

# Appendix 12.3

## Phase 2 Habitat Survey (NVC)

## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>The Study Area</b>	<b>2</b>
<b>3</b>	<b>Methodology</b>	<b>4</b>
<b>4</b>	<b>Survey Constraints and Limitations</b>	<b>5</b>
<b>5</b>	<b>NVC Survey Results and Vegetation Descriptions</b>	<b>7</b>
5.1	Summary of NVC Communities	7
5.2	Woodland and Scrub	7
5.3	Mires and Flushes	17
5.4	Wet Heaths	25
5.5	Dry Heaths	27
5.6	Calcifugous Grasslands and bracken-dominated vegetation	29
5.7	Mesotrophic Grasslands	33
5.8	Calcicolous Grasslands	36
5.9	Swamps and Tall-Herb Fens	37
5.10	Aquatic Communities	39
5.11	Vegetation of Open Habitats	40
5.12	Non-NVC Communities & Categories	41
<b>6</b>	<b>Evaluation of Botanical Interest</b>	<b>43</b>
6.1	Overview	43
6.2	Groundwater Dependent Terrestrial Ecosystems (GWDTE)	43
6.3	Annex I Habitats	44
6.4	Scottish Biodiversity List Priority Habitats	48
6.5	Cairngorms National Park Authority Priority Habitats	49
6.6	Summary	50
<b>7</b>	<b>Glossary</b>	<b>53</b>
<b>8</b>	<b>References</b>	<b>55</b>

## Annexes

Annex A NVC Target Notes

Annex B Target Note Photographs

Annex C Community Photographs

## Tables

Table 12.3.1: Designated sites with botanical qualifying features that overlap with the Project 9 study area.	3
Table 12.3.2: Communities within the study area which, depending on hydrogeological setting, may potentially be classified as GWDTE (yellow = moderately groundwater dependent and red = highly groundwater dependent).	43
Table 12.3.3: NVC communities recorded within the study area and corresponding Annex I habitat types.	45
Table 12.3.4: Summary of study area NVC communities and associated sensitivities.	50

## Photographs

Photograph B.1: Target note 1. <i>Populus tremula</i> within W11 woodland	60
Photograph B.2: Target note S2_1. M6d.	60
Photograph B.3: Target note S4_4. M6d and M15a	61
Photograph B.4: Target note S4_5. M15a	61
Photograph B.5: Target note S5_6. W11 woodland with abundant <i>Populus tremula</i>	62
Photograph C.1: W3 <i>Salix pentandra</i> – <i>Carex rostrata</i> woodland	64
Photograph C.2: W4 <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland	65
Photograph C.3: W4b <i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland, <i>Juncus effusus</i> sub-community	65
Photograph C.4: W6 <i>Alnus glutinosa</i> – <i>Urtica dioica</i> woodland	66
Photograph C.5: W7 <i>Alnus glutinosa</i> – <i>Fraxinus excelsior</i> – <i>Lysimachia nemoreum</i> woodland	66
Photograph C.6: W17 and H12 mosaic	67
Photograph C.7: W19 <i>Juniperus communis</i> – <i>Oxalis acetosella</i> woodland	67
Photograph C.8: M4 <i>Carex rostrata</i> - <i>Sphagnum fallax</i> mire	68
Photograph C.9: M6 <i>Carex echinata</i> - <i>Sphagnum fallax/denticulatum</i> mire	68
Photograph C.10: M25 <i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	69
Photograph C.11: M23a <i>J. effusus/acuteiflorus</i> – <i>Galium palustre</i> rush-pasture, <i>J. acuteiflorus</i> sub-community	69
Photograph C.12: M23a <i>J. acuteiflorus</i> sub-community & U4 grassland	70
Photograph C.13: M27 <i>Filipendula ulmaria</i> – <i>Angelica sylvestris</i> mire	70
Photograph C.14: H10 <i>Calluna vulgaris</i> – <i>Erica cinerea</i> heath	71
Photograph C.15: H12, M6, M15 and M17 mosaic	71
Photograph C.16: MG1 <i>Arrhenatherum elatius</i> grassland	72
Photograph C.17: MG1/U4b mosaic	72
Photograph C.18: MG9 <i>Holcus lanatus</i> – <i>Deschampsia cespitosa</i> grassland	73
Photograph C.19: MG10a <i>Holcus lanatus</i> – <i>Juncus effusus</i> rush-pasture, Typical sub-community	73
Photograph C.20: MG10a, U4b and MG6 mosaic	74
Photograph C.21: S9 <i>Carex rostrata</i> swamp	74
Photograph C.22: <i>Carex lasiocarpa</i> swamp	75
Photograph C.23: OV25, MG6, U4 mosaic	75



## 1 Introduction

- 1.1.1 CH2M HILL Fairhurst Joint Venture (CFJV) is the Lead Design Consultant for the A9 Dualling Central Section (Glen Garry to Dalraddy). MacArthur Green has been commissioned to assist CFJV with vegetation and habitat classification elements relating to the Design Manual for Roads and Bridges (DMRB) Stage 2 options appraisal and the DMRB Stage 3 iterative design assessment process.
- 1.1.2 Surveys took the form of National Vegetation Classification (NVC) surveys. The NVC survey provides a standardised system for classifying and mapping semi-natural habitats in Great Britain. The aim of the NVC survey was to classify, map and describe the vegetation communities present within the relevant study area in order to identify those areas of greatest ecological interest/sensitivity: Habitats Directive Annex I habitats, Scottish Biodiversity List (SBL) priority habitats, Cairngorms National Park Authority (CNPA) priority habitats and potential Groundwater Dependent Terrestrial Ecosystems (GWDTE).
- 1.1.3 This document details the results of the NVC field surveys (together with an evaluation of those communities recorded) carried out for Project 9 (Crubenmore to Kincaig) during 2015.

## 2 The Study Area

- 2.1.1 Project 9 extends from NN 945 690, 1km south east of Glentruim House and 3.5km north east of Crubenmore, north-eastwards to around NH 818 042 near Meadowside Quarry, 2km south west of Kincaig. The study area, within which NVC surveys were undertaken, was determined by buffering the maximum extent of the design footprint by 250 metres (m). The 250m buffer was applied to ensure surveys covered the necessary area to determine the presence of potential GWDTEs, in line with the Scottish Environment Protection Agency (SEPA) guidance on GWDTE (SEPA, 2014a, 2014b). In certain areas, it was possible to reduce the extent of the 250m study area accordingly due to the presence of a natural hydrological barrier, which would mean any potential GWDTE on the other side of the hydrological barrier would not be affected by any dualling works on the A9. Three such hydrological barriers were identified within Project 9: (1) in the south-westernmost part of Project 9, a short section of the River Truim to the west of the A9 provides a hydrological barrier; (2) the River Spey at a few localities provides another hydrological barrier (e.g. to the west of the A9 by Kingussie, and to the south-east of the A9 in the north of Project 9, by Insh Marshes National Nature Reserve (NNR)); and, (3) a section of the Milton Burn within the central study area, on the southern side of the A9. No other definite hydrological barriers were identified. Features such as the existing A9, associated trunk and minor roads, and adjacent railway were not considered definite hydrological barriers, because of the potential for deeper groundwater flows to exist beneath them.
- 2.1.2 The built-up areas of Kingussie within the 250m study area were excluded from the NVC survey. The NVC study area is shown in **Drawings 12.15 to 12.27 in Volume 3**.
- 2.1.3 The Project 9 NVC study area contains a wide range of upland and lowland woodlands, grasslands and mires. Swamps are also extensive in certain sections. The general character of the Project 9 study area is markedly different to abutting sections (e.g. Project 8 to the south). Compared with Projects 7 and 8 it contains a greater abundance and diversity of woodland, and a smaller extent of mire and heath vegetation, which are replaced here by more intensively managed and agriculturally improved grasslands. The majority of the Project 9 study area is low-lying and flat, or of gentle relief, particularly in the extensive floodplain of the River Spey. The slightly more elevated and upland elements within Project 9 study area are mainly to the east of the A9, from Ruthven southwards to Crubenmore.
- 2.1.4 Most of the vegetation in the study area has been impacted anthropogenically over time in a number of ways. In upland areas, these impacts have been mainly through moorland management techniques such as muirburn (for grouse), grazing and drainage, but also forestry in some areas; these management activities have clearly influenced the plant communities here. In more lowland areas, arable and livestock farming and associated agricultural practices are clear drivers and maintainers of many habitats and vegetation types present, and the species composition of much of the vegetation shows the influences of grazing, drainage, re-seeding and fertiliser application.
- 2.1.5 Parts of the study area also overlap with designated sites containing habitat-related, or botanical, qualifying features. Along Project 9, the study area covered parts of the River Spey – Insh Marshes Site of Special Scientific Interest (SSSI) and the Insh Marshes Special Area of Conservation (SAC). The relevant qualifying features for each designation are detailed in **Table 12.3.1**.

Table 12.3.1: Designated sites with botanical qualifying features that overlap with the Project 9 study area.

Designated Site	Qualifying Feature	Last Assessed Condition	Last Site Condition Monitoring Assessment Date
River Spey – Insh Marshes SSSI	Floodplain fen	Favourable Maintained	10/08/2014
	Vascular plant assemblage	Favourable Maintained	09/07/2007
Insh Marshes SAC	Alder woodland on floodplains	Unfavourable Recovering	19/05/2009
	Very wet mires often identified by an unstable 'quaking' surface	Favourable Maintained	04/10/2002

### 3 Methodology

- 3.1.1 The vegetation was surveyed by a team of suitably qualified and experienced botanical surveyors using the NVC scheme (Rodwell, 1991-2000; 5 volumes) and in accordance with NVC survey guidelines (Rodwell, 2006). The NVC scheme provides a standardised system for classifying and mapping semi-natural habitats, and ensures that surveys are carried out to a consistent level of detail and accuracy.
- 3.1.2 Homogenous stands and mosaics of vegetation were identified and mapped by eye, and drawn as polygons on high resolution field maps; i.e. 1:5,000 @A3 using 10 cm orthoimagery. These polygons were surveyed qualitatively to record dominant and constant species, sub-dominant species and other notable species present. The surveyors worked progressively across the study area to ensure that no areas were missed and that mapping was accurate. 10 cm resolution aerial photography of the study area was used to aid accurate mapping of vegetation boundaries. NVC communities were attributed to the mapped polygons using surveyor experience and matching field data against published floristic tables (Rodwell, 1991-2000). Stands were classified to sub-community level where possible, although in many cases the vegetation was mapped to community level only because the vegetation was too species poor or patches were too small to allow meaningful sub-community determination; or because some areas exhibited features or fine-scale patterns of two or more sub-communities.
- 3.1.3 Quadrat sampling was not used in this survey because experienced NVC surveyors do not necessarily need to record quadrats in order to reliably identify NVC communities and sub-communities (Rodwell, 2006). Notes were made about the structure and flora of larger areas of vegetation in many places (such as the abundance and frequency of species, and in some cases condition and evident anthropogenic impacts). It can be better to record several larger scale qualitative samples than one or two smaller quantitative samples; furthermore, qualitative information from several sample locations can be vital for understanding the dynamics and trends in local (study area) vegetation patterns (Rodwell, 2006).
- 3.1.4 Due to small scale vegetation and habitat variability, and numerous zones of habitat transition between similar NVC communities, many polygons represent complex mosaics of two or more NVC communities. Where polygons have been mapped as mosaics, an approximate percentage cover of each NVC community within the polygon is given so that the dominant community and character of the vegetation could be ascertained.
- 3.1.5 Botanical nomenclature in this report follows that of Stace (2010) for vascular plants and Atherton *et al* (2010) for bryophytes.

## 4 Survey Constraints and Limitations

- 4.1.1 The NVC survey for Project 9 was carried out from 13 July 2015 to 17 July 2015 inclusive, during the optimal season for habitat surveys. Surveys were carried out by three surveyors, over five days, approximately between the hours of 08:30 – 20:30. The weather conditions were amenable to survey: bright, with broken cloud and relatively light to moderate winds, and with infrequent light showers. Some parts of the study area were inaccessible and could not be surveyed in detail, or were surveyed from a suitable vantage point; however, these constraints are not considered to affect the validity of the survey results or the robustness of any assessments made from the data, as detailed below.
- 4.1.2 The land within the boundary of the Highland Wildlife Park in the north of the study area was not surveyed directly; instead the vegetation was assessed from a combination of viewing the habitats from the park boundary and aerial imagery. This area is managed and of low botanical interest given the predominance of plantation forestry and improved grassland habitats.
- 4.1.3 In the north of the study area, sections of the Insh Marshes were not surveyed; due to Health and Safety concerns. In these areas the ground was surveyed up to the edge of the Highland Mainline (HML) railway. Beyond the HML railway, the Insh Marshes and its associated swamp and fen, habitats within the study area were considered unsafe to walk over and survey in detail. This was due to the presence of large deep ditches, standing water of unknown depths and soft, unstable, and often quaking rafts of surface vegetation and associated soft sediments. This constraint is not considered to be of concern for the following reasons:
- the un-surveyed area is outwith the project footprint, and will therefore not be subject to direct habitat loss or impacts
  - the dualling route option will avoid this general area given the various constraints and sensitivities, e.g. the presence of designated sites, the location of the HML railway and B9152 road, and engineering constraints in such wet habitats
  - the HML railway may also constitute a hydrological barrier, thereby negating the need for surveys beyond this point for GWDTE
  - the fen and swamp habitats in this area are unlikely to have high groundwater dependency, they appear to be maintained by standing water in the floodplain and by the River Spey
  - NVC data, if required for this area, already exists in the form of Scottish Natural Heritage (SNH) NVC data, collected as part of the habitat surveys for the River Spey – Insh Marshes SSSI designation. NVC surveys were undertaken for the SSSI in 1989; the general nature of the swamp and fen habitats here appear unlikely to have changed very much in the intervening period, given the site's protection.
- 4.1.4 The NVC system does not cover all possible semi-natural vegetation or habitat types that may be found. Since the NVC was adopted for use in Britain in the 1980s, further survey work and an increased knowledge of vegetation communities has led to additional communities being described that do not fall within the NVC system. Where such communities are found and recorded they are given a non-NVC community code and are described.
- 4.1.5 It should be noted that the results from this survey, and the matches made in describing communities, represent a current community evaluation at the time of survey, as opposed to one seeking to describe what the community was before any human interference, or what it might become in the future. In light of this, a clear constraint of the vegetation survey and evaluation

process as used in this and other surveys is that it offers only a snapshot of the vegetation communities present and should not be interpreted as a static long-term reference.

## 5 NVC Survey Results and Vegetation Descriptions

### 5.1 Summary of NVC Communities

- 5.1.1 The categories of vegetation within the study area include the following 52 NVC communities recorded during the survey:
- Woodland and scrub: W3, W4, W5, W6, W7, W8, W9, W10, W11, W16, W17, W18, W19, W23
  - Mires and flushes: M3, M4, M5, M6, M10, M17, M19, M20, M23, M25, M27
  - Wet heaths: M15
  - Dry heaths: H10, H12, H18
  - Grasslands and bracken: U1, U2, U4, U5, U20, MG1, MG6, MG7, MG9, MG10, MG11, CG10
  - Swamp and tall-herb fens: S4, S9, S10, S11, S19, S22
  - Aquatic communities: A24
  - Vegetation of open habitats: OV24, OV25, OV27, OV28.
- 5.1.2 The following sections describe the flora, structure and habitats of these communities and any associated observed sub-communities, found within this study area. For each NVC community description, the first paragraph refers to the community in Britain or Scotland as a whole, before moving on to the other paragraphs which describe the vegetation as it was found to occur within this study area. The NVC communities within each broad habitat type (e.g. woodland) are described in order of community number within the study area.
- 5.1.3 The survey results are displayed in **Drawings 12.15 to 12.27 in Volume 3**. Target notes were also made during surveys, mainly to pinpoint areas or species of special interest (see **Annex A**) with corresponding photographs given in **Annex B**. Further photographs of a number of the typical habitat types found within the study area are provided within **Annex C**.
- 5.1.4 For each community description, reference is made to any association with Annex I habitats, Scottish Biodiversity List (SBL) priority habitats, Cairngorms National Park Authority (CNPA) priority habitats, and potential GWDTE status (as per SEPA guidance). These associations are study area specific; full details and discussion are provided in **section 6**.

### 5.2 Woodland and Scrub

- 5.2.1 Woodland is widespread and quite extensive throughout the Project 9 study area, and a diverse range of types are present in varying habitat patch sizes. Some woodland types are rare, and some of the stands recorded are small and atypical for the assigned NVC communities or sub-communities, as further described below. A small number of woodland communities account for the majority of the woodland present.

*W3 Salix pentandra – Carex rostrata woodland*

*GWDTE status – Moderate; SBL – Wet woodland; CNPA – Wet & riparian woodland*

- 5.2.2 This is a community of peat soils kept moist by moderately base-rich and calcareous groundwater in open water transitions, most common in northern Britain (Rodwell *et al* 1991; Hall *et al* 2004).

W3 is fairly constant in its composition and structure. The canopy is low, uneven-topped and dominated by *Salix* spp. usually *S. pentandra* and/ or *S. cinerea*; *Betula pubescens* can also be present. The field layer can vary widely. Many stands have several species co-dominating, but the overall assemblage of species is distinctive. Tall herbs and horsetails are the most prominent feature; shorter herbs often form a patchy lower layer. Large grasses, rushes and sedges may or may not be abundant, and bryophytes are abundant, sometimes forming a complete ground carpet (Rodwell *et al* 1991; Hall *et al* 2004).

- 5.2.3 There are a number of stands of W3 within the study area which are centred on wet marshy and fen areas. The main locus of W3, and its largest stands within the study area, is around the fringes of the Insh Marshes, particularly in a band of trees between the B9152 and the HML railway; there are also extensive areas of open water at this location. There are some smaller stands in a marsh/ fen basin area between the A9 and the B9152, to the west of Lynchat. There is one further small stand within a wet hollow to the east of the Burn of Inverton (to the south-east of Inverton), surrounded by drier W11 (**paragraph 5.2.30**) and W17 (**paragraph 5.2.36**) woodlands.
- 5.2.4 These stands of W3 generally have a canopy dominated by *Salix cinerea* with frequent *Betula pubescens* and in places, occasional *Alnus glutinosa*. Many of the trees have abundant lichen cover. There are also numerous saplings and evidence of vigorous regeneration. Within the field and basal layers there is abundant to frequent *Equisetum fluviatile*, *Carex rostrata*, *C. vesicaria*, *Filipendula ulmaria*, *Galium palustre*, *Agrostis stolonifera*, *Juncus effusus*, *Sphagnum squarrosum* and *S. fallax*. The small patch of W3 near Inverton has a canopy dominated by *Betula pubescens* instead of *Salix* spp. The field layer in this stand corresponds to M4 (**paragraph 5.3.4**) and M5 (**paragraph 5.3.8**) type vegetation.

#### W4 *Betula pubescens* – *Molinia caerulea* woodland

Communities/sub-communities recorded: W4, W4b

*GWDTE status* – High; *SBL* – Upland birchwoods (W4 at the community level) or Wet woodland (W4b); *CNPA* – Wet & riparian woodland

- 5.2.5 W4 is a community of moist, moderately acidic, though not necessarily highly oligotrophic, peaty soils. It is characteristic of thin or drying ombrogenous peats which are isolated from the influence of base-rich or eutrophic groundwaters, but is also found on peaty gleys flushed by rather base- and nutrient-poor water (Rodwell *et al* 1991; Hall *et al* 2004). *Betula pubescens* is the most common woody species, and is usually dominant. The great abundance of *Molinia caerulea* is the most distinctive feature of the field layer, and other species may be limited to areas between *Molinia* tussocks. A number of bryophytes can be found within W4; *Sphagnum* spp. are usually present (Rodwell *et al* 1991; Hall *et al* 2004).
- 5.2.6 Within the study area, W4 occurs mainly as small, scattered and fragmented stands, and does not form any large expanses of woodland. For the most part it is found in mosaics with drier *Betula* woodlands; W11 (**paragraph 5.2.30**) and W17 (**paragraph 5.2.36**). W4 woodland within the study area was generally recorded to community level only, owing to the nature of the small stands and its often species-poor nature; many associated species, where present, are shared with adjoining W11/ W17 woodland. As a result of this, W4 within the study area (except for wetter W4b – see below), was considered as part of a larger network of ‘upland birchwoods’ as opposed to ‘wet woodland’ (see **section 6**).

- 5.2.7 Community level W4 within the study area has a canopy dominated by *Betula* spp., with only occasional to rare *Salix* spp. or *Sorbus aucuparia*. The field layer is typically dominated by a species-poor sward of *Molinia caerulea*. Where the *M. caerulea* becomes less tussocky and thins out, there are other species such as *Agrostis capillaris*, *Anthoxanthum odoratum*, *Galium saxatile*, *Blechnum spicant* and *Pteridium aquilinum*. The basal layer sometimes contains scattered patches of *Sphagnum palustre* and *S. fallax*.
- 5.2.8 A few very small stands of the wetter **W4b *Juncus effusus* sub-community** are present within the study area. These stands mostly have dominant *Betula pubescens*, but in one stand *Salix cinerea* is the canopy dominant. The field layer is usually rushy with stands containing either or both of *J. effusus* and *J. acutiflorus*. Other associates present include *Carex nigra*, *C. rostrata*, *C. echinata*, *Potentilla erecta* and *Myrica gale*. The moss layer includes extensive carpets of *Sphagnum fallax*, with some *S. palustre*.

#### W5 *Alnus glutinosa* – *Carex paniculata* woodland

Communities recorded: W5

*GWDTE status – Moderate; Annex I - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*; SBL – Wet woodland; CNPA – Wet & riparian woodland*

- 5.2.9 W5 is a community of base-rich, moderately eutrophic, wet to waterlogged organic soils on topogenous or soligenous mires. It is especially associated with fen peats in open water transitions, flood-plain mires and basin mires where there is strong influence from base-rich groundwaters (Rodwell *et al* 1991; Hall *et al* 2004). It is primary woodland, developing naturally over certain types of fen. *Alnus glutinosa* and *Salix cinerea* are the most frequent species invading the fen; they often co-dominate in young stands, forming low, open and uneven canopies (Rodwell *et al* 1991; Hall *et al* 2004). As the stand ages, *A. glutinosa* tends to exclude *S. cinerea* or relegates it to the shrub layer. The field layer is strongly influenced by the nature of the invaded swamp and fen vegetation; large tussocky *Carex* spp. (especially *C. paniculata*) usually form a major component (Rodwell *et al* 1991; Hall *et al* 2004).

A single relatively small patch of W5 woodland was recorded within the study area, located around co-ordinates 278600 801800; adjacent to the HML railway, east of Lynchat, and on the edge of the Insh Marshes. Here, the W5 community is found in a transition to S9 (**paragraph 5.9.3**) and S10 (**paragraph 5.9.7**) swamps.

#### W6 *Alnus glutinosa* – *Urtica dioica* woodland

Communities/sub-communities recorded: W6, W6b, W6e

*GWDTE status – Moderate; Annex I - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*; SBL – Wet woodland; CNPA – Wet & riparian woodland*

- 5.2.10 W6 is a poorly-defined community of eutrophic moist soils, especially where there has been substantial deposition of mineral matter, or on floodplain mires where enriched waters flood fen peat (Rodwell *et al* 1991; Hall *et al* 2004). *Alnus glutinosa* is usually the most common tree, particularly on wetter soils, but is replaced by *Salix* spp. or *Betula pubescens* on some sites. Unlike the other *A. glutinosa* woodland types (W5 and W7), the field layer generally lacks the richer and tall swamp and fen species, and is instead replaced by a species-poor, albeit quite

distinctive, field layer. The most typical species is *Urtica dioica*. The few other typical species are mainly characteristic of damp to moderately wet habitats (Rodwell *et al* 1991; Hall *et al* 2004).

- 5.2.11 Within the study area, nine stands of woodland were classed as W6. Many of these were not atypical stands; some were of planted origin or contained planted elements. The stands were often a smaller component of larger and partly drier, woodland mosaics. Some of the stands were also found away from floodplains or wetland areas (in settings not usually associated with the W6 community).
- 5.2.12 The most semi-natural looking patches of W6 were small thin riparian stands by the River Spey near Kingussie, though even here there was evidence of some tree planting. In these areas, *Alnus glutinosa* is the canopy dominant, but there is often frequent to occasional *Betula pubescens* and/ or *Salix* spp. Here, in particular stands, there are areas of planted *Fraxinus excelsior*, *Pinus contorta* and *Larix* spp. The ungrazed field layers contain dominant and abundant *Urtica dioica* and *Galium aparine*, with frequent to occasional *Filipendula ulmaria*, *Holcus lanatus*, *Dactylis glomerata*, *Cirsium palustre*, *Deschampsia cespitosa*, *Rumex obtusifolius* and *Heracleum sphondylium*.
- 5.2.13 A further few small stands, although not always found in typical locations, align more closely to a particular sub-community. One stand is more in line with the **W6b *Salix fragilis* sub-community**; here, the canopy is instead dominated by *Salix cinerea* with only occasional *Alnus glutinosa* and *Betula pubescens*, and the field layer is almost exclusively by *U. dioica* and *G. aparine*.
- 5.2.14 Two stands resembling the **W6e *Betula pubescens* sub community** were recorded. However, these stands are of planted origin, containing generally younger and smaller trees. These stands abut the western embankment of the existing A9, from the overpass over the B970 by Kingussie northwards to the Spey Bridge. The woodland here is the driest of the recorded W6 stands and consists mainly of short *A. glutinosa* with frequent *B. pubescens* and occasional *Salix* spp. The field layer is grassy and contains frequent *Holcus lanatus*, *Dactylis glomerata*, *Deschampsia cespitosa* and *Galium aparine*. *Urtica dioica* is sparse in these stands. There is also some *Anthoxanthum odoratum*. Were it not for the presence of *A. glutinosa* these stands could feasibly be classified as W11 woodland (**paragraph 5.2.30**).
- 5.2.15 Given the size, location and setting, flora and often planted origin of these areas of W6, only one of the stands (which is abutting the River Spey) is considered to be of possible Annex I alluvial forest habitat status – see **paragraph 6.3.9** for further details.

W7 *Alnus glutinosa* – *Fraxinus excelsior* – *Lysimachia nemoreum* woodland

Communities/sub-communities recorded: W7, W7a, W7b, W7c

*GWDTE status* – High; Annex I - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*; *SBL* – Wet woodland; *CNPA* – Wet & riparian woodland

- 5.2.16 W7 is typical of moist to very wet mineral soils which are only moderately base-rich and not very eutrophic (Rodwell *et al* 1991; Hall *et al* 2004). It is most extensive in the wetter parts of Britain, but usually occurs in soils where there is no great tendency for peat accumulation. *Alnus glutinosa* is the main tree species, and is commonly accompanied by other species such as *Fraxinus excelsior*, *Betula* spp., *Salix* spp. and *Acer pseudoplatanus*. The field layer can be very varied; the wetness and nutrient status of the soil determines what other species may occur, these being mainly grasses and herbaceous dicotyledons (Rodwell *et al* 1991; Hall *et al* 2004).

There are three sub-communities; differences between them are related to the extent of waterlogging, the nature of the water supply and its movement.

- 5.2.17 There are a number of patches of W7 within the study area. These exhibit a wide range of variation within the bounds of this community. In places the vegetation was recorded to community level only. However, areas of W7 ranged from being very wet, lush and moderately species-rich with field layers similar to *Juncus acutiflorus* or *Filipendula ulmaria* mires (i.e. M23a/ M27 – see below) through to drier and more species poor-stands with abundant *Deschampsia cespitosa* (MG9-like – see **paragraph 5.7.11**). Therefore, all three sub-communities were recorded: **W7a *Urtica dioica* sub-community**, **W7b *Carex remota* – *Cirsium palustre* sub-community** and **W7c *Deschampsia cespitosa* sub-community**. Where a sub-community was recorded, it was most often W7a.
- 5.2.18 In all but one stand of W7, *Alnus glutinosa* is the canopy dominant; the other stand has a canopy dominated by *Betula* spp. Within the canopy the abundant *A. glutinosa* is most often joined by variable but subordinate amounts of *Betula* spp., *Salix cinerea*, *S. caprea*, *S. aurita* and *S. alba*, and with only occasional *Fraxinus excelsior* and *Sorbus aucuparia*.
- 5.2.19 As indicated in **paragraph 5.2.17**, the wetness between stands is highly variable, and this is reflected in variation of the field layer. At the drier end of W7, the W7c field layer is more constant and distinguishable, obvious through its sward of dominant tussocky *Deschampsia cespitosa*. Other associates recorded within W7c include *Oxalis acetosella*, *Holcus lanatus*, *Anthoxanthum odoratum* and, rarely, *Mercurialis perennis*.
- 5.2.20 At the wetter end of W7, W7a and W7b stands contained a more diverse range of associates, although species composition and diversity between stands is typically varied. Within these stands there is often abundant *Filipendula ulmaria*, *Juncus acutiflorus*, *J. effusus*, *J. bulbosus*, *Agrostis stolonifera*, *Ranunculus repens*, *Myosotis scorpioides*, *Stellaria uliginosa* and *Equisetum fluviatile*. Other species which are frequent and occasional, but sometimes locally prominent, include *Holcus lanatus*, *Deschampsia cespitosa*, *Ranunculus acris*, *R. flammula*, *Eleocharis palustris*, *Galium palustre*, *Urtica dioica*, *Caltha palustris*, *Agrostis capillaris*, *Potentilla palustris*, *P. erecta*, *Epilobium palustre*, *Phalaris arundinacea*, *Glyceria fluitans*, *Viola palustris*, *Cirsium palustre*, *Iris pseudacorus*, *Cardamine pratensis*, *Carex sylvatica*, *C. nigra*, *C. curta*, *Valeriana officinalis*, *Rumex acetosa* and *Mimulus* sp.

#### W8 *Fraxinus excelsior* – *Acer campestre* – *Mercurialis perennis* woodland

Communities recorded: W8

##### *SBL* – Lowland mixed deciduous woodland

- 5.2.21 This is a community most common and abundant in the relatively warm, dry lowlands of southern and eastern Britain (Rodwell *et al* 1991; Hall *et al* 2004). However, it also occurs in Scotland, mainly in lowland settings. It occurs on various types of calcareous soils in areas where the effects of leaching are limited. *Fraxinus excelsior*, *Acer campestre* and *Corylus avellana* are characteristic of W8, but may play quite a minor role, as other species that are occasional in the community as a whole can be locally abundant (e.g. *Tilia x europaea*, *Ulmus glabra* and *Acer pseudoplatanus*) (Rodwell *et al* 1991; Hall *et al* 2004). This community encompasses a very wide range of floristic variation, indicated by seven sub-communities whose definitions are based primarily on the dominant field layer species. Within these sub-communities the tree and shrub layers can vary greatly. *Mercurialis perennis* (also common in W9) is the most distinctive field layer species (Rodwell *et al* 1991; Hall *et al* 2004).

- 5.2.22 A single small area of W8 woodland was recorded within the study area. It occurs here in a mosaic with W10 *Quercus robur* – *Pteridium aquilinum* – *Rubus fruticosus* woodland, flanking the Raitts Burn just north of Balavil Cottage.
- 5.2.23 Within this stand of W8 there are no obvious canopy dominants, the most common species being *Fraxinus excelsior*, *Acer pseudoplatanus* and *Tilia x europaea*. These tree species are accompanied by occasional *Fagus sylvatica*, *Sorbus aucuparia*, *Aesculus hippocastanum* and *Abies* sp. The most abundant plant in the ungrazed field layer is *Mercurialis perennis*, which forms a dense sward. The field layer also contains the tall grasses *Dactylis glomerata* and *Poa trivialis*, as well as other species including *Urtica dioica*, *Galium aparine* and a few fronds of *Pteridium aquilinum*. The general lack of ferns, and an absence of bryophytes, means the classification of this area as W8 is more appropriate than as its upland counterpart W9 *Fraxinus excelsior* – *Sorbus aucuparia* – *Mercurialis perennis* woodland.

#### W9 *Fraxinus excelsior* – *Sorbus aucuparia* – *Mercurialis perennis* woodland

##### Communities recorded: W9

- 5.2.24 W9 is a community of permanently moist calcareous soils in the sub-montane climate of north-west Britain. It is commonly found by streams and flush lines in the uplands, where the climate is cool, wet and windy (Rodwell *et al* 1991; Hall *et al* 2004). In typical stands, *Fraxinus excelsior* and *Corylus avellana* are the most abundant woody species, and *Betula pubescens* and *Sorbus aucuparia* may be co-dominant. The field layer is usually a complex mosaic, with no single species dominating, although *Mercurialis perennis* and *Hyacinthoides non-scripta* both tend to be frequent. Other features distinctive of W9 include an abundance of *Oxalis acetosella*, various fern species, and a well-developed bryophyte layer (Rodwell *et al* 1991; Hall *et al* 2004).
- 5.2.25 One area of W9 was mapped around Balavil, although this is not typical W9 woodland and its canopy is very mixed and includes exotic conifers and non-native broadleaved species. The woodland here is a mosaic of W9 and W10 (section 5.2.27). Areas were assigned, loosely, to the W9 community based on a more basiphilous field layer containing abundant *Mercurialis perennis*. Species in the canopy include *Tilia x europaea*, *Acer platanoides*, *Fagus sylvatica*, *Aesculus hippocastanum*, *Chamaecyparis* sp., *Larix* spp., *Pinus* spp. and *Abies* sp. *Rhododendron ponticum* is also widespread within this area. The field layer includes abundant *Urtica dioica*, *Galium aparine*, *Pteridium aquilinum* and *Rubus fruticosus*, particularly where it grades into W10 (section 5.2.27).
- 5.2.26 Particular stands of W9 can be classed as an Annex I, SBL or CNPA habitat, to recognise higher conservation value, but this particular example of W9 does not qualify for this because of its modified nature with abundant non-native tree species and widespread *Rhododendron ponticum*.

#### W10 *Quercus robur* – *Pteridium aquilinum* – *Rubus fruticosus* woodland

##### Communities/sub-communities recorded: W10, W10d

*SBL – Lowland mixed deciduous woodland (non-conifer stands); CNPA – Upland oak (Quercus spp. stands)*

- 5.2.27 This is a variable community of base-poor brown earths, found mainly in the lowlands of southern Britain (Rodwell *et al* 1991; Hall *et al* 2004). However, it can be found scattered in the north as well. Typically, *Quercus* spp. are the most common trees, and *Betula pendula* is

abundant. *Fraxinus excelsior* can be frequent, with *Acer pseudoplatanus* and sometimes *Ulmus glabra*, in the north-west. Some stands are dominated by planted conifers, but with enough of a field layer to classify the vegetation type (Rodwell *et al* 1991; Hall *et al* 2004). The field layer is varied but usually lacks base-rich indicators such as *Mercurialis perennis*. The bryophyte cover is generally low.

- 5.2.28 A number of predominately small stands of W10 are scattered throughout the study area, in the relatively lowland settings. They are commonly within, or on the fringes of, improved agricultural land, or around the periphery of towns. The canopies of stands are very varied; some are typical of the community and dominated by *Quercus* spp., but these are rare; others are mixtures of various broadleaves and some solely consist of conifers. In a lot of cases the community classification was assigned to a particular stand more on the character and species composition of the field layer rather than the canopy species; these field layers commonly showed some effects of agricultural improvement. As a result, most stands were recorded to community level.
- 5.2.29 As indicated in **paragraph 5.2.28**, some stands do contain a canopy of *Quercus* spp. with occasional associates, such as *Tilia x europaea*, *Fagus sylvatica*, *Acer pseudoplatanus*, *Aesculus hippocastanum*, *Alnus glutinosa* and *Pinus sylvestris*. The *Quercus* spp. canopies tend to be rather open. Other broadleaved dominated stands of W10 only contain occasional, and sometimes no *Quercus* spp. Instead, their canopies are typically characterised by abundant *A. pseudoplatanus* and *T. x europaea*, and in places with frequent to occasional *A. hippocastanum*, *Fraxinus excelsior*, *P. sylvestris*, *F. sylvatica*, *Prunus avium* and *Abies* sp. One stand on the edge of Kingussie also contains *Fagus sylvatica* f. *purpurea* and *Prunus laurocerasus*, and is probably of planted origin. A number of W10 stands within the study area also have a canopy dominated by conifers (*Pinus* spp. and *Abies* sp.), sometimes with occasional broadleaves of the species already listed.
- 5.2.30 Throughout the stands of W10, the most common feature of the field layer, is its grassy nature and a species composition with similarities to that associated with agricultural improvement. In some places it is grazed into a short green sward, whereas in others, where grazing is absent or infrequent, larger broad-leaved and tussocky grasses are a prominent feature. Most stands were recorded at the community level, but one area was mapped as W10d *Holcus lanatus* sub-community due to a thick sward of ungrazed *Holcus lanatus* with frequent *Dactylis glomerata*. These species remain abundant in most stands of W10 present, and they are accompanied by varying abundances of *Poa trivialis*, *Holcus mollis*, *Deschampsia cespitosa*, *Urtica dioica*, *Pteridium aquilinum*, *Rubus fruticosus* and *R. idaeus*. Occasionally there is some *Cynosurus cristatus*, *Ranunculus repens*, *Conopodium majus*, *Anthoxanthum odoratum*, *Oxalis acetosella*, *Veronica chamaedrys*, *Stellaria media*, *Taraxacum* spp., *Trifolium repens* and, rarely, *Mercurialis perennis*. Bryophytes are typically rare.

W11 *Quercus petraea* – *Betula pubescens* – *Oxalis acetosella* woodland

Communities/sub-communities recorded: W11, W11c, W11d

*SBL* – Upland birchwoods (or Upland oakwood where *Quercus* spp. forms >30% of canopy cover); *CNPA* – Birch and aspen woodland (or Upland oak where *Quercus* spp. form the canopy)

- 5.2.31 W11 is a community of moist, free-draining base-poor brown earth soils in the cooler, wetter north-west of Britain. It is characteristic of substrates that are neither markedly calcareous nor strongly acidic. The character of the community is heavily influenced by grazing (Rodwell *et al*

1991; Hall *et al* 2004). These woodlands have a canopy of *Betula* spp. and/ or *Quercus* spp. and a field layer dominated mainly by grasses. The canopy composition reflects its affinities with the W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* community described in **paragraphs 5.2.37 to 5.2.39**, and from which it is distinguished mainly by the swards of grasses including *Agrostis* spp., *Holcus mollis* and *Anthoxanthum odoratum*, rather than one dominated by pleurocarpous mosses, sub-shrubs and *Deschampsia flexuosa*.

- 5.2.32 W11 is widespread throughout the whole study area, as stands of natural woodland and also stands of planted origin, the latter being mainly in shelter-belts along the A9. Many stands were not recorded to sub-community level; these typically consist of a canopy of *Betula* spp. over a semi-improved grassy field layer similar to U4a or U4b grasslands. The W11 woodlands in the study area have evidently been subject to grazing for many years and have a relatively open canopy. In some locations they may represent the establishment of a *Betula* canopy within an area that was formerly open, acid grassland. These stands of ‘acid grassland with a *Betula* canopy’ do not fit well into the W11 sub-communities. However, in other areas, a number of stands of the **W11d *Stellaria holostea* – *Hypericum pulchrum* sub-community** were recorded, as well as a stand of **W11c *Anemone nemorosa* sub-community**.
- 5.2.33 Throughout the W11 within the study area, the canopy of the vast majority of stands is dominated by *Betula* spp.; some stands are pure *Betula* spp. However, a few stands within the northern parts of the study area have a *Quercus* spp. canopy, and a few others contain a mixed *Quercus* spp. and *Populus tremula* co-dominant canopy (with *Betula* spp. beneath). Some stands, especially those of *Betula*, also contain scattered *Sorbus aucuparia*. *Corylus avellana* is an occasional sub-canopy component. Saplings of the above species are also present in some of the ungrazed stands. In one stand by Meadowside Quarry, the sub layer contains abundant *P. tremula* saplings originating from suckers; however, where there is grazing these disappear. The effects of grazing on tree regeneration, the sub-canopy and field layer can be seen in photograph B-5 in **Annex B**. Here, it is easily seen that on the side of the fence where grazing has been excluded the young saplings, in this case of *P. tremula*, have proliferated, while grazing on the other side of the fence has resulted in a short sward with no young tree regeneration.
- 5.2.34 The W11 field layer throughout the study area is variable, but in general terms it is grassy and contains a few constant and usually abundant species (with a flora similar to that of U4 grassland). Many stands of W11 are in mosaics with W17 woodland (**paragraph 5.2.37**), and in these areas there is typically some species overlap in the transitional zone, often seen through the W11 flora becoming more mossy before reverting back to a grass-dominated field layer. The most constantly abundant species present throughout the W11 in this survey include *Agrostis* spp., *Anthoxanthum odoratum*, *Holcus lanatus* and *H. mollis*. Other grasses frequent in particular stands include *Festuca rubra*, *F. ovina*, *Deschampsia flexuosa*, *D. cespitosa*, *Poa pratensis* and *Arrhenatherum elatius*. *Pteridium aquilinum* is also abundant in many stands. Other field layer species include frequent to occasional *Oxalis acetosella*, *Teucrium scorodonia*, *Hypericum pulchrum*, *Veronica chamaedrys*, *Luzula multiflora*, *Viola riviniana*, *Myosotis arvensis*, *Conopodium majus*, *Urtica dioica*, *Dryopteris dilatata*, *Galium saxatile*, *Vaccinium myrtillus* and *Potentilla erecta*. Rarely some tussocks of *Juncus effusus* appear in more poorly drained parts. Mosses are usually present, although variable in their cover, being more abundant in areas where the W11 is juxtaposed with W17 woodland. The most common moss species found in W11 in this survey are *Rhytidiadelphus squarrosus*, *R. triquetrus*, *Hylocomium splendens* and *Pleurozium schreberi*.

W16 *Quercus* spp. – *Betula* spp. – *Deschampsia flexuosa* woodland

Communities recorded: W16

*SBL – Upland birchwoods; CNPA – Birch and aspen woodland*

- 5.2.35 The W16 community is confined to very acidic, oligotrophic soils in the lowlands and upland fringes of Britain. Soils are typically free-draining, usually sandy and podzolic. Long-established stands occur as high-forest *Quercus*-coppice or wood-pasture, but many stands are recent developments on heathland (Rodwell *et al* 1991; Hall *et al* 2004). Both species of *Quercus* may be present, *Betula* spp. can be very abundant, and may dominate, especially in recently formed stands on old heathland, where self-sown *Pinus sylvestris* may also be abundant (Rodwell *et al* 1991; Hall *et al* 2004). The field layer is generally species-poor. *Deschampsia flexuosa* and *Pteridium aquilinum* are the most consistent species. Sub-shrubs may be frequent in ungrazed stands, particularly in the north-west. Dry soils and low atmospheric humidity limit the contribution of bryophytes (Rodwell *et al* 1991; Hall *et al* 2004).
- 5.2.36 Only three small areas of the W16 community were noted in this survey, as patches with larger mosaics of *Betula*-dominated W11 and W17 woodland, the W16 often on small areas of steep slope with thin dry soils. The W16 community within the study area has a canopy of *Betula* and a species-poor field layer consisting of a sward of dominant *Deschampsia flexuosa* with scattered plants of *Potentilla erecta* and *Galium saxatile*. Bryophytes are virtually absent.

W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland

Communities/sub-communities recorded: W17, W17b, W17d

*SBL – Upland birchwoods (or Upland oakwood where Quercus spp. forms >30% of canopy cover); CNPA – Birch and aspen woodland (or Upland oak where Quercus spp. form the canopy)*

- 5.2.37 W17 *Quercus petraea* – *Betula pubescens* – *Dicranum majus* woodland is a community of very acid, often thin and fragmentary soils in the cool, wet north-west of Britain where there is a strong tendency for mor accumulation and where high rainfall leads to strong leaching (Rodwell *et al* 1991; Hall *et al* 2004). Local differences in climate and topography have a strong influence on the vegetation and frequently interact with grazing to determine the distinctive floristics of the sub-communities (Rodwell *et al* 1991). In this community, *Quercus petraea* and/or *Betula pubescens* usually dominate, although *B. pubescens* is particularly frequent to the north-west where *Quercus* spp. are scarce. The field layer is usually characterised by ericoid shrubs, *Pteridium aquilinum* and grasses; bryophytes are also particularly abundant within this community (Rodwell *et al* 1991; Hall *et al* 2004).
- 5.2.38 W17 is widespread throughout the study area, often as single stands of the community, but also in mosaics with W11 woodland (**section 5.2.31**). The ubiquitous cover of bryophytes in W17 often serves as point of distinction between the two communities. However, in many areas it is clearly evident that the stands of W17 are areas where *Betula* spp. have invaded areas of dry heathland; this is often seen as thickets of young *Betula* spp. with H10 (**paragraph 5.5.2**) or H12 (**paragraph 5.5.6**) dry heath field layers.
- 5.2.39 Though sometimes recorded at the community level, the stands within the study area generally fall into two sub-communities: **W17b Typical sub-community** and **W17d *Rhytidiadelphus***

**triquetrus sub-community.** The great abundance of the moss *Rhytidiadelphus triquetrus* readily identifies the W17d sub-community, with vascular plants in a subordinate role. Within the stands of W17 as a whole, *Betula* spp. are always the canopy dominant; there is also frequent *Sorbus aucuparia* and sometimes occasional *Quercus* sp. The basal layer contains extensive carpets of mosses that effectively blanket the ground in places. The most abundant moss is *Rhytidiadelphus triquetrus*, but others such as *Hylocomium splendens*, *Dicranum majus*, *Rhytidiadelphus loreus*, *R. squarrosus*, *Pleurozium schreberi*, *Pseudoscleropodium purum*, *Thuidium tamariscinum* and *Plagiothecium undulatum* are also found throughout. Above the mossy carpet there are a few constant species which are characteristic of the field layer, the most common of these being *Vaccinium myrtillus* and *Deschampsia flexuosa*. *Calluna vulgaris* is also abundant in certain stands, particularly where heathland has been invaded by the trees. Other characteristic species found commonly in the field layer include *Erica cinerea* and *Pteridium aquilinum*. The grasses *Festuca ovina*, *Anthoxanthum odoratum* and *Holcus lanatus* are occasional, as are a few herbs such as *Galium saxatile*.

#### W18 *Pinus sylvestris* – *Hylocomium splendens* woodland

Communities/sub-communities recorded: W18, W18c

- 5.2.40 W18 *Pinus sylvestris* – *Hylocomium splendens* woodland is a community of strongly leached, lime-free, podzolic soils in the central and north-western Highlands of Scotland. Variation in composition is generally related to the density and age of the pine canopy, but climate, soils and the incidence of browsing, grazing and burning are also important. *P. sylvestris* is always the most abundant tree, though *Betula* spp. may be common. There is a heathy field layer and bryophytes are abundant (Rodwell *et al* 1991; Hall *et al* 2004).
- 5.2.41 W18 was recorded in only two small polygons within the study area. These stands are of non-natural planted origin. One stand is along the B9152 roadside east of Kingussie, and the other is within the Highland Wildlife Park. One area was recorded to community level, whilst the other was recorded as the **W18c *Luzula pilosa* sub-community**.
- 5.2.42 The canopy is typically and diagnostically dominated by *P. sylvestris*. The field layer is mossy and locally dominated by *Rhytidiadelphus loreus* with *Hylocomium splendens* in a species-poor assemblage. The only other frequent species in the field layer is *Deschampsia flexuosa*. More occasional is the presence of *Galium saxatile*, *Anthoxanthum odoratum*, *Poa trivialis*, *Viola riviniana* and *Rumex acetosella*.

#### W19 *Juniperus communis* spp. *communis* – *Oxalis acetosella* woodland

Communities/sub-communities recorded: W19, W19a

##### *Annex 1 – Juniperus communis formations on heaths or calcareous grasslands*

- 5.2.43 This is a community of medium to high altitudes, mostly within the cooler and relatively dry parts of northern Britain. It occurs on a wide variety of free-draining soils, and edaphic differences, together with grazing and browsing, have important influences on the floristics of the vegetation (Rodwell *et al* 1991; Hall *et al* 2004). The main centre of distribution of W19 is in the east-central Highlands, particularly the hills of the Cairngorm and Monadhliath ranges. *Juniperus communis* spp. *communis* is always the most abundant woody species in this community, although some stands can also have an open canopy of *Betula* spp. (Rodwell *et al* 1991; Hall *et al* 2004). Stands of W19 can have less than 60% cover of *J. communis* and extensive stretches of a closed canopy are exceptional; the usual situation is of a varied, patchy cover with some more open areas.

Within a stand of W19 the individual bushes can have very varied growth forms. The other major elements in W19 are ericoids, ferns, herbs, and bryophytes (which almost always make a prominent contribution to the vegetation) (Rodwell *et al* 1991; Hall *et al* 2004).

- 5.2.44 W19, and more specifically the **W19a *Vaccinium vitis-idaea* – *Deschampsia flexuosa* sub-community**, was recorded in a number of stands in the northern sections of the study area; notable stands were present just west of Meadowside Quarry and to the north of Kerrow (to the west of the A9, just north of Kingussie).
- 5.2.45 These stands of W19 are dominated by *J. communis*, with rare *Betula pubescens*. The field layer is often heavily grazed by sheep, resulting in a very short sward of U4-type grassland; in other areas the flora is similar to that of an intensively grazed H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath in transition to U4 grassland. The grazed sward beneath and amongst the *J. communis* contains varying abundances of species typical to the community, including *Agrostis capillaris*, *Anthoxanthum odoratum*, *Deschampsia flexuosa*, *Potentilla erecta* and *Galium saxatile*. *Calluna vulgaris* and *Vaccinium myrtillus* are sometimes present as scattered plants, but for the most part they have been almost completely grazed out. The most common mosses here are *Rhytidiadelphus squarrosus*, *Hylocomium splendens* and *Pleurozium schreberi*.

### W23 *Ulex europaeus* – *Rubus fruticosus* scrub

#### Communities recorded: W23

The W23 community is dominated by *Ulex europaeus* and has a usually sparse and species-poor ground flora, or in some places no ground flora at all. It is a community of acidic and free draining soils on gentle to steep, rocky slopes at low altitudes. The vegetation often develops after woodland clearance of, or on, abandoned pasture (Rodwell *et al* 1991; Averis *et al* 2004).

- 5.2.46 Within the study area this community occurs where *Ulex europaeus* and/ or *Cytisus scoparius* form a relatively continuous canopy or a more open canopy in a mosaic with ground vegetation. The underlying field layer is generally heathy (equating to H12) or grassy (approximating to U4).
- 5.2.47 W23 was recorded as infrequent small patches within the study area, mainly along roadsides or around the edges of farmland. In some areas the canopy consists solely of *U. europaeus*, whereas in some other fragmentary stands *Cytisus scoparius* is the main shrub. In most stands there is a U4 grassland-type ground flora. *Rubus fruticosus* is an occasional associate.

## 5.3 Mires and Flushes

- 5.3.1 Various mire types and associated flush communities are present within the study area, often occupying flatter and gently sloping peaty areas. However, areas of mire tend to be fragmented and there are very few large expanses of blanket bog habitat. The communities are described in further detail below.

### M3 *Eriophorum angustifolium* bog pool community

#### *Annex 1, SBL, CNPA - Blanket bog*

- 5.3.2 The M3 *Eriophorum angustifolium* bog pool community is typically found as small stands on barer exposures of acid peat in depressions, erosion channels or shallow peat cuttings on a wide range of mire types (Rodwell *et al* 1991; Elkington *et al* 2001). It can occur in permanently flooded pools and natural hollows on surfaces of more or less intact mires, and on dried-up hollows and

among erosion features where the peat has been worn down in gullies or redistributed (Rodwell *et al* 1991; Elkington *et al* 2001; Averis *et al* 2004). The typical species, *Eriophorum angustifolium*, can occur as dense and often tall swards, but equally as common, it occurs as sparser shoots scattered over expanses of bare peat (Averis *et al* 2004).

- 5.3.3 Areas of M3 are uncommon within the study area. Where present, the community forms a minor component of mixed vegetation mosaics and occurs mainly in association with M17 mire and M15 wet heath. The community occurs in some places as permanently flooded bog pools within these mires, but also as species-poor continuous swards of *E. angustifolium*. The dominant species in these areas is always *E. angustifolium*. Where other species are present they are sparse and include *Carex echinata*, *C. nigra*, *Erica tetralix*, *Eriophorum vaginatum* and occasional *Sphagnum* spp.

#### M4 *Carex rostrata* - *Sphagnum fallax* mire

*Annex I – Transition mires and quaking bogs; SBL – Upland flushes, fens and swamps; CNPA – Wetlands*

- 5.3.4 The M4 community is characteristic of pools and seepage areas on peat soils of topogenous and soligenous mires where the waters are fairly acid and only slightly enriched. It can occur in bog pools on the surface of basin mires, but is more common in soligenous areas as in mire lags and the wettest parts of water-tracks (Rodwell *et al* 1991; Elkington *et al* 2001). This mire typically has a cover of sedges over a carpet of semi-aquatic *Sphagnum* spp.
- 5.3.5 M4 is sparsely scattered throughout the study area, mostly as small stands marking the passage and localised ponding of surface water in depressions. However, one substantial area of M4 exists around coordinates 270855 797602, west of Ralia Lodge. At this location Ordnance Survey (OS) maps show the presence of a standing waterbody, Loch Buide. However, as found during the surveys, this loch no longer exists as standing water; it has over time, evidently through the process of succession, become a transitional mire with M4 vegetation.
- 5.3.6 The M4 community as a whole is readily recognised within the study area by the tall swards of *Carex rostrata* over lawns of *Sphagnum fallax* and *S. cuspidatum*, and it varies little from this dominance of defining species. Other species present are limited by the waterlogged substrate and shade from the *C. rostrata*; they include *Myrica gale*, *Erica tetralix*, *Carex nigra*, *C. echinata*, *Eriophorum angustifolium*, *Juncus acutiflorus* and *Molinia caerulea*. Within the lawns of *Sphagnum* spp., *S. palustre* and *S. squarrosum* are also occasional.
- 5.3.7 Species-poor, waterlogged and agriculturally unproductive, this community is not subject to any form of management, as there is little evidence of drainage and the habitat is too wet to be of grazing value.

#### M5 *Carex rostrata* – *Sphagnum squarrosum* mire

*GWDE status – High; Annex I – Transition mires and quaking bogs; SBL – Upland flushes, fens and swamps; CNPA – Wetlands*

- 5.3.8 M5 mire is typically found as floating rafts of vegetation on soft, spongy peats in topogenous mires and in soligenous areas with mildly acid to moderately calcareous nutrient-poor waters. It is characteristically found in zonation and mosaics. The community has a widespread but fairly local distribution in northern and western parts of Britain (Rodwell *et al* 1991; Elkington *et al* 2001).

- 5.3.9 M5 is characterised overall by the dominance of sedges with scattered poor-fen herbs over a patchy carpet of moderately base-tolerant *Sphagnum* spp. The commonest species throughout are *Carex rostrata* and *C. nigra*, with the former generally more extensive; *C. lasiocarpa* can be locally prominent. The bryophyte carpet helps define M5 mire against closely related vegetation types; especially distinctive is the presence of *Sphagnum squarrosum* and/ or *S. teres* (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.3.10 Small patches of M5 were recorded within seven polygons mapped across the study area. It occurs here in a mosaic with similar mire communities (e.g. M4 – **section 5.3.4**) or around transitional swamp margins (i.e. S9 and S10 swamps – **sections 5.9.3** and **5.9.7**).
- 5.3.11 These M5 swards are dominated by *Carex rostrata*, with occasional *C. nigra*. The community is generally differentiated from the surrounding vegetation by the presence of mounds of *Sphagnum squarrosum*, or a local abundance of *S. teres*. Other species present in these areas of M5 mire include locally abundant *Filipendula ulmaria*, *Menyanthes trifoliata* and *Oenanthe crocata*. Frequent to occasional are *Valeriana officinalis*, *Equisetum fluviatile*, *Rumex acetosa* and *Galium palustre*.

#### M6 *Carex echinata* - *Sphagnum fallax/denticulatum* mire

Communities/sub-communities recorded: M6, M6a, M6c, M6d

*GWDTE status – High; SBL – Upland flushes, fens and swamps; CNPA - Wetlands*

- 5.3.12 This mire is the major soligenous community of peats and peaty gleys irrigated by base poor waters in the sub-montane zone of northern and western Britain. It typically occurs as small stands among other mire communities, grasslands and heaths, and is sometimes found with swamp and spring vegetation. It is commonly found in tracts of unenclosed upland pasture, particularly between 200m and 400m (although it may also be found much higher) and is ubiquitous in upland Britain (Rodwell *et al* 1991; Elkington *et al* 2001). The M6 community has a distinct general character but includes a wide variation in species composition, expressed as four sub-communities (two of which are visually similar to the M23 community). It is essentially a poor-fen with small sedges or rushes dominating over a carpet of oligotrophic and base-intolerant *Sphagna* (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.3.13 M6 is widespread throughout the study area in both upland and lowland settings, mostly as small flushes, runnels or soakways, and along and within occluding ditches and minor watercourses. Three of the four sub-communities occur within the Project 9 study area: M6a, M6c and M6d.
- 5.3.14 The **M6a *Carex echinata* sub-community** is common and scattered throughout the study area. In this sub-community a sward of sedges grows among an underlying lawn of *Sphagnum fallax*. *Carex echinata* and *C. nigra* are abundant to frequent. Other species that are occasional to rare here include *C. rostrata*, *C. panicea*, *Eriophorum angustifolium*, *Erica tetralix*, *Molinia caerulea*, *Juncus squarrosus*, *Festuca rubra*, *Nardus stricta*, *Holcus lanatus*, *Juncus acutiflorus*, *Myrica gale*, *Potentilla erecta*, *Drosera rotundifolia* and *Equisetum fluviatile*. In the moss layer, *Sphagnum fallax* is abundant, with frequent *S. denticulatum* and *S. palustre*, and occasional *S. papillosum* and *Polytrichum commune*.
- 5.3.15 The **M6c *Juncus effusus* sub-community** is widely scattered and frequent throughout the study area in wet depressions, usually in small, linear extents associated with surface waters. A tall sward of *J. effusus* over a species-poor lawn of *S. fallax* and *P. commune* indicates this sub-community. The M6c sub-community is very species-poor. Most of the vegetation contains little more than the three species already listed. Rare to occasional associates include *Galium saxatile*,

*G. palustre*, *M. caerulea*, *Potentilla palustris*, *Rumex acetosa*, *Potentilla erecta*, *Sphagnum palustre*, *S. denticulatum*, *Aulacomnium palustre*, *Carex echinata* and *C. nigra*.

5.3.16 The dominance of *Juncus acutiflorus* with a moderately rich but uneven assemblage of associates distinguishes the **M6d *Juncus acutiflorus* sub-community** from the other sub-communities. Associated with the M6d dominants is often abundant and occasionally co-dominant *Myrica gale*. The vegetation is further enriched by occasional to rare *Carex rostrata*, *C. panicea*, *C. nigra*, *C. echinata*, *Eriophorum angustifolium*, *Erica tetralix*, *Potentilla erecta*, *Molinia caerulea*, *Narthecium ossifragum*, *Deschampsia cespitosa*, *Cirsium palustre*, *Ranunculus repens*, *Luzula multiflora*, *Festuca ovina*, *F. rubra*, *Viola palustris*, *Anthoxanthum odoratum* and *Rumex acetosa*. However, in many stands of M6d within the study area the vegetation is little more than swards of *J. acutiflorus* rooted in the lawn of *Sphagnum fallax*. *S. fallax* remains dominant within the extensive moss layer throughout; it is also accompanied by *S. palustre*, *S. capillifolium* and *P. commune* in places. Transitions between M6d and M23a are widespread where the two communities occur within mixed mire mosaics; in these mosaics M6d tends to occupy lines of surface water pathways through areas of M23a.

5.3.17 The M6c and M6d sub-communities are of very limited grazing value and of little economic importance. In some places M6 is associated with drainage but more generally it reflects the topography-influenced passage or retention of surface water.

M10 *Carex dioica* - *Pinguicula vulgaris* mire

Communities/sub-communities recorded: M10, M10a

*GWDTE status* – High; *Annex I* – Alkaline fens; *SBL* – Upland flushes, fens and swamps; *CNPA* - Wetlands

5.3.18 The M10 *Carex dioica* – *Pinguicula vulgaris* mire is a soligenous mire of mineral soils and shallow peats kept very wet by base-rich, calcareous and oligotrophic waters (Rodwell *et al* 1991; Elkington *et al* 2001). The community includes a range of distinctive calcicolous flush vegetation in which the bulk of the sward is composed of small sedges, dicotyledons and bryophytes. It is essentially a small sedge mire and is usually found as small stands. The community typically occurs in unenclosed uplands, and most of the stands are grazed and trampled by large herbivores (Rodwell *et al* 1991; Elkington *et al* 2001). The community can occur wherever there is flushing with base-rich water, either below a springhead or where water emerges more diffusely from the ground, most stands being constantly irrigated (Averis *et al* 2004).

5.3.19 This mire was generally recorded to community level, but on occasion the **M10a *Carex demissa*-*Juncus bulbosus/kochii* sub-community** was recorded. Within the study area, M10 flushes are infrequent, with this community recorded in only five mapped polygons. Some of these areas of M10 are relatively species-poor, with little more than an open sward of sedges such as *Carex viridula*, *C. panicea*, *C. echinata* and *Eriophorum angustifolium* rooted amongst *Sphagnum denticulatum* with occasional *Scorpidium scorpioides*. Where better developed, these species remain frequent to occasional in an assemblage including frequent to occasional *Blindia acuta*, *Campyllum stellatum*, *Scorpidium revolvens*, *Narthecium ossifragum*, *Pinguicula vulgaris*, *Carex dioica*, *C. hostiana*, *Erica tetralix*, *Drosera rotundifolia*, *Festuca vivipara*, *Nardus stricta* and *Eleocharis quinqueflora*.

5.3.20 The presence of acid mire elements such as *N. ossifragum* and *E. tetralix* is indicative of the M10a sub-community, the other sub-communities being defined by the appearance of more base-demanding and/ or distinctive species.

- 5.3.21 These small soligenous mires are typically present as narrow flushes running through other habitats, especially M15 wet heath. This community is a GWDTE, due to its dependency on base-rich groundwater seepages (which are usually associated with a definite source point).

M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire

Communities/sub-communities recorded: M17, M17a, M17b, M17c

*Annex 1, SBL, CNPA – Blanket bog*

- 5.3.22 M17 *Trichophorum germanicum* – *Eriophorum vaginatum* blanket mire is the characteristic blanket bog vegetation of the more oceanic parts of Britain. It is typically found on deposits that are maintained in a permanently waterlogged state by a high and generally stagnant water table (Rodwell *et al* 1991; Elkington *et al* 2001). It usually occurs on peats greater than 2m in depth overlying flat or gently sloping ground (Rodwell *et al* 1991). However, it can also occur extensively on shallower peat. The peats show varying degrees of humification but are typically highly acidic, with a surface pH usually not much above 4 (Rodwell *et al* 1991).
- 5.3.23 This community is dominated by mixtures of monocotyledons, ericoid sub-shrubs and *Sphagnum* spp. It can occur as extensive, relatively uniform tracts, or as hummock and hollow complexes, with this community giving way to bog pool vegetation in the hollows (Rodwell *et al* 1991; Elkington *et al* 2001). Among the bulkier vascular species, the most common are *Trichophorum germanicum*, *Eriophorum vaginatum*, *E. angustifolium*, *Molinia caerulea*, *Calluna vulgaris* and *Erica tetralix*. *Sphagnum* spp. are an important component of the ground layer and can form extensive lawns. Burning, marginal peat-cutting and drainage have often resulted in surface drying of the peat and hence a modification of the vegetation (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.3.24 M17 is the most common blanket mire type within the study area, although its distribution is localised and it does not cover large areas. It is mainly in the southern sections of the study area, and small scattered fragments also occupy depressions, level areas and gentle inclines on the slopes surrounding the A9. The majority of areas align with the **M17a *Drosera rotundifolia*-*Sphagnum* spp. sub-community**. The M17a sub-community is distinguished by the presence of extensive wet lawns of *Sphagnum* spp. and the frequency of *Drosera rotundifolia*.
- 5.3.25 The vascular vegetation cover in M17a is an assemblage of the grasses and sedges already listed above. *C. vulgaris* is only rarely prominent in the vegetation. Other species recorded commonly throughout these areas include *Narthecium ossifragum*, *Potentilla erecta* and *D. rotundifolia*. *Juncus squarrosus* is present in patches. The M17a moss layer is dominated by *Sphagna*, especially *S. capillifolium*, *S. subnitens* and *S. papillosum*. *Sphagnum cuspidatum*, *S. fallax* and *S. denticulatum* are locally abundant within the occasional pools and soakways. Where there are low hummocks, pleurocarpous mosses such as *Hylocomium splendens*, *Hypnum jutlandicum* and *Pleurozium schreberi* are prominent, often in association with *C. vulgaris*. Other moss species, including *Aulacomnium palustre* and *Polytrichum commune*, occur occasionally in the wetter parts, typically in association with *S. fallax*.
- 5.3.26 Although M17a is the most common sub-community here, the **M17b *Cladonia* sub-community** occurs rarely. This sub-community indicates a drier situation to that of M17a. Within M17b the characteristic M17 species remain, but *Sphagnum* cover and diversity is much reduced, with the main *Sphagnum* species in M17b in the study area being *Sphagnum capillifolium*. The reduced cover of *Sphagnum* is also accompanied by *Cladonia* spp. increasing in prominence, and occasional records of *Racomitrium lanuginosum*.

5.3.27 One area of **M17c *Juncus squarrosus* - *Rhytidiadelphus loreus* sub-community** was recorded, distinguished by a higher cover of *Juncus squarrosus* and pleurocarpous mosses.

5.3.28 M17 has likely been reduced in extent in certain parts of the study area by agricultural improvement, and probably also by grazing, peat cutting and drainage.

**M19 *Calluna vulgaris* – *Eriophorum vaginatum* blanket mire**

Communities/sub-communities recorded: M19, M19a

*Annex I, SBL, CNPA – Blanket bog*

5.3.29 This is the typical blanket bog vegetation of high-altitude ombrogenous peats in the wet and cold climate of the uplands of northern Britain. In particular, it occurs on high-level plateaux and broad watersheds, usually above 300 m, and is confined to deeper peats on flat or gently-sloping ground (Rodwell *et al* 1991; Elkington *et al* 2001). It is generally dominated by mixtures of *Eriophorum vaginatum* and ericoid sub-shrubs (especially *Calluna vulgaris*). *Sphagnum* spp. can be prominent over wetter ground but are not as luxuriant or rich as in M17 mire (Rodwell *et al* 1991; Elkington *et al* 2001).

5.3.30 M19 is present within the study area but is not extensive or widespread. It often occurs with M15 wet heath, in mosaics where the M15 has probably been derived from M19 under certain treatments. The M19 vegetation is co-dominated by *Calluna vulgaris* and tussocks of *Eriophorum vaginatum*. The co-dominance by *E. vaginatum* and *C. vulgaris* often results in the suppression of the species in between the tussocks so that the associated species are of a low number and low total cover. They include frequent to occasional *Eriophorum angustifolium*, *Erica tetralix*, *Narthecium ossifragum* and *Potentilla erecta*. *Hylocomium splendens* and *Pleurozium schreberi* are frequent on the tussocks and *Sphagnum capillifolium* and *S. fallax* grow in damp depressions between tussocks. The occurrences of *E. tetralix* place the vegetation into the **M19a *Erica tetralix* sub-community**.

**M20 *Eriophorum vaginatum* blanket mire**

Communities recorded: M20

*Annex I, SBL, CNPA – Blanket bog*

5.3.31 M20 *Eriophorum vaginatum* blanket mire is a community characteristic of ombrogenous peats on bogs where certain treatments have greatly affected the vegetation; grazing and burning have been of greatest significance, but drainage has also played a part in the development of M20 (Rodwell *et al* 1991; Elkington *et al* 2001). It is commonest on blanket mires where these factors have contributed both to floristic impoverishment and to erosion of the peats. The peats are generally drier than in M17 and most M19 bogs, often showing surface oxidation (Rodwell *et al* 1991; Elkington *et al* 2001).

5.3.32 The community comprises species-poor ombrogenous bog vegetation dominated by *E. vaginatum*, the tussocks of which form an open or closed canopy 10-30 cm high. Ericoid sub-shrubs are patchy, while *Deschampsia flexuosa* is fairly common. Bryophytes tend to be sparse and patchy; *Sphagnum* spp. are scarce with *Sphagnum capillifolium* and *S. papillosum* the most usual species (Rodwell *et al* 1991; Elkington *et al* 2001).

5.3.33 Within the study area, one small pocket of M20 vegetation was found, forming a small part of fragmented mire by Milton of Nuide. This small area is a mosaic of S9, M20, M4, M6c and M17.

The M20 vegetation consists of little other than a sward of *Eriophorum vaginatum* with some *Sphagnum* patches.

M23 *Juncus effusus/acutiflorus* – *Galium palustre* rush-pasture

Communities/sub-communities recorded: M23, M23a, M23b

*GWDTE status* – High; *SBL* – Upland flushes, fens and swamps (M23a only); *CNPA* – Wetlands (M23a) and Wet grasslands (M23b)

- 5.3.34 This rush-pasture is a community of gently-sloping ground in and around the margins of soligenous flushes, as a zone around topogenous mires and wet heaths, and in poorly drained, comparatively unimproved or reverted pasture. It can be found on a variety of moderately acid to neutral soils that are kept moist to wet for most of the year (Rodwell *et al* 1991; Elkington *et al* 2001). As a result this community can be, at least partially, potentially dependent on groundwater; however, it is also commonly associated with surface water flows and surface water collection. This vegetation is characterised by the abundance of either *Juncus effusus* or *J. acutiflorus* (sometimes both), with a ground layer of mesophytic herbs common in moist or permanently wet grasslands; associates are quite diverse. Acidophilous *Sphagna* and *Polytrichum commune* are rare in the M23 community (Averis *et al* 2004).
- 5.3.35 M23 forms scattered stands throughout the study area, predominately towards the lower flatter areas around the floodplains of watercourses and in wet neglected pasture. Both sub-communities occur here. Within the study area M23 frequently forms mosaics with the M6 *Carex echinata* - *Sphagnum fallax/denticulatum* mire community (see **section 5.3.12**).
- 5.3.36 The **M23a *Juncus acutiflorus* sub-community** is the more common of the two sub-communities within the study area; it is also generally more species-rich than M23b. A tall rush sward dominated by *J. acutiflorus* with a moderately diverse range of herb associates is sufficient to distinguish this sub-community from M23b. Usually associated with surface water movement, this sub-community is commonly linear in nature although it may also form fans or diffuse areas around watercourses. It is scattered throughout the length of the study area.
- 5.3.37 The field layer beneath the *J. acutiflorus* sward is highly variable between and within stands, and is strongly influenced by the water level. Where the field layer beneath the rushes is better developed, there is a variable assemblage of the species listed in the next paragraph; these are widely frequent to occasional but are abundant locally. Among these associated species the grasses are most abundant in relatively dry, marginal areas of the habitat, while more mixed forb-rich assemblages are common in the wetter areas.
- 5.3.38 The species commonly found with *J. acutiflorus* in this sub-community in the study area include *J. effusus*, *Holcus lanatus*, *Agrostis capillaris*, *Ranunculus repens*, *R. acris*, *R. flammula*, *Cardamine pratensis*, *Galium palustre*, *Pedicularis palustris*, *Epilobium palustre*, *Potentilla palustris*, *Viola palustris*, *Rumex acetosa*, *Caltha palustris*, *Carex echinata*, *C. nigra*, *C. panicea*, *C. rostrata*, *C. hostiana*, *Deschampsia cespitosa*, *Eleocharis palustris*, *Filipendula ulmaria*, *Lychnis flos-cuculi*, *Poa pratensis*, *Anthoxanthum odoratum*, *Hydrocotyle vulgaris*, *Myosotis scorpioides*, *Mentha aquatica* and *Cirsium palustre*. Where the field layer is not overly dense there can be an abundance of the mosses *Calliergonella cuspidata* and *Brachythecium rivulare*.
- 5.3.39 The **M23b *Juncus effusus* sub-community** is also scattered along the lower ground, within depressions where water collects, and alongside minor watercourses and ditches. It is usually associated here with grasslands used as pasture. As well as being dominated by *J. effusus*, this

sub-community also differs from M23a in being grassier and less species rich. Beneath the tall sward of *J. effusus* there is a field layer of often abundant *A. stolonifera*, *Poa* spp., *Deschampsia cespitosa*, *Filipendula ulmaria* and *H. lanatus*. Where the grass sward is less dense there are small herbs and mosses, including frequent to occasional *Brachythecium rivulare*, *Calliergonella cuspidata*, *Carex nigra*, *Rumex acetosa*, *Caltha palustris*, *Stellaria graminea*, *Ranunculus repens*, *Cirsium palustre*, *Cardamine pratensis* and *Galium palustre*.

M25 *Molinia caerulea* – *Potentilla erecta* mire

Communities/sub-communities recorded: M25, M25a, M25b, M25c

*GWDTE status* – Moderate; *Annex I* - Blanket bog; *SBL* – Blanket bog (M25a and M25b)/Upland flushes, fens and swamps (M25c); *CNPA* – Wetlands (M25c only)

- 5.3.40 M25 mire is a community of moist, but usually well aerated, acid to neutral peats and peaty soils (Rodwell *et al* 1991). It generally occurs over gently-sloping ground, marking out seepage zones and flushed margins of topogenous mires, but also extends onto the fringes of ombrogenous mires (Rodwell *et al* 1991; Elkington *et al* 2001; Averis *et al* 2004). *Molinia caerulea* is the most abundant species found in this community. The associated flora is usually species-poor, and consists largely of *Juncus* spp. and a few dicotyledons. Occasionally sub-shrubs can be quite common, particularly *Calluna vulgaris* and *Erica tetralix*. *Myrica gale* is local but can be quite extensive and dense in co-dominance with *M. caerulea*. Treatments such as burning, grazing and drainage are likely to be largely responsible for the development of this community over ground that would naturally host some other kind of mire or wet heath vegetation (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.3.41 M25 is not extensive within the study area, although it is common in smaller patches as marginal areas and in mosaics with blanket bog, wet heaths and occasionally swamps. M25 sub-communities are defined according to the *M. caerulea* associates. Within the study area all three sub-communities are present; however M25a and M25c, are the most common.
- 5.3.42 Much of the M25 present takes the form of **M25a *Erica tetralix* sub-community**, indicated here by the presence of a range of wet heath and bog associates (*cf.* grasses or tall herbs indicative of the other two sub-communities). Within the M25a in the study area, *M. caerulea* is typically dominant because of the density of its tall tussocks and leaf litter. The sparse associates include *E. tetralix*, *C. vulgaris*, *Potentilla erecta*, *Juncus* spp. *Galium saxatile*, *Luzula multiflora*, *Festuca rubra*, *F. vivipara*, *Carex nigra*, *Carex panicea* and *Narthecium ossifragum*. *Myrica gale* is locally abundant and co-dominant in some areas. *Sphagna* are present in some areas and are mainly of the species *S. fallax* and *S. palustre*.
- 5.3.43 The **M25c *Angelica sylvestris* sub-community** is as common as M25a within the study area, although its locus is centred on more marshy and fen-like areas, mainly around the edges of the Insh Marshes. Within the vegetation of this sub-community *M. caerulea* remains dominant to abundant and is accompanied by frequent to occasional *Deschampsia cespitosa*, *Juncus acutiflorus*, *J. effusus*, *Angelica sylvestris*, *Cirsium palustre*, *Holcus lanatus*, *Agrostis canina*, *Ranunculus repens*, *Rumex acetosa*, *Veronica officinalis*, *Lotus pedunculatus* and *Caltha palustris*.
- 5.3.44 Rarely, the **M25b *Anthoxanthum odoratum* sub-community** was recorded. Here, M25b is characterised by a slightly shorter sward of *M. caerulea*, and the habitat is also drier with other grasses becoming more noticeable. Species appearing frequently in this sub-community include *Anthoxanthum odoratum*, *Agrostis* spp. and *Holcus lanatus*.

M27 *Filipendula ulmaria* – *Angelica sylvestris* mire

Communities/sub-communities recorded: M27, M27a

*GWDTE status* – Moderate; *SBL* – Lowland fens; *CNPA* – Wetlands

- 5.3.45 This community is typically found where moist, reasonably rich, circumneutral soils occur in situations protected from grazing. It can be found in both topogenous and soligenous mires and is especially typical of silted margins of slow-moving streams and soakways, the edges of flushes and damp hollows, and also of artificial habitats such as along dykes and roadside ditches and around ponds (Rodwell *et al* 1991; Elkington *et al* 2001). The community cannot tolerate grazing which is anything more than very light or sporadic, so stands often persist only outside grazed enclosures and around un-reclaimed mires and flushes (Rodwell *et al* 1991; Elkington *et al* 2001). *Filipendula ulmaria* forms the overwhelming dominant and the only constant. Bryophytes are few in number and of low cover (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.3.46 A number of small stands of M27, and most often the **M27a *Valeriana officinalis* - *Rumex acetosa* sub-community** are present within the study area. These stands are mainly in the northern part of the study area, in marginal areas around the Insh Marshes and associated wetlands, where the community can be seen grading into local swamp communities. The community is also occasionally found as small patches on the River Spey floodplain, where it locally grades into M23 *Juncus* spp. pastures with the presence of grazing.
- 5.3.47 *Filipendula ulmaria* is the dominant component of all stands of M27, except in one polygon where *Valeriana officinalis* replaces *F. ulmaria* as the dominant tall herb. Other species include abundant *Carex rostrata*, *Equisetum fluviatile*, *Valeriana officinalis* (locally dominant, as described above), *Ranunculus repens* and *Rumex acetosa*. The tall sward of the abundant species sometimes reduces the cover of more diminutive herbs. Other species present in generally smaller quantity in these stands include *Angelica sylvestris*, *Juncus effusus*, *J. acutiflorus*, *Galium palustre*, *Holcus lanatus*, *Potentilla palustris*, *Epilobium palustre*, *Molinia caerulea*, *Deschampsia cespitosa*, *Heracleum sphondylium*, *Poa pratensis*, *Cirsium palustre*, *Phalaris arundinacea*, *Myosotis* spp. and *Cardamine pratensis*.

## 5.4 Wet Heaths

- 5.4.1 Wet heath makes up a relatively small proportion of the study area, occupying some of the more upland and peaty gentle sloping areas in the south of the study area, east of the A9. It forms mosaics and transitions with other mire types as well as dry heaths and calcifugous grasslands. Wet heath tends to be found on shallower peats than blanket mire communities; however, this is not always the case, due to the impacts of certain treatments (such as grazing and drainage) resulting in the development of wet heath communities on deeper peat (see below).

### M15 *Trichophorum germanicum* – *Erica tetralix* wet heath

Communities/sub-communities recorded: M15, M15a, M15b, M15c

*GWDTE status* – Moderate; *Annex I* – Northern Atlantic wet heath or blanket bog; *SBL* – Upland heathland or blanket bog; *CNPA* – Upland heathland

- 5.4.2 This wet heath community is characteristic of moist and generally acid and oligotrophic peats and peaty mineral soils in the wetter western and northern parts of Britain. It is also associated with

thinner or better drained areas of ombrogenous peat (Rodwell *et al* 1991; Elkington *et al* 2001). It is a vegetation type with few constant species and wide variation in its flora and dominant species. *Calluna vulgaris*, *Molinia caerulea*, *Trichophorum germanicum* and *Erica tetralix* are usually all of high frequency, and it is mixtures of these species that give the vegetation its general character. However, sometimes one or two of them may be missing and their relative proportions can be very varied (Rodwell *et al* 1991; Elkington *et al* 2001). The shrubby species *Erica cinerea*, *Vaccinium myrtillus* and *Myrica gale* are important in particular sub-communities. Other species found commonly in M15 are *Potentilla erecta*, *Polygala serpyllifolia*, *Narthecium ossifragum* and *Eriophorum angustifolium*. By contrast *E. vaginatum* is notably scarce. M15 is an extremely variable community in terms of dominants, constants and co-dominants, which can vary markedly over short distances. Grazing and burning have important effects on the floristics and structure of this community, and draining and peat-cutting have extended its coverage to formerly deeper and wetter peats in which blanket mire communities (i.e. M17-M19) were probably initially present (Rodwell *et al* 1991; Elkington *et al* 2001).

- 5.4.3 M15 is widespread throughout the study area, particularly towards the southern end where the general character of Project 9 becomes more upland. M15 within the study area shows large variations, highlighted by the presence of three sub-communities; in order of decreasing abundance within the study area these are M15b, M15a and M15c. Even within the sub-communities there is considerable variation, particularly within M15b. Each of these three sub-communities is discussed further below. M15 within the study area occurs on varying depths of peat. In some cases M15 occupies its natural landscape setting on gentler peaty slopes. However, the community is also present on deeper peat on flatter ground where the vegetation may previously have been blanket mire communities but with a flora altered over time by grazing, burning and drainage, thereby facilitating the development of the M15 assemblage.
- 5.4.4 By far the most common sub-community of M15 within the study area is the **M15b Typical sub-community**. M15b is extensive in many parts of the study area, where it consists mainly of a sward with variable amounts of the main characteristic species: *Calluna vulgaris*, *Molinia caerulea*, *Trichophorum germanicum* and *Erica tetralix*. The relative proportions of these species can be very varied within small areas, and each of these species can attain local dominance. For example, in some stands of M15b *C. vulgaris* and *M. caerulea* are co-dominant, and where *Myrica gale* is also frequent the community can be seen grading into M25 mire (**paragraph 5.3.40**). In other stands, *C. vulgaris* is notably absent or very sparse and the sward is made up of a mix of *M. caerulea*, *T. germanicum*, *M. gale* and *E. tetralix*. Generally, throughout M15b within the study area, *M. gale* is frequent and sometimes locally dominant. Many other species are frequently to occasionally scattered in these M15b heaths: they include *Carex panicea*, *C. binervis*, *C. nigra*, *C. pauciflora*, *C. echinata*, *Narthecium ossifragum*, *Juncus squarrosus*, *Juncus acutiflorus*, *Eriophorum angustifolium*, *Anthoxanthum odoratum*, *Luzula multiflora*, *Festuca ovina*, *Potentilla erecta*, *Galium saxatile* and *Blechnum spicant*. *E. vaginatum* is only a sparse occasional. The M15b field layer often contains *M. caerulea* litter among and beneath the vascular plants, but in this same zone mosses can be common, with the following species found in varying abundances: *Sphagnum capillifolium*, *S. fallax*, *S. palustre*, *Dicranum scoparium*, *Plagiothecium undulatum*, *Aulacomnium palustre*, *Hypnum jutlandicum*, *Pleurozium schreberi*, *Hylocomium splendens*, *Rhytidiadelphus squarrosus* and *Polytrichum commune*. *Cladonia* spp. (lichens) are locally abundant. *Sphagnum cuspidatum*, *S. denticulatum*, *S. fallax* and *S. palustre* are locally frequent in wet depressions and soakways. *Sphagnum papillosum* is only occasionally present.
- 5.4.5 The **M15a *Carex panicea* sub-community** is present as a few small stands. It is more of a soligenous mire than a wet heath (Averis *et al* 2004). It occurs within the study area as flushed

areas within the other sub-communities of M15 and other mires, as well as occurring as some discrete stands. M15a has a thinner canopy of the characteristic species described above, though within the study area often lacking much *Calluna vulgaris* due to the wetter soils. In the study area, this sub-community is distinguished from the other sub-communities of M15 by the presence of species indicative of flushing. Especially characteristic here are the small sedges *Carex panicea*, *C. viridula* and *C. pulicaris*. *Myrica gale* is also very frequent within many stands of M15a and is often the main canopy sub-shrub. Other species common within M15a are *Narthecium ossifragum*, *Eriophorum angustifolium*, *Potentilla erecta*, *Carex nigra*, *Drosera rotundifolia*, *Succisa pratensis*, *Pinguicula vulgaris* and the mosses *Sphagnum denticulatum*, *S. capillifolium*, *S. fallax* and, locally, *Scorpidium scorpioides*.

- 5.4.6 The **M15c *Cladonia* spp. sub-community** is uncommon within the study area, being recorded in two small stands. M15c is drier than M15a and M15b, and in the study area has a generally more open sward with *Trichophorum germanicum* and *Calluna vulgaris* the most abundant of the four main constituent species; there are also rare sprigs of *Vaccinium myrtillus*. The ground layer largely lacks the *Sphagna* of the wetter sub-communities which are generally replaced here by mixes of pleurocarpous mosses, *Racomitrium lanuginosum* and the lichens *Cladonia arbuscula*, *C. portentosa* and *C. uncialis*.
- 5.4.7 The M15 community as a whole has been impacted by burning, grazing and drainage, and many areas are also suffering from encroachment by abundant young *Betula* spp.

## 5.5 Dry Heaths

- 5.5.1 There are some substantial areas of dry heath in the southern part of the study area, particularly on higher, steeper and drier slopes to the east of the existing A9. The dry heath commonly forms mosaics and transitions with various mire, wet heath and grassland communities. The dry heath across most of the study area is dominated by *Calluna vulgaris*. Three recognised dry heath NVC communities have been identified within the Project 9 study area, as per below.

### H10 *Calluna vulgaris* – *Erica cinerea* heath

Communities/sub-communities recorded: H10, H10a, H10d

#### *Annex 1 – European dry heaths; SBL, CNPA – Upland heathland*

- 5.5.2 H10 *Calluna vulgaris* – *Erica cinerea* heath is a dry heath community that occurs widely throughout the more oceanic (western) parts of Scotland and around the east-central part of the Highlands. It is characteristic of acid to circumneutral and generally free-draining soils, and is typically dominated by *Calluna vulgaris*. *Erica cinerea* is another constant but is generally subordinate to *C. vulgaris*. H10 is commonly found in zonation and mosaics with grasslands, other heath types and mire communities (Rodwell *et al* 1991; Elkington *et al* 2001).
- 5.5.3 H10 is relatively sparse and fragmented within the study area, rarely forming larger homogenous stands. It is found mainly on shallow and dry soils on moderate to steep slopes, usually in mosaics with H12 heath or calcifugous grasslands. In some locations it is a secondary heath, for example having colonised cut slopes created during the original construction of the existing A9.
- 5.5.4 H10 was often mapped to community level only, but the majority of stands are floristically closest to the species-poor **H10a Typical sub-community**. In these areas *Calluna vulgaris* is the canopy dominant. *Erica cinerea* is also abundant and is co-dominant in places. These two species characterise the community and its canopy within the study area. More occasional within H10a

here are *Deschampsia flexuosa*, *Agrostis capillaris*, *Anthoxanthum odoratum*, *Vaccinium myrtillus*, *Carex binervis*, *Erica tetralix*, *Potentilla erecta* and *Galium saxatile*. The ground layer consists of pleurocarpous mosses and *Cladonia* spp. (lichens).

- 5.5.5 A few stands of the slightly more base-enriched **H10d *Thymus polytrichus* – *Carex pulicaris* sub-community** were also recorded in the study area. In these stands *Calluna vulgaris* and *Erica cinerea* continue to be prominent co-dominants, and are accompanied by frequent to occasional *Potentilla erecta*, *Thymus polytrichus*, *Festuca ovina*, *Deschampsia flexuosa*, *Deschampsia cespitosa*, *Anthoxanthum odoratum*, *Agrostis capillaris*, *Molinia caerulea*, *Viola riviniana*, *Succisa pratensis*, *Plantago lanceolata*, *Prunella vulgaris*, *Galium saxatile* and *Lotus corniculatus*. These H10d heaths are clearly grazed, as evident through the short vegetation and heavily poached ground with the substrate consequently exposed.

#### H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath

Communities/sub-communities recorded: H12, H12a, H12c

#### *Annex 1 – European dry heaths; SBL, CNPA – Upland heathland*

- 5.5.6 H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath is a common sub-shrub community of acidic to circumneutral, free-draining mineral soils throughout the cold and wet sub-montane zone, generally between 200m and 600m. H12 is generally dominated by *Calluna vulgaris* although the cover of this species can be open and degenerate. *Vaccinium myrtillus* is constant, though it is usually subordinate to *C. vulgaris*. The ground layer is generally characterised by bulky mosses (Rodwell *et al* 1991; Elkington *et al* 2001). H12 heaths are rather uniform and they cover extensive areas throughout large parts of Scotland.
- 5.5.7 H12 vegetation is the most common and widespread dry heath community within the study area. It forms large homogenous and continuous stands in the southern part of the study area (east of the A9), as well as forming many smaller stands and mosaics throughout Project 9. Within the study area the H12 vegetation consists of dense canopies of *C. vulgaris* with shoots of *V. myrtillus* where the former is not overly dominant. Herbs are usually inconspicuous below the canopy, and there is a dense carpet of pleurocarpous mosses including *Hylocomium splendens*, *Hypnum jutlandicum*, *Pleurozium schreberi* and *Rhytidiadelphus loreus*.
- 5.5.8 Two H12 sub-communities were identified during the surveys. The **H12a *Calluna vulgaris* sub-community** is by far the commonest, and is the typical form of dry heather moor that is managed for red grouse. It is characterised by a quite species-poor species assemblage. It is extensive along parts of Project 9, especially on slopes to the east of the A9. Here, the topography of mounds, ridges and slopes provides the appropriate free-draining conditions, with wet heath and blanket bog occupying the intervening depressions, flats and hollows.
- 5.5.9 The vegetation of a large proportion of the H12a consists of little more than *Calluna vulgaris* over a lawn of pleurocarpous mosses, with *Vaccinium myrtillus* and the other associates present only where the canopy is less dense or where burning has taken place. Where the *Calluna* canopy is less dense, *Erica cinerea* can become more frequent, as well as a number of other species that are otherwise rare beneath the *Calluna* canopy: for example *Arctostaphylos uva-ursi*, *Vaccinium vitis-idaea*, *Carex binervis*, *Galium saxatile*, *Polygala serpyllifolia* and *Potentilla erecta*. The moss layer is dominated by *Hylocomium splendens* and *Hypnum jutlandicum* with occasional *Plagiothecium undulatum*, *Pleurozium schreberi*, *Rhytidiadelphus loreus* and *R. triquetrus*. In places there are *Cladonia* spp. (lichens). Other infrequent associates include *Juncus squarrosus*, *Deschampsia flexuosa*, *Nardus stricta*, *Empetrum nigrum*, *Erica tetralix* and *Molinia caerulea* as

sparse plants. In many areas of H12a *Vaccinium myrtillus* is locally absent, the vegetation therefore resembling H9 *Calluna vulgaris* – *Deschampsia flexuosa* heath but with a more diverse assemblage of pleurocarpous mosses. This form of the H12 community is associated with grouse moor and management by burning; sheep may graze as well, albeit at a low density.

- 5.5.10 The **H12c *Galium saxatile* – *Festuca ovina* sub-community** was recorded rarely within the study area. In this sub-community, relatively high levels of grazing reduce the cover of the *Calluna vulgaris* canopy and the vegetation takes on a more grassy appearance. Elements of U4 and U5 calcifugous grasslands then become established. The *Calluna vulgaris* cover is variable within this sub-community but it is generally shorter (<25 cm) in places, depending upon the level of grazing. In open areas the grasses dominate, especially *Nardus stricta*, *Festuca ovina*, *Anthoxanthum odoratum*, *Deschampsia flexuosa*, *Agrostis capillaris* and *A. canina/vinealis*. The typical small herbs *Galium saxatile* and *Potentilla erecta* scramble throughout, benefitting from the reduced levels of shade from the *C. vulgaris*. This sub-community is associated with pastoral management.

#### H18 *Vaccinium myrtillus* – *Deschampsia flexuosa* heath

Communities recorded: H18

#### *Annex I – European dry heaths; SBL, CNPA – Upland heathland*

- 5.5.11 H18 *Vaccinium myrtillus* – *Deschampsia flexuosa* heath is typical of moist but free draining acid to neutral mineral soils, humic rankers and dry peats over steeper slopes at moderate to high altitudes (Rodwell *et al* 1991; Averis *et al* 2004). H18 includes moss-rich and grassy sub-shrub vegetation in which *V. myrtillus* is the most frequent and generally the most abundant ericoid (Rodwell *et al* 1991; Elkington *et al* 2001). H18 can be a near-natural heath or one that is clearly anthropogenic; H18 is common at lower altitudes as a derivative of H12 *Calluna vulgaris* – *Vaccinium myrtillus* heath where the H12 heaths have been burned and then grazed too hard to allow *Calluna vulgaris* to re-establish (Rodwell *et al* 1991; Averis *et al* 2004).
- 5.5.12 Only one very small area of H18 heath was recorded within the study area. This is in the most southerly section of the study area, to the west of the A9, in a mosaic with U4, U2 and H12 communities. In this area the localised grazing of H12 heath has resulted in conversion to H18 *Vaccinium* – *Deschampsia* heath. The vegetation here is species-poor and dominated by little more than *V. myrtillus* along with *D. flexuosa* and *Potentilla erecta* over a patchy moss layer containing *Rhytidiadelphus squarrosus*, *Hylocomium splendens* and *Pleurozium schreberi*. There is also a sparse growth of *Calluna vulgaris*, *Agrostis capillaris*, *Anthoxanthum odoratum* and *Galium saxatile*.

## 5.6 Calcifugous Grasslands and bracken-dominated vegetation

### U1 *Festuca ovina* – *Agrostis capillaris* – *Rumex acetosella* grassland

Sub-communities recorded: U1b

- 5.6.1 U1 is characteristic of thin, base-poor, oligotrophic and summer-parched soils. It is generally a lowland community but can extend as scattered patches into the uplands. It tends to have an open sward of small tussocky grasses among which there can be an abundance of dicotyledons. The sward usually contains *Agrostis capillaris*, *Aira praecox* and *Festuca ovina*, with frequent to

occasional *Rumex acetosella*. Grazing and disturbance are typically important contributory factors in maintaining the open structure of the vegetation (Rodwell *et al* 1992; Cooper, 1997).

- 5.6.2 U1 was recorded in four small stands within the study area, where it belongs to the **U1b Typical sub-community**. These are thin swards of vegetation on steep ground or on the tops of hummocks. Species here include *Agrostis capillaris*, *Pilosella officinarum*, *Plantago lanceolata*, *Rumex acetosella*, *Lotus corniculatus*, *Aira praecox* and *Koeleria macrantha*, with a little *Thymus polytrichus*.

#### U2 *Deschampsia flexuosa* grassland

Communities/sub-communities recorded: U2, U2a, U2b

- 5.6.3 This grassland is characteristic of base poor soils that are free draining but not parched and are sometimes quite moist. It occurs through the upland fringes and in moderately oceanic parts of the lowlands. The community is often seen in close association with some heaths and mires, and can grade into them. *Deschampsia flexuosa* grassland comprises swards in which often tussocky *D. flexuosa* is the obvious dominant with a number of sparse associates (Rodwell *et al* 1992). Many stands of U2 grassland have evidently been derived from some sort of disturbance in previous heath, mire or woodland, and the community often appears to be transitional post-disturbance vegetation (Averis *et al* 2004).
- 5.6.4 U2 is present within the study area as a number of relatively small stands, often in a mosaic with other calcifugous grasslands, or around dry heath. Both sub-communities occur within the study area, and *D. flexuosa* typically forms the dominant cover in both. The commonest sub-community here is the more graminoid-rich **U2a *Festuca ovina* – *Agrostis capillaris* sub-community**; here, the community dominant (*D. flexuosa*) is accompanied by other grasses including *Festuca ovina*, *Agrostis capillaris* and *Anthoxanthum odoratum*, as well as the herbs *Potentilla erecta* and *Galium saxatile*. In some places the moss *Rhytidiadelphus triquetrus* is common.
- 5.6.5 **U2b *Vaccinium myrtillus* sub-community** was recorded more rarely. This vegetation has a slightly heathy character. It includes a species-poor assemblage of abundant *D. flexuosa*, *Calluna vulgaris*, *Galium saxatile* and the moss *Hylocomium splendens*. There are also smaller amounts of *Vaccinium myrtillus*, *Agrostis capillaris*, *Festuca ovina*, *F. rubra*, *Anthoxanthum odoratum*, *Holcus lanatus*, *Deschampsia cespitosa*, *Hypnum jutlandicum* and *Pleurozium schreberi*.

#### U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland

Communities/sub-communities recorded: U4, U4a, U4b, U4c

*U4c only: Annex I – Species-rich *Nardus* grassland; SBL – Upland calcareous grassland; CNPA - Grasslands*

- 5.6.6 The U4 *Festuca ovina* - *Agrostis capillaris* - *Galium saxatile* grassland is a form of predominantly upland grassland of well-drained, acidic and base-poor mineral soils throughout the wet and cool regions of north-west Britain where it dominates extensive areas of pastureland (Rodwell *et al* 1992; Cooper 1997). Throughout this geographic range the community can often be found forming a distinctive component of larger mosaics of other grasslands, heaths, and mires.
- 5.6.7 U4 grassland is generally identified by the presence of an often close-cropped, grass-rich sward dominated by various combinations of *A. capillaris*, *F. ovina* and *Anthoxanthum odoratum*, with

*G. saxatile* and *Potentilla erecta* consistent associates. A well-developed moss layer is also characteristic, but in the U4b sub-community described below it may be limited by the dense, relatively productive sward of grasses.

- 5.6.8 U4 is widespread and extensive along the whole length of the study area; it is the most common grassland community here. It covers extensive lowland and semi-improved farmland areas that are enclosed for grazing, and smaller discrete patches in mosaics with upland fringe mire, heath and grassland communities. In the latter case the U4 grasslands often occupy the best-drained situations that are subject to grazing by sheep. Two sub-communities are widespread within the study area, as described below, with a third sub-community isolated to one small stand.
- 5.6.9 By far, the most common variant is the **U4b *Holcus lanatus* - *Trifolium repens* sub-community**, which is widespread within the study area, especially at lower altitudes and where there has been some agricultural improvement on more fertile and relatively deeper soils. This improvement is apparent from the relatively productive, broad-leaved grass sward including abundant *Holcus lanatus*. In season, the flowers of frequent to abundant *T. repens* serve as another point of distinction. Some U4b swards consist almost exclusively of *Holcus lanatus*. Other areas of U4b contain *H. lanatus* along with varying amounts of *Agrostis capillaris*, *Poa* spp., *Festuca rubra*, *F. ovina* and *Anthoxanthum odoratum*. *Trifolium repens* is frequent and abundant locally. Other associates include frequent to occasional *Cerastium fontanum*, *Cynosurus cristatus*, *Lolium perenne*, *Plantago lanceolata*, *Ranunculus repens*, *R. acris*, *Cirsium arvense*, *Veronica chamaedrys*, *Juncus effusus*, *Deschampsia cespitosa* and *Conopodium majus*. Valuable as pasture, this community is managed by relatively continuous grazing, although other treatments such as ploughing, re-seeding and fertiliser application may have been applied in the past to bring it into its 'semi-improved' condition. In areas where this grassland has been neglected, or ungrazed for a period of time, there can be some invasion by large tussock-forming grasses such as *Arrhenatherum elatius* and *Dactylis glomerata*, representing a transition towards MG1 *Arrhenatherum elatius* grassland.
- 5.6.10 The remainder of U4 within the study area is mainly the **U4a Typical sub-community**, which is relatively species-poor and has no distinguishing species. The sward can be thick with mosses, and *Galium saxatile* and *Potentilla erecta* are very common. Within the study area, U4a is generally associated with extensive grazing and smaller areas juxtaposed with other types of habitat. It is strongly associated with dry heath. Small patches of grassland amongst heath are usually referable to the U4a sub-community, which it is probably derived from heath through the influence of grazing. U4a also occurs on raised, free-draining, mineral mounds protruding through wet heath, blanket bog and other forms of mire.
- 5.6.11 In these U4a grasslands the main sward of *Agrostis capillaris*, *Festuca ovina* and *Anthoxanthum odoratum* is enriched in places by *Cynosurus cristatus*, *Nardus stricta* and *F. rubra* in association with a limited number of frequent to occasional associates. *Galium saxatile* and *Potentilla erecta* are consistent. The following species occur more rarely, though they may be locally frequent to occasional: *Taraxacum* spp., *Luzula campestris*, *L. multiflora*, *Viola riviniana*, *Veronica chamaedrys*, *Campanula rotundifolia*, *Carex panicea*, *C. pilulifera*, *Deschampsia flexuosa*, *Calluna vulgaris*, *Senecio jacobaea*, *Plantago lanceolata*, *Cerastium fontanum*, *Ranunculus acris*, *Rumex acetosella* and *R. acetosa*. Occasionally there are some sprigs of *Thymus polytrichus*, but not enough to classify the vegetation as CG10 *Festuca ovina* - *Agrostis capillaris* - *Thymus polytrichus* grassland (see section 5.8.1). Where the cover of vascular species is open, there is a patchy distribution of pleurocarpous mosses, especially *Rhytidiadelphus squarrosus* but also other species such as *Brachythecium rutabulum*, *Hylocomium splendens*, *Kindbergia praelonga* and *Pleurozium schreberi*. Moderate to high levels of grazing are responsible for the maintenance of this sub-community, whose derivation from dry heath is apparent in places due to its close

juxtaposition with heath as well as the localised persistence of close-cropped, spindly heather within the U4a.

- 5.6.12 A single small stand of U4 more closely resembling **U4c *Lathyrus linifolius* – *Stachys betonica* sub-community** was recorded where the grassland flora suggests a slight calcareous influence. This U4c grassland is on the edge of the study area to the north of the A9, by Creagan Breugach, east of Nuide Farm. In this stand, the community constants (*A. capillaris*, *F. ovina* and *A. odoratum*) are joined by a more species-rich flora, including occasional *Galium verum* and *Lathyrus linifolius*.

#### U5 *Nardus stricta* – *Galium saxatile* grassland

Communities/sub-communities recorded: U5, U5a

- 5.6.13 U5 grassland tends to be found on damp mineral soils which have peaty upper horizons. It typically occupies slopes where the depth and wetness of the soil are intermediate between those of the drier podzols under U4 grasslands and wet shallow peats found under U6 grassland. The underlying rock can be anything from acid to basic, but the soils are generally acidic (Rodwell *et al* 1992; Averis *et al* 2004). U5 is common on the higher hill slopes of the cool, wet north and west of Britain (Rodwell *et al* 1992; Cooper, 1997). U5 is also commonly found on well-drained but moist alluvial soil along the margins of streams (Averis *et al* 2004).
- 5.6.14 The sward of the U5 community is dominated by *Nardus stricta* in association with the same main species as listed above for U4, albeit at a lower cover. The prominence of *N. stricta* defines U5 and the appearance of additional species defines some of the sub-communities.
- 5.6.15 Given the generally more improved and more lowland setting of much of the Project 9 study area, U5 is not common here. It does not form the large stands that are seen further south along Projects 7 and 8. Instead, within the study area, U5 occurs mainly as small stands in mosaics with other grasslands and heaths around the upland fringes; these areas are clustered in the southern sections of the study area.
- 5.6.16 Often recorded to community level, most stands took the form of a single sub-community, the **U5a Species-poor sub-community**. U5a lacks any of the species distinctive to the other sub-communities and is readily identified on this basis alone. The sward is largely dominated by *Nardus stricta* and its litter, and the sub-community is visible from a distance on the basis of its light appearance. *Galium saxatile* is typically abundant. Other species locally frequent or occasional include *Agrostis capillaris*, *Anthoxanthum odoratum*, *Festuca ovina*, *F. vivipara*, *Holcus lanatus*, *Calluna vulgaris*, *Erica tetralix*, *Potentilla erecta*, *Carex panicea* and *Veronica chamaedrys*. Mosses such as *Hypnum jutlandicum*, *Rhytidiadelphus squarrosus* and *Pleurozium schreberi* are common in places. The U5a sub-community is a low productivity vegetation type; this, combined with the dominance of the unpalatable *Nardus stricta*, means that grazing of the community is limited.

#### U20 *Pteridium aquilinum* – *Galium saxatile* community

Communities/sub-communities recorded: U20, U20a, U20b, U20c

- 5.6.17 The U20 *Pteridium aquilinum* – *Galium saxatile* community occurs on well aerated and often moist soils which are base-poor to circumneutral (Rodwell *et al* 1992; Cooper, 1997). *Pteridium aquilinum* is the sole dominant and is overwhelmingly abundant in some stands. This is a community of little ecological value.

- 5.6.18 U20 occurs as scattered stands within the study area, usually in mosaics with other grasslands (particularly U4) and often within and around clearings in woodland (e.g. W11); it does not form large extensive stands along Project 9. All three sub-communities are represented within the study area. The commonest sub-community here is the more grass-rich **U20a Anthoxanthum odoratum sub-community**, in which *P. aquilinum* dominates but is generally associated with a field layer of grassland floristically similar to the U4 community. *Holcus lanatus* is usually the most abundant grass in these stands, but is accompanied by variable amounts of *Agrostis capillaris*, *Festuca ovina*, *Anthoxanthum odoratum*, *Galium saxatile*, *Potentilla erecta* and *Rumex acetosa*.
- 5.6.19 Some stands of the more heath-like **U20b Vaccinium myrtillus – Dicranum scoparium sub-community** were recorded where there are some ericoids growing with the *Pteridium aquilinum*. More often though, these areas of U20b were more recognisable from their higher cover of mosses including *Rhytidiadelphus squarrosus*, *Pleurozium schreberi*, *Dicranum scoparium*, *Hylocomium splendens*, *Hypnum jutlandicum* and *Pseudoscleropodium purum*.
- 5.6.20 A few stands of the **U20c Species-poor sub-community** were also recorded. *P. aquilinum* is the overwhelming dominant here, with plants below the *P. aquilinum* canopy shaded out or covered by frond litter. Only occasional associates from U20a and U20b are found within the areas of U20c.

## 5.7 Mesotrophic Grasslands

### MG1 Arrhenatherum elatius grassland

Communities/sub-communities recorded: MG1, MG1a, MG1b

- 5.7.1 MG1 is essentially ungrazed grassland in which coarse-leaved tussock grasses are dominant in the sward. It is found on circumneutral and free draining soils throughout the British lowlands. Key to its development is the irregularity or absence of grazing (Rodwell *et al* 1992).
- 5.7.2 MG1 is widely scattered throughout the study area, in usually small stands. It occurs as strips or patches around arable or improved field margins, along road sides, road embankments, and track and cycle track verges (or in close proximity to them), particularly those that have been neglected and unmown. There are also two larger stands where pasture appears to have been ungrazed for a long time. Much of the MG1 is in mosaics with other grasslands such as unmanaged U4b, and rank weedy vegetation such as OV24 and OV27. In places, its transition with U4b probably represents U4b developing into MG1 as a result of the cessation of grazing.
- 5.7.3 MG1 was generally mapped at the community level, but some stands were assigned a sub-community. Two specific sub-communities were noted: **MG1a Festuca rubra sub-community** and **MG1b Urtica dioica sub-community**.
- 5.7.4 Although species-richness and particular species abundances vary from stand to stand, as a whole, MG1 vegetation within the study area mainly consists of dominant to abundant *Arrhenatherum elatius*, *Dactylis glomerata* and *Holcus lanatus*. Other species occasional to frequent here include *Festuca rubra*, *Heracleum sphondylium*, *Achillea millefolium*, *Deschampsia cespitosa*, *Urtica dioica*, *Cirsium arvense*, *Lathyrus pratensis*, *Anthriscus sylvestris*, *Filipendula ulmaria*, *Rumex obtusifolius*, *R. acetosa*, *Agrostis capillaris*, *Anthoxanthum odoratum*, *Valeriana officinalis*, *Veronica chamaedrys*, *Ranunculus repens* and *Centaurea nigra*.

### MG6 *Lolium perenne* – *Cynosurus cristatus* grassland

Communities/sub-communities recorded: MG6, MG6b

- 5.7.5 MG6 is the major permanent pasture type on moist but freely draining circumneutral brown soils in lowland Britain, and is often found in enclosed stands. It has usually been subjected to some form of improvement such as fertiliser application and drainage, and many stands have been derived from historical ploughing and re-seeding (Rodwell *et al* 1992).
- 5.7.6 Fields of MG6 grassland, including one example of the **MG6b *Anthoxanthum odoratum* sub-community**, are common within the study area as enclosed fields bordering the route of the A9. These fields are managed for agriculture, being used for hay/ silage or livestock grazing, and probably improved with periodic fertiliser applications. The vegetation is dominated by a sward of *Lolium perenne*, with *Cynosurus cristatus*, *Holcus lanatus* and *Phleum pratense* frequent in some fields. Other occasional associates include *Anthoxanthum odoratum*, *Poa annua*, *Juncus effusus*, *Ranunculus* spp., *Plantago lanceolata*, *Trifolium repens*, *Cirsium arvense* and *Bellis perennis*.
- 5.7.7 In some places, *Holcus lanatus* attains such local abundance that the community grades into the U4b *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland *Holcus lanatus* - *Trifolium repens* sub-community. The MG6 community is maintained by agricultural practices and intensive grazing.

### MG7 *Lolium perenne* leys and related grasslands

Communities/sub-communities recorded: MG7, MG7b

- 5.7.8 MG7 *Lolium perenne* leys and related grasslands are species-poor, grass dominated swards characterised by the abundance of *L. perenne* and other specifically selected grasses. This community is a distinctive one of intensive grassland treatment, including the frequent addition of fertilisers (Rodwell *et al* 1992; Cooper, 1997). Grasslands of this type are often specifically sown as high productivity swards for intensive agricultural use, such as for hay or silage.
- 5.7.9 In the study area, MG7 occurs as improved agricultural fields, and appears to be primarily used for hay/silage. These fields have an even more artificially improved character than the similar MG6 *Lolium perenne* – *Cynosurus cristatus* grasslands described above. The vegetation was generally recorded to community level, but some stands were classified as **MG7b *Lolium perenne* – *Poa trivialis* leys**. As is typical for this community, the vegetation is almost completely dominated by a sward of *Lolium perenne*. The only associates found to be at least locally frequent are *Poa pratensis*, *Bromus hordeaceus*, *Trifolium repens* and *Bellis perennis*. Other associates are occasional and include *Poa annua*, *P. trivialis*, *Holcus lanatus*, *Agrostis capillaris*, *Dactylis glomerata*, *Cerastium fontanum*, *Prunella vulgaris*, *Myosotis arvensis* and *Stellaria media*. Some stands contain a few more weed species, with occasional *Rumex obtusifolius*, *Senecio jacobaea*, *Matricaria discoidea*, *Cirsium arvense* and *Urtica dioica*. This community is maintained by agriculture.

### MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland

Communities recorded: MG9, MG9a, MG9b

*GWDTE Status – Moderate; CNPA – Wet grasslands*

- 5.7.10 MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland is highly characteristic of permanently moist, gleyed and periodically inundated circumneutral soils across large areas of the British lowlands. It can exist on level to moderately sloping ground in areas of pasture or meadow, but can also be found along woodland rides and fen/wetland margins. MG9 usually contains a coarse and tussocky sward dominated by *D. cespitosa* (Rodwell *et al* 1992; Cooper, 1997).
- 5.7.11 MG9 is present as frequent small stands in and around wetter parts of the study area; it is mostly in mosaics with MG10 and M23 *Juncus* spp. dominated vegetation and is often grazed by livestock. Although both MG9 sub-communities were recorded within the study area, **MG9a *Poa trivialis* sub-community** is the more common type; **MG9b *Arrhenatherum elatius* sub-community** forms only small patches.
- 5.7.12 The vegetation of both sub-communities is dominated by *Deschampsia cespitosa*, and *Holcus lanatus* is locally abundant between the tussocks. Other species are occasional to locally frequent: these include *Poa trivialis*, *Arrhenatherum elatius*, *Dactylis glomerata*, *Filipendula ulmaria*, *Juncus effusus*, *J. acutiflorus*, *Rumex acetosa*, *Cirsium palustre*, *Ranunculus acris*, *R. repens* and *Cardamine pratensis*.

### MG10 *Holcus lanatus* – *Juncus effusus* rush-pasture

Communities/sub-communities recorded: MG10, MG10a

*GWDTE Status – Moderate; CNPA – Wet grasslands*

- 5.7.13 MG10 is a form of rush-pasture characteristic of areas with strongly impeded drainage over a wide range of usually acid to neutral mineral soils on level to gently sloping ground (Rodwell *et al* 1992; Cooper, 1997). This community requires consistently high soil moisture (Rodwell *et al* 1992). It occurs across most of the British lowlands, with the typical sub-community being particularly prominent towards the north and west. Although found on various soil types including brown earth and calcareous earth throughout its range, this habitat can also have close associations with various types of mire vegetation and can form significant parts of rush-dominated mire mosaics in areas of suitably moist soils.
- 5.7.14 MG10 is characterised by an assemblage in which tussocks of *Juncus effusus* are present in species-poor swards of *Holcus lanatus*, *Agrostis stolonifera*, *Poa trivialis* and forbs including *Ranunculus acris*, *R. repens*, *Rumex acetosa*, *Cardamine pratensis* and *Trifolium repens*. Mosses such as *Brachythecium rutabulum*, *Calliergonella cuspidata*, *Kindbergia praelonga* and *Rhytidiadelphus squarrosus* often form diffuse wefts over the damp soil and among the larger plants (Rodwell *et al* 1992; Cooper, 1997).
- 5.7.15 MG10 forms widespread small stands within the study area, mostly within wetter hollows, flow lines and poorly drained parts of agricultural fields where *Juncus effusus* has taken over (e.g. within U4b, MG6 and MG7 grasslands). It is also often present in mosaics with other wet grasslands (MG9), *Juncus* spp. mires (M6 and M23), and occasionally around the drying edges of swamps and fens.

- 5.7.16 The vegetation within the study area is referable to the **MG10a Typical sub-community**. This reflects both the species-poor nature of the vegetation as well as absence of the species characteristic of the other sub-communities (i.e. no *Juncus inflexus* or *Iris pseudacorus*). The vegetation is typically dominated by dense tussocks of *J. effusus*, with frequent to occasional *H. lanatus* and tussocks of *Deschampsia cespitosa* and the typical species already listed for the community as a whole. Other occasional associates include *Juncus acutiflorus*, *Filipendula ulmaria* and *Veronica chamaedrys*. The sward throughout the study area is generally species-poor. Rarely, *Juncus acutiflorus* is as abundant as *J. effusus* (noting that the associated species assemblages in these places are similar to those in *J. effusus*-dominated MG10a and very unlike those in M6d and M23a *J. acutiflorus*-dominated mires).

MG11 *Festuca rubra* – *Agrostis stolonifera* – *Potentilla anserina* grassland

Sub-communities recorded: MG11a

*GWDTE Status* – Moderate; *CNPA* – Wet grasslands

- 5.7.17 MG11 is a varied grassland type which includes generally species-poor, open and closed swards. *Agrostis stolonifera* together with *Festuca rubra* and/or *Potentilla anserina* are usually the most abundant species. The cover of *P. anserina* is very variable and occasionally it may dominate. MG11 is characteristic of a wide variety of moist but free-draining circumneutral soils which are in many cases frequently inundated with water (Rodwell *et al* 1992; Cooper, 1997). It is predominately a lowland vegetation type.
- 5.7.18 Only one very small area of MG11 was recorded within the study area; this is of the **MG11a *Lolium perenne* sub-community**. This occupies a small damp patch of grassland by a gate, where *Potentilla anserina* dominates the vegetation, within a wider area of improved MG7 grassland.

## 5.8 Calcareous Grasslands

CG10 *Festuca ovina* – *Agrostis capillaris* – *Thymus polytrichus* grassland

Sub-communities recorded: CG10a

*GWDTE Status* – High; *Annex I* – Species-rich *Nardus* grassland; *SBL* – Upland calcareous grassland; *CNPA* – Grasslands

- 5.8.1 CG10 is a sub-montane community of base-rich and often moist brown earths which have developed over a wide variety of calcareous bedrocks and coarse-textured superficial deposits. The soils have a moderately calcareous superficial pH of 5-7. The community can be found up to 750m in altitude, and is generally restricted to areas of cool, moist and cloudy climatic conditions in the uplands. The grassland is typically a plagioclimax vegetation maintained by grazing (usually sheep) (Rodwell *et al* 1992; Cooper, 1997).
- 5.8.2 CG10 generally occurs as swards close-cropped by grazing, and dominated by *Agrostis capillaris* and *Festuca ovina*. Other graminoids occur, some of these indicating particular sub-communities. Of the dicotyledons the commonest species is *Thymus polytrichus*, which is abundant (Rodwell *et al* 1992; Cooper, 1997).
- 5.8.3 CG10 occurs locally within the study area, mostly as small patches of vegetation on thin rocky soils or among rock outcrops. The majority of this CG10 is closely associated with U4 grassland,

both communities often grading into each other in mosaics. In the study area, both these communities share a similar assemblage of species, the separation between them depending largely on the relative abundances of *Thymus polytrichus* (more common in CG10) and *Galium saxatile* (more common in U4). The CG10 grassland in the study area is referable to the **CG10a *Trifolium repens* – *Luzula campestris* sub-community**. It is characterised by a sward of abundant *Agrostis capillaris*, *Festuca ovina* and *Anthoxanthum odoratum*. *Galium saxatile* and *Potentilla erecta* are also frequent (*G. saxatile* sparser than *T. polytrichus*), along with occasional species as listed for U4 above (particularly U4a). *Rhytidiadelphus squarrosus* is the most common moss.

## 5.9 Swamps and Tall-Herb Fens

### S4 *Phragmites australis* swamp and reed-beds

Sub-communities recorded: S4a

*SBL – Reedbeds; CNPA – Wetlands*

5.9.1 S4 is found in a wide range of permanently wet or periodically waterlogged habitats of differing trophic states and with a variety of substrates. Stands are common in open water transitions around lakes and ponds, in floodplain mires and in estuaries, along dykes, canals and slow-flowing lowland rivers, in small pools, peat cuttings and on salt marshes. The community is usually very species-poor with the vegetation overwhelmingly dominated by *Phragmites australis*; no other species attains even occasional frequency throughout (Rodwell *et al* 1995).

5.9.2 A few stands of S4 (specifically the **S4a *Phragmites australis* sub-community**) occur within fen complexes around the Insh Marshes. Here, the S4 vegetation is completely dominated by *Phragmites australis* with only occasional associates from adjacent mire and fen communities.

### S9 *Carex rostrata* swamp

Communities/sub-communities recorded: S9, S9a, S9b

*SBL – Lowland fens; CNPA – Wetlands*

5.9.3 S9 swamp is generally a community of the north and west of Britain. The vegetation is typically a swamp of shallow to moderately deep, mesotrophic to oligotrophic standing waters with organic substrates. It also occurs more fragmentarily in peat cuttings (Rodwell *et al* 1995). The S9 community is readily recognised by the tall, dense growth of *Carex rostrata* rooted in shallow water. Separation from other communities in which *C. rostrata* is present is based on its almost exclusive dominance in this community and the low cover and diversity of associates.

5.9.4 S9 is common and widespread throughout the study area, from small marginal stands around wet hollows and pools to larger stands in marshes and around waterbodies and rivers. Both sub-communities (**S9a *Carex rostrata* sub-community** and **S9b *Menyanthes trifoliata* - *Equisetum fluviatile* sub-community**) occur here.

5.9.5 The dominance of *Carex rostrata* and absence or extremely low cover and number of associates makes the S9a sub-community easy to identify. S9a within the study area is typically species-poor, with some stands consisting solely of *C. rostrata*. Where associates occur in S9a, they tend to be rare occurrences of the additional species characteristic of S9b. Within areas of S9b, *C. rostrata* continues to dominate the vegetation and is accompanied by frequent to occasional

*Equisetum fluviatile*, *Menyanthes trifoliata*, *Potentilla palustris*, *Potamogeton polygonifolius*, *Ranunculus flammula*, *Carex nigra*, *Juncus effusus*, *Myosotis* sp., and *Eleocharis palustris*.

- 5.9.6 S9 is common here in mosaics with other similar swamp and mire communities, especially S10, S11, S19, M5 and M23. In some areas, transitions can be seen between S9 and these communities. For example, transitions were noted between S9 and M5, where species more typical of M5 encroach into the margins of S9, indicated by the presence of species such as *Sphagnum squarrosum*, *S. teres*, *S. denticulatum*, *S. palustre*, *Calliergonella cuspidata* and *Carex echinata*.

#### S10 *Equisetum fluviatile* swamp

Communities/sub-communities recorded: S10, S10a, S10b

*SBL – Lowland fens; CNPA – Wetlands*

- 5.9.7 S10 occurs in similar situations to S9 (see **paragraph 5.9.3**), being found in shallow to moderately deep, eutrophic to oligotrophic, standing waters in both lowland and upland lakes and pools. This community consists of open or closed vegetation up to around 50 cm tall, in which *Equisetum fluviatile* is the most abundant species. No other species is frequent throughout, although in each sub-community some of the associates may be locally abundant (Rodwell *et al* 1995).
- 5.9.8 S10 was recorded frequently in relatively small stands in marshy areas and around pools and waterbody margins throughout the study area. Both the **S10a *Equisetum fluviatile* sub-community** and **S10b *Carex rostrata* sub-community** are present, commonly in mosaics with each other as well as with other swamp communities and wet *Juncus* spp. pastures.
- 5.9.9 S10a swamps here typically consist almost exclusively of *Equisetum fluviatile*, but with frequent *Menyanthes trifoliata* where there is more open water, and occasional *Carex rostrata*. The S10b sub-community is more species-rich, although it is still dominated by *E. fluviatile*; it appears to have developed on more consolidated substrates than those with S10a. In addition to *E. fluviatile*, these S10b swamps have frequent to abundant *Carex rostrata*, *Filipendula ulmaria* and *Calliergonella cuspidata*, and occasional *Menyanthes trifoliata*, *Valeriana officinalis*, *Potentilla palustris*, *P. erecta*, *Galium palustre*, *Juncus acutiflorus*, *Brachythecium rivulare*, *Campylium stellatum* and *Calliergon giganteum*. In some stands of S10b there is also occasional to rare *Dactylorhiza purpurella*, *Pedicularis palustris*, *Scutellaria galericulata*, *Carex echinata* and *Potamogeton polygonifolius*.

#### S11 *Carex vesicaria* swamp

Sub-communities recorded: S11a

*GWDE Status – High; SBL – Lowland fens; CNPA – Wetlands*

- 5.9.10 The S11 community occurs in open-water transitions on mesotrophic inorganic or peaty substrates around lakes and in slow-moving or standing waters of streams and dykes. This community is usually dominated by *Carex vesicaria*. *C. vesicaria* forms an open or closed cover in which there is often some emergent *Equisetum fluviatile* and some scrambling *Galium palustre*; *Juncus effusus* can sometimes also be abundant. Few other species are frequent within the community (Rodwell *et al* 1995).

- 5.9.11 S11 is uncommon within the study area. One small stand was recorded around Milton of Nuide, and all other remaining stands are on an expanse of wet rush pasture and marshy ground extending from the remains of Ruthven Barracks, east of the A9, northwards to the River Spey at Ballochbuie Island. All stands are of the **S11a *Carex vesicaria* sub-community**, where *C. vesicaria* is virtually the sole dominant. The community is generally in mosaics with other wet communities, primarily S9 swamp and M23 *Juncus* spp. pasture.

#### S19 *Eleocharis palustris* swamp

Communities/sub-communities recorded: S19, S19a

*SBL – Lowland fens; CNPA – Wetlands*

- 5.9.12 S19 is a swamp of standing or running waters up to 50 cm deep, occurring around large lakes and small ponds and along stream margins (Rodwell *et al* 1995). S19 is easily identified by the dominance of *Eleocharis palustris* rooted in shallow water.

- 5.9.13 This community was recorded a number of times in small isolated pools within farmland or within the margins of standing water bodies such as Lochan an Tairbh and the numerous unnamed small waterbodies around Milton of Nuide. The community generally takes the form of the **S19a *Eleocharis palustris* sub-community** due to the sole dominance of *E. palustris* and the absence of any associates. This sub-community is confined here to marginal areas of open water, so its total extent within the study area is only small.

#### S22 *Glyceria fluitans* water-margin vegetation

Sub-communities recorded: S22a

*SBL – Lowland fens; CNPA – Wetlands*

- 5.9.14 The S22 community is characteristic of shallow, standing or sluggish, mesotrophic waters and fine mineral substrates, and is commonly found around ponds and wet depressions in fens and pastures and on the margins of small dykes and streams. This community is characterised by a dominant low mat or floating carpet of *Glyceria fluitans*. No other species reaches even occasional frequency throughout, but the most usual associates are plants of shallow water margins. The *Glyceria* sub-community (S22a) includes stands where a quaking raft of *G. fluitans* extends out into small areas of sometimes deeper open water in fens (Rodwell *et al* 1995).

- 5.9.15 Three areas of the **S22a *Glyceria fluitans* sub-community** were recorded within the study area as marginal vegetation in shallow standing waters by Milton of Nuide. These areas consisted of pure stands of *Glyceria fluitans*.

## 5.10 Aquatic Communities

### A24 *Juncus bulbosus* community

Communities recorded: A24

- 5.10.2 A24 is characteristic of shallow standing waters that are base-poor, oligotrophic and often peaty. It occurs widely in the sheltered parts of lakes and small pools, and is most common through the north and west of Britain. *Juncus bulbosus* is the most prominent feature of the vegetation, and

it can be found along with a number of distinctive associates, although some stands can have little else other than *J. bulbosus* (Rodwell *et al* 1995).

- 5.10.3 Three stands of this community were recorded in shallow standing water ponds by Milton of Nuide (centred around co-ordinates 273300, 798100). The vegetation here is characterised by dominant *Juncus bulbosus*.

## 5.11 Vegetation of Open Habitats

### OV24 *Urtica dioica* – *Galium aparine* community

Communities recorded: OV24

- 5.11.1 OV24 is a tall-herb weed community which occurs widely throughout lowland Britain; under suitable conditions it is also found in the upland fringes. It typically occurs on disturbed, nutrient-rich soils and is frequently found around dumps of rich soil, dung or farm waste, in neglected gardens and around abandoned buildings, on waste land, and on disturbed verges and tracks (Rodwell *et al* 2000).
- 5.11.2 Within the study area there are some small areas of OV24, usually found on disturbed or nutrient enriched lowland ground, or by tracks. The vegetation is dominated by the characteristic species, *Urtica dioica* and *Galium aparine*, with occasional *Chamerion angustifolium*.

### OV25 *Urtica dioica* – *Cirsium arvense* community

Communities/sub-communities recorded: OV25, OV25a

- 5.11.3 OV25 is a tall-herb weed community. It is found throughout lowland Britain, on disturbed, nutrient-rich soils, usually where there are patches of bare or lightly covered ground in which *Cirsium* spp. can establish themselves. It is typically found in poorly managed meadows, on abandoned arable land or waste land, on disturbed verges and tracks, and in cleared woodland or young plantations (Rodwell *et al* 2000).
- 5.11.4 OV25 was frequently recorded as small stands within the study area; primarily along roadsides, as patches of vegetation within intensively grazed grassland areas (mainly U4, MG6 and MG7) that showed signs of localised ground enrichment, or around arable fields. The vegetation was mainly recorded to community level, but some stands were mapped as the **OV25a *Holcus lanatus* – *Poa annua* sub-community**. The OV25 vegetation within the study area is rather species-poor and typically has abundant *Urtica dioica*, *Cirsium arvense*, *Holcus lanatus*, *Poa* spp. and *Rumex obtusifolius*. Occasionally there is also *Ranunculus repens*, *Dactylis glomerata*, *Trifolium repens* and (where adjacent to hedgerows) *Rubus fruticosus*.

### OV27 *Chamerion angustifolium* community

- 5.11.5 OV27 *Chamerion angustifolium* tall-herb vegetation is a community that generally occurs on damp, fertile disturbed soils in woodlands, on heaths and along road verges and railway embankments (Rodwell *et al* 2000). It is also common in regenerating conifer plantation clear-fell areas. The OV27 community is marked by the dominant tall growth of *C. angustifolium*.
- 5.11.6 Within the study area such stands of *C. angustifolium* are frequent in close proximity to the A9 and subsidiary roads, and along railway embankments. These patches of OV27 occur in association with a variety of other vegetation types, but especially grasslands such as MG1 and U4b, and some woodlands. No distinctive associates are present because the tall growth of *C.*

*angustifolium* suppresses the underlying vegetation. Such stands are therefore mapped at the level of the community.

#### OV28 *Agrostis stolonifera* - *Ranunculus repens* community

##### Sub-communities recorded: OV28a

- 5.11.7 OV28 is one of the open communities typical of periodically inundated habitats. A mat of stolons and runners of *Agrostis stolonifera* and *Ranunculus repens* is a characteristic consistent feature of this type of vegetation. OV28 is a community of damp silts and clays on river islands and banks, in and around sluggish streams, drainage ditches and seasonally inundated hollows in poorly drained pastures, arable fields and river floodplains, and on waterlogged made ground (Rodwell *et al* 2000). The two sub-communities are typical of different situations within this range of habitats. The OV28a sub-community is usually found in wetter places, where water levels fall later in spring or remain on the surface; for example on river shoals, around drains and streams and in more or less permanently wet hollows. OV28b is more typical of depressions in pastures, amongst dumped soil and along trackways where the ground is wet in winter (Rodwell *et al* 2000).
- 5.11.8 One patch of herb-rich OV28 was mapped within the study area, and this belongs to the **OV28a *Polygonum hydropiper* – *Rorippa sylvestris* sub-community**. The vegetation occupies a silty low level and flat bank directly adjacent the River Spey, just upstream of the A9-Spey bridge crossing by Kingussie. At this location, the community is subject to frequent inundation.
- 5.11.9 The vegetation in this area is dominated by *Ranunculus repens*, with abundant to frequent *Myosotis scorpioides* and *Veronica montana*. *Juncus effusus*, *Potentilla anserina* and *Rumex obtusifolius* are occasional.

## 5.12 Non-NVC Communities & Categories

- 5.12.1 A number of non-NVC vegetation types or features were mapped during the survey. These were classified as follows, with codes given in parentheses:
- *Carex lasiocarpa* swamp (CL)
  - Conifer plantation (CP)
  - Mixed plantation (MP)
  - Broadleaved plantation (BP)
  - Bare ground (BG)
  - Buildings and associated driveways and private gardens (BD)
  - Arable (AR)
  - Quarry (QY)
  - Scattered wood/scrub/shrubs (SWS)
  - Running water (RW)
  - Standing water (SW)
- 5.12.2 The plantation areas were generally unremarkable in terms of their flora and species composition, but in a few cases a community could be assigned based on the composition of the

field layer flora (as described above). In more mature plantations, coniferous ones in particular, there is often no ground flora except for some scattered mosses; the ground instead is blanketed in woody debris and conifer needles. Younger plantations generally have a grassy understorey, most often resembling that of the U4 grassland community. These woodland plantation areas, along with areas of bare ground, quarry, arable fields, and buildings with associated gardens are floristically poor and of negligible botanical importance.

5.12.3 Occasionally there are small areas of scattered trees (such as young *Betula* spp. and *Salix* spp.) and shrubs that together do not align to any NVC community. For example, these areas often account for small scrub invasion and encroachment into heath. All of these non-NVC types recorded in the study area are of minor botanical importance and are therefore not discussed further within this report.

5.12.4 The other bulleted non-NVC vegetation type recorded above, CL, is described in below.

*Carex lasiocarpa* swamp community (CL)

5.12.5 One patch of *Carex lasiocarpa* swamp vegetation was identified in the margins of the surface water body Lochan an Tairbh, located just to the north of the A9 carriageway at coordinates 274945 799080. Here, in the shallow water, *C. lasiocarpa* dominates a stretch of the marginal vegetation, and forms a single species stand with no other associates. The remainder of the margins of Lochan an Tairbh contains a mixture of the swamp communities S9, S10 and S19.

5.12.6 As with similar swamp NVC communities, this *C. lasiocarpa* swamp is not a GWDTE habitat. However, it should be considered as SBL lowland fen and CNPA wetland, in line with the other swamp communities in the Project 9 study area (see **section 5.9**).

## 6 Evaluation of Botanical Interest

### 6.1 Overview

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

- SEPA guidance on GWDTE
- Habitats Directive (92/43/EEC) Annex I habitats
- Scottish Biodiversity List (SBL) priority habitats
- Cairngorms National Park Authority (CNPA) priority habitats

6.1.2 A summary table of all NVC communities recorded and any respective sensitivity is then given.

### 6.2 Groundwater Dependent Terrestrial Ecosystems (GWDTE)

6.2.1 SEPA has classified a number of NVC communities as potentially dependent on groundwater (SEPA, 2014a, 2014b). Wetlands or habitats containing these particular NVC communities are to be considered GWDTE unless further information can be provided to demonstrate this is not the case. Many of the NVC communities on the list are very common habitat types across Scotland, and some are otherwise of low ecological value. Furthermore, some of the NVC communities may be considered GWDTE only in certain hydrogeological settings. Using SEPA's (2014a, 2014b) guidance, **Table 12.3.2** shows which communities recorded within the study area may be considered GWDTE. Those communities which may have limited (moderate) dependency on groundwater in certain settings are marked in yellow and NVC communities recorded that are likely to be considered high, or sensitive GWDTE in certain hydrogeological settings are highlighted in red.

Table 12.3.2: Communities within the study area which, depending on hydrogeological setting, may potentially be classified as GWDTE (yellow = moderately groundwater dependent and red = highly groundwater dependent).

NVC Code	NVC Community Name
W3	<i>Salix pentandra</i> – <i>Carex rostrata</i> woodland
W5	<i>Alnus glutinosa</i> – <i>Carex paniculata</i> woodland
W6	<i>Alnus glutinosa</i> – <i>Urtica dioica</i> woodland
M15	<i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath
M25	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire
M27	<i>Filipendula ulmaria</i> – <i>Angelica sylvestris</i> mire
MG9	<i>Holcus lanatus</i> – <i>Deschampsia cespitosa</i> grassland
MG10	<i>Holcus lanatus</i> – <i>Juncus effusus</i> rush pasture
MG11	<i>Festuca rubra</i> – <i>Agrostis stolonifera</i> – <i>Potentilla anserina</i> grassland
W4	<i>Betula pubescens</i> – <i>Molinia caerulea</i> woodland
W7	<i>Alnus glutinosa</i> – <i>Fraxinus excelsior</i> – <i>Lysimachia nemoreum</i> woodland
M5	<i>Carex rostrata</i> – <i>Sphagnum squarrosum</i> mire
M6	<i>Carex echinata</i> – <i>Sphagnum fallax/denticulatum</i> mire

NVC Code	NVC Community Name
M10	<i>Carex dioica</i> - <i>Pinguicula vulgaris</i> mire
M23	<i>Juncus effusus/acutiflorus</i> – <i>Galium palustre</i> rush pasture
CG10	<i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Thymus polytrichus</i> grassland
S11	<i>Carex vesicaria</i> swamp

- 6.2.2 The location and extent of all identified potential GWDTE are shown in **Drawings 10.23 to 10.34** in **Volume 3**.
- 6.2.3 Potential GWDTE sensitivity of each polygon containing a potential GWDTE is classified on a four-tier approach as follows:
- ‘Highly – dominant’ where potential high GWDTE(s) dominate the polygon
  - ‘Highly - sub-dominant’ where potential high GWDTE(s) make up a sub-dominant percentage cover of the polygon
  - ‘Moderately – dominant’ where potential moderate GWDTE(s) dominate the polygon and no potential high GWDTEs are present
  - ‘Moderately - sub-dominant’ where potential moderate GWDTE(s) make up a sub-dominant percentage cover of the polygon and no potential high GWDTEs are present.
- 6.2.4 Where a potential high GWDTE exists in a polygon it outranks any potential moderate GWDTE communities within that same polygon.
- 6.2.5 The above GWDTE sensitivity has been assigned solely on the SEPA listings (SEPA, 2014a, 2014b). However, depending on a number of factors such as geology, superficial geology, presence of peat and topography, many of the potential GWDTE communities recorded may in fact be only partially groundwater fed or not dependent on groundwater. Determining the actual groundwater dependency of particular areas or habitat will require further assessment, which is presented in **Appendix 10.2** in **Volume 2**.

## 6.3 Annex I Habitats

### Overview

- 6.3.1 A number of NVC communities can also correlate to various Annex I habitat types. However, the fact that an NVC community can be attributed to an Annex I type does not necessarily mean all instances of that NVC community constitute Annex I habitat. Its Annex I status can depend on various factors such as quality, extent, species assemblages, geographical setting, substrates and so on.
- 6.3.2 Using Joint Nature Conservation Committee (JNCC) Annex I habitat listings and descriptions<sup>1</sup>, which have then been compared with survey results and field observations, the following NVC communities within the study area which constitute Annex I habitat are shown in **Table 12.3.3**. The locations of these Annex I habitat types are also shown within **Drawings 12.28 to 12.39** in **Volume 3** with polygons highlighted according to the prevailing Annex I habitat type (see **Table 12.3.3**). Polygons containing mosaics or multiple Annex I habitats are highlighted by the dominant Annex I habitat type.

<sup>1</sup> <http://jncc.defra.gov.uk/page-1523>

6.3.3 Further details on the inclusion or omission of certain NVC communities/sub-communities and/or Annex I types are also provided below.

Table 12.3.3: NVC communities recorded within the study area and corresponding Annex I habitat types.

NVC Code	NVC Community Name	Annex I Code	Annex I Title
W5	<i>Alnus glutinosa</i> – <i>Carex paniculata</i> woodland	91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>
W6, W6b, W6e	<i>Alnus glutinosa</i> – <i>Urtica dioica</i> woodland	91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>
W7, W7a, W7b, W7c	<i>Alnus glutinosa</i> – <i>Fraxinus excelsior</i> – <i>Lysimachia nemoreum</i> woodland	91E0	Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>
W19, W19a	<i>Juniperus communis</i> spp. <i>communis</i> – <i>Oxalis acetosella</i> woodland	5130	<i>Juniperus communis</i> formations on heaths or calcareous grasslands
M3	<i>Eriophorum angustifolium</i> bog pool community	7130	Blanket bog
M4	<i>Carex rostrata</i> - <i>Sphagnum fallax</i> mire	7140	Transition mires and quaking bogs
M5	<i>Carex rostrata</i> – <i>Sphagnum squarrosum</i> mire	7140	Transition mires and quaking bogs
M10, M10a	<i>Carex dioica</i> - <i>Pinguicula vulgaris</i> mire	7230	Alkaline fens
M15, M15a, M15b, M15c	<i>Trichophorum germanicum</i> – <i>Erica tetralix</i> wet heath	4010, or 7130	Northern Atlantic wet heaths with <i>Erica tetralix</i> , or blanket bog where peat depth is greater than 0.5 m
M17, M17a, M17b, M17c	<i>Trichophorum germanicum</i> – <i>Eriophorum vaginatum</i> blanket mire	7130	Blanket bog
M19, M19a	<i>Calluna vulgaris</i> – <i>Eriophorum vaginatum</i> blanket mire	7130	Blanket bog
M20	<i>Eriophorum vaginatum</i> blanket mire	7130	Blanket bog
M25, M25a, M25b, M25c	<i>Molinia caerulea</i> – <i>Potentilla erecta</i> mire	7130	Blanket bog, where peat depth is greater than 0.5 m
H10, H10a, H10d	<i>Calluna vulgaris</i> - <i>Erica cinerea</i> heath	4030	European dry heaths
H12, H12a, H12c	<i>Calluna vulgaris</i> – <i>Vaccinium myrtillus</i> heath	4030	European dry heaths
H18	<i>Vaccinium myrtillus</i> – <i>Deschampsia flexuosa</i> heath	4030	European dry heaths
U4c	U4c <i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Galium saxatile</i> grassland <i>Lathyrus montanus</i> – <i>Stachys betonica</i> sub-community	6230	Species-rich <i>Nardus</i> grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe) (U4c only)
CG10a	<i>Festuca ovina</i> – <i>Agrostis capillaris</i> – <i>Thymus praecox</i> grassland	6230	Species-rich <i>Nardus</i> grassland, on siliceous substrates in mountain areas (and submountain areas in continental Europe)

#### 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

6.3.4 This habitat type comprises a range of woodland types dominated by mixtures of *Quercus* spp. and *Betula* spp. It is characteristic of base-poor soils in areas of at least moderately high rainfall in northern and western parts of the UK. The habitat corresponds particularly to NVC types W10e, W11, W16b and W17.

6.3.5 Extensive areas of W11 and W17 were recorded within the study area, but they were not deemed to be of Annex I status because:

- They are predominately birchwoods with little or no oak
- They generally lack any characteristics such as a rich bryophyte assemblage which would refer to them as ‘old sessile oak woods’
- The few stands of oak present in the study area also lack the species characteristic of this Annex I habitat type.

#### 91C0 Caledonian forest

6.3.6 Caledonian forest comprises relict indigenous pine forests of *Pinus sylvestris*, and associated *Betula* spp. and *Juniperus communis* woodlands of northern character. The majority of this habitat corresponds to NVC type W18 *Pinus sylvestris* – *Hylocomium splendens* woodland.

6.3.7 W18 was only recorded in two small polygons within the study area and the stands are of planted origin. One stand is along the roadside of the B9152 east of Kingussie, and the other stand within the Highland Wildlife Park. Given their planted origin, W18 within the study area has not been deemed a candidate area for Annex I H91C0 Caledonian forest status.

#### 91D0 Bog woodland

6.3.8 Under certain combinations of physical circumstances, scattered trees can occur across the surface of a bog in a relatively stable ecological relationship as open woodland, without the loss of bog species. This true bog woodland is much rarer than the progressive invasion of bogs by trees through natural colonisation or afforestation following changes in the drainage pattern which leads eventually to the loss of the bog vegetation. Secondary *Betula* spp. woodland on degraded bogs, and woodland encroachment resulting from falling water tables, are excluded from the Annex I definition. A few NVC types (e.g. W3, W4c and W18) could fall within this Annex I type, but none of these communities within the study area were considered to be Annex I Bog woodland. Within the study area, trees found within mire habitats were due to *Betula* spp. and scrub invasion of drying mire surfaces.

#### 91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*

6.3.9 This Annex I type comprises woods dominated by *Alnus glutinosa* and *Salix* spp. on floodplains in a range of situations from islands in river channels to low-lying wetlands alongside the channels. The habitat typically occurs on moderately base-rich, eutrophic soils subject to periodic inundation. Many such woods are dynamic, being part of a successional series of habitats. Their structure and function are best maintained within a larger unit that includes the open communities, mainly fen and swamp, of earlier successional stages. On the drier margins of these areas, other tree species such as *Fraxinus excelsior* and *Ulmus* spp., may become abundant. In other situations the *Alnus glutinosa* woods occur as a stable component within transitions to surrounding dry-ground forest.

6.3.10 The ground flora is correspondingly varied. Some stands are dominated by tall herbs, reeds and sedges, with species such as *Urtica dioica*, *Phragmites australis*, *Carex paniculata* and *Filipendula ulmaria*. Other stands have lower-growing communities with *Ranunculus repens*, *Galium palustre*, *Chrysosplenium oppositifolium* and *Caltha palustris*.

- 6.3.11 In the UK this Annex I habitat falls mainly within the W2a, W5, W6 and W7 NVC types. Riparian trees are excluded from the Annex I type except where these form part of a wider network of alluvial woodland and wetland communities.
- 6.3.12 Areas of W5, W6 and W7 woodland are present within the study area, although all stands are relatively small and often isolated and fragmented. Each polygon in which these communities have been recorded has been assessed on a case-by-case basis, to ascertain if it may be classified as this Annex I type, based on community size, location, flora etc. Thin strips of riparian trees or stands (possibly of planted origin) away from floodplains or the appropriate setting for this Annex I type have been excluded. As a result of this process eight of the nine stands in which W6 *Alnus glutinosa* – *Urtica dioica* woodland was recorded were considered not to belong to this Annex I habitat, primarily because of their size and geographical location (see **paragraph 5.2.10**). Nine of 14 stands in which W7 woodland is present could possibly be considered to qualify as this Annex I habitat; some of these were within floodplains or along river banks but others were set back from such features and isolated. The one area of W5 woodland was included as Annex I Alluvial forest.

#### 5130 *Juniperus communis* formations on heaths or calcareous grasslands

- 6.3.13 In Scotland, *Juniperus communis* is found on a wide range of acidic substrates supporting acidophilous plant communities. In many instances these are simply stands of heathland or acidic grassland that have become invaded by *J. communis*. However, at sites where the *J. communis* has evidently been established for longer, the community corresponds to NVC type W19 *Juniperus communis* ssp. *communis* – *Oxalis acetosella* woodland. All instances of W19 within the study area have been assigned to this Annex I type. Such vegetation is typically dominated by *J. communis*, with *Betula pubescens* and *Sorbus aucuparia* often scattered throughout. The understory is rich in acidophilous species, such as *Vaccinium myrtillus*, *Oxalis acetosella*, *Galium saxatile* and *Luzula pilosa*. There is usually a well-developed layer of pleurocarpous mosses and ferns.

#### 7130 Blanket bog

- 6.3.14 Annex I type 7130 Blanket bog correlates directly with a number of NVC communities within the study area such as the M17, M19 and M20 mires. However, 7130 Blanket bog can also include bog pool communities (M1-M3) where these occur within blanket mires such as M17-M20. As such M3 within the study area is also assigned to the blanket bog Annex I type, as it is often associated with areas of M17, M19 and M20 mire.
- 6.3.15 M25 mire and M15<sup>2</sup> wet heath can also fall within the 7130 Blanket bog Annex I type where the peat depth underlying these communities is greater than 0.5m. In the absence of detailed peat depth data for areas of M25 mire, these have also been classified as potential Annex I Blanket bog, to represent a worst-case scenario.
- 6.3.16 M15 also falls under the 4010 Northern Atlantic wet heaths with *Erica tetralix* Annex I type, and therefore does not need blanket bog status to be recognised as of Annex I conservation interest.

#### 7140 Transition mires and quaking bogs

- 6.3.17 All examples of M4 *Carex rostrata* - *Sphagnum fallax* mire and M5 *Carex rostrata* – *Sphagnum squarrosum* mire within the study area were assigned to the Annex I type Transition mires and

<sup>2</sup> Excluding the M15a *Carex panicea* sub-community, due to its flushed nature over shallower substrates.

quaking bogs. The term ‘transition mire’ relates to vegetation that in floristic composition and general ecological characteristics is intermediate between acid bog and alkaline fen.

#### 7230 Alkaline fens

- 6.3.18 Alkaline fens consist of a complex assemblage of vegetation types characteristic of sites where there is tufa and/ or peat formation with a high-water table and a calcareous base-rich water supply. The core vegetation is short sedge mire. All examples of M10 mire in the study area fall within this Annex I habitat type.

#### 4010 Northern Atlantic wet heaths with *Erica tetralix*

- 6.3.19 All examples of M15 wet heaths are included within the 4010 Northern Atlantic wet heaths category. However, as per **paragraph 6.3.14**, in areas where peat depth is greater than 0.5m these areas could also feasibly fall within the Annex 1 7130 Blanket bog classification.

#### 4030 European dry heaths

- 6.3.20 European dry heaths typically occur on freely-draining, acidic to circumneutral soils with generally low nutrient content. Ericaceous dwarf shrubs dominate the vegetation. The most common dwarf shrub is heather *Calluna vulgaris*.
- 6.3.21 All dry heath in the study area is semi-natural and evidently derived from woodland or scrub through a long history of grazing and burning. The three dry heath communities recorded - H10, H12, and H18 – all fall within this Annex I type. These NVC types can also be included within the Annex I type H4060 Alpine and Boreal heaths, but only where they are at higher altitudes and include arctic-alpine floristic elements. These communities within the study area are lower altitudinal examples so they all fall under the 4030 European dry heaths Annex I type.
- 6.3.22 The most common form of dry heath in the study area is H12. However, as noted in **section 5.5.6**, the most common form of H12 here is a species-poor, botanically impoverished form of the H12a *Calluna vulgaris* sub-community which consists of little more than *C. vulgaris* over a lawn of pleurocarpous mosses.

#### 6230 Species-rich *Nardus* grassland, on siliceous substrates in mountain areas

- 6.3.23 Species-rich *Nardus* grasslands on siliceous substrates in mountain areas (and submountain areas in continental Europe) tend to develop where there is flushing through base-rich strata on siliceous bedrock. These may include moderately base-rich metamorphic and igneous rocks. Species-rich *Nardus* grasslands on limestone are excluded from the definition of this Annex I habitat because limestone lacks silica. Two main types of grassland belonging within the species-rich *Nardus* grassland Annex 1 habitat occur in the UK: CG10 *Festuca ovina* – *Agrostis capillaris* – *Thymus polytrichus* grassland and CG11 *Festuca ovina* – *Agrostis capillaris* – *Alchemilla alpina* grassland. However, the base-enriched U5c and species-rich flushed U4c calcifugous grassland sub-communities can also fall within 6230 species-rich *Nardus* grassland. This Annex I type is sparse within the study area, and is accounted for by some small areas of CG10a and U4c.

## 6.4 Scottish Biodiversity List Priority Habitats

- 6.4.1 The SBL is a list of animals, plants and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. The SBL was published in 2005 to satisfy the requirement under Section 2(4) of The Nature Conservation (Scotland) Act 2004.

- 6.4.2 The SBL identifies habitats which are the highest priority for biodiversity conservation in Scotland: these are termed ‘priority habitats’. Some of these priority habitats are quite broad and include several NVC types.
- 6.4.3 The relevant SBL priority habitat types (full descriptions of which can be found on the Biodiversity Scotland website<sup>3</sup>), and associated NVC types recorded within the study area are as follows:
- **Wet woodland:** W3, W4b, W5, W6, W7
  - **Upland birchwoods:** W4 (at community level), W11 and W17
  - **Upland oakwoods:** W11 and W17 (where oak forms >30% of canopy cover)
  - **Lowland mixed deciduous woodland:** W8 and W10 (where the canopy is not primarily coniferous)
  - **Blanket bog:** M17, M19, M20, and M3 (M3 where associated with M17/M19/M20), and M15<sup>4</sup>/M25 where peat depth is greater than 0.5 m
  - **Upland flushes, fens and swamps:** M4, M5, M6, M10 and M23a
  - **Upland heathland:** M15, H10, H12 and H18
  - **Upland calcareous grassland:** CG10 and U4c
  - **Lowland fens:** M27, S9, S10, S11, S19 and S22
  - **Reedbeds:** S4.
- 6.4.4 These SBL priority habitats correspond with UK Biodiversity Action Plan (BAP) Priority Habitats<sup>5</sup>.
- 6.4.5 This information is also summarised in **Table 12.3.4**. The locations of these SBL priority habitats are also shown within **Drawings 12.28 to 12.39** in **Volume 3**, with polygons highlighted according to the prevailing SBL priority habitat, unless already identified as an Annex I habitat type. Polygons containing mosaics or multiple priority habitats are highlighted by the dominant SBL habitat type.

## 6.5 Cairngorms National Park Authority Priority Habitats

- 6.5.1 The CNPA also identifies a number of priority habitats within its Cairngorms Nature Action Plan (CNAP) 2013-2018. The aims of the plan reflect the consultation on and commitment to the National Park Partnership Plan 2012-2017 and the need for action on threatened and endangered habitats and species. The CNPA priority habitats are broad and encompass many possible NVC communities. They do however align closely with the SBL and UK BAP priority habitats.

The relevant CNPA priority habitat types, and associated NVC types, recorded within the study area are as follows:

- **Wet & riparian woodland:** W3, W4, W5, W6 and W7
- **Birch and aspen woodland:** W11, W16 and W17
- **Upland oak:** W10, W11 and W17 (where canopy is dominated by oak)

<sup>3</sup> <http://www.biodiversityscotland.gov.uk/advice-and-resources/habitat-definitions/priority/>

<sup>4</sup> Excluding the M15a *Carex panicea* sub-community, due to its flushed nature over shallower substrates.

<sup>5</sup> <http://jncc.defra.gov.uk/page-5718>

- **Blanket bog:** M17, M19, M20 and M3 (M3 where associated with M17/M19/M20)
- **Wetlands<sup>6</sup>:** M4, M5, M6, M10, M23a, M25c, M27, S4, S9, S10, S11, S19 and S22
- **Wet grasslands:** M23b, MG9, MG10 and MG11
- **Upland heathland:** M15, H10, H12 and H18
- **Grasslands:** CG10 and U4c.

6.5.2 This information is also summarised in **Table 12.3.4**. The locations of these CNPA priority habitats are also shown within **Drawings 12.28 to 12.39** in **Volume 3**, with polygons highlighted according to the prevailing CNPA priority habitat, unless already identified as an Annex I or SBL priority habitat. Polygons containing mosaics or multiple priority habitats are highlighted by the dominant CNPA habitat type.

## 6.6 Summary

6.6.1 **Table 12.3.4** provides a summary of all the NVC communities recorded within the study area, and any associated habitat sensitivities as described above.

Table 12.3.4: Summary of study area NVC communities and associated sensitivities.

NVC Codes Recorded	Potential GWDTE Status	Annex I Type Code	SBL Priority Habitat Type	CNPA Priority Habitat Type
<b>Woodland and Scrub</b>				
W3	Moderate		Wet woodland	Wet & riparian woodland
W4	High		Upland birchwoods (for W4 at community level) or Wet woodland (stands of <b>W4b</b> )	Wet & riparian woodland
W5	Moderate	91E0 Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>	Wet woodland	Wet & riparian woodland
W6, W6b, W6e	Moderate	91E0 Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>	Wet woodland	Wet & riparian woodland
W7, W7a, W7b, W7c	High	91E0 Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>	Wet woodland	Wet & riparian woodland
W8			Lowland mixed deciduous woodland	
W9				
W10, W10d			Lowland mixed deciduous woodland (where the canopy is not coniferous)	Upland oak (where canopy is dominated by oak)
W11, W11c, W11d			Upland birchwoods <u>or</u> Upland oakwood (where oak forms >30% of canopy cover)	Birch and aspen woodland <u>or</u> Upland oak (where canopy is dominated by oak)
W16			Upland birchwoods	Birch and aspen woodland

<sup>6</sup> Many of these communities are included within the wetlands CNPA priority habitat on the assumption that their 'wetlands' category includes the following SBL and UKBAP priority habitat types: upland flushes, fens and swamps; lowland fens; reedbeds.

NVC Codes Recorded	Potential GWDTE Status	Annex I Type Code	SBL Priority Habitat Type	CNPA Priority Habitat Type
W17, W17b, W17d			Upland birchwoods <i>or</i> Upland oakwood (where oak forms >30% of canopy cover)	Birch and aspen woodland <i>or</i> Upland oak (where canopy is dominated by oak)
W18, W18c				
W19, W19a		5130 <i>Juniperus communis</i> formations on heaths or calcareous grasslands		
W23				
<b>Mires and Wet Heath</b>				
M3		7130 Blanket bogs	Blanket bog	Blanket bog
M4		7140 Transition mires and quaking bogs	Upland flushes, fens and swamps	Wetlands
M5	High	7140 Transition mires and quaking bogs	Upland flushes, fens and swamps	Wetlands
M6, M6a, M6c, M6d	High		Upland flushes, fens and swamps	Wetlands
M10, M10a	High	7230 Alkaline fens	Upland flushes, fens and swamps	Wetlands
M15, M15a, M15b, M15c	Moderate	4010 Northern Atlantic wet heaths with <i>Erica tetralix</i> <i>or</i> 7130 Blanket bogs (where peat is greater than 0. m deep) (*M15a excluded from blanket bog)	Upland heathland <i>or</i> blanket bogs (where peat is greater than 0.5m deep) (*M15a excluded from blanket bog)	Upland heathland
M17, M17a, M17b, M17c		7130 Blanket bogs	Blanket bog	Blanket bog
M19, M19a		7130 Blanket bogs	Blanket bog	Blanket bog
M20		7130 Blanket bogs	Blanket bog	Blanket bog
M23a, M23b	High		Upland flushes, fens and swamps (applies to <b>M23a</b> only)	Wetlands ( <b>M23a</b> ); Wet grasslands ( <b>M23b</b> )
M25, M25a, M25b, M25c	Moderate	7130 Blanket bogs (where peat is greater than 0.5m deep)	Blanket bog (where peat is greater than 0.5m deep - <b>M25a</b> and <b>M25b</b> ); Upland flushes, fens and swamps ( <b>M25c</b> )	Wetlands ( <b>M25c</b> only)
M27, M27a	Moderate		Lowland fens	Wetlands
<b>Dry Heaths</b>				
H10, H10a, H10d		4030 European dry heaths	Upland heathland	Upland heathland
H12, H12a, H12c		4030 European dry heaths	Upland heathland	Upland heathland
H18		4030 European dry heaths	Upland heathland	Upland heathland
<b>Calcifugous Grasslands</b>				
U1b				
U2, U2a, U2b				

NVC Codes Recorded	Potential GWDTE Status	Annex I Type Code	SBL Priority Habitat Type	CNPA Priority Habitat Type
U4, U4a, U4b, U4c		6230 Species-rich <i>Nardus</i> grassland on siliceous substrates in mountain areas (and submountain areas in continental Europe) - <b>U4c</b> only	Upland calcareous grassland - <b>U4c</b> only	Grasslands - <b>U4c</b> only
U5, U5a				
U20, U20a, U20b, U20c				
<b>Mesotrophic Grasslands</b>				
MG1, MG1a, MG1b				
MG6, MG6b				
MG7, MG7b				
MG9, MG9a, MG9b	Moderate			Wet grasslands
MG10, MG10a	Moderate			Wet grasslands
MG11a				Wet grasslands
<b>Calicolous Grasslands</b>				
CG10a	High	6230 Species-rich <i>Nardus</i> grassland on siliceous substrates in mountain areas (and submountain areas in continental Europe)	Upland calcareous grassland	Grasslands
<b>Aquatic Communities</b>				
A24				
<b>Swamps and Tall-Herb Fens</b>				
S4a			Reedbeds	Wetlands
S9, S9a, S9b			Lowland fens	Wetlands
S10, S10a, S10b			Lowland fens	Wetlands
S11a	High		Lowland fens	Wetlands
S19, S19a			Lowland fens	Wetlands
S22a			Lowland fens	Wetlands
<b>Vegetation of Open Habitats</b>				
OV24				
OV25, OV25a				
OV27				
OV28a				

## 7 Glossary

**acidophilous:** plants/bryophytes that prefer to grow in an acidic environment.

**base-poor:** environments which have few chemical bases, they are dominated by environmental acids (usually organic acids) and so are acidic.

**base-rich:** environments which are neutral or alkaline.

**base-richness:** the level in soil or water of chemical bases, such as calcium or magnesium ions. Chemical bases are alkalis. Many plants and bryophytes are restricted to base-rich or base-poor environments.

**calcareous:** calcareous grassland forms on soils that are base-rich.

**calcicolous:** a plant that grows and thrives in soil rich in lime.

**calcifugous:** growing or living in acid soil.

**circumneutral soil:** nearly neutral, having a pH between 6.5 and 7.5.

**dicotyledon:** a plant that produces flowers and has two cotyledons (i.e. embryonic leaves).

**forb:** a herbaceous flowering plant that is not a graminoid (grasses, sedges and rushes).

**graminoid:** grasses; monocotyledonous, usually herbaceous plants with narrow leaves growing from the base. They include the true grasses, of the family Poaceae (also called Gramineae), as well as the sedges (Cyperaceae) and the rushes (Juncaceae).

**humic rankers:** shallow soils with an organic-rich (humose) surface layer overlying a weakly developed, thin subsoil on to rock.

**lagg:** zone where water draining a bog meets that from adjoining mineral soils. A characteristic of the lagg zone is that normally it has more available plant nutrients, is more alkaline and hence shows greater species diversity.

**mesophytic:** a land plant that grows in an environment having a moderate amount of moisture, neither a particularly dry nor particularly wet environment.

**mesotrophic grassland:** neutral grassland, characterised by vegetation dominated by grasses and herbs on a range of circumneutral soils.

**monocotyledons:** flowering plants group which have just one cotyledon.

**mor:** forest humus that forms a layer of largely organic matter distinct from the mineral soil beneath.

**mosaic:** a pattern of two or more vegetation types disposed in intimate relationships to one another.

**oligotrophic:** lacking in plant nutrients.

**ombrogenous:** dependant on rain for its formation. Ombrogenous bog is a peat-forming vegetation community lying above groundwater level: it is separated from the mineral soil, and is thus dependent on rain water for mineral nutrients. The resulting lack of dissolved bases gives strongly acidic conditions. Two types of ombrogenous bogs are commonly distinguished: raised bogs and blanket bogs.

**palaeochannel:** a remnant of an inactive river or stream channel that has been either filled or buried by younger sediment. The sediments that the ancient channel is either cut into or buried by can be either unconsolidated, semi-consolidated, consolidated, or lithified.

**plagioclimax community:** an area or habitat in which anthropogenic influences have prevented the habitat/ecosystem developing further. It may have been prevented from reaching its full climatic climax or shifted towards a different climax type by activities such as burning, grazing, vegetation clearance etc.

**pleurocarpous:** A type of moss in which the female sex organs and capsules are borne on short, lateral branches, and not at the tips of branches. Pleurocarpous mosses tend to form spreading carpets rather than erect tufts.

**podsol:** a soil that develops in temperate to cold moist climates under coniferous or heath vegetation; an organic mat over a grey leached layer.

**siliceous:** containing abundant silica; (plants) growing in or needing soil rich in silica.

**soligenous:** where water movements are predominantly lateral. Produced by inflow of surface water or rise of groundwater and not completely by locally precipitated water.

**topogenous mire:** a type of mire that forms under climatic conditions of reduced rainfall, with consequent lower humidity and summer drought, which restrict the growth of wetland vegetation to areas where precipitation is concentrated (e.g. valley bottoms).

## 8 References

- Atherton, I., Bosanquet, S. & Lawley, M. (2010). *Mosses and Liverworts of Britain and Ireland: a field guide*. British Bryological Society.
- Averis, A., Averis, B., Birks, J., Horsfield, D., Thompson, D., & Yeo, M. (2004). *An Illustrated Guide to British Upland Vegetation*. JNCC, Peterborough. ISBN 1 86107 553 7.
- Cooper, E.A. (1997). *Summary Descriptions of National Vegetation Classification grassland and montane communities*. ISBN 1 86107 433 3.
- Elkington, T., Dayton, N., Jackson, D.L., & Strachan, I.M. (2001). *National Vegetation Classification: Field guide to mires and heaths*. ISBN 1 86107 526 X.
- Hall, J.E., Kirby, K.J., & Whitbread, A.M. (2004). *National Vegetation Classification: Field guide to woodland*. ISBN 1 86107 554 5.
- Rodwell, J.S. (Ed), *et al.* (1991 – 2000). *British Plant Communities* (5 volumes). Cambridge, Cambridge University Press.
- Rodwell, J.S. (2006). *NVC Users' Handbook*. ISBN 978 1 86107 574 1.
- SEPA. (2014a). Land Use Planning System SEPA Guidance Note 4: *Planning advice on windfarm developments*. Issue No: Version 7. Issue date: 14/05/2014.
- SEPA. (2014b). Land Use Planning System SEPA Guidance Note 31: *Guidance on Assessing the Impacts of Windfarm Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems*. Version 2. Issue date: 27/10/2014.
- Stace, C.A. (2010). *New Flora of the British Isles*. 3rd Edition. Cambridge University Press.

# Annex A

## NVC Target Notes

## Annex A NVC Target Notes

A number of target notes were made during the surveys, often to pinpoint springs/ flushes, or areas with species of interest. These target notes are detailed in **Table A.1**. A representative sample of corresponding target note photographs is provided in **Annex B**.

Table A.1: Project 9 study area target notes.

Target Note ID	Easting	Northing	NVC Community	Description	Photo reference
1	281526	804055		North-east end of area of woodland (mainly W11) with abundant <i>Populus tremula</i> and some <i>Quercus</i> sp., between A9 and quarry	1
S2_1	268998	795667	M6d	Small runnel which is surface water fed by small drain/watercourse. <i>Juncus acutiflorus</i> , <i>Sphagna</i> , <i>Narthecium ossifragum</i> , <i>Erica tetralix</i>	2
S3_1	274084	798972		<i>Populus tremula</i>	
S3_2	274320	798950		<i>Populus tremula</i> in woodland (visible on aerial photo)	
S3_3	274350	798980		<i>Populus tremula</i> in woodland (visible on aerial photo)	
S3_4	274370	798970		Two <i>Quercus</i> sp. in woodland	
S4_1	276660	801530		<i>Populus tremula</i>	
S4_2	276730	801600		<i>Populus tremula</i>	
S4_3	277428	801603		<i>Sphagnum affine</i> in M15a mire	
S4_4	277267	802083	M15a/M6d		3
S4_5	277731	802071	M15a		4
S4_6	277752	802160	M15a	Flushed area with small <i>Carex</i> spp.	
S4_7	277863	802143	M15a	Flushed area with small <i>Carex</i> spp.	
S4_8	278133	802025	M6d/M23a	Associated with ditch cut through this area	
S4_9	278145	802044	M15a	Flushed area with small <i>Carex</i> spp.	
S5_1	279588	802658		A few <i>Populus tremula</i> scattered along 100m length of woodland on south-east side of road	
S5_2	279647	802685		<i>Ulmus glabra</i> on south-east side of road.	
S5_3	279720	802730		Small patch of <i>Populus tremula</i> c. 40m across, on north-west side of road	
S5_4	280354	803162		<i>Populus tremula</i> in area 30m long, along south-east side of road. <i>Quercus</i> in woodland on other side of road	
S5_5	280440	803210		<i>Populus tremula</i> along south-east side of road	
S5_6	281185	803824		South-west end of area of woodland (mainly W11) with abundant <i>Populus tremula</i> and some <i>Quercus</i> sp., between A9 and quarry	5
S5_7	281382	803819		<i>Populus tremula</i> in area 30m long, between road and railway	

# Annex B

## Target Note Photographs

## Annex B Target Note Photographs

The following photographs correlate to the target notes described in **Annex A, Table A.1**. Photographs are not provided here for all target notes, due to the similarity between many photographs; instead a number of photographs are provided in order to give a general characterisation of certain types of community present, and to also show local variation between communities of the same NVC class.

Photograph B.1: Target note 1. *Populus tremula* within W11 woodland



Photograph B.2: Target note S2\_1. M6d.



Photograph B.3: Target note S4\_4. M6d and M15a



Photograph B.4: Target note S4\_5. M15a



Photograph B.5: Target note S5\_6. W11 woodland with abundant *Populus tremula*



# Annex C

## General Community Photographs

## Annex C Community Photographs

The following selected photographs are provided to give a visual representation to a number of the community types present within the study area.

*Photograph C.1: W3 Salix pentandra – Carex rostrata woodland*

*Betula sp. dominant over Carex rostrata and Sphagna.*



Photograph C.2: W4 *Betula pubescens* – *Molinia caerulea* woodland



Photograph C.3: W4b *Betula pubescens* – *Molinia caerulea* woodland, *Juncus effusus* sub-community



Photograph C.4: W6 *Alnus glutinosa* – *Urtica dioica* woodland



Photograph C.5: W7 *Alnus glutinosa* – *Fraxinus excelsior* – *Lysimachia nemoreum* woodland

Example of neutral wet woodland.



Photograph C.6: W17 and H12 mosaic

**Betula spp. invasion of heath.**



Photograph C.7: W19 Juniperus communis – Oxalis acetosella woodland



Photograph C.8: M4 *Carex rostrata* - *Sphagnum fallax* mire

Open area consists of M4 over former extent of Loch Buide.



Photograph C.9: M6 *Carex echinata* - *Sphagnum fallax/denticulatum* mire

M6 flushes downslope of W4b woodland.



Photograph C.10: M25 *Molinia caerulea* – *Potentilla erecta* mire

M25 where *Myrica gale* is co-dominant with *M. caerulea*.



Photograph C.11: M23a *J. effusus/acutiflorus* – *Galium palustre* rush-pasture, *J. acutiflorus* sub-community



Photograph C.12: M23a *J. acutiflorus* sub-community & U4 grassland

M23a around minor watercourse, U4 *Festuca ovina* – *Agrostis capillaris* – *Galium saxatile* grassland on slope in foreground.



Photograph C.13: M27 *Filipendula ulmaria* – *Angelica sylvestris* mire



Photograph C.14: H10 *Calluna vulgaris* – *Erica cinerea* heath



Photograph C.15: H12, M6, M15 and M17 mosaic

H12 heath on *Calluna* dominated slopes (brown), flatter areas are peaty with M6 (green distant areas) and M15 and M17 (mottled). *Betula* spp. and *Salix* spp. invasion across the mosaic.



Photograph C.16: MG1 *Arrhenatherum elatius* grassland



Photograph C.17: MG1/U4b mosaic

Typical example of coarse roadside sward of MG1 and U4b.



Photograph C.18: MG9 *Holcus lanatus* – *Deschampsia cespitosa* grassland



Photograph C.19: MG10a *Holcus lanatus* – *Juncus effusus* rush-pasture, Typical sub-community MG10a in hollow, dominated by *Juncus effusus*.



*Photograph C.20: MG10a, U4b and MG6 mosaic*

Typical farmland mosaic along Project 9



*Photograph C.21: S9 Carex rostrata swamp*

S9 swamp adjacent to the River Spey.



Photograph C.22: *Carex lasiocarpa* swamp

*C. lasiocarpa* swamp at Lochan an Tairbh; S9, S10 and S19 also present around margins.



Photograph C.23: OV25, MG6, U4 mosaic



