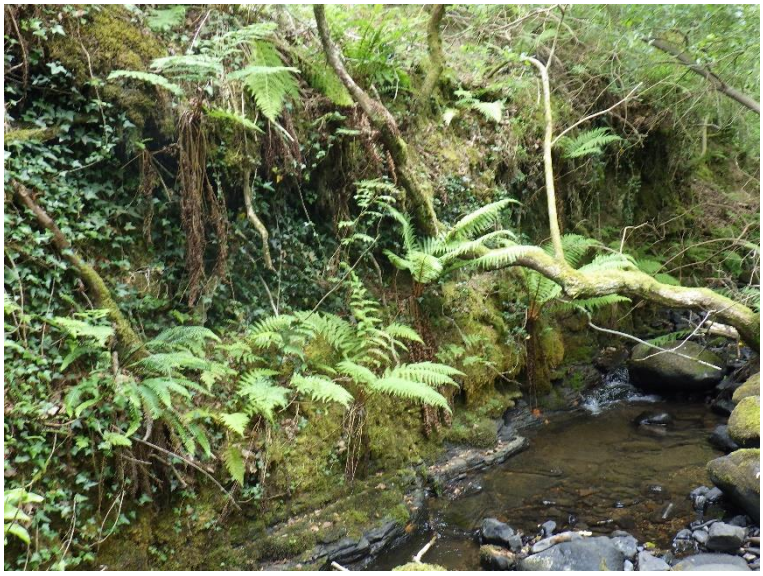
**Table 25. Species-list for Afon Dulais stream at TN11**

*Alnus glutinosa*
*Angelica sylvestris*
*Athyrium filix-femina*
*Cirsium palustre*
*Deschampsia cespitosa*
*Epilobium palustre*
*Equisetum palustre*
*Filipendula ulmaria*
*Galium palustre*
*Glyceria fluitans*
*Holcus lanatus*
*Hydrocotyle vulgaris*
*Juncus acutiflorus*
*Juncus bulbosus*
*Juncus effusus*
*Juncus inflexus*
*Lotus pedunculatus*
*Molinia caerulea*
*Myosotis laxa*
*Potentilla erecta*
*Pulicaria dysenterica*
*Ranunculus acris*
*Ranunculus repens*
*Rhododendron ponticum*
*Rumex acetosa*
*Scutellaria galericulata*
*Scutellaria minor*
*Silene flos-cuculi*
*Stellaria graminea*
*Valeriana officinalis*
*Wahlenbergia hederacea*

### *Damp, shaded cliffs*

Several shaded streams within woodland near the study area margins include steep rock outcrops and small waterfalls, creating a humid, moss-covered habitat with abundant ferns. Two of these were investigated during the survey. TN3 is a stream-side cliff, and TN2 a waterfall. Both were too steep and slippery to search fully, but provisional species lists were compiled of the most abundant species.

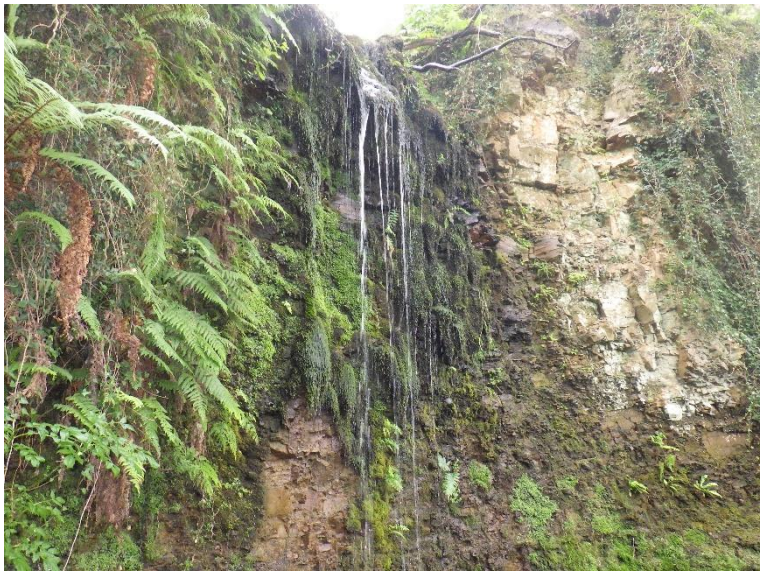
The damp cliff habitat does not easily fit within the NVC, but it is probably best to describe it as local variations within the W11 *Quercus petraea – Betula pubescens – Oxalis acetosella* woodland and W9 *Fraxinus excelsior – Sorbus aucuparia – Mercurialis perennis* woodland that surround these streams. The local high abundance of bryophytes and ferns has affinity with the W17a *Quercus petraea – Betula pubescens – Dicranum majus* woodland *Isothecium myosuroides – Diplophyllum albicans* sub-community, but it is not a good match in the absence of several other species that should be constant in that habitat.



*Streamside cliff at TN3*

## Table 26. Species-list for damp, shaded cliff habitats

| Species | TN2 | TN3 | Frequency |
|---|---|---|---|
| *Athyrium filix-femina* | X | X | V |
| *Diplophyllum albicans* | X | X | V |
| *Dryopteris affinis* | X | X | V |
| *Dryopteris dilatata* | X | X | V |
| *Dryopteris filix-mas* | X | X | V |
| *Fraxinus excelsior* | X | X | V |
| *Hedera helix sl* | X | X | V |
| *Isothecium myosuroides* | X | X | V |
| *Mnium hornum* | X | X | V |
| *Pellia epiphylla* | X | X | V |
| *Platyhypnidium riparioides* | X | X | V |
| *Polytrichastrum formosum* | X | X | V |
| *Quercus petraea* | X | X | V |
| *Sorbus aucuparia* | X | X | V |
| *Thuidium tamariscinum* | X | X | V |
| *Asplenium scolopendrium* | X | | III |
| *Blechnum spicant* | | X | III |
| *Brachypodium sylvaticum* | X | | III |
| *Brachythecium rutabulum* | | X | III |
| *Cardamine cf flexuosa* | X | | III |
| *Carex remota* | | X | III |
| *Chrysosplenium oppositifolium* | | X | III |
| *Conocephalum conicum* | X | | III |
| *Corylus avellana* | | X | III |
| *Cratoneuron filicinum* | | X | III |
| *Deschampsia flexuosa* | | X | III |
| *Digitalis purpurea* | | X | III |
| *Festuca gigantea* | | X | III |
| *Fissidens adianthoides* | | X | III |
| *Fissidens taxifolius* | X | | III |
| *Geum urbanum* | | X | III |
| *Ilex aquifolium* | X | | III |
| *Kindbergia praelonga* | X | | III |
| *Lysimachia nemorum* | | X | III |
| *Metzgeria furcata* | X | | III |
| *Polystichum setiferum* | X | | III |
| *Polytrichum commune* | | X | III |
| *Rubus fruticosus* | | X | III |
| *Thamnobryum alopecurum* | | X | III |
| *Viola riviniana* | | X | III |



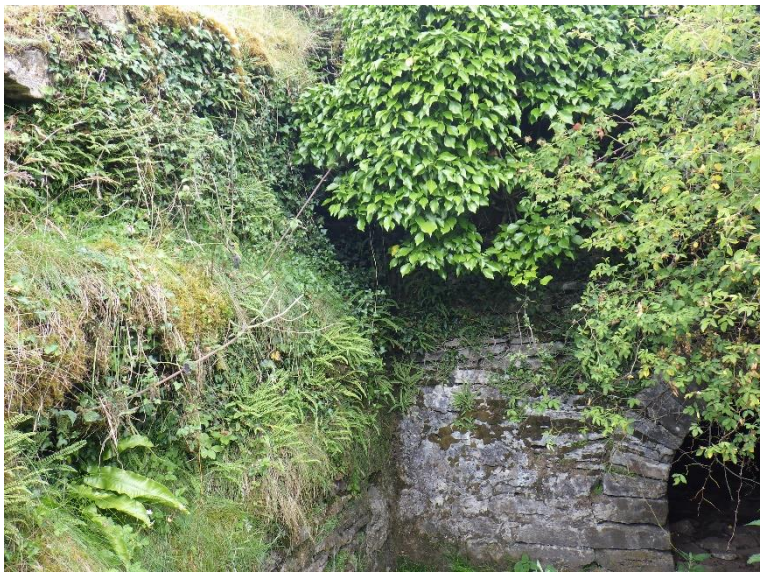
*Waterfall at TN2*

### *Vegetation on old stone walls*

Several examples of vegetation growing on old stone walls were seen. The largest is a former railway retaining wall in west of the study area. This heavily shaded wall was visible from the cycleway and appears to be largely covered in ferns and Ivy. However, it lies outside the Celtic Energy land ownership boundary so could not be examined closely. Vegetation was also seen on old brickwork on retaining walls at the washery, and the Onllwyn railway bridge, but only in very small quantity. The one example of vegetation on old stone walls that was collected as a target note was from a former mine structure in the south-west of the study area (TN1). In terms of the NVC the closest communities are possibly OV39 *Asplenium trichomanes – A.ruta-muraria* community, or W21 *Crataegus monogyna – Hedera helix* scrub, but it is not a good match for either. Other examples of vegetated stonework may be present at structures outside the Celtic Energy landholding that could not be accessed during the current survey. For example, there is a disused mine shown on the Ordnance Survey map in land at the far west of the study area.

**Table 27. Species-list for vegetated old stonework at TN1**

*Asplenium adiantum-nigrum*
*Asplenium scolopendrium*
*Asplenium trichomanes*
*Epilobium brunnescens*
*Epilobium montanum*
*Festuca rubra*
*Fragaria vesca*
*Geranium dissectum*
*Geranium robertianum*
*Hedera helix sl*
*Pseudoscleropodium purum*
*Rosa canina*
*Rubus fruticosus*
*Sedum acre*
*Sorbus aucuparia*
*Urtica dioica*



*Vegetation on old stone walls at a disused mining structure (TN1)*

# 4. Evaluation

This section evaluates the nature conservation significance of the plant communities in a geographical context, based on the approach set out in 'Guidelines for Ecological Impact Assessment' (CIEEM, 2018). The criteria used to assist in the evaluation are summarised in Table 28.

**Table 28: Evaluation criteria**

| Level of Value | Habitats |
|---|---|
| International | Areas designated as Special Areas of Conservation (SAC), Special Protection Areas (SPA) or Ramsar sites in response to European Directives and International Conventions. |
| National | Areas designated as Sites of Special Scientific Interest (SSSI), National Nature Reserve (NNR), or equivalent for key areas, habitats and plant communities. |
| Regional | Areas of habitat of suitable size and quality to be considered for notification as SSSI (based on Guidelines for the Selection of Biological SSSIs, JNCC 1998). Extensive areas of Environment (Wales) Act (2016) Section 7 habitats, listed as 'habitats of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales. |
| County | Areas meeting Wildlife Sites Guidelines selection criteria; areas of Section 7 habitats; areas of Ancient woodland. |
| District/Local value | Areas of LBAP habitat. Important hedgerows classified under The Hedgerow Regulations 1997. Any non-designated habitat assemblage of moderate biodiversity value. |

The study confirmed that there is a wide variety of vegetation types within the study area. A high proportion of the site comprises recently restored, heavily grazed semi-improved pasture and this is very species-poor with negligible botanical interest.

There are no habitats or plant communities that are considered important in a national context. In this case the habitats of greatest value for nature conservation are included within the Welsh Government's Environment (Wales) Act list of Section 7 habitats. The examples of Section 7 habitats present at this site are relatively small or species poor examples of the habitats. This is because the majority of the study area has been heavily affected by human activity, either through mine-working or intensive sheep-grazing, and this has affected the size and quality of the habitats. Consequently the highest value that should be considered from the criteria above is county context rather than regional context in this case.

Several of the plant communities would be deemed to be of county importance on the basis of the Wildlife Sites Guidelines. Each is evaluated in Table 29 below, in the same order that they have been presented in the report. For the purposes of this assessment the value relates only to the vegetation, and not to other wildlife such as birds, mammals or fungi (e.g. a pond might be valued as Local value for its flora, but could potentially be of county value for amphibians or breeding birds, or vice versa).

**Table 29. Summary evaluation of habitats within the study area, based on vegetation**

| Vegetation type | Comments | Evaluation |
|---|---|---|
| Semi-natural broad-leaved woodland | Small examples of W11 upland oak woodland, and W9 upland mixed ash woodland present near site perimeter. These are Section 7 habitats and include small remnants of ancient woodland. | **County** value. |
| Plantation and scrub woodland | Relatively young habitats with limited botanical diversity. | **Local** value. |
| Conifer plantation | Relatively young and even-aged, with only a sparse ground flora. The large population of Common Wintergreen is of importance in a county context. | Mostly **Local** value, but Common Wintergreen is of **County** value. |
| Acid grassland | Patchily distributed through much of the study area and mainly represented by U1 and U4 grassland, sometimes forming mosaics with other vegetation. Most of the acid grassland is relatively species-poor and in a heavily-grazed state. | The diverse swards and mosaics with heath vegetation are of **County** value. Low diversity young or sparse swards are of **negligible** value. |
| Neutral grassland | Mostly limited to small patches and road-side strips, mainly MG5 and MG1 but very variable in species diversity. | **Local** value. |
| Semi-improved acid grassland | Many extensive examples, especially on well-drained slopes associated with former mining activity. Including some areas with high densities of ant-hills. | Older, diverse swards are of **County** value. Younger, species-poor swards are of **negligible** value. |
| Sparse grassland on coal spoil and washery sidings | Many variations on U1 grassland. There is a full spectrum of cover and diversity from almost bare spoil to very high diversity vegetation which includes locally uncommon species. | Conservation value reflects the diversity of the swards. Young, species-poor stands are of **Negligible** value, but well established diverse swards are of **Local** and **County** value. |
| Dry heath | The study area supports very few examples of heath with >25% cover by dwarf shrub species that would qualify as the S7 habitat 'upland heathland'. The largest area is in the restoration area in the centre of the site, which supports H1 heath. Heath is mostly only present as mosaic component amongst acid grassland on former colliery slopes. | **County** value. |
| Wet heath/ marshy grassland mosaic | Only a few small examples present, and mostly M25 mire, grading into other habitat mosaics. All that were seen support a good range of species. | **County** value. |
| *Sphagnum*-rich bog vegetation | Only a few small areas are present, but they all support uncommon plants and all occur in association with other diverse marshy grassland and heath. | **County** value. |

| Vegetation type | Comments | Evaluation |
|---|---|---|
| Marshy grassland | Several relatively large areas are present that are dominated by Purple Moor-grass (M25 mire) and rush pasture (M23 mire). The most diverse would qualify as the S7 habitat 'Purple Moor-grass and rush pastures'.<br>An extensive area of diverse, minerotrophic M23/ M24 marshy grassland is present in wet fields with coal spoil north of the washery.<br>A high proportion of marshy grassland on recently restored farmland is species poor MG10 rush pasture with negligible value. | The diverse M23 and M25 swards are of **County** value.<br>Lower diversity MG23 swards are of no more than **Local** value. |
| Flush vegetation | Several small M23 flushes are present; mostly at the margins of the grazed upland areas. They support a diverse sward with locally uncommon plant species. | **County** value. |
| Swamp | Several areas of swamp vegetation are present, but they are mostly too small to qualify as priority habitat. Only one small area of S4 reedbed is present, but this is relatively small and species-poor. | **Local** value. |
| Ponds | There is an extensive network of ponds within the site. They are of man-made origin but support a variety of vegetation types, including several locally rare plant species such as Floating Bur-reed. | Ponds with rare plant species may be of **County** value. Most individual ponds are of **Local** value. |
| Ditches | There are a range of ditch types within the site. Most are small with a limited wetland flora. Several larger ones support a more diverse flora. | Most small ditches have negligible value, but some larger ones have **Local** value. |
| Stream | The Afon Dulais is the only significant stream within the study area. It has a natural channel profile with a naturally meandering course and is bordered by diverse wetland vegetation and therefore meets the wildlife sites qualifying criteria. | **County** value. |
| Damp shaded cliffs | Local features associated with woodland streams, with a diverse assemblage of ferns and bryophytes. | **Local** value (but some may be part of County value woodland). |
| Vegetated old stone walls | A small number of man-made features with sparse vegetation. The largest in the study area was not accessible. | **Negligible** value (but some may be part of local value woodland). |

The majority of plants recorded during the study are common and widespread species. The only species found that has any special statutory protection under the Wildlife and Countryside Act is Bluebell, which was present in woodland. The protection of Bluebell only relates to sale, so is not relevant to the Project. None of the plants seen are included in the Environment (Wales) Act 2016 Section 7 lists of species of 'principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales'.

Several plants were found that are listed as being rare or in South Wales in the Wildlife Sites Guidelines (Wales Biodiversity Partnership, 2008). Under these guidelines a site is considered significant in a county context if it supports one or more Primary Species or five or more Contributory Species. In this case the rare species recorded are summarised below:

- Bee Orchid (Contributory Species). Locally abundant on sparsely vegetated coal spoil at the washery.
- Bird Cherry (Contributory Species). In plantation/ scrub on restored areas north of Nant Helen mine (probably planted).
- Brookweed (Contributory Species). Locally frequent in base-rich damp ground at the washery.
- Brown Sedge (Contributory Species). Rare on flushed ground on coal spoil at the washery.
- Common Cudweed (Primary Species). Two plants observed in disturbed ground in horse-grazed pasture south-east of the washery.
- Common Wintergreen (Primary Species). Abundant in conifer plantation at north-western boundary.
- Eyebright (*Euphrasia arctica ssp borealis*) (Contributory Species). Occasional in grassland on coal spoil/ washery sidings.
- Floating Bur-reed (Primary Species). Flowering plants confirmed in two upland ponds. Floating leaves of non-flowering plants present in several other ponds suggest that it is probably also present in those, but they could not be confirmed with certainty.
- Lesser Bulrush (Primary Species). Present along margins of water treatment pond at TN6.
- Royal Fern (Contributory Species). A single young plant noted in *Sphagnum*-rich mire near Quadrat 48.
- Small Cudweed (Contributory Species). Locally abundant on sparsely vegetated spoil.
- Spiked Water-milfoil (Contributory Species). Present in ponds at TN4.
- Viviparous Fescue (Primary Species). Several plants noted in sparsely vegetated coal spoil near pond at TN6.

*Viviparous Fescue, a 'Primary Species' recorded at TN6.*

It is likely that further investigations within the study area would confirm the presence of many more plant species, and that some of these would include additional locally scarce species.

*Common Cudweed, a 'Primary Species' recorded in horse-grazed pasture east of the washery (at Quadrat 126). This species might also occur at low density on coal spoil in other parts of the site.*

*Lesser Bulrush, a 'Primary Species' present beside water treatment pond (at TN6).*

*A flowering head of Floating Bur-reed; a 'Primary Species' that was confirmed in ponds at TN5 and 10. Floating leaves likely to be this species were also seen in several other ponds but could not be confirmed in the absence of flowering heads.*

Two other plants listed in the Wildlife Sites Guidelines were recorded at the washery (by the same surveyor) in 2015, namely Grass Vetchling (Contributory Species) in species-rich neutral grassland, and Fen Bedstraw (Primary Species) in marshy grassland to the north. Although neither were seen during the present study there is a reasonable probability that they may still be present but were not seen during the present survey because the plants only occur at a low density and the whole area could not be searched thoroughly.

In addition to plants noted for their rarity, several species were found that are significant because of their listing on Schedule 9 of the Wildlife and Countryside Act as non-native invasive species. They include the following:

- Japanese Knotweed. Small patches at the washery, and by northern cycleway.
- Montbretia. Several clumps near the washery buildings.
- Hollyberry Cotoneaster. Scattered plants in plantation / scrub and washery coal spoil.
- Himalayan Cotoneaster Scattered plants on washery coal spoil.
- Wall Cotoneaster. Scattered plants on washery coal spoil.
- Entire-leaved Cotoneaster. Scattered plants on washery coal spoil.

*Japanese Knotweed at the washery, near Quadrat 99*

*Himalayan Cotoneaster on coal spoil at the washery (near Q125).*

# 5. References

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.

Hill, M.O. (2015). TABLEFIT version 2.0 for identification of vegetation types. Wallingford: Centre for Ecology and Hydrology.

Hipkin, C. & Hipkin H. (2019). Species-rich marshy grasslands in the Dulais valley, Neath Port Talbot. Botanical Society of the British Isles Welsh Bulletin. 103, 28-30.

JNCC (2010). Handbook for Phase 1 Habitat Survey – A Technique for Environmental Audit. Joint Nature Conservation Committee, Peterborough.

Rodwell, J.S. (ed.), C.D. Pigott, D.A. Ratcliffe, A.J.C. Malloch, H.J.B. Birks, M.C.F. Proctor, D.W. Shimwell, J.P. Huntley, E. Radford, M.J. Wiggington, P. Wilkins, (1991 - 2000). British Plant Communities. Volumes 1-5. Cambridge University Press, Cambridge.

Wales Biodiversity Partnership (2008). Guidelines for the Selection of Wildlife Sites in Wales.

# Appendix 1. Plant species list

The following species list presents the scientific and common names of all the plant species identified during the vegetation surveys. Due to the size of the site, restrictions on access to some parts, and nature of the sampling, this should not be considered a comprehensive list of every plant species within the study area.

| Species | Common name |
|---|---|
| ***VASCULAR PLANTS*** | |
| *Acer campestre* | Field Maple |
| *Acer pseudoplatanus* | Sycamore |
| *Achillea millefolium* | Yarrow |
| *Achillea ptarmica* | Sneezewort |
| *Agrostis canina* | Velvet Bent |
| *Agrostis capillaris* | Common Bent |
| *Agrostis stolonifera* | Creeping Bent |
| *Aira caryophyllea* | Silver Hair-grass |
| *Aira praecox* | Early Hair-grass |
| *Alchemilla sp.* | Lady's Mantle |
| *Alnus cordata* | Italian Alder |
| *Alnus glutinosa* | Alder |
| *Alnus incana* | Grey Alder |
| *Alopecurus geniculatus* | Marsh Foxtail |
| *Alopecurus pratensis* | Meadow Foxtail |
| *Anagallis tenella* | Bog Pimpernel |
| *Anaphalis margaritacea* | Pearly Everlasting |
| *Angelica sylvestris* | Angelica |
| *Anthoxanthum odoratum* | Sweet Vernal-grass |
| *Anthyllis vulneraria* | Kidney-vetch |
| *Arenaria serpyllifolia* | Thyme-leaved Sandwort |
| *Arrhenatherum elatius* | False Oat-grass |
| *Asplenium adiantum-nigrum* | Black Spleenwort |
| *Asplenium scolopendrium* | Hart's-tongue Fern |
| *Asplenium trichomanes* | Maidenhair Spleenwort |
| *Athyrium filix-femina* | Lady Fern |
| *Bellis perennis* | Daisy |
| *Betula pendula* | Silver Birch |
| *Betula pubescens* | Downy Birch |
| *Blechnum spicant* | Hard Fern |
| *Brachypodium sylvaticum* | False Brome |
| *Briza media* | Quaking Grass |
| *Bromus hordeaceus* | Soft Brome |
| *Buddleja davidii* | Butterfly Bush |
| *Callitriche sp.* | Water Starwort |
| *Calluna vulgaris* | Heather |
| *Caltha palustris* | Marsh Marigold |

| Species | Common name |
|---|---|
| *Cardamine cf flexuosa* | Wavy Bittercress |
| *Cardamine pratensis* | Cuckoo Flower |
| *Carex acutiformis* | Lesser Pond-sedge |
| *Carex binervis* | Green-ribbed Sedge |
| *Carex curta* | White Sedge |
| *Carex demissa* | Common Yellow-Sedge |
| *Carex disticha* | Brown Sedge |
| *Carex echinata* | Star Sedge |
| *Carex flacca* | Glaucous Sedge |
| *Carex hirta* | Hairy Sedge |
| *Carex hostiana* | Tawny Sedge |
| *Carex leporina* | Oval Sedge |
| *Carex nigra* | Common Sedge |
| *Carex otrubae* | False Fox-sedge |
| *Carex pallescens* | Pale Sedge |
| *Carex panicea* | Carnation Sedge |
| *Carex paniculata* | Greater Tussock-sedge |
| *Carex pendula* | Pendulous Sedge |
| *Carex pilulifera* | Pill Sedge |
| *Carex pulicaris* | Flea Sedge |
| *Carex remota* | Remote Sedge |
| *Carex rostrata* | Bottle Sedge |
| *Carex spicata* | Spiked Sedge |
| *Carex sylvatica* | Wood Sedge |
| *Carlina vulgaris* | Carline Thistle |
| *Castanea sativa* | Sweet Chestnut (Planted) |
| *Centaurea nigra* | Common Knapweed |
| *Centaurium erythraea* | Common Centaury |
| *Cerastium fontanum* | Common Mouse-ear |
| *Chamerion angustifolium* | Rose-Bay Willowherb |
| *Chrysosplenium oppositifolium* | Opposite-leaved Golden-saxifrage |
| *Circaea lutetiana* | Enchanter’s Nightshade |
| *Cirsium arvense* | Creeping Thistle |
| *Cirsium palustre* | Marsh Thistle |
| *Cirsium vulgare* | Spear Thistle |
| *Cornus sanguinea* | Dogwood |
| *Cornus sericea* | Red-osier Dogwood |
| *Corylus avellana* | Hazel |
| *Cotoneaster bullatus* | Hollyberry Cotoneaster |
| *Cotoneaster integrifolius* | Entire-leaved Cotoneaster |
| *Cotoneaster simonsii* | Himalayan Cotoneaster |
| *Crataegus monogyna* | Hawthorn |
| *Crepis capillaris* | Smooth Hawk's-beard |
| *Crocosmia crocosmiiflora* | Montbretia |
| *Cynosurus cristatus* | Crested Dog’s-tail |
| *Cytisus scoparius* | Broom |

| Species | Common name |
|---|---|
| *Dactylis glomerata* | Cock's-foot Grass |
| *Dactylorhiza fuchsii* | Common Spotted-orchid |
| *Dactylorhiza maculata* | Heath Spotted-orchid |
| *Dactylorhiza praetermissa* | Southern Marsh-orchid |
| *Dactylorhiza sp.* | Hybrid Marsh-orchid |
| *Danthonia decumbens* | Heath Grass |
| *Daucus carota* | Wild Carrot |
| *Deschampsia cespitosa* | Tufted Hair-grass |
| *Deschampsia flexuosa* | Wavy Hair-grass |
| *Digitalis purpurea* | Foxglove |
| *Dipsacus fullonum* | Teasel |
| *Drosera rotundifolia* | Round-leaved Sundew |
| *Dryopteris affinis* | Scaly Male-fern |
| *Dryopteris carthusiana* | Narrow Buckler-fern |
| *Dryopteris dilatata* | Broad Buckler-fern |
| *Dryopteris filix-mas* | Male Fern |
| *Eleocharis palustris* | Common Spike-rush |
| *Elytrigia repens* | Couch |
| *Epilobium brunnescens* | New Zealand Willowherb |
| *Epilobium ciliatum* | American Willowherb |
| *Epilobium hirsutum* | Greater Willowherb |
| *Epilobium montanum* | Broad-leaved Willowherb |
| *Epilobium palustre* | Marsh Willowherb |
| *Epilobium parviflorum* | Hoary Willowherb |
| *Epilobium tetragonum* | Square-stalked Willowherb |
| *Epipactis helleborine* | Broad-leaved Helleborine |
| *Equisetum arvense* | Field Horsetail |
| *Equisetum fluviatile* | Water Horsetail |
| *Equisetum palustre* | Marsh Horsetail |
| *Equisetum sp.* | Horsetail (indeterminate) |
| *Erica tetralix* | Cross-leaved Heath |
| *Erigeron acris* | Blue Fleabane |
| *Eriophorum angustifolium* | Common Cotton-grass |
| *Eriophorum vaginatum* | Hare's-tail Cotton-grass |
| *Eupatorium cannabinum* | Hemp Agrimony |
| *Euphrasia cf arctica ssp borealis* | Eyebright |
| *Euphrasia cf nemorosa* | Eyebright |
| *Euphrasia sp.* | Eyebright |
| *Fagus sylvatica* | Beech (planted) |
| *Festuca gigantea* | Giant Fescue |
| *Festuca ovina* | Sheep's Fescue |
| *Festuca rubra* | Red Fescue |
| *Festuca vivipara* | Viviparous Sheep's-fescue |
| *Filago germanica* | Common Cudweed |
| *Filago minima* | Small Cudweed |
| *Filipendula ulmaria* | Meadowsweet |

| Species | Common name |
|---|---|
| *Fragaria vesca* | Wild Strawberry |
| *Fraxinus excelsior* | Ash |
| *Galeopsis cf tetrahit* | Common Hemp-nettle |
| *Galium aparine* | Cleavers |
| *Galium palustre* | Marsh Bedstraw |
| *Galium saxatile* | Heath Bedstraw |
| *Geranium dissectum* | Cut-leaved Crane's-bill |
| *Geranium molle* | Dove's-foot Crane's-bill |
| *Geranium robertianum* | Herb Robert |
| *Geum urbanum* | Wood Avens |
| *Glyceria fluitans* | Floating Sweet-grass |
| *Hedera helix sl* | Ivy |
| *Heracleum sphondylium* | Hogweed |
| *Hieracium sp.* | Hawkweed (indeterminate) |
| *Hirschfeldia incana* | Hoary Mustard |
| *Holcus lanatus* | Yorkshire Fog |
| *Holcus mollis* | Creeping Soft-grass |
| *Hyacinthoides non-scripta* | Bluebell |
| *Hydrocotyle vulgaris* | Marsh Pennywort |
| *Hypericum androsaemum* | Tutsan |
| *Hypericum maculatum* | Imperforate St. John's-wort |
| *Hypericum perforatum* | Perforate St. John's-wort |
| *Hypericum pulchrum* | Slender St. John's-wort |
| *Hypericum tetrapterum* | Square-stalked St. John's-wort |
| *Hypochaeris radicata* | Common Cat's-Ear |
| *Ilex aquifolium* | Holly |
| *Iris pseudacorus* | Yellow Flag Iris |
| *Isolepis setacea* | Bristle Club-rush |
| *Juncus acutiflorus* | Sharp-flowered Rush |
| *Juncus articulatus* | Jointed Rush |
| *Juncus bufonius* | Toad Rush |
| *Juncus bulbosus* | Bulbous Rush |
| *Juncus conglomeratus* | Compact Rush |
| *Juncus effusus* | Soft Rush |
| *Juncus inflexus* | Hard Rush |
| *Juncus squarrosus* | Heath Rush |
| *Juncus tenuis* | Slender Rush |
| *Larix sp.* | Larch |
| *Lathyrus pratensis* | Meadow Vetchling |
| *Lemna minor* | Common Duckweed |
| *Leontodon hispidus* | Rough hawk-bit |
| *Leontodon saxatilis* | Lesser Hawk-bit |
| *Leucanthemum vulgare* | Ox-eye Daisy |
| *Linum catharticum* | Fairy Flax |
| *Lolium perenne* | Perennial Rye-grass |
| *Lotus corniculatus* | Common Bird's-foot Trefoil |

| Species | Common name |
|---|---|
| *Lotus pedunculatus* | Greater Bird's-foot Trefoil |
| *Luzula campestris* | Field Woodrush |
| *Luzula multiflora* | Heath Woodrush |
| *Luzula pilosa* | Hairy Woodrush |
| *Lycopus europaeus* | Gypsywort |
| *Lysimachia nemorum* | Yellow Pimpernel |
| *Lysimachia nummularia* | Creeping Jenny |
| *Lythrum portula* | Water Purslane |
| *Lythrum salicaria* | Purple Loosestrife |
| *Malus pumila* | Apple |
| *Medicago lupulina* | Black Medick |
| *Melilotus cf officinalis* | Ribbed Melilot |
| *Mentha aquatica* | Water Mint |
| *Molinia caerulea* | Purple Moor-grass |
| *Montia fontana* | Blinks |
| *Myosotis laxa* | Tufted Forget-me-not |
| *Myosotis scorpioides* | Water Forget-me-not |
| *Myosotis secunda* | Creeping Forget-me-not |
| *Myriophyllum spicatum* | Spiked Water-milfoil |
| *Narcissus sp.* | Daffodil (garden variety) |
| *Nardus stricta* | Mat-grass |
| *Nothofagus nervosa* | Rauli |
| *Odontites vernus* | Red Bartsia |
| *Oenothera sp.* | Evening Primrose (indeterminate) |
| *Onobrychis viciifolia* | Common Sainfoin |
| *Ononis repens* | Restharrow |
| *Ophrys apifera* | Bee Orchid |
| *Oreopteris limbosperma* | Lemon-scented Fern |
| *Osmunda regalis* | Royal Fern |
| *Oxalis acetosella* | Wood Sorrel |
| *Pastinaca sativa* | Wild Parsnip |
| *Pedicularis palustris* | Marsh Lousewort |
| *Pedicularis sylvatica* | Common Lousewort |
| *Persicaria hydropiper* | Water-pepper |
| *Persicaria maculosa* | Redshank |
| *Philonotis fontana* | Fountain Apple-moss |
| *Phleum pratense* | Timothy |
| *Phragmites australis* | Common Reed |
| *Picea sitchensis* | Sitka Spruce |
| *Pilosella aurantiaca* | Fox-and-cubs |
| *Pilosella officinarum* | Mouse-ear Hawkweed |
| *Pinus cf nigra* | Austrian Pine |
| *Pinus contorta* | Lodgepole Pine |
| *Plantago lanceolata* | Ribwort Plantain |
| *Plantago major* | Greater Plantain |
| *Poa annua* | Annual Meadow-grass |

| Species | Common name |
|---|---|
| *Poa compressa* | Flattened Meadow-grass |
| *Poa palustris* | Swamp Meadow-grass |
| *Poa pratensis* | Smooth Meadow-grass |
| *Poa trivialis* | Rough Meadow-grass |
| *Polygala serpyllifolia* | Heath Milkwort |
| *Polygonatum sp.* | Solomon's Seal (planted) |
| *Polypodium vulgare* | Common Polypody |
| *Polystichum setiferum* | Soft Shield-fern |
| *Potamogeton natans* | Broad-leaved Pondweed |
| *Potamogeton polygonifolius* | Bog Pondweed |
| *Potentilla anglica* | Trailing Tormentil |
| *Potentilla anserina* | Silverweed |
| *Potentilla erecta* | Tormentil |
| *Potentilla palustris* | Marsh Cinquefoil |
| *Potentilla reptans* | Creeping Cinquefoil |
| *Potentilla sterilis* | Barren Strawberry |
| *Primula veris* | Cowslip |
| *Prunella vulgaris* | Self-Heal |
| *Prunus avium* | Wild Cherry |
| *Prunus padus* | Bird Cherry |
| *Prunus spinosa* | Blackthorn |
| *Pulicaria dysenterica* | Fleabane |
| *Pyrola minor* | Common Wintergreen |
| *Quercus petraea* | Sessile Oak |
| *Quercus robur* | Pedunculate Oak |
| *Quercus x rosacea* | Hybrid Oak |
| *Ranunculus acris* | Meadow Buttercup |
| *Ranunculus flammula* | Lesser Spearwort |
| *Ranunculus omiophyllus* | Round-leaved Water-crowfoot |
| *Ranunculus repens* | Creeping Buttercup |
| *Reynoutria japonica* | Japanese Knotweed |
| *Rhinanthus minor* | Yellow Rattle |
| *Rhododendron ponticum* | Rhododendron |
| *Ribes nigrum* | Black Currant |
| *Rosa arvensis* | Field Rose |
| *Rosa canina* | Dog Rose |
| *Rosa rugosa* | Japanese Rose |
| *Rosa sherardii* | Sherard's Downy-rose |
| *Rubus fruticosus* | Bramble |
| *Rumex acetosa* | Common Sorrel |
| *Rumex acetosella* | Sheep's Sorrel |
| *Rumex conglomeratus* | Clustered Dock |
| *Rumex crispus* | Curled Dock |
| *Rumex obtusifolius* | Broad-Leaved Dock |
| *Rumex sanguineus* | Wood Dock |
| *Sagina filicaulis* | Slender Pearlwort |

| Species | Common name |
|---|---|
| *Sagina procumbens* | Procumbent Pearlwort |
| *Salix alba* | White Willow |
| *Salix aurita* | Eared Willow |
| *Salix caprea* | Goat Willow |
| *Salix cinerea* | Grey Willow |
| *Salix repens* | Creeping Willow |
| *Salix viminalis* | Osier |
| *Sambucus nigra* | Elder |
| *Samolus valerandi* | Brookweed |
| *Sanicula europaea* | Sanicle |
| *Scorzoneroides autumnalis* | Autumn Hawk-bit |
| *Scrophularia auriculata* | Water Figwort |
| *Scrophularia nodosa* | Common Figwort |
| *Scutellaria galericulata* | Common Skullcap |
| *Scutellaria minor* | Lesser Skullcap |
| *Sedum acre* | Wall Pepper |
| *Senecio aquaticus* | Marsh Ragwort |
| *Senecio jacobaea* | Ragwort |
| *Silene flos-cuculi* | Ragged Robin |
| *Solanum dulcamara* | Bittersweet |
| *Solidago virgaurea* | Goldenrod |
| *Sonchus oleraceus* | Smooth Sow-thistle |
| *Sorbus aucuparia* | Rowan |
| *Sorbus intermedia* | Swedish Whitebeam (planted) |
| *Sparganium angustifolium* | Floating Bur-reed |
| *Stachys palustris* | Marsh Woundwort |
| *Stachys sylvatica* | Hedge Woundwort |
| *Stellaria alsine* | Bog Stitchwort |
| *Stellaria graminea* | Lesser Stitchwort |
| *Stellaria media* | Chickweed |
| *Succisa pratensis* | Devil's-bit Scabious |
| *Taraxacum sp.* | Dandelion |
| *Tilia cordata* | Small-leaved Lime (planted) |
| *Torilis japonica* | Upright Hedge-parsley |
| *Tragopogon pratensis* | Goat's-beard |
| *Trichophorum cespitosum* | Deer-grass |
| *Trifolium dubium* | Lesser Trefoil |
| *Trifolium pratense* | Red Clover |
| *Trifolium repens* | White Clover |
| *Trocdaris verticillatum* | Whorled Caraway |
| *Tussilago farfara* | Colt’s Foot |
| *Typha angustifolia* | Lesser Bulrush |
| *Typha latifolia* | Bulrush |
| *Ulex europaeus* | Common Gorse |
| *Urtica dioica* | Nettle |
| *Vaccinium myrtillus* | Bilberry |

| Species | Common name |
|---|---|
| *Valeriana dioica* | Marsh Valerian |
| *Valeriana officinalis* | Common Valerian |
| *Verbascum thapsus* | Greater Mullein |
| *Veronica arvensis* | Wall Speedwell |
| *Veronica beccabunga* | Brooklime |
| *Veronica chamaedrys* | Germander Speedwell |
| *Veronica montana* | Wood Speedwell |
| *Veronica officinalis* | Heath Speedwell |
| *Veronica scutellata* | Marsh Speedwell |
| *Veronica serpyllifolia* | Thyme-leaved Speedwell |
| *Viburnum opulus* | Guelder Rose |
| *Vicia cracca* | Tufted Vetch |
| *Vicia hirsuta* | Hairy Tare |
| *Vicia sativa* | Common Vetch |
| *Vicia sepium* | Bush Vetch |
| *Viola palustris* | Marsh Violet |
| *Viola riviniana* | Common Dog-violet |
| *Vulpia bromoides* | Squirrel-tail Fescue |
| *Wahlenbergia hederacea* | Ivy-leaved Bellflower |
| **BRYOPHYTES** | |
| *Aneura pinguis* | Greasewort |
| *Atrichum undulatum* | Common Smoothcap |
| *Aulacomnium palustre* | Bog Groove-moss |
| *Brachythecium rivulare* | River Feather-moss |
| *Brachythecium rutabulum* | Rough-stalked Feather-moss |
| *Bryum alpinum* | Alpine Thread-moss |
| *Bryum pseudotriquetrum* | Marsh Bryum |
| *Calliergon cordifolium* | Heart-leaved Spear-moss |
| *Calliergonella cuspidata* | Pointed Spear-moss |
| *Campyliadelphus chrysophyllus* | Golden Feather-moss |
| *Campylopus introflexus* | Heath Star-moss |
| *Ceratodon purpureus* | Redshank |
| *Chiloscyphus polyanthos* | St Winifred's Moss |
| *Climacium dendroides* | Tree Moss |
| *Conocephalum conicum* | Great Scented Liverwort |
| *Cratoneuron filicinum* | Fern-leaved Hook-moss |
| *Ctenidium molluscum* | Chalk Comb-moss |
| *Dichodontium palustre* | Marsh Forklet-moss |
| *Dicranum majus* | Greater Fork-moss |
| *Dicranum scoparium* | Broom Fork-moss |
| *Didymodon insulanus* | Cylindric Beard-moss |
| *Diplophyllum albicans* | White Earwort |
| *Encalypta streptocarpa* | Spiral Extinguisher-moss |
| *Eurhynchium striatum* | Common Striated feather-moss |
| *Fissidens adianthoides* | Maidenhair Pocket-moss |
| *Fissidens bryoides* | Lesser Pocket-moss |

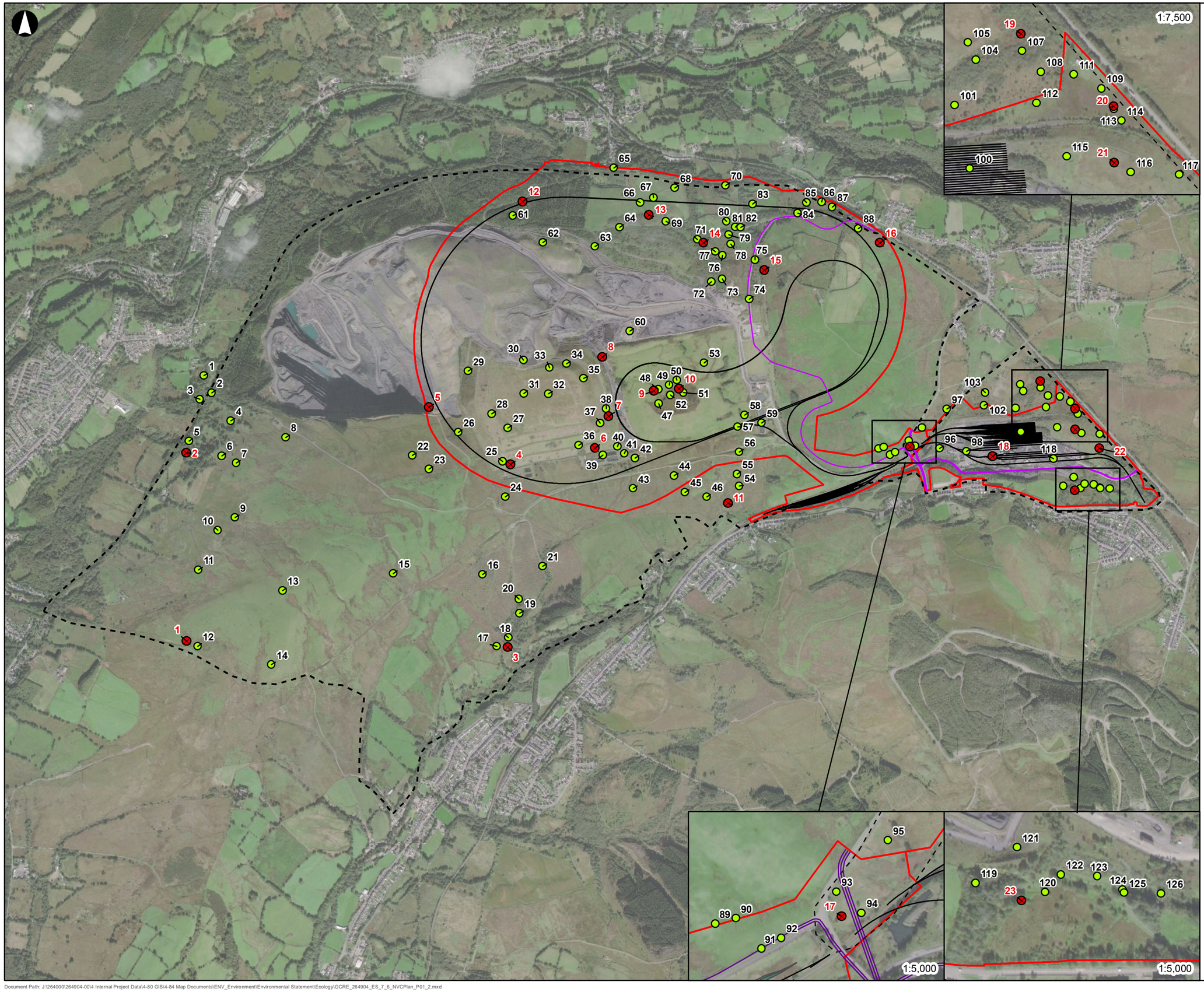
| Species | Common name |
|---|---|
| *Fissidens taxifolius* | Common Pocket-moss |
| *Funaria hygrometrica* | Common Cord-moss |
| *Homalothecium lutescens* | Yellow Feather-moss |
| *Homalothecium sericeum* | Silky Wall Feather-moss |
| *Hookeria lucens* | Shining Hookeria |
| *Hylocomium splendens* | Glittering Feather-moss |
| *Hypnum cupressiforme* | Cypress-leaved Plait-moss |
| *Hypnum jutlandicum* | Heath Plait-moss |
| *Hypnum lacunosum* | Great Plait-moss |
| *Isothecium myosuroides* | Mouse-tail Moss |
| *Kindbergia praelonga* | Common Feather-moss |
| *Lophocolea bidentata* | Bifid Crestwort |
| *Lophozia ventricosa* | Tumid Notchwort |
| *Metzgeria furcata* | Forked Veilwort |
| *Mnium hornum* | Swan's-neck Thyme-moss |
| *Pellia sp.* | Pellia (non-fruiting) |
| *Plagiomnium cf rostratum* | Long-beaked Thyme-moss |
| *Plagiomnium undulatum* | Hart's-tongue Thyme-moss |
| *Plagiothecium undulatum* | Waved Silk-moss |
| *Platyhypnidium riparioides* | Long-beaked Water Feather-moss |
| *Pleurozium schreberi* | Red-stemmed Feather-moss |
| *Pogonatum aloides* | Aloe Haircap |
| *Pogonatum urnigerum* | Urn Haircap |
| *Pohlia melanodon* | Pink-fruited Thread-moss |
| *Pohlia wahlenbergii* | Pale glaucous Thread-moss |
| *Polytrichastrum formosum* | Bank Haircap |
| *Polytrichum commune* | Common Haircap |
| *Polytrichum juniperinum* | Juniper Haircap |
| *Polytrichum piliferum* | Bristly Haircap |
| *Pseudoscleropodium purum* | Neat Feather-moss |
| *Ptilidium ciliare* | Ciliated Fringewort |
| *Racomitrium aciculare* | Yellow Fringe-moss |
| *Racomitrium ericoides* | Dense Fringe-moss |
| *Racomitrium cf fasciculare* | Green Mountain Fringe-moss |
| *Racomitrium lanuginosum* | Woolly Fringe-moss |
| *Rhizomnium punctatum* | Dotted Thyme-moss |
| *Rhytidiadelphus loreus* | Little Shaggy-moss |
| *Rhytidiadelphus squarrosus* | Springy Turf-moss |
| *Rhytidiadelphus triquetrus* | Big Shaggy-moss |
| *Scapania irrigua* | Heath Earwort |
| *Sphagnum capillifolium* | Acute-leaved Bog-moss |
| *Sphagnum cuspidatum* | Feathery Bog-moss |
| *Sphagnum denticulatum* | Cow-horn Bog-moss |
| *Sphagnum fallax* | Flat-topped Bog-moss |
| *Sphagnum fimbriatum* | Fringed Bog-moss |
| *Sphagnum inundatum* | Lesser Cow-horn Bog-moss |

| Species | Common name |
|---|---|
| *Sphagnum papillosum* | Papillose Bog-moss |
| *Sphagnum squarrosum* | Spiky Bog-moss |
| *Sphagnum subnitens* | Lustrous Bog-moss |
| *Sphagnum sp.* | Bog-moss (ideterminate) |
| *Sphagnum tenellum* | Soft Bog-moss |
| *Thamnobryum alopecurum* | Fox-tail Feather-moss |
| *Thuidium tamariscinum* | Common Tamarisk-moss |
| *Ulota bruchii* | Bruch's Pincushion |
| *Warnstorffia exannulata* | Ringless Hook-moss |
| *Warnstorffia fluitans* | Floating Hook-moss |
| **ALGAE** | |
| *Chara sp.* | Stonewort |
| *Nitella sp.* | Stonewort |
| **LICHENS** | |
| *Cladonia cervicornis ssp verticillata* | Lichen |
| *Cladonia cf coccifera* | Lichen |
| *Cladonia crispata* | Lichen |
| *Cladonia floerkeana* | Lichen |
| *Cladonia foliacea* | Lichen |
| *Cladonia furcata* | Lichen |
| *Cladonia gracilis* | Lichen |
| *Cladonia pyxidata* | Lichen |
| *Cladonia rangiformis* | Lichen |
| *Cladonia uncinata* | Lichen |
| *Cladonia sp.* | Lichen |
| *Hypogymnia physodes* | Lichen |
| *Peltigera sp.* | Lichen |

*Locally abundant Ivy-leaved Bellflower in marshy grassland near Quadrat 45.*

# Appendix 2. Location of quadrats and target notes

A3




**Legend**

- Planning Development Boundary
- Study Area
- Proposed Access Road
- Site Layout Plan
- NVC Target Note
- NVC Quadrat

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

| Issue | Date | By | Chkd | Appd |
|---|---|---|---|---|
| P01.3 | 2020-08-05 | KD | CP | NH |

Meters
0 250 500 1,000

ARUP

4 Pierhead Street
Cardiff CF10 4QP
Tel +44 29 2047 3727 Fax +44 29 2047 2277
www.arup.com

Client

Llywodraeth Cymru
Welsh Government

Job Title

**Global Centre for Rail Excellence**

Figure Title

**NATIONAL VEGETATION SURVEY (NVC) PLAN**

Scale at A3

**1:20,000**

| Job No | Drawing Status |
|---|---|
| **264904** | **For Issue** |

| Drawing No | Issue |
|---|---|
| **Figure 7.6** | **P01.3** |

Document Path: J:\264000\264904-00\4 Internal Project Data\4-80 GIS\4-84 Map Documents\ENV_Environment\Environmental Statement\Ecology\GCRE_264904_ES_7_6_NVCPlan_P01_2.mxd