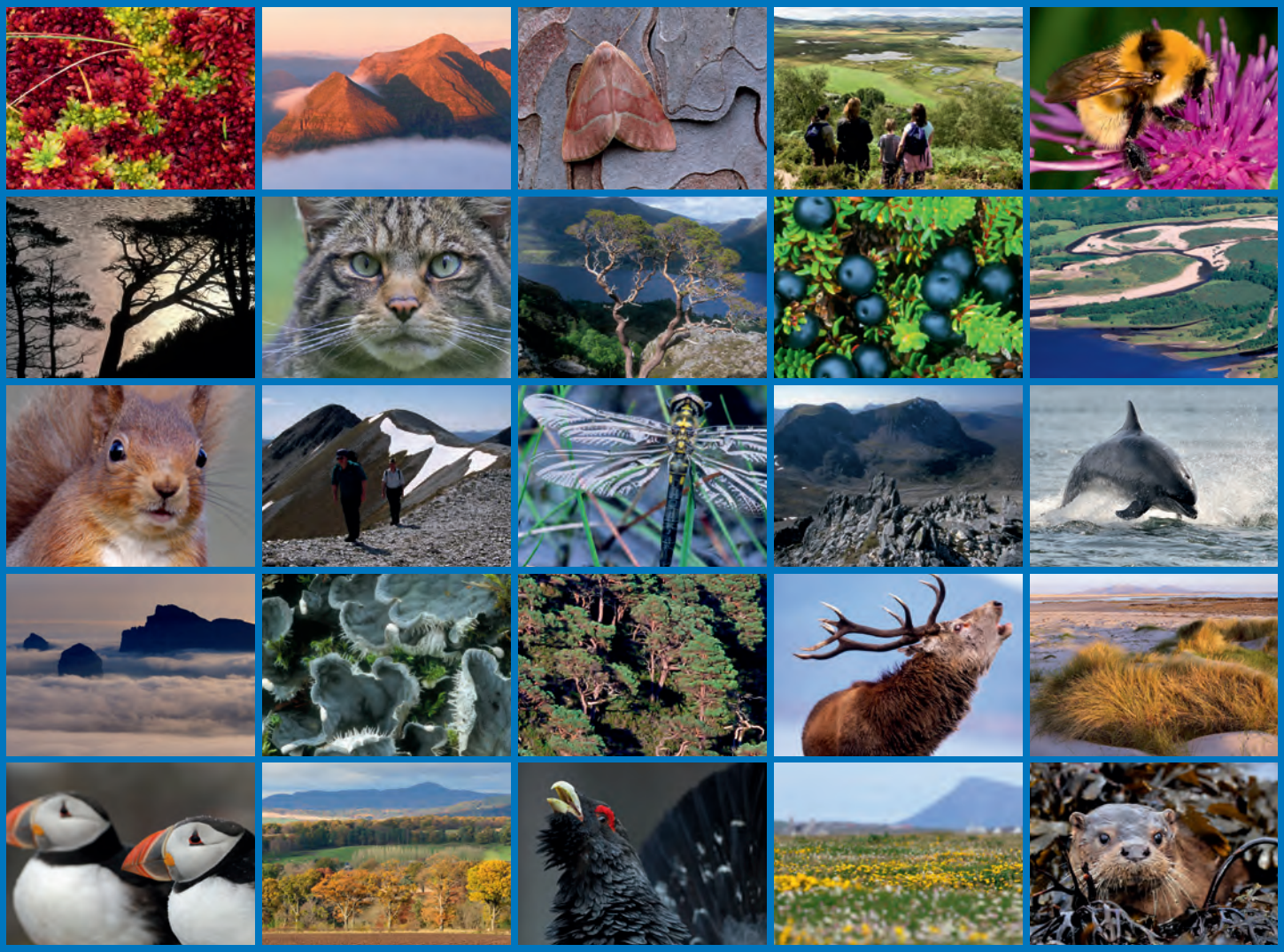
Scottish Natural Heritage
Commissioned Report No. 564

# Loch of Isbister and the Loons Site of Special Scientific Interest and Special Area of Conservation: National Vegetation Classification survey and Site Condition Monitoring of basin fen



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# COMMISSIONED REPORT

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# Loch of Isbister and the Loons Site of Special Scientific Interest and Special Area of Conservation:

# National Vegetation Classification survey and Site Condition Monitoring of basin fen

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COMMISSIONED REPORT

# Summary

# Loch of Isbister and the Loons Site of Special Scientific Interest and Special Area of Conservation: National Vegetation Classification survey and Site Condition Monitoring of basin fen

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**Background**

Loch of Isbister and the Loons SSSI comprises a basin mire and shallow, naturally eutrophic loch with a combined area of 105 ha. The site is also designated as Loch of Isbister SAC. Almost the entire mire is very wet, with the water level close to the surface in summer and extensive inundation in winter. There is peat formation in the centre of the main mire basin but strong influences from calcareous groundwater make for a complex array of wetland habitats comprising swamps including reed-beds and rich and poor fen. The site is also important for breeding birds, especially waders and wildfowl. Most of the site is owned by the RSPB and managed as a nature reserve.

This research was commissioned by Scottish Natural Heritage primarily to obtain a detailed National Vegetation Classification (NVC) report and map of the site; secondly to develop and apply site-specific attributes and targets for Site Condition Monitoring (SCM) of the basin fen feature; and thirdly to develop a protocol for monitoring grazing pressures and impacts at the site.

**Main findings**

- Altogether 36 NVC types and a further four potential new units and variants were identified.

- The most extensive mire, swamp and tall herb communities of the site are M5 *Carex rostrata-Sphagnum squarrosum* mire, M6 *Carex echinata-Sphagnum fallax/denticulatum* mire (and an unusual intermediate with M15 *Erica tetralix-Trichophorum germanicum* wet heath), M9 *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire, S4 *Phragmites australis* swamps and reed-beds and S27 *Carex rostrata-Comarum palustre* tall-herb fen.

- Other notable communities covering smaller areas are M10 Carex dioica-Pinguilica *vulgaris* mire, M13 *Schoenus nigricans-Juncus subnodulosus* mire, an unusually sedge-rich form of M25 *Molinia caerulea-Potentilla erecta* mire, S10 *Equisetum fluviatile* swamp, SD17 dune slack and a type of *Carex nigra* mire not described in the NVC.

- Grassland, wet heath, fen-meadow and rush-pasture communities are also present.

- Many of the mire and swamp communities are atypical and occur in complex mosaics: mapping them has presented a considerable challenge.

- A total of 152 species and four hybrids of vascular plants was recorded. They include Holy Grass *Hierochloe odorata* (nationally rare), Northern Yellow-cress *Rorippa islandica* (nationally scarce) and Slender-leaved Pondweed *Potamogeton filiformis* (nationally uncommon).

- Attributes and targets for SCM of the basin fen feature were reviewed in consultation with SNH advisors. Six NVC communities representing the feature at this site, M5, M9, M10, M13, S10 and S27, were selected for detailed monitoring. The standard methodology was applied with minor changes. In addition, the extent of all accessible reed-beds was measured to establish a baseline for future monitoring.

- SCM was carried out. The outcome was favourable for all broad attributes. With regard to attributes for vegetation composition M5, M10 and S10 met all targets. However M9, M13 and S27 failed to meet one or more of these targets. These failures are likely to be a reflection of the geographical location and particular character of the site and should be interpreted in that light.

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# 1. INTRODUCTION

## 1.1 Study objectives

The primary objective was to obtain an assessment of the nature and distribution of plant communities at the site using National Vegetation Classification (NVC) methods. There have been previous vegetation surveys of the site or parts of it using NVC and other methods. However, difficulties have been encountered in identifying clear patterns in much of the vegetation and in assigning some of the most widespread types to particular units of the NVC and there have been significant differences in community diagnosis. These uncertainties have presented challenges to site condition monitoring (SCM), particularly of the basin fen which is one of the features for which the site is designated.

The second objective was to apply the findings of the NVC survey to the development of site-specific SCM attributes and targets, compatible with national standards, for the basin fen and to assess its condition against these criteria.

The third objective was to develop a method of monitoring grazing impacts at the site. The RSPB, who manage the majority of the site, have recently initiated a new programme of grazing management, using cattle. It is important to gain information on the effects this might have on the notified basin fen feature and be in a position to decide if necessary on fine-tuning of the management.

## 1.2 Site designations

The Loch of Isbister and the Loons is designated as a Site of Special Scientific Interest (SSSI) and the site is also designated as Loch of Isbister Special Area of Conservation (SAC). Basin fen is the notified habitat feature of the SSSI. An element of basin fen - 'very wet mires often identified by an unstable quaking surface' – is a notified feature of the SAC, together with 'naturally nutrient-rich lakes or lochs which are often dominated by pondweed' (i.e. the Loch of Isbister). The documented area of the site is 105 ha, of which approximately 50 ha comprise the open water of the Loch of Isbister and a bay on its northern edge.

## 1.3 Site description

The overall character of the site has been described several times in previous reports, and particular aspects including hydrology, stratigraphy, water and soil chemistry and interrelationships with plant communities have been investigated in detail (see paragraph 1.4 below). It would be superfluous to cover this ground it detail again, so what follows is a brief summary drawing substantially on previous accounts.

The site is a basin mire with shallow loch, almost level and c.19 m above sea level. Close by on the north, west and south sides hills rise to c.100 m, while to the east a flat plain extends across the central part of the West Mainland of Orkney. Situated almost centrally in the site is a low mound of glacial till called the Skooant, c. 9 ha in extent, comprising more or less dry ground and almost separating the main mire part (the 'Loons' of the site name) of the basin from the Loch of Isbister. There is a further, smaller area of mire and swamp, part of it transition to open water, along the western side of the loch.

As explained by Crawford (1975), who partially drew on the work of Moar (1969), the present Loons is essentially a calcareous basin mire developed from the formerly more extensive Loch of Isbister through the gradual development of sedge and *Sphagnum* peat. The calcareous quality is derived from the local geology and from a layer of marl formed beneath the basin. The underlying rocks are Stromness Flags of the Middle Old Red Sandstone, which are moderately calcareous, overlain on the surrounding hills with glacial till. Almost all the land in the surrounding area is utilised intensively for agriculture, mainly improved

grassland and cereal crops, with the exception of smaller areas of extensively grazed wetland. These factors result in high pH values in open water (*op.cit*.) and no doubt some eutrophication from run-off.

The mire is extensively inundated in winter and the water level is close to the surface over most of the site in summer. Data on water levels, collected by RSPB, are summarised in the management plan for the Reserve (Knight, Leitch & Dow, 2010). These show considerable variation between different parts of the basin in the degree of change between winter and summer and also in short-term fluctuations. Small burns and field drains enter the mire from the north, and the high water level is maintained by these together with direct precipitation and springs, with overspill from the loch in winter. There are two points at which water escapes the basin as a whole, a large open ditch near the farm of Folsetter at the north-east corner of the site and another exiting the eastern side of the Loch of Isbister. There is apparently a weir or sluice controlling water flow in the loch ditch but this is some distance off site and was not investigated. Within the mire, surface water seeps and flows through broad, shallow, vegetated channels mainly following two routes, one around the northern edge to exit near Folsetter, the other along the southern and western sides past the Skooant and into the Loch of Isbister. Broadly speaking there are soligenous zones around the outside of the mire and a mainly topogenous centre. However the distribution of such zones is not a clear one and has been further confused by peat cutting which, in the words of Crawford (*op.cit*.), has created "a mosaic of areas that are exposed to soligenous water interspersed with a network of ombrotrophic peat". There are several natural pools in the basin, mostly small with the exception of one in the centre that has an area of more than one hectare.

Peat cutting in the northern section of the Loons ceased apparently at or shortly after the end the Second World War. The site has also been used historically for cutting of bog hay and some grazing. According to Crawford (*op.cit*.), at the time of his study there were intensive efforts by local farmers to maximise grazing of the drier parts of the site, even by spreading manure. The RSPB now own almost all the site and use grazing as part of an overall conservation management plan.

### 1.4 Previous studies

Moar (*op.cit.*) investigated the stratigraphy and pollen record of the basin. Crawford (*op.cit.*) and his team from St Andrews University intensively sampled vegetation along transects through part of the Loons and ordinated the results. Crawford's inferences concerning the distribution of plant species and associations produced by the interaction of flooding and nutritional status are particularly interesting and are consistent with the results of the present NVC survey.

In 1981 Brunt carried out intensive sampling and association analysis of the vegetation and produced fine-scale maps of his resulting communities.

In 1991 Prosser and Wallace (1992) carried out an NVC survey for RSPB. They too employed transects, and used TWINSPAN and other computer analysis to sort groups and identify the units of the NVC to which they belonged. Most, but not all, of their findings concur with those of the present study. They also analysed data on plant species they found at the Loons and compared results with the 'expected frequencies' for these species in the relevant units in the NVC.

In 1993 a topographical and hydrological survey was carried out for RSPB (Spoor & Hann, 1993).

Finally, in order to monitor the effect of grazing on the vegetation, RSPB introduced a programme of monitoring in 2001 (Kennedy, 2002), repeated in 2006 (Cadbury & Cadbury, 2007). This involved recording data on the vegetation and NVC diagnosis of 40 fixed plots at four locations. Kennedy used the MATCH programme for his NVC diagnosis and most of his MATCH co-efficients were low. On re-visiting the plots, the Cadbury's disagreed about the identity of NVC communities present at three of the four locations. They put the differences down to interpretation rather than real change.

## 2. NVC SURVEY

### 2.1 Methods

#### *2.1.1 Personnel*

Field work and data analysis were undertaken by John Crossley with some advice from Theo Loizou, sub-contractor for this and a concurrent survey of another SSSI in Orkney. This report was written by John Crossley.

#### *2.1.2 Field survey and mapping*

Before undertaking detailed fieldwork John Crossley visited the site on 13 July, and again with Theo Loizou on 16 July, in order to gain some preliminary understanding of the range and types of vegetation present. Field work was then carried out on nine days between 28 July and 30 August, with further late visits on 27 and 29 September to resolve some uncertainties.

Mapping of homogeneous units of vegetation (polygons) in the field was carried out using maps and copies of aerial photographs at a scale of 1:2500. The complexity of vegetation at the site is such that it could not be usefully represented on a coarser-scale map. Discrimination of major features and natural boundaries such as pools, runnels, peat cuttings and contrasts between wet and dry areas was good on the photographs. A GPS device was used in delineating some vegetation boundaries not apparent on aerial photographs, notably reed-beds.

Sampling of vegetation types was carried out as recommended in the NVC Users' handbook (Rodwell, 2006). At least five samples were taken in each vegetation type, where possible, to provide a constancy score of I-V (some vegetation types of scarce occurrence and/or peripheral to the basin mire were sampled fewer than five times). Thereafter, 'free' mapping of communities was possible, with continued sampling to confirm type and register variations. Where it was difficult to establish the vegetation type, sampling was continued to achieve a larger data set. Up to 16 samples were taken in the more problematic and widespread communities, and a total of 114 altogether (see Annex 3).

However, homogeneous stands of single vegetation types of sufficient size to map as polygons on their own, even at a scale of 1:2500, were rare. Therefore nearly all the map polygons represent mosaics of up to six different types, with usually two to three of these being the major components. The method used to represent this on the NVC map has been to list the component types of a polygon on a scale of 1–10, this representing approximately the proportion of ground covered by each type. In addition, significant vegetation of another type occurring at much less than 10% has been represented by adding it to the list in brackets without a cover value. For example M9b, S27b, S10, (M10b): 5, 3, 2 indicates a polygon with c. 50%, 30% and 20% cover respectively of M9b, S27b and S10 in which M10b was also present. Boundaries between different vegetation types were often not clear-cut, but it was felt that the range of variation present was in nearly all cases adequately dealt with by the fine-scale of mapping and that additional identification of transitions would over-complicate the map. Thus transitions are discussed in the relevant sections of this report but rarely identified or mapped as distinct units. Where they have been they are represented thus: M9-M15.

Quadrat size was 2 x 2 m except in tall herb and swamp where it was generally 4 x 4, but sometimes 2 x 2 m in shorter, homogeneous vegetation and very small stands. Species occurring in a quadrat were assigned cover and abundance scores in accordance with the DOMIN scale. Species noted outside but close to the quadrat and still within the sample stand were also recorded using a plus (+) sign. A 10-figure grid reference for every quadrat

was recorded using a GPS device. Vegetation height was also recorded, but altitude and aspect were not, since altitude across the entire site does not vary by more than 3 m.

Two digital photos were taken of nearly every quadrat (a few were missed or the photos lost)[1], one a close-up of the vegetation, the other a wider view, except in tall swamp and mire communities where a single photograph was sufficient. A compass bearing was recorded for the wider view or single photo. The photos in electronic form are held by SNH (see Annex 8 for further details of data files supplementary to this report.)

A small number of target notes (see Annexes 3 and 4), some with photographs, were made and positions recorded. These relate to uncommon species and management issues.

### *2.1.3 Data analysis*

Quadrat data were entered in tables in Microsoft Excel and matched to community and sub-community using the text and tables published in British Plant Communities (Rodwell, 1991, 1992, 1995, 2000). The data were sorted manually into apparently homogeneous groups. Problematic single samples and groups of samples were analysed using the 'TABLEFIT' programme (Hill, 2011). Results obtained thus were used critically as an aide to diagnosis. The data are summarised in synoptic tables contained in Annex 1. These tables are set out exactly as in published NVC tables, with constants in the top sections, sub-community differentials and preferentials in the following sections, and so on. The complete raw data and essential details of all quadrats are contained in electronic files held by SNH (see Annex 8 for further details of data files supplementary to this report).

NVC quadrat data recorded in the summary tables in Annex 1 and in the raw data file include some species aggregates. Use of aggregates follows the practice adopted in published tables for each of the communities and is necessary in order to construct tables showing species' status in the community in a comparable way. The aggregates used are: *Agrostis canina* agg. to include *Agrostis canina sens. strict*. and *A. vinealis*; *Festuca ovina* agg. to include *F. ovina, F. fliformis* and *F vivipara;* and *Hypnum cupressiforme sens. lat.* to include *H. cupressiforme* and *H. jutlandicum*. There are some instances in the published tables where segregate names are used: again, the same practice is followed in this report.

Though ending up as aggregates in the tables, the segregates were in fact recorded in the field. It is worth noting that in the *Festuca ovina* aggregate *only F. filiformis* and *F. vivipara* were recorded, and in the *Agrostis canina* aggregate only *A. vinealis* was recorded.

Some groups correspond well or reasonably well with an NVC type, but others do not. In these cases the TABLEFIT programme is not particularly useful, as it generates a number of alternative answers, some inappropriate, with low scores. Many problematic groups represent local particularities, accentuated by intensive sampling in a limited area. In the context of the broad national coverage of the NVC, these groups are within the range of variation to be expected and it is sensible to assign them to existing units of the classification and give reasons for doing so. However a very few may be viewed as provisional new units of the NVC. Three such have been identified in this survey. Two of these are consistent with types already identified as occurring more widely in Scotland (including Orkney) while a third appears to represent a completely new type.

Reasoning in respect of particular provisional new types and variants is given in relevant sections of this report, but it is useful to summarise here the underlying considerations.

[1] Due to an oversight, there are no photographs of the few quadrats representing M10b, M23b, MG10, S9b and S28, which were sampled on 27/9 and 29/9/2012.

These have been set out in fuller form in a previous NVC report for a nearby mire site (Crossley, 2004).

- There are aspects of the Orkney flora, of consistent occurrence in the islands, which are unusual in comparison with the median of British vegetation. The cool oceanic climate, the effect of sea spray deposited in varying amounts over the entire archipelago and the isolation from the Scottish mainland are likely to be the chief reasons. For instance, *Empetrum nigrum* ssp. *nigrum* is almost ubiquitous in heaths and more or less acidic mires, *Festuca ovina* appears to be entirely replaced by *F. vivipara* (or occasionally by *F. filiformis*), *Agrostis canina sens. strict.* seems to be completely absent, and the saltmarsh species *Triglochin maritima* is common in inland wetlands. Such local particularities can make it difficult to reconcile local data with that in the published NVC tables.

- Little or no data used in the compilation of NVC community accounts and tables in Rodwell (1991) for lowland mire types came from Orkney or even the north of Scotland, so significant variation on a more than a narrowly local basis is to be expected.

- Reviews carried out for JNCC (Rodwell *et. al*. 2000) and SNH (Cooper & MacKintosh 1996) have drawn attention to variation and gaps at community and sub-community levels in the NVC and briefly described the vegetation concerned. Some of the problematic vegetation at the Loons is almost certainly referable to some of the additional types described in the reviews.

#### *2.1.4 Plant records and nomenclature*

A complete list of vascular plants was recorded - see Annex 5. Nomenclature for vascular plants follows Stace (2010) and for bryophytes Smith (2004).

Names of NVC communities have been up-dated to the same nomenclature.

### 2.2 Habitats and plant communities

A scanned copy of the original NVC map is reproduced here at Annex 2 for illustrative purposes only. The original is held by SNH (see Annex 8) and will be digitised in the future.

#### *2.2.1 Overview*

The site description (section 1.3) and summary of previous studies (section 1.4) have outlined the environmental setting and indicated some problems of identifying and mapping the vegetation. However the overall character and distribution of habitats and main NVC communities is reasonably clear.

The soligenous zones referred to in section 1.3 are characterised by swamp, tall herb and rich fen and flush communities, including reed-beds. The main NVC communities are S27 *Carex rostrata-Comarum palustre* tall-herb fen, M9 *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire, S4 *Phragmites australis* swamp and reed-bed and others with less cover, including M13 *Schoenus nigricans-Juncus subnodulosos* mire, S10 *Equisetum fluviatile* swamp, and MCxn *Carex nigra* mire (provisional new community). Associated with these zones, but mainly in the north-east corner on thin peat or peaty mineral soil, are areas of flushed M15 *Trichophorum germanicum-Erica tetralix* wet heath and M25 *Molinia caerulea-Potentilla* mire, with some M27 *Filipendula ulmaria-Angelica sylvestris* mire. Near Spurdagrove on the northern edge of the site is a confusing area where human impacts including eutrophication have produced a mosaic of swamp, fen and

grassland habitats including M28 *Iris pseudacorus-Filipendula ulmaria* mire and MG13 *Agrostis stolonifera-Alopecurus* grassland. Drier grasslands are a minor feature, confined to site boundaries and very small raised areas within the fen.

In contrast to these areas, on deeper peat in the west-central part of the mire, including also a section east of Netherdale that extends almost to the northern margin of the mire, is more ombrotrophic mire vegetation mainly comprising forms of M5 *Carex rostrata-Sphagnum squarrosum* mire and M6 *Carex echinata-Sphagnum fallax/denticulatum* mire with transitions from these to heath. However the difference between the two areas is not clear-cut because of soligenous influence and an irregular surface caused by former peat-cutting. For example, S27 tall-herb fen, among others, is also present here. The most recent area of peat cutting is a jumble of different vegetation types, including swamp, rich fen, *Molinia* grassland and bits of heath on dry edges.

*Figure 1.* Loch of Isbister, with S27 tall herb fen and S4 reed-bed.

To the southeast of these areas there is first a large, apparently mesotrophic pool with reed-bed, then, approaching the Skooant and north bay of the Loch of Isbister, the peat becomes shallower and the ground progressively firmer. However there are water tracks through it and much of it is inundated in winter. The area has previously been used for grazing livestock and parts for harvesting winter fodder, and the remains of linear banks and ditches are evidence of past use and attempts at 'improvement'. Hence this is a complex area of vegetation, much of it not straightforward in NVC terms. S27 tall-herb fen in an unusual grassy form is common, with transitions to acidic mire on areas of thin peat. On firmer ground nearer the loch there are M23 *Juncus effusus/acutolorus-Galium palustre* rush pasture with M27 mire and MG9 *Holcus-lanatus Deschampsia cespitosa* grassland. Then in frequently flooded areas close to the Loch of Isbister there is unusual vegetation with an abundance of *Carex nigra* together with *Potentilla anserina* and *Agrostis stolonifera:* this is very like SD17 dune-slack. Nearby, hollows that are flooded other than for a few weeks in summer also have an unusual flora comprising mainly annuals, including the Nationally Scarce *Rorippa islandica.*

To the south-west of the Loch of Isbister and separate from the main area of mire is a much smaller area of similar habitats and vegetation communities. The mosaics here are complex but the pattern of distribution is more straightforward, with open water transition comprising reed-beds at the loch edge, grading into swamp, rich fen, flushed heath, and M25 and M27 mires.

The vegetation of the loch edge is highly variable depending on the substrate. Locally along parts of the western shore, soft silt supports reed-beds. Mainly along the northern shore, firm, moist soils support damp grassland with MG9 grassland and M27 mire at the water's edge. Elsewhere the loch edge has a hard, stony substrate supporting a sparse vegetation cover of basiphilous herbs in the draw-down zone. The aquatic flora was not thoroughly investigated, but the species list compiled indicates the A11 *Potamogeton pectinatus-Myriophyllum spicatum* community, the *Potamogeton filiformis* sub-community (A11c), typical of clean, base-rich waters.

*Table 1. List of vegetation types recorded*

| | |
|---|---|
| M5 | *Carex rostrata-Sphagnum squarrosum* mire |
| M6b | *Carex echinata-Sphagnum fallax/denticulatum* mire, *Carex nigra-Nardus stricta* sub-community |
| M6-M15 | M6 *Carex echinata-Sphagnum fallax/denticulatum* mire/M15 *Trichophorum germanicum-Erica tetralix* wet heath intermediate community |
| M9a | *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire, *Campylium stellatum-Scorpidium scorpioides* sub-community |
| M9b | *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire, *Carex diandra-Calliergon giganteum* sub-community |
| M10a | *Carex dioica-Pinguilica vulgaris* mire, *Carex demissa-Juncus bulbosus* sub-community |
| M10b | *Carex dioica-Pinguilica vulgaris* mire, *Briza media-Primula farinosa* sub-community |
| M13 | *Schoenus nigricans-Juncus subnodulosus* mire (no sub-community) |
| M15 | *Trichophorum germanicum-Erica tetralix* wet heath (no sub-community) |
| M15a | *Trichophorum germanicum-Erica tetralix* wet heath, *Carex panicea* sub-community |
| M23b | *Juncus effusus/acutiflorus-Galium palustre* rush-pasture, *Juncus effusus* sub-community |
| M25a | *Molinia caerulea-Potentilla erecta* mire, *Erica tetralix* sub-community |
| M25b | *Molinia caerulea-Potentilla erecta* mire, *Anthoxanthum odoratum* sub-community |
| M25x | *Molinia caerulea-Potentilla erecta* mire, M25x *Carex pulicaris* provisional sub-community |
| M27a | *Filipendula ulmaria-Angelica sylvestris* mire, *Valeriana officinalis-Rumex acetosa* sub-community |
| M27b | *Filipendula ulmaria-Angelica sylvestris* mire, *Urtica dioica-Viccia cracca sub-community* |
| M27c | *Filipendula ulmaria-Angelica sylvestris* mire, *Juncus effusus-Holcus lanatus sub-community* |
| M28 | *Iris pseudacorus-Filipendula ulmaria* mire (no sub-community) |
| M28a | *Iris pseudacorus-Filipendula ulmaria* mire, *Juncus effusus-J acutiflorus sub-community* |
| MG5c | *Cynosurus cristatus-Centaurea nigra* grassland, *Danthonia decumbens* sub-community |
| MG6 | *Lolium perenne-Cynosurus cristatus* grassland (no sub-community) |
| MG9a | *Holcus lanatus-Deschampsia cespitosa* grassland, *Poa trivialis* sub-community |
| MG10 | *Holcus lanatus-Juncus effusus* rush-pasture (no sub-community) |
| MG13 | *Agrostis stolonifera-Alopecurus geniculatus* grassland |
| U4b | *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland, *Holcus lanatus-Trifolium repens* sub-community |
| S4 | *Phragmites australis* swamps and reed-beds |
| S4b | *Phragmites australis* swamps and reed-beds, *Galium palustre* sub-community |
| S4c | *Phragmites australis* swamps and reed-beds, *Menyanthes trifoliata sub-community* |
| S9b | *Carex rostrata swamp, Menyanthes trifoliata-Equisetum fluviatile* sub-community |
| S10a | *Equisetum fluviatile* swamp, *Equisetum fluviatile* sub-community |
| S10b | *Equisetum fluviatile* swamp, *Carex rostrata* sub-community |
| S10bi | *Equisetum fluviatile* swamp, *Carex rostrata* sub-community *Menyanthes trifoliata* species-poor variant S10bi |
| S19a | *Eleocharis palustris* swamp, *Eleocharis palustris* sub-community |
| S27 | *Carex rostrata-Comarum palustre* tall-herb fen (no sub-community) |
| S28a | *Phalaris arundinacea* tall-herb fen, *Phalaris arundinacea* sub-community |
| SD17c | *Potentilla anserina-Carex anserina* dune-slack, *Caltha palustris* sub-community (SD17c) |
| SD17d | *Potentilla anserina-Carex anserina* dune-slack, *Hydrocotyle vulgaris-Ranunculus flammula* sub-community |
| **Provisional new NVC** | |
| MCxn | *Carex nigra* provisional new mire community |
| OVx | *Juncus bufonius-Gnaphalium uliginosum* provisional new dwarf-rush community |
| **Non-NVC** | |
| Jc | Rush-pasture with *Juncus conglomeratus* |
| Ow | Open Water |
| Mud | Bare mud |
| Sxp | Mixed *Salix* scrub plantation |

*2.2.2 Mires and heaths*

**M5 *Carex rostrata-Sphagnum squarrosum* mire**

This type of mire is present almost entirely in the grazing compartment immediately east of the Loons hide, covering approximately one hectare in fairly consistent form and further areas nearby mingled with other vegetation, especially M9 *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire and S27 *Carex rostrata-Comarum palustre* fen. It is scarce elsewhere on the site, though small nuclei, sometimes occupying just a few square metres, may be found intermingled with other vegetation, especially M9 and S27, and occasionally M6 and M13.

M5 occurs over shallow peat where water tables remain relatively high. Here, it appears to be separated from adjacent M9 and S27 only by the slightest elevation above calcareous waters. The floristics are not typical and suggest that seasonal drying of the peat surface is greater than optimal for the community.

This unusual form of M5 is characterised by a short, even cover of *Empetrum nigrum* ssp. *nigrum*, *Aulacomnium palustre* and *Sphagna,* the latter mainly comprising *S. subnitens* with some *S. palustre* and S*. capillifolium*, pricked through with *Comarum palustre, Carex nigra, Eriophorum angustifolium,* grasses and poor-fen forbs. *Menyanthes trifoliata* is patchily present. Thus it lacks the community nominate and key constant species *Carex rostrata* and *Sphagnum squarrosum,* and it includes species not typical of M5, especially *Empetrum nigrum*, but other community constants are well represented. The combination of these constants with the *Sphagna* and *Menyanthes trifoliata* indicates M5 as the closest unit in the NVC. The presence of *Anthoxanthum odoratum, Potentilla erecta, Festuca vivipara* and *Carex panicea* suggests a transition to M6 *Carex echinata-Sphagnum fallax/denticulatum* mire, albeit an unusual form of that (see M6-M15 below).

*Figure 2.* M5 *Carex rostrata-Sphagnum squarrosum* mire (quadrat 8).

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

The ***Carex nigra-Nardus stricta*** **sub-community** (**M6b)** was identified, also an unusual transitional form here referred to as **M6-M15** *Carex echinata-Sphagnum fallax/denticulatum – Trichophorum germanicum-Erica tetralix* wet heath transition.

M6b is found mainly in the northern part of the site, especially in a hard-grazed form in the Netherdale enclosure, which is probably the most base-poor section of the site, and also in the east-central part where it forms the major component in mosaic with different vegetation including swamp and rich fen. The main area at Netherdale is c. 2 ha in extent.

M6-M15 occurs further south, very near the centre of the basin, and occupies c.2 ha. Here this community is apparently associated with a thin peat layer partially isolated from the calcareous waters of the basin, and somewhat drier, at least in summer, than that supporting the M5 community. The M6-M15 form with its substantial dwarf shrub component no doubt occupies drier areas than M6b.

Grazing levels and impacts are highly variable in different enclosures and are likely also to determine the cover of dwarf shrubs.

**M6b *Carex nigra-Nardus stricta* sub-community**

Most of the community constants and sub-community preferentials of M6b are well represented, including *Carex echinata, Polytrichum commune, Potentilla erecta, Viola palustris, Molinia caerulea, Eriophorum angustifolium, Nardus stricta, Carex nigra* and *C. panicea*, and there are some *Sphagna*. The cover of *Molinia caerulea* is variable. The species of *Sphagna* present include *S. palustre* but are otherwise slightly atypical, in that no *S. fallax* was found (in this community or anywhere else on the site) and S*. denticulatum* agg. is very scarce, whilst *S. subnitens* is relatively frequent. *Carex echinata* is never abundant, whilst the grasses *Holcus lanatus* and *Anthoxanthum odoratum* are unusually frequent. The abundance of *Aulacomnium palustre* is also unusual.

The height of the vegetation is less than 10 cm in large parts of the grazed Netherdale enclosure, but is up to 40 cm in the east-central part of the basin.

**M6-M15 Carex *echinata-Sphagnum fallax/denticulatum – Trichophorum germanicum-Erica tetralix* wet heath transition**

The M6-M15 vegetation is peculiar. *Sphagna*, *Polytrichum commune* and a similar array of herbs indicate affinity with the form of M6b described, but abundant *Empetrum nigrum spp. nigrum* and small amounts of *Calluna vulgaris* give the appearance of a heath – except there is no heath like it described in the NVC. With plentiful *Empetrum nigrum, Sphagna* and some *Aulacominum palustre* it looks quite like the M5 described earlier, but it is drier and lacks both *Comarum palustre* and *Menyanthes trifoliata*, whilst occasional *Polygala serpyllifolia* and bryophytes including *Hylocomium splendens* and *Pleurozium schreberi* further indicate the transition to heath. There is little or no sign of grazing.

**M9 *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire**

Typically in M9 *Carex rostrata* is the main sedge, often with C*. limosa* and/or C*. diandra*, each of these being preferential to one of the sub-communities, with a more general presence of *C. nigra* and *C. panicea* – but not at this site*. C rostrata* is very locally present, almost entirely at the north-east corner near Spurdagrove and at the far south-western end next to the Loch of Isbister. Neither *C. limosa* nor *C. diandra* is present. Nevertheless, vegetation best identified as M9 occurs frequently in most parts of the site. *Carex nigra*,

normally a companion species in this community, almost everywhere takes the place of *C. rostrata* as the constant and sometimes abundant sedge.

Along with S27 this rich mire is present in all the soligenous parts of the basin, mainly around the perimeter but also extending along a network of shallow water tracks into many more central parts and occupying old peat cuttings and natural depressions. It is present also to the south-west of the Loch of Isbister.

Of the community constants, *Calliergonella cuspidata* is always present and usually abundant, *Menyanthes trifoliata* and *Comarum palustre* are well represented throughout, and often abundant. *Eriophorum angustifolium* and *Galium palustre* are frequent. The community is fairly species-rich, with up to 29 species recorded in a single quadrat.

Almost all this vegetation can be assigned to the ***Carex diandra-Calliergon giganteum*** **sub-community (M9b)**. It is herbaceous, often quite tall (up to 70 cm), and preferentials including *Caltha palustris, Epilobium palustre, Silene flos-cuculi* and *Mentha aquatica* are constant, though the nominate *Calliergon giganteum* and Mniaceous mosses are rather scarce. In some stands *Comarum palustre* has a much greater presence than is typical for the community type. Less typical also is the constant presence of the grasses *Holcus lanatus, Agrostis stolonifera* and *Festuca rubra*. An unusual but not incongruous feature is the frequent presence of *Sagina nodosa*.

The very local presence of 'brown mosses' *Campylium stellatum* and *Scorpidium cossonii* with occasional *Potamogeton polygonifolius*, *Triglochin palustris, Triglochin palustris, Juncus bulbosus* and *Dactylorhiza purpurella* indicates a transition to the ***Campylium stellatum-Scorpidium scorpioides*** **sub-community (M9a)**, and this is reflected in some of the samples collected. Unequivocal (but still without *Carex rostrata*) M9a, with an abundance of these brown mosses and few of the taller herbs, is scarce. The characteristic base-tolerant *Sphagna* sometimes associated with this sub-community are absent, though *S. subnitens* occurs occasionally.

Separation of this community from S27 *Carex rostrata-Comarum palustre* tall-herb fen is difficult, especially so when the forms found of both communities, but more especially S27, are not typical. In particular, an abundance of *Comarum palustre* often obscures the distinguishing features of these communities. Separation has been made as far as has been possible on the greater species-richness and greater cover of the characteristic bryophytes in M9. The mapping of M9 and S27 in any one area is at best indicative of the relative cover of the two communities.

**M10 *Carex dioica-Pinguilica vulgaris* mire**

Two patches of short, sedge- and bryophyte-rich vegetation on saturated level ground not far from the Loons hide were identified as M10 and closest to the ***Briza media-Primula farinosa*** **sub-community (M10b).**

This is rich vegetation, with 36 species recorded in a single quadrat. The two community nominates *Carex dioica* and *Pinguicula vulgaris* are absent from the samples recorded, but were seen elsewhere and the other constants and sub-community preferentials are well represented. Small sedges and rushes comprise *Carex panicea, C. flacca, C. hostiana, C nigra, Juncus articulatus* and *J bulbosus.* Bryophytes in profusion include *Calliergonella cuspidata, Campylium stellatum, Bryum pseudotriquetrum, Scorpidium revolvens, Ctenidium molluscum, Fissidens adianthoides* and *Cratoneuron filicinum*. Preferentials of the *Carex demissa-Juncus bulbosus* sub-community (M10a) are absent whilst those of M10b, including *Carex flacca, Agrostis stolonifera*, *Calliergonella cuspidata*, *Euphrasia officinalis*, *Pedicularis palustris* and *Equisetum palustre* are well represented. However the absence of the sub-

community nominates makes the diagnosis of M10b somewhat unsatisfactory. The floristics are similar to those of M9a, which lends understanding to its occurrence here.

Elsewhere the community is rare and occupies fragmentary transition zones between flushed wet heath or acid grassland and adjacent rich fen. In these places the ***Carex demissa-Juncus bulbosus*** **sub-community (M10a)** is present, but no sampling was carried out.

Most of the stands are located in areas kept short by grazing and, in one case, annual mowing.

**M13 *Schoenus nigricans-Juncus subnodulosus* mire**

This mire type encompasses all the stands where *Schoenus nigricans* is very much the dominant. Its large and robust tussocks provide a strong structural element to the vegetation - a feature of M13.

Scattered small stands, more or less linear in shape, of this community occur in nearly all parts of the site except the centre, always adjacent to or surrounded by wetter areas of mire, tall-herb fen and swamp, and probably where there is some upwelling of water. The transition to other, wetter communities is usually abrupt, but there are some small areas of transition.

*Molinia caerulea* is abundant and often co-dominates with *Schoenus nigricans*. The tops of the tussocks may have a little *Calluna vulgaris*, and, more rarely, *Erica tetralix*, but the dwarf shrubs seldom have any prominence. It is moderately rich vegetation, with 23-32 species recorded per quadrat. Small sedges and forbs including *Carex panicea, C, pulicaris, C, nigra, C. flacca, C. hostiana, Succisa pratensis, Potentilla erecta, Caltha palustris, Hydrocotyle vulgaris, Hypericum pulchrum, Parnassia palustris* and others occupy the sides of tussocks and runnels between them where spacing allows. These micro-habitats also support some bryophytes of flushes and rich fens including *Campylium stellatum, Scorpidium revolvens, Fissidens adianthoides* and the more ubiquitous *Calliergonella cuspidata*. The relatively dry tops of tussocks often have other bryophytes including *Pseudoscleropodium purum, Hylocomium splendens* and *Kindbergia praelonga*.

Thus, with the exception of *Juncus subnodulosus,* the community constants and many of the sub-community preferentials and community associates are well represented. The absence of the Southern-temperate *J. subnodulosus* is however important and makes the diagnosis of M13 somewhat unsatisfactory. Indeed, if the dominance and structural importance of *Schoenus nigricans* were overlooked it would be possible to separate this single community into several others, depending on the differing local representation of accompanying species, comprising M25 *Molinia caerulea-Potentilla erecta* mire, M15a *Trichophorum germanicum-Erica tetralix* wet heath (*Carex panicea* sub-community), M10 *Carex dioica-Pinguicula vulgaris* mire and M9 *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire, probably in that order. Indeed, *Schoenus nigricans* can be found at low density in all of these communities at this site. But it was felt that uniting all the *Schoenus*-dominated vegetation was the more comprehensible approach.

No particular sub-community was identified.

There is little sign of grazing impact, even where it occurs in a moderately grazed compartment near the Loons hide.

*Figure 3. M13 Schoenus nigricans-Juncus subnodulosus* mire (viewed at quadrat 93). Background mainly swamp and rich fen communities.

**M15 *Trichophorum germanicum-Erica tetralix* wet heath**

The ***Carex panicea* sub-community (M15a)** occurs in most parts of the site, covering small areas, mainly around the fringes. It is more a flushed mire than a wet heath, though *Calluna vulgaris* is always present, and conspicuous in most stands. It is fairly species-rich, with 29 species in the one quadrat sampled. *Molinia caerulea, Eriophorum angustifolium, Potentilla erecta* and *Narthecium ossifragum* are also constant, with sedges comprising *Carex nigra, C. panicea, C. pulicaris, C. echinata* and *C. hostiana*. Bryophytes are conspicuous, including the flush species *Campylium stellatum*, *Ctenidium molluscum* and *Fissidens adianthoides*. However *Sphagna*, usually a feature of this kind of vegetation, are scarce. Unusually, *Thalictrum alpinum* occurs in some stands. The largest stand, which is lightly grazed and in favourable condition, is at the north-eastern end of the site, near Folsetter, and the next-largest, in similar condition, is at the far south-west close to the Loch of Isbister. Some smaller stands in areas with more grazing are in less favourable condition, with *Calluna* reduced to stumps and *Molinia* abundant.

Other examples of wet heath occur on peat hummocks and banks around old peat cuttings in the north-central part of the basin. These have not been classified to sub-community level. They are, by comparison to the M15a, species-poor, with 19 species in the single quadrat sampled. Besides the community constants *Calluna vulgaris*, *Molinia caerulea* and *Potentilla erecta*, some preferentials of the Typical (M15b) and *Vaccinium myrtillus* (M15d) sub-communities are present, comprising *Eriophorum angustifolium, Sphagnum palustre, Anthoxanthum odoratum, Luzula multiflora, Polytrichum commune* and *Nardus stricta*, along with conspicuous quantities of companion species *Empetrum nigrum*, with the additional and incongruous *Rumex acetosa*. *Hylocomium splendens* is frequent and some of the driest spots have *Erica cinerea* and *Deschampsia flexuosa*, indicating a shift towards a dry heath community, but the areas are negligible. Areas of this vegetation are lightly grazed or not grazed at all.

**M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture**

This rather ill-defined assemblage of tall rushes, poor-fen and wet grassland herbs is found on poorly-drained mineral soils where grazing pressure is heavy or where some past agricultural 'improvement' has modified the vegetation. The areas concerned are confined to the edges of improved grassland at the Skooant and a slightly raised area north of the north bay of the Loch of Isbister. *Juncus effusus* is scarce on the site as a whole but here it is patchily prominent with J*. conglomeratus*. Mesotrophic herbs comprising *Holcus lanatus, Agrostis stolonifera, Deschampsia cespitosa, Ranunculus acris, Festuca rubra, Rumex acetosa* and *Senecio aquaticus* are present together with others characteristic of more acidic mires and grasslands, including *Potentilla erecta, Carex panicea, Carex nigra* and *Molinia caerulea*. It also runs into adjacent M27 *Filipendula ulmaria-Angelica sylvestris* mire and still wetter communities where such species as *Caltha palustris, Ranunculus flammula, Hydrocotyle vulgaris* and *Comarum palustre* make an appearance.

**M25 *Molinia caerulea-Potentilla erecta* mire**

*Molinia caerulea* is common and widespread throughout the site in a variety of communities and becomes abundant or dominant quite frequently in stands around the perimeter, especially in the north-east and south-west corners. The other constant of the community, *Potentilla erecta*, is always present in small amounts.

There is one stand only of the ***Erica tetralix* sub-community (M25a)**, next to the public road near Spurdagrove. It is species-poor, with *Molinia* overwhelmingly abundant, but unusual for including much *Schoenus nigricans* and *Equisetum arvense*. The *Molinia* tussocks are large, with deep, wet runnels between them. *Calluna vulgaris* occurs, though not prominently, indicating transition to M15a wet heath.

The ***Anthoxanthum odoratum* sub-community (M25b)** occurs occasionally in small stands in many parts of the site, with the largest single area west of the Loch of Isbister. *Molinia* is not as abundant as in M25a. This is much grassier vegetation and the sub-community preferentials *Anthoxanthum odoratum, Holcus lanatus, Festuca rubra* and *Luzula multiflora* are well represented. The differentials *Pseodoscleropodium purum* and *Carex flacca* are frequent and *Viola palustris* is occasional. However this is rather richer vegetation than usual for M25b, with 16-27 species recorded in quadrats, indicating a transition to the Angelica sylvestris M25c sub-community. M25c preferentials including *Angelica sylvestris, Cirsium palustre* and *Equisetum palustre* are occasional. More striking is the frequent and sometimes abundant occurrence of a variety of herbs, companion species in the community as a whole, including *Carex panicea, Succisa pratensis* and *Carex nigra*, accompanied less frequently by others including *Agrostis stolonifera, A. canina agg.,* and *Carex echinata*. Others not normally associated with M25 include *Juncus conglomeratus, Equisetum fluviatile, Caltha palustris* and *Silene flos-cuculi*.

More striking still are stands of even more herb-rich M25 mire, with 18-32 species per quadrat. This vegetation is akin to M24 *Molinia caerulea-Cirsium dissectum* fen-meadow, though *Cirsium dissectum*, found no further north than Kintyre in Scotland, is absent. The floristics are similar to those of the already rich M25b at this site, but *Molinia* is more abundant and additionally it has frequent *Carex pulicaris, C. hostiana, Thalictrum alpinum* and *Triglochin palustris,* with occasional *Carex dioica, C. lepidocarpa, Scorzoneroides autumnalis, Sagina nodosa, Galium saxatile, Campylium stellatum, Mnium hornum, Hylocomium splendens* and others. Apparently very similar vegetation recorded elsewhere in Scotland is referred to in Rodwell *et al* (2000), where affinities with M24 *Molinia caerulea-Cirsium dissectum* fen-meadow are discussed, and in Cooper & MacKintosh (1996). It is referred to here as **M25x *Carex pulicaris* provisional sub-community**.

The M25x vegetation occurs widely, mainly in small stands, throughout the site. There is a larger one at the north-east corner, near Folsetter.

Grazing impacts on M25b and M25c vary. Most stands are lightly grazed, but there are some small poached and run-down stands just north of and south-west of the Loch of Isbister.

**M27 *Filipendula ulmaria-Angelica sylvestris* mire**

All three sub-communities of this mire were identified, occurring in many parts of the site, picking out reasonably rich, permanently moist but not waterlogged soils. It is conspicuous along the edges of the loch and some pools, forming small levees in these situations. It is absent from the central basin. Most stands are small, but there is a more extensive area at the north-east corner, between Spurdagrove and Folsetter.

The ***Valeriana officinalis-Rumex acetosa*** sub-community (M27a) is the most common of the three. *Filipendula ulmaria* is abundant and most of the community preferentials and some differentials, including *Angelica sylvestris, Cardamine pratensis, Succisa pratensis, Rumex acetosa, Ranunculus acris, Galium palustre, Poa trivialis, Caltha palustris* and *Carex nigra* are well represented. *Valeriana officinalis*, not recorded anywhere on the site, is absent. Bryophytes include *Calliergonella cuspidata, Plagiomnium undulatum* and *Kindbergia praelonga*. Some stands are situated close to M25, and transitional elements in the flora are evident, with *Molinia caerulea* frequent though never abundant. There are occasional wetter stands with a little *Carex rostrata*. Some stands are quite rich, with 29 species recorded in a quadrat. Grazing impacts are almost everywhere low.

The ***Urtica dioica-Viccia cracca sub-community*** **(M27b)**, with much *Urtica dioica* and *Iris pseudacorus*, together with small amounts of grasses including *Poa trivialis, Elytrigia repens* and *Arrhenatherum elatius*, is present in a small stand on drier, sloping ground next to the public road near Spurdagrove and on a curious islet (possibly a broch) reached by stepping stones in the Loch of Isbister.

Vegetation similar to M27a, but with less *Filipendula* and a much greater contribution from grasses has been assigned to the ***Juncus effusus-Holcus lanatus*** **sub-community (M27c).** More grazing by cattle probably accounts for the somewhat ill-assorted character of this vegetation. The sub-community preferential *Juncus effusus* is scarce but *J. conglomeratus* is frequent. *Molinia caerulea* is frequent and other preferentials and differentials of the sub-community comprising *Holcus lanatus, Anthoxanthum odoratum, Agrostis stolonifera* and *Senecio aquaticus* are well represented. Other frequent grasses include *Deschampsia cespitosa* and *Festuca rubra.*

**M28 *Iris pseudacorus-Filipendula ulmaria* mire**

**M28a *Iris pseudacorus-Filipendula ulmaria* mire, *Juncus effusus-J acutiflorus* sub-community** is scarce at the site, being confined to a few small stands along the northern edge and one fringing part of the south-west shore of the Loch of Isbister. *Iris pseudacorus* is overwhelmingly abundant. A few tall stems of *Poa trivilialis* show among the iris and most stands have a little *Filipendula ulmaria* and *Angelica sylvestris*. There is a scattering of other grasses including *Anthoxanthum odoratum*, *Festuca rubra, Agrostis stolonifera, Holcus lanatus* and *Deschampsia cespitosa*, with forbs including *Ranunculis acris, R. repens, Rumex acetosa, Epilobium palustre* and *Caltha palustris*.

There are some species-poor, almost pure, stands of *Iris pseudacorus* in swamps or emergent in open water, at the Loons hide pool, at Spurdagrove and at the south end of the

Loch of Isbister. These cannot be assigned to a sub-community of M28. The one at Spurdagrove is associated with nutrient-enriched MG13 Agrostis *stolonifera-Alopecurus geniculatus* grassland.

***MCxn Carex nigra* mire – provisional community**

Scattered throughout the site and associated with many other types there is vegetation characterised by at least frequent, and often abundant, *Carex nigra* with grasses, sedges and 'intermediate-fen' forbs. The grasses are chiefly *Agrostis stolonifera, Holcus lanatus* and *Festuca rubra*. Sedges and rushes that occur with frequency are *Carex panicea, Juncus articulatus* and J*. bulbosus*. Of the forbs, *Epilobium palustre* is always present and *Caltha palustris* nearly always, the latter sometimes in quantity. There are many others, especially *Silene flos-cuculi, Rhinanthus minor, Cirsium palustre, Senecio aquaticus, Angelica sylvestris* and, at the wetter end of the spectrum, *Equisetum fluviatile*. There is often a bryophyte layer, combining rich-fen with common grassland species. *Calliergonella cuspidata* can be abundant. Some grassy stands are species-poor. Others, with some similarity to M9 *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire, are relatively rich.

Vegetation from similar habitats resembling this *Carex nigra* mire has been identified in the JNCC review (Rodwell *et al*, 2000), both as a potential new *Carex nigra-Agrostis stolonifera-Senecio aquaticus* grassland community in the Calthion palustris alliance, and as a potential new *Carex nigra-Agrostis stolonifera* community in the Potentillion anserinae alliance. Cooper and MacKintosh in their SNH review (1996) note the occurrence of this type of vegetation elsewhere in Scotland. It seems to be very similar to a type described by Dargie in the *Sand dune vegetation survey of Scotland*, in greatest detail in the volume on the Inner Hebrides (Dargie, 1999), which he named 'Mx *Carex nigra* provisional new rich fen NVC type', with three variants. However, Dargie's type appears to be more broadly drawn and to include at least some vegetation which is here interpreted as forms of M9, S27 and SD17.

These *Carex nigra* mires occur throughout the site but almost always in small stands. Some larger ones in the more grazed areas may represent a poached and degraded form of M9 *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire, but others seem to be less modified and represent part of the variation in the swamp and mire communities.

In the NVC this vegetation comes closest to SD17 *Potentilla anserina-Carex anserina* dune-slack. The table in Annex 1 is arranged in the order of that community.

***Juncus conglomeratus* rush pasture – non NVC**

*Juncus conglomeratus* is the only common large rush on this site and in places it is the major component of a form of rush-pasture. Below the rushes is a ground flora mainly of poor-fen herbs. Sedges and grasses include *Carex nigra, C. panicea, C. echinata, C. pulicaris, Holcus lanatus, Anthoxanthum odoratum* and *Festuca rubra*. A mixed array of forbs includes *Potentilla erecta, Epilobium palustre, Rumex acetosa, Senecio x ostenfeldii, Hydrocotyle vulgaris, Silene vulgaris* and *Succisa pratensis*. *Comarum palustre* is occasionally abundant. The frequent and sometimes abundant bryophyte flora is equally disparate, with *Hylocomium splendens, Calliergonella cuspidata, Rhytidiadelphus squarrosus* and *Pseudoscleropodium purum.* This vegetation occupies some transitional zones, mainly in the north-west of the site, between patches of U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland and adjacent mire and swamp communities with *Comarum palustre*. No doubt the U4 is derived, through grazing by livestock, from heathland, and the *J. conglomeratus* vegetation would once have been a heath/mire transition. Grazing is now generally light in the area in which it occurs.

### *2.2.3 Grasslands*

Grasslands are not a major feature of the site, apart from that covering the Skooant. Elsewhere, around the site's boundary there are some more or less dry strips of grassland, some rush pasture and disturbed and/or nutrient-enriched wet grassland. Such areas also occur very locally in the heart of the site.

**MG5 *Cynosurus cristatus-Centaurea nigra* grassland**

One sub-community occurs, the ***Danthonia decumbens* (MG5c) sub-community**, in a single small area of grassland south-west of the Loons hide.

This grassland has plentiful *Festuca rubra* with some *Agrostis capillaris, Anthoxanthum odoratum* and *Holcus lanatus* and frequent forbs characteristic of the community including *Plantago lanceolata, Trifolium repens* and *Trifolium pratense*. The community nominate *Cynosurus cristatus* is sparse. Some preferentials of the sub-community including *Scorzoneroides autumnalis, Luzula campestris* and *Prunella vulgaris* are present, also some companion species especially *Rhinanthus minor* and *Ranunculus acris*, but this not a species-rich or even well-defined example of the community or sub-community. The presence of *Silene flos-cuculi* and *Deschampsia cespitosa*, albeit in small quantities, is evidence of the damp conditions.

**MG6 *Lolium perenne-Cynosurus cristatus* grassland**

This grassland covers the more or less dry, heavily grazed area known as the Skooant, the low glacial mound north of the Loch of Isbister; elsewhere it occurs as narrow strips along the south-western fringes of the site where the SSSI boundary is with fields of improved grassland.

*Agrostis capillaris, Holcus lanatus* and *Festuca rubra* are the most abundant grasses, with a little *Lolium perenne, Cynosurus cristatus* and *Anthoxanthum odoratum. Agrostis stolonifera* becomes plentiful in damper places. *Ranunculus acris* is frequent throughout and *Bellis perennis, Trifolium repens* and *Plantago lanceolata* are abundant in hard-grazed swards.

**MG9 *Holcus lanatus-Deschampsia cespitosa* grassland**

One sub-community occurs here, the ***Poa trivialis* sub-community (MG9a)**. It forms occasional small stands on the periphery of the site and around loch and pool shores on moist, circumneutral mineral soils that are not particularly well draining. The community picks out such areas among a wide range of other communities, most frequently M27 and M23.

*Deschampsia cespitosa* is plentiful to abundant in all stands and is always accompanied by the other constant of the community, *Holcus lanatus*. Some preferentials of the sub-community are present, but only *Anthoxanthum odoratum* and *Ranunculus acris* with any abundance. *Filipendula ulmaria* is locally frequent. Apart from these, the companion species *Rumex acetosa, Angelica sylvestris, Festuca rubra* and *Ranunculus repens* are frequent.

However this is variable vegetation often showing transitions to adjacent much wetter communities. Thus several species not typical of the community at all, including *Epilobium palustre, Equisetum palustre, E. fluviatile, Galium palustre* and *Caltha palustris* are locally frequent.

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

This community occurs very locally on the periphery of the site, in very small stands except for one larger area east of Netherdale. These stands occur on wet, circumneutral mineral soil on the boundary between improved grassland and mire and are preferentially grazed by cattle. The Netherdale area, a strip bordering improved grassland, was tentatively identified as MG10 but it was not possible to get more than a quick look at it because of the presence of a bull.

The community constant *Juncus effusus* is very scarce, as it is on the site as a whole. Nevertheless this grassland with *Agrostis stolonifera, Holcus lanatus* and *Ranunculus repens,* the three other constants, is closer to MG10 than any other community. There is a weak representation of species from the Typical (MG10a) and *Iris pseudacorus* (MG10c) sub-communities, comprising *Angelica sylvestris, Juncus articulatus, Filipendula ulmaria* and *Silene flos-cuculi* and many companion species. The latter include abundant *Festuca rubra,* plentiful *Anthoxanthum odoratum* and frequent to occasional *Rumex acetosa, Potentilla anserina, Caltha palustris, Trifolium repens, Cardamine pratensis, Ranunculus acris* and *Calliergonella cuspidata.*

**MG13 *Agrostis stolonifera-Alopecurus geniculatus* grassland**

Two areas of this grassland were recorded; one is at the extreme western corner of the site, below the farm of Skorn, the other at the north, below the farm of Spurdagrove. The former is a very small area on the site periphery and associated with semi-improved grassland. The latter is below a drainage outlet and was mapped as almost exactly the same shape and size by Brunt in 1981. Both areas occur in waterlogged ground, the one at Spurdagrove on deep spongy silt with apparent nutrient-enrichment.

The community in both areas is characterised by thick mats of soft grass, mainly comprising *Agrostis stolonifera* or *Alopecurus geniculatus,* with some *Holcus lanatus* and *Glyceria fluitans.* Other frequent species, none more than sparse in the vegetation, include *Ranunculus repens, Caltha palustris and Equisetum fluviatile*.

**U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland**

All U4 grassland on the site shows signs of improvement and can be assigned to the ***Holcus lanatus-Trifolium repens* sub-community (U4b)**. This grassland occurs in scattered patches and spots around the site periphery and on slightly raised areas in the basin. The largest patches, near Folsetter, are typical examples of the U4b sub-community. Normally this community is associated with free-draining, neutral to acid soils. This is the case here for the Folsetter area, but some other patches are atypically wet for this community.

Three of the five community constants, *Agrostis capillaris, Anthoxanthum odoratum* and *Potentilla erecta*, are well represented throughout. Both the others, *Galium saxatile* and *Festuca ovina* agg., are scarce. Among the sub-community preferentials there is a little *Holcus lanatus, Trifolium repens, Achillea millefolium, Cerastum fontanum and Poa humilis* (represented by *Poa pratensis* agg. in the community tables). Others include *Festuca rubra (*sometimes plentiful), *Nardus stricta, Carex echinata, C. panicea, Succisa pratensis Lotus corniculatus, Luzula multiflora, Molinia caerulea, Agrostis vinealis, Rumex acetosa*, *Scorzoneroides autumnalis* and *Hypochaeris radicata.* Bryophytes are frequent, especially *Rhytidiadelphus triquetrus* and *Pseudoscleropodium purum*.

Elements in the flora indicating wetter conditions are locally frequent. They include *Epilobium palustre, Cirsium palustre, Senecio x ostenfeldii, Angelica sylvestris, Equisetum palsutre* and *Calliergonella cuspidata.*

### *2.2.4 Swamps and tall-herb fens*

**S4 Phragmites australis swamps and reed-beds**

Reed-beds occur in swamps and shallow standing water at several places: adjacent to the Loons pool; near Spurdagrove; fringing a pool near the centre of the basin; edging the far western shore of the Loch of Isbister; and forming a stand in open water further south in the Loch of Isbister. These are reed-beds with *Phragmites australis* overwhelmingly dominant, and are usually sharply defined from adjacent vegetation (or open water), though there is sometimes an intervening band of thinning reed cover. These intervening areas are characterised by S27 tall-herb and other swamp and rich fen communities. Another 'reed-bed' south-west of the Loch of Isbister actually comprises a variety of mire and swamp communities with *Phragmites* only locally dominant.

The ***Menyanthes trifoliata*** **sub-community (S4c)** is the most frequent community, comprising all but one of the reed-beds that it was possible to survey, including the largest one near the Loons pool. These are dense stands with reed up to two metres in height. They have an under-storey typical of this sub-community, mainly of *Menyanthes trifoliata* with some *Equisetum fluviatile*, lesser amounts of *Comarum palustre* and occasionally *Carex rostrata*. *Utricularia minor* was recorded in one stand. Also present as a minor component, but occasionally frequent, are a number of swamp and tall herb fen associates not typical of the more southern stands of this sub-community on which the published NVC description is based. They include *Mentha aquatica, Myosotis scorpioides, Poa trivialis, Cardamine pratensis, Carex nigra, Epilobium palustre, Caltha palustris* and *Epilobium parviflorum*.

*Figure 4.* Aberdeen Angus cattle grazing reed-bed at the Loons hide pool (see target note 4, Annex 4)

Where cattle have access, as at the Loons pool, they graze the reed avidly (see Figure 4 and target notes TN3 & TN4, Annex 4).

There is a single area of the ***Galium palustre*** **sub-community (S4b)** near Spurdagrove. This is mainly on slightly drier ground than the S4c and parts of the reed-covered area at this location consist of *Phragmites* with M27 *Filipendula ulmaria-Angelica sylvestris* mire. The floristic differences between the two sub-communities are not strikingly different at this site, but the absence in S4b of *Menyanthes*, the frequent presence of *Galium palustre*, together with occasional bryophytes including *Brachythecium rivulare, B. rutabulum, Calliergon cordifolium* and *Lophocolea bidentata* provide an evident contrast. This reed-bed is not grazed by livestock.

A substantial area of reed at the south-western end of the Loch of Isbister extends well out into the loch and there is open water between it and the shore. In at least one place it is fringed with *Hippuris vulgaris*. It and a smaller water-fringe stand along the loch edge were inaccessible for survey and have been mapped as S4 (no sub-community). The OS 1:25000 map (2007) of the area and previous surveys indicate that the larger stand was in recent times more extensive and connected to the loch shore.

**S9b *Carex rostrata swamp, Menyanthes trifoliata-Equisetum fluviatile* sub-community**

Just one small stand of this community was found, among mire and swamp to the south-west of the Loch of Isbister. In shallow water over peaty mud, *Carex rostrata* grows through *Menyanthes trifoliata* and *Comarum palustre*, with a little *Eleocharis palustris* and *Ranunculus flammula*. A previous survey (Prosser & Wallace, *op. cit*.) recorded the *Carex rostrata* (S9a) sub-community with the S4 reed-bed now in open water. It may still be there.

**S10 *Equisetum fluviatile* swamp**

*Equisetum fluviatile* is a common plant on the site and often comprises a significant component of swamp and mire vegetation, especially of S27 *Carex rostrata-Comarum palustre* tall-herb fen. However, it rarely occurs abundantly in the pure or species-poor stands typical of S10. Two small stands of the ***Equisetum fluviatile*** **sub-community** (**S10a)** were found, both comprising pure or almost pure stands edging open water, one at the Loons pool hide and another at the south end of the Loch of Isbister.

The ***Carex rostrata*** **sub-community (S10b)** is also very uncommon, being found only in one small stand on the western edge of the Loons hide reed-bed. It is less-species-poor than S10a, comprising abundant *E. fluviatile* with an under-storey mainly of *Menyanthes trifoliata* and *Comarum palustre. Carex rostrata* is absent.

Elsewhere, a feature of the site is the many small, shallow pools; surprisingly firm underfoot, with a near-complete cover of *Menyanthes trifoliata* and little else but for the occasional shoot of *E. fluviatile*, and sometimes not even this. Some of the larger, deeper pools also have dense stands of *M. trifoliata* growing along edges and out into open water. This vegetation is not described in the NVC, but is closest to the S10b *Carex rostrata* sub-community, which can have a high cover of *Menyanthes*. It is here named and mapped as the ***Carex rostrata*** **sub-community *Menyanthes trifoliata* variant S10bi**.

*Figure 5.* S10 *Equisetum fluviatile* swamp*, Carex rostrata* sub-community *Menyanthes trifoliata* variant S10bi (viewed from quadrat 10)

**S19a *Eleocharis palustris* swamp, *Eleocharis palustris* sub-community**

Small stands of this sub-community of S19, comprising pure stands of *E. palustris,* are frequent in shallow water around the edges of the Loch of Isbister and some larger pools.

As noted in the description of the S17d *Hydrocotyle vulgaris-Ranunculus flammula* sub-community of *Potentilla anserina-Carex anserina* dune-slack, the wettest areas of that community, with abundant *Eleocharis palustris*, have similarities with the S19c *Agrostis stolonifera* sub-community of S19.

***S27 Carex rostrata-Comarum palustre* tall-herb fen**

The S27 community occupies a greater area than any other on the site. It is commonly found with the usually very similar M9 with which it forms gradations. As in the case of that community it occurs in all parts, sometimes in homogeneous stands but more often in mosaics with other mire and swamp communities. And, as in the case of M9 at this site, the place of *Carex rostrata* as the main sedge in this community is taken almost everywhere by *Carex nigra*. MCxn mire and locally M5 and M6b are also often part of the mosaics, whose constitution and patterning are no doubt determined by fine differences in peat depth and exposure to calcareous waters. Locally it also grades into SD17d 'dune slack', where *Eleocharis palustris* and *Potentilla anserina* become prominent in the vegetation. In places it occupies the margins of reed-beds. Among it, water tracks and small shallow pools are usually characterised by S10bi with its abundance of *Menyanthes trifoliata* and few accompanying species.

S27 at this site is rarely 'tall-herb'. It is characterised nearly everywhere by an overwhelming abundance of *Comarum palustre* and a vegetation height of c. 30-50 cm. With the *Comarum*

*palustre* and *Carex nigra* there is *Galium palustre* and frequently some *Menyanthes trifoliata*. *Eriophorum angustifolium* is frequent and locally has a higher cover than *C. nigra*, whilst on the edges of reed-beds *Phragmites australis* forms an upper storey to the vegetation. *Equisetum fluviatile* is locally frequent also. With these are varied mixtures of monocotyledons and other herbs.

Some of these accompanying species, including *Ranunculus flammula, Ranunculus repens, Senecio aquaticus or S. x ostenfeldii, Stellaria alsine, Angelica sylvestris* and *Silene flos-cuculi* are preferential for one or other of the sub-communities, but they are less frequent and have lower cover than several of the community associates especially *Epilobium palustre, Cardamine pratensis* and *Caltha palustris.* Other prominent associates are *Agrostis stolonifera* and *Holcus lanatus,* and when these are joined by *Festuca rubra*, which is not listed as an associate of the community in the published NVC table, the vegetation becomes distinctly grassy. Bryophyte cover is generally thin and patchy: *Calliergonella cuspidata* and *Calliergon cordifolium* are the most frequent species.

*Figure 6.* S27 tall herb fen, showing abundance of *Comarum palustre*, typical of most stands (viewed from quadrat 23)

It is difficult to place this local expression of S27 in one or other of the sub-communities. The scarcity of *Carex rostrata* and its replacement by one or more of the other characteristic monocotyledons suggests the S27b *Lysimachia vulgaris* sub-community. However, accompanying species are not strongly indicative of that sub-community, whilst the frequent presence of *Equisetum fluviatile* and *Ranunculus flammula* is more indicative of the S27a *Carex rostrata-Equisetum fluviatile* sub-community. Even those stands with *Carex rostrata* are intermediate in character, or in some other way atypical. For these reasons it has been decided not to apportion any of this vegetation to a sub-community.

**S28a *Phalaris arundinacea* tall-herb fen, *Phalaris arundinacea* sub-community**

The single small stand of this community, close to the western shore of the Loch of Isbister, is about 1.5 metres in height and mainly comprises a dense growth of *Phalaris arundinacea* with some *Iris pseudacorus.* With them grow occasional other tall herbs including *Filipendula ulmaria* and *Angelica sylvestris*, and beneath them occasional grasses and small herbs including *Galium palustre*, *Callitriche stagnalis* and *Hydrocotyle vulgaris*. Scattered bryophytes include *Calliergonella cuspidata, Kindbergia praelonga* and *Brachythecium rutabulum*.

*2.2.5 Maritime communities and open habitats*

**SD17 *Potentilla anserina-Carex anserina* dune-slack**

In seasonally flooded hollows north-west of the Loch of Isbister and locally at the upper levels of the drawdown zone along the south-west shore of the loch there is vegetation much resembling SD17 *Potentilla anserina-Carex anserina* dune-slack, the ***Hydrocotyle vulgaris-Ranunculus flammula* sub-community (SD17d)**. Three constants of that community, *Potentilla anserina, Carex nigra* and *Agrostis stolonifera,* are frequent to abundant, and the fourth, *Calliergonella cuspidata,* is also present, though less frequent. Of the preferentials and differentials of the SD17d sub-community, *Eleocharis palustris* and *Galium palustre* are frequent, while *Hydrocotyle vulgaris*, *Ranunculus flammula* and *Mentha aquatica* are occasional. The main difference from the community and sub-community as described in Rodwell (2000) is the abundance of *Comarum palustre*, typically only a scarce associate of the community. Also unusual is the occasional presence of *Persicaria amphibia*, which is abundant in one large stand. Most of this vegetation is on ground that is fairly firm in summer. Cattle appear to relish the shoots of *Eleocharis* and it is well grazed.

Some of the wettest stands of this vegetation in the lower parts of the hollows could be seen as a form of S19 *Eleocharis palustris* swamp. The *Agrostis stolonifera* sub-community (S19c) has some of the same preferentials, especially *Agrostis stolonifera and Potentilla anserina*, and shares some of the less frequent preferentials and associates. However, the saltmarsh species characteristic of the S19 sub-community such as *Glaux maritima* and *Juncus gerardii* are absent.

Much smaller areas of stony loch margins support sparse vegetation with the same constants and some *Juncus articulatus* but otherwise rather different associates, including *Festuca rubra, Trifolium repens, Scorzoneroides autumnalis, Carex oederi* and *Linum catharticum*. It is close to the ***Caltha palustris* sub-community (SD17c)**. No quadrats were sampled. Some of this vegetation is heavily trampled by cattle.

**OVx *Juncus bufonius-Gnaphalium uliginosum* provisional new community**

Occupying the lowest parts of seasonally flooded hollows and muddy loch and pool shores is this open vegetation mainly of summer annual herbs with some *Potentilla anserina*. *Juncus bufonius* and *Gnaphalium uliginosum* cover much of the ground, though the lowest parts of depressions are sparsely vegetated. Often with them is the Nationally Scarce *Rorippa islandica*. Apart from these few, the diminutive moss *Tortula truncata* is frequent and there is a scatter of seedlings and other annuals, such as *Senecio aquaticus, Myosotis laxa, Ranunculus repens, Stellaria alsine, Plantago major, Poa annua* and *Polygonum aviculare*. This community is not described in the NVC, but is not uncommon in Orkney, especially in dried-up winter flood-pools near the coast. Many of these pools are in areas grazed by cattle and the soft surface is churned up by their hooves. This disturbance probably assists in the annual renewal of these mainly ephemeral communities.

## 2.3 Plant species

Annex 5 lists the 156 species and hybrids of vascular plant that were recorded within the site boundary. Notable additions to previous site lists are *Hierochloe odorata* (Nationally Rare), and *Rorippa islandica* (Nationally Scarce). *Hierochloe odorata* was found in an area measuring c.100 x 15m close to the south-west shore of the Loch of Isbister (325397 E, 1023392 N). *Rorippa islandica* is frequent in the lowest parts of dried-up pools and on mud exposed by falling summer water levels around the northern and western shores of the Loch of Isbister. Notable in the aquatic flora of the Loch of Isbister, but already known from there, is *Potamogeton filiformis.*

Bryophytes were recorded within quadrat samples, but the current work did not include the production of a site list. Particular notice was taken of *Sphagnum* species, since they are good indicators of the trophic status of mires. *S. subnitens* is quite frequent and widespread. *S. palustre* and *S. capillifolium* are less frequent and more local. *S. denticulatum* is rare. No other species were recorded. The frequent records of *S. papillosum* by Cadbury & Cadbury in 2005 appear to be an error: the species found at their recording sites is *S. palustre*.

## 2.4 Other species

Great yellow bumblebees *Bombus distinguendus* (UKBAP Priority species) were seen on the site on several occasions. The highest count was on 13 July when 15 queens were counted, all feeding on *Comarum palustre* flowers.

## 3. SITE CONDITION MONITORING

### 3.1 Background

Site Condition Monitoring (SCM) is SNH's programme for monitoring the condition of nature conservation features of special interest on designated sites in Scotland.[2] In 2002 a SCM survey assessed the status of the basin fen feature at the site as "favourable maintained". However that survey noted some differences from the Prosser and Wallace NVC 1992 survey, and an incomplete NVC survey in 2004 (SNH unpublished data) further identified significant community and mapping differences that were judged unlikely to be solely due to natural change. The findings of the 2004 survey also exposed discrepancies between the attributes and associated targets for common standards monitoring of basin fen (JNCC, 2004) and composition of vegetation communities at this site. Against this background a key focus of this project has been to develop a means of carrying out SCM in the light of the findings of the NVC survey, and to complete a second SCM assessment.

### 3.2 Methodology

A teleconference meeting between the contractor, Andrew McBride (SNH Wetland Ecology Advisor and Kate Thompson (SNH Operations Officer, Kirkwall) was convened on 12 Oct 2012 to decide upon methods of carrying out SCM. With the NVC survey completed, the unusual quality of much the vegetation at the site and poor conformity to published NVC types was confirmed. It was noted that this would inevitably lead to failures, or partial failures, to meet standard targets for basin fen vegetation composition. However, with much improved understanding of the vegetation composition of the mire, it was decided that common standards could be applied almost unchanged and that discrepancies and apparent failures to meet targets would be addressed by Andrew McBride through management notes. In this context Andrew McBride noted the importance of natural successional change, and also that the extent of variation in the component habitats and vegetation communities of wetlands was not fully represented in the SCM Guidance.

Regarding methods of survey and assessment it was agreed:

- The baseline against which condition would be assessed would be the 1991 NVC report for RSPB by Prosser and Wallace.
- For habitat extent, structure and composition, attributes and targets for assessment would be unchanged from CSM guidance.
- The following key NVC communities represent the basin fen feature: M5, M9, M10, M13, S4 (see note below), S10 and S27, of which M5, M9 and S27 represent the SAC quaking mire feature.
- M5, M9, M10, S10 and S27 would be assessed for positive and negative indicator species as prescribed in guidance, i.e. no change to accommodate known site-specific differences in these communities.
- For M13, *Carex pulicaris* would be added as a positive indicator species.
- For the purpose of this assessment, *Scorpidium cossonii* would be treated as the same taxon as *S. revolvens*.
- Vegetation samples to be used for the assessment would be the quadrat data for relevant communities already gathered for the NVC survey.
- Indicators of local distinctiveness: these were agreed to be two unusual vegetation communities described in the NVC report, the S10bi *Equisetum fluviatile swamp,*

[2] Further information can be found at http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/site-condition-monitoring/

*Carex rostrata sub-community, Menyanthes trifoliata* variant and the OVx *Juncus bufonius-Gnaphalium uliginosum* provisional new community, and one species, Holy Grass *Hierochloe odorata*. Appropriate attributes and targets would be set.

It was also established that the approach taken to monitoring S4 reed-bed would be different from that adopted for the other communities. Though it is an important component of the basin fen at this site there is a concern about its possible expansion at the expense of other representative communities. The priority was for monitoring to detect the extent of reed-beds rather than the condition of the community present. Hence S4 was measured for its current extent only, to provide a base-line for future monitoring (see section 3.8).

### 3.3 Data analysis and presentation

All the survey quadrat data for the relevant NVC communities (see Annex 8) were re-analysed for species composition to accord with common standards methodology. Conversion from NVC DOMIN scale to % cover was required. The conversion scale used was as follows:

| DOMIN | % |
|---|---|
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 7 |
| 5 | 20 |
| 6 | 30 |
| 7 | 40 |
| 8 | 60 |
| 9 | 80 |
| 10 | 100 |

Figures for % frequency were rounded to the nearest 5.

### 3.4 SCOTMEC

In addition, observations of land management and other site characteristics were completed on a pro-forma that is designed to help in the diagnosis of potential issues that may compromise the condition of the feature. See Annex 6 for the completed pro-forma.

### 3.5 Main findings

These are set out in tables 2 to 5.

*Table 2. Broad attributes – targets and results*

| Attribute | Standard target (no site-specific target) | Target result | |
|---|---|---|---|
| **Habitat extent** | No reduction in the total combined extent of wetland in relation to established baseline | No change | Pass |
| **Habitat composition** | No loss of the component types of wetlands and no significant change in cover | No change in extent of key component type – basin fen | Pass |
| **Habitat Structure** | Cover of bare ground ≤10% | Almost no bare ground present - <1% - except:<br>a) very locally at 'pinch-points' and loafing areas where cattle congregate where up to 10-20% bare, and<br>b) dried out temporary pools and loch margins (naturally bare) | Pass |
| | Cover of litter ≤25% | Negligible litter cover – not more than 10% in all key communities except M13, where up to 25% | Pass |
| **Vegetation composition : indicators of negative change - undesirable non-woody species** | a) Invasive non-native species absent or no more than rare | No invasive non-native species found | Pass |
| | b) Other undesirable species without high or increasing frequency/cover | See relevant sections for each individual NVC community | |
| **Vegetation composition : indicators of negative change - woody species** | Woody species no more than scattered and <1.5m high, cover <10% on open fen, saplings/ seedlings no more than rare, none in flushes and springs. | 1 planted non-native *Salix pentandra* recorded | Pass |

*Table 3. Summary of the condition of the assessed basin fen communities*

| Vegetation type | Number of plots assessed | Number of targets | | Pass/ Fail | Comments/reasons for failure |
|---|---|---|---|---|---|
| | | passed | failed | | |
| *Carex rostrata – Sphagnum squarrosum* mire (M5) | 5 | 3 or 4 | 0 or 1 | Pass? | Cover of positive indicator *Carex* species borderline low |
| *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum mire* (M9) | 7 | 5 | 1 | Fail | Too few positive indicator cyperaceous species constant |
| *Carex dioica-Pinguicula vulgaris* mire (M10) | 2 | 2 | 0 | Pass | |
| *Schoenus nigricans-Juncus subnodulosus mire (M13)* | 6 | 3 | 1 | Fail | Too few positive indicator *Carex* species constant. |
| *Equisetum fluviatile* swamp *Carex rostrata* sub-community (S10a) | 2 | 2 | 0 | Pass | |
| *Equisetum fluviatile* swamp *Carex rostrata* sub-community (S10b) | 4 | 3 | 0 | Pass | |
| Carex rostrata-Comarum palustre tall-herb fen (S27) | 16 | 5 | 1 | Fail? | On balance, fails on combined cover of positive indicator cyperaceous species above 25%, or combined *Phragmites australis* and *Juncus effusus* below 25% (see section 3.6) |

*Table 4. Species composition of assessed communities - target and results (Note that sample sizes are shown in Table 3)*

| **Vegetation composition** | ***Carex rostrata-Sphagnum squarrosum* mire (M5)** | | |
|---|---|---|---|
| **Attribute** | **Target** | **Target result** | |
| **Cover of positive indicator species** | *Carex rostrata, C. lasiocarpa, C nigra, Eriophorum angustifolium*: combined >10% | c.9% | Fail? |
| | *Sphagnum subnitens, S. squarrosum, S. teres, S. palustre, S fallax, Aulacomnium palustre*: individually or combined >25% | c. 50% | Pass |
| **Associated species** | *Comarum palustre, Menyanthes trifoliata, Galium palustre, Succisa pratensis, Ranunculus flammula, Epilobium palustre, Silene flos-cuculi*: at least four constant | 4 constant | Pass |
| **Cover of negative indicator species – non-woody** | Not more than one of *Phragmites australis, Phalaris arundinacea, Glyceria maxima, Typha latifolia, Epilobium hirsutum, Urtica dioica* and *Juncus* spp and that <5% cover<br>Not more than one of *Pteridium aquilinum* and *Rubus fruticosus* and that < 5% cover | Absent | Pass |
| Frequency of occurrence and mean cover (%) of above species in sample quadrats. Data used to inform target results are highlighted (P = positive indicator; N = negative indicator) | | Frequency (%) | Mean cover %) |
| P | *Carex rostrata* | 0 | 0 |
| P | *Carex lasiocarpa* | 0 | 0 |
| P | *Carex nigra* | 100 | 5 |
| P | *Eriophorum angustifolium* | 80 | 4 |
| P | *Sphagnum subnitens* | 80 | 15 |
| P | *Sphagnum squarrosum, S. teres, S. fallax* | 0 | 0 |
| P | *Sphagnum palustre* | 50 | 2 |
| P | *Aulacomnium palustre* | 100 | 35 |
| P | *Comarum palustre* | 100 | 20 |
| P | *Menyanthes trifoliata* | 70 | 5 |
| P | *Galium palustre* | 0 | 0 |
| P | *Succisa pratensis* | 60 | 5 |
| P | *Ranunculus flammula* | 0 | 0 |
| P | *Epilobium palustre* | 70 | 2 |
| P | *Silene flos-cuculi* | 80 | 2 |
| N | *Phragmites australis, Phalaris arundinacea, Glyceria maxima, Typha latifolia, Epilobium hirsutum, Urtica dioica, Juncus* spp, *Pteridium aquilinum, Rubus fruticosus* | 0 | 0 |

| **Vegetation composition** | ***Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire (M9)** | | |
|---|---|---|---|
| **Attribute** | **Target** | **Target result** | |
| **Frequency of positive indicator species** | *Carex diandra, C. lasiocarpa, C. rostrata, C. limosa, C. panicea, C. nigra, Eriophorum angustifolium*: at least two constant, one of which must be C. *diandra, C. lasiocarpa* or *C. rostrata*. | 1 constant but not C*. diandra, C. lasiocarpa, C. rostrata.* | Fail |
| | *Campylium stellatum, Scorpidium scorpioides, Scorpidium revolvens/cossonii, Bryum pseudotriquetrum, Palustriella commutata, Cratoneuron filicinum, Ctenidium molluscum*: at least one present | 4 present | Pass |
| **Cover of positive indicator species** | *Calliergonella cuspidata, Calliergon giganteum*: either or both, combined cover >20% | Combined 72% | Pass |
| **Cover of negative indicator species – non-woody** | Not more than one of *Phragmites australis, Phalaris arundinacea, Glyceria maxima, Epilobium hirsutum, Urtica dioica, Brachythecium rutabulum* and *Kindbergia praelonga* and that <5% cover | Absent | Pass |
| | Not more than one of *Pteridium aquilinum, Rubus fruticosus* and *Molinia caerulea* and that < 5% cover | 1 present, cover 2% | Pass |

| Frequency of occurrence and mean cover (%) of above species in sample quadrats. Data used to inform target results are highlighted (P = positive indicator; N = negative indicator) | | Frequency (%) | Mean cover (%) |
|---|---|---|---|
| P | *Carex diandra* | 0 | 0 |
| P | *Carex lasiocarpa* | 0 | 0 |
| P | *Carex rostrata* | 15 | 3 |
| P | *Carex limosa* | 0 | 0 |
| P | *Carex panicea* | 15 | 1 |
| P | *Carex nigra* | 95 | 12 |
| P | *Eriophorum angustifolium* | 40 | 1 |
| P | *Campylium stellatum* | 30 | 7 |
| P | *Scorpidium scorpioides* | 0 | 0 |
| P | *Scorpidium revolvens/cossonii* | 40 | 1 |
| P | *Bryum pseudotriquetrum* | 55 | 1 |
| P | *Cratoneuron filicinum* | 40 | 1 |
| P | *Ctenidium molluscum* | 0 | 0 |
| P | *Calliergonella cuspidata* | 100 | 70 |
| P | *Calliergon giganteum* | 15 | 2 |
| N | *Phragmites australis, Phalaris arundinacea, Glyceria maxima, Epilobium hirsutum, Urtica dioica, Brachythecium rutabulum, Kindbergia praelonga* | 0 | 0 |
| N | *Pteridium aquilinum, Rubus fruticosus* | 0 | 0 |
| N | *Molinia caerulea* | 30 | 2 |

| **Vegetation composition** | ***Carex dioica-Pinguicula vulgaris* mire (M10)** | | |
|---|---|---|---|
| **Attribute** | **Target** | **Target result** | |
| **Frequency of positive indicator species** | *Carex hostiana, C. dioica, C. viridula agg., C. flacca, C. panicea*: at least two species or sub-species constant | 3 constant | Pass |
| **Cover of negative indicator species – non-woody** | *Phragmites australis* not more than rare, <20 shoots in any sample | Absent | Pass |
| | *Molinia caerulea* <25% cover | Cover 2% | Pass |
| Frequency of occurrence and mean cover (%) of above species in sample quadrats. Data used to inform target results are highlighted (P = positive indicator; N = negative indicator) | | Frequency (%) | Mean cover (%) |
| P | *Carex hostiana* | 100 | 5 |
| P | *Carex dioica* | 0 | 0 |
| P | *Carex viridula agg.* | 0 | 0 |
| P | *Carex flacca* | 100 | 3 |
| P | *Carex panicea* | 100 | 15 |
| N | *Phragmites australis* | 0 | 0 |
| N | *Molinia caerulea* | 50 | 2 |

| **Vegetation composition** | ***Schoenus nigricans-Juncus subnodulosus* mire (M13)** | | |
|---|---|---|---|
| **Attribute** | **Target** | **Target result** | |
| **Frequency of positive indicator species** | *Schoenus nigricans* constant, cover <80% in at least 40% of samples. | Constant. Cover c.55% in 50% of samples | Pass |
| | *Carex hostiana*, *C. dioica, C. viridula* agg., *C. flacca, C. panicea*: at least two species or sub-species constant | 1 constant | Fail |
| | **Site-specific addition**: *C. pulicaris* included in list of *Carex* spp. constant | | |
| **Cover of negative indicator species – non-woody** | *Phragmites australis* not more than rare, <20 shoots in any sample | Absent | Pass |
| | *Molinia caerulea* <25% cover | Cover 20% | Pass |
| Frequency of occurrence and mean cover (%) of above species in sample quadrats. Data used to inform target results are highlighted (P = positive indicator; N = negative indicator) | | Frequency (%) | Cover in 40% of samples |
| P | *Schoenus nigricans* | 100 | 40 |
| | | | Mean cover (%) |
| P | *Carex hostiana* | 15 | <1 |
| P | *Carex dioica* | 0 | 0 |
| P | *Carex viridula agg.* | 0 | 0 |
| P | *Carex flacca* | 15 | <1 |
| P | *Carex panicea* | 50 | 2 |
| P | *Carex pulicaris* | 85 | 2 |
| N | *Phragmites australis,* | 0 | 0 |
| N | *Molinia caerulea* | 100 | 20 |

| **Vegetation composition** | ***Equisetum fluviatile* swamp (S10)** | | | |
|---|---|---|---|---|
| **Attribute** | **Target** | | **Target result** | |
| **Cover of positive indicator species** | ***Equisetum fluviatile* sub-community (S10a):** *Equisetum fluviatile* constant | | Constant | Pass |
| | ***Carex rostrata* sub-community (S10b):** *Equisetum fluviatile* forming an open stand, cover <80% | | Stands very open/thin | Pass |
| **Associated species** | ***Carex rostrata sub-community (S10b):*** *Carex rostrata, Menyanthes trifoliata, Comarum palustre:* at least one species present, combined cover >20% | | 2 present, combined cover 70% | Pass |
| **Cover of negative indicator species – non-woody** | *Phragmites australis, Phalaris arundinacea, Glyceria maxima* and *Typha latifolia* not more than rare and <25% cover | | Absent | Pass |
| Frequency of occurrence and mean cover (%) of above species in sample quadrats. Data used to inform target results are highlighted (P = positive indicator; N = negative indicator) | | | Frequency (%) | Mean cover (%) |
| P | *Equisetum fluviatile* sub-community: | *Equisetum fluviatile* | 100 | 90 |
| P | *Carex rostrata* sub-community: | *Equisetum fluviatile* | 75 | 15 |
| P | *Carex rostrata* | | 0 | 0 |
| P | *Menyanthes trifoliata* | | 100 | 70 |
| P | *Comarum palustre* | | 25 | <1 |
| N | *Phragmites australis, Phalaris arundinacea, Glyceria maxima and Typha latifolia* | | 0 | 0 |

| Vegetation composition | | Carex rostrata-Comarum palustre tall-herb fen (S27) | | |
|---|---|---|---|---|
| **Attribute** | | **Target** | **Target result** | |
| **Cover of positive indicator species** | | EITHER *Carex rostrata, C. vesicaria, C. nigra, C. elata, C. aquatilis, C. appropinquata, Eriophorum angustifolium*: combined cover >25%<br><br>OR *Phragmites australis, Juncus effusus*: combined cover <25% | Combined cover 12%.<br><br>Combined cover 7% | Fail*<br><br>*Majority fail – see section 3.6 |
| | | *Comarum palustre, Menyanthes trifoliata, Equisetum fluviatile* individually or together combined cover >25% | Combined cover 73% | Pass |
| **Frequency of positive indicator species** | | *Calliergonella cuspidata, Calliergon cordifolium, C. giganteum*: at least one species at least rare | 2 frequent | Pass |
| **Associated species** | | *Galium palustre, Cardamine pratense, Epilobium palustre, Mentha aquatica, Myosotis laxa, Caltha palustris, Hydrocotyle vulgaris, Veronica scutellata, Lysimachia vulgaris*: at least 3 species constant | 3 constant | Pass |
| **Cover of negative indicator species – non-woody** | | Not more than one of *Phragmites australis, Phalaris arundinacea, Glyceria maxima, Epilobium hirsutum, Urtica dioica* and that <5% cover | 1 present. Cover <1 | Pass |
| | | Not more than one of *Pteridium aquilinum, Rubus fruticosus* and *Molinia caerulea* and that < 5% cover | 1 present. Cover <1 | Pass |
| Frequency of occurrence and mean cover (%) of above species in sample quadrats. Data used to inform target results are highlighted (P = positive indicator; N = negative indicator) | | | Frequency (%) | Mean cover (%) |
| P | *Carex rostrata* | | 10 | 5 |
| P | *Carex vesicaria, Carex elata, Carex aquatilis, Carex appropinquata* | | 0 | 0 |
| P | *Carex nigra* | | 85 | 3 |
| P | *Eriophorum angustifolium* | | 45 | 2 |
| P | *Phragmites australis* | | 10 | 1 |
| P | *Juncus effusus* | | 1 | <1 |
| P | *Comarum palustre* | | 95 | 60 |
| P | *Menyanthes trifoliata* | | 50 | 10 |
| P | *Equisetum fluviatile* | | 50 | 3 |
| P | *Calliergonella cuspidata* | | 40 | 6 |
| P | *Calliergon cordifolium* | | 35 | 2 |
| P | *Calliergon giganteum* | | 0 | 0 |
| P | *Galium palustre* | | 80 | 2 |
| P | *Cardamine pratense* | | 60 | 2 |
| P | *Epilobium palustre* | | 90 | 6 |
| P | *Myosotis laxa* | | 0 | 0 |

| **Carex rostrata-Comarum palustre tall-herb fen (S27) SCM results (cont.)** | | | |
|---|---|---|---|
| Frequency of occurrence and mean cover (%) of above species in sample quadrats. Data used to inform target results are highlighted (P = positive indicator; N = negative indicator) | | Frequency (%) | Mean cover (%) |
| P | *Caltha palustris* | 70 | 4 |
| P | *Hydrocotyle vulgaris* | 25 | <1 |
| P | *Veronica scutellata* | 0 | 0 |
| P | *Lysimachia vulgaris* | 0 | 0 |
| N | *Phragmites australis* | 10 | <1 |
| N | *Phalaris arundinacea, Glyceria maxima, Epilobium hirsutum, Urtica dioica* | 0 | 0 |
| N | *Pteridium aquilinum, Rubus fruticosus* | 0 | 0 |
| N | *Molinia caerulea* | <1 | <1 |

*Table 5. Indicators of local distinctiveness – targets and results*

| **S10bi *Equisetum fluviatile* swamp, *Carex rostrata* sub-community, *Menyanthes trifoliata* variant** | | | |
|---|---|---|---|
| **Attribute** | **Target** | **Target result** | |
| **Frequency of positive indicator species** | *Menyanthes trifoliata*: constant and cover >75% | Cover 80% | Pass |
| **Distribution and extent** | Sub-community variant present at 100% of 5 sample points:<br>HY2490524012<br>HY2484924211<br>HY2590224315<br>HY2488324265<br>HY2556324262 | Present 100% | Pass |
| | | | |
| **OVx *Juncus bufonius-Gnaphalium uliginosum* provisional new community** | | | |
| **Attribute** | **Target** | **Target result** | |
| **Frequency of positive indicator species** | *Juncus bufonius, Gnaphalium uliginosum* and *Potentilla anserina:* at least 2 constant | 2 constant | Pass |
| | *Rorippa islandica*: present in at least 80% of samples | Present 100% | Pass |
| **Distribution and extent** | Community present at 100% of 5 sample points:<br>HY2557224126<br>HY2552823940<br>HY2521623626<br>HY2544823365<br>HY2545423364 | Present 100% | Pass |
| | | | |
| ***Hierochloe odorata*** | | | |
| **Distribution and extent** | *Hierochloe odorata* present throughout stand c.100m x c.15m in size centred at HY2539723392 | Present throughout | Pass |

### 3.6 Comment

The ***Carex rostrata–Sphagnum squarrosum*** **mire (M5)** narrowly fails to reach the target (9% against target of >10%) of combined cover for four specified cyperaceous species, passes comfortably on cover of *Sphagna* and *Aulacomnium palustre*, passes on presence of associated species (4 against target of 4) and passes on cover of negative indicator species (0 against target of <10%).

Taking into account the atypical nature of this M5, which lacks *Carex rostrata* and has substantial cover of *Empetrum nigrum,* and the 1% failure on the cover of cyperaceous species the overall result should be regarded as a pass.

The ***Carex rostrata-Calliergonella cuspidata/Calliergon giganteum*** **mire (M9)** passes comfortably on all targets except that for number and species of positive indicator cyperaceous constants. Of the seven target species, *Carex diandra, C. lasiocarpa, C. rostrata, C. limosa, C. panicea, C. nigra* and *Eriophorum angustifolium* of which at least two should be constant, one of which must be *Carex diandra, C. lasiocarpa or C rostrata,* only *Carex nigra* is constant, with *Eriophorum angustifolium* on 40% frequency and C*. rostrata* on 15%. *Carex diandra, C. lasiocarpa* and *C. limosa* are not present at the site while *C. rostrata* is very local. In contrast, scores for frequency and cover of positive indicator bryophytes (4 present against target of 1, and 72% cover against target of >20%) and an absence of negative indicator species are positive features.

***Carex dioica-Pinguicula vulgaris*** **mire (M10)** passes very comfortably.

The ***Schoenus nigricans-Juncus subnodulosus*** **mire (M13)** passes comfortably on *Schoenus* constant but without excessive cover, but fails on number of specified *Carex* species constant (1 present against target of at least 2), even with the site-specific addition of *Carex pulicaris*. *C. pulicaris* is constant, *C. panicea* on 50%, *C. hostiana* and *C. flacca* on 15%. It passes comfortably on one of the targets for negative indicator species (*Phragmites australis* is absent) and more narrowly on the one for *Molinia caerulea* (20% cover against target of <25%). *Molinia* is abundant in most stands of this northern form of M13, at least in its ungrazed or lightly grazed state. It is rich vegetation (22-32 species recorded per quadrat) but not as rich as the better examples of true southern M13.

***Equisetum fluviatile*** **swamp (S10)** passes very comfortably.

***Carex rostrata-Comarum palustre*** **tall-herb fen (S27)** would pass on combined cover of seven named cyperaceous species **>**25% **or** combined *Phragmites australis/Juncus effusus* **<**25%, if the result of this test was accepted without qualification, since *P. australis/J. effusus* cover is well within target at 7%. However, S27 with *Phragmites* or *J. effusus* (in practice only *Phragmites* because *J. effusus* is scarce on the site as a whole and rarely intrudes into S27) comprises a relatively small proportion of total S27 at the site and cannot alone be taken as representative of the community here. S27 with some of the cyperaceous species comprises a much greater proportion of the community and the cover of these species is well below target at 12%. The seven named species are poorly represented. *Carex vesicaria, C. elata, C. aquatilis* and *C appropinquata*, are not present. And as in the case of M9, the key sedge *Carex rostrata* is very local. The cyperaceous component in the vegetation is provided in almost all places by *C. nigra* and *Eriophorum angustifolium*. On balance therefore S27 at this site will not reach targets for the key cyperaceous species or *Phragmites/J. effusus*.

S27 however passes comfortably on frequency of positive indicator bryophytes (2 frequent against target of at least one rare) and on combined cover of the two positive indicator dicotyledons *Comarum palustre, Menyanthes trifoliata* and *Equisetum fluviatile* (73% against

target of >25%). The cover of *Comarum palustre* is generally very high at this site and *E. fluviatile* and *M. trifoliata* are also well represented.

It also passes on presence of associated species constant (3 against target of 3) and cover of negative indicator species (<1% against target of <5%).

S27 therefore reaches or exceeds targets for 5 out of 6 attributes. The high frequency (95%) of grasses comprising *Agrostis stolonifera, Holcus lanatus* and *Festuca rubra*, with occasional *Anthoxanthum odoratum,* could be seen as a negative attribute not picked up by the SCM.

### 3.7 Management - issues and impacts

There is no effective on-site control of water levels and grazing with cattle is the main management activity. The site is divided in to several fenced compartments. Grazing levels and significant impacts are very varied, including nil in some compartments.

The area of bare ground estimated for SCM (<1%) was well below target level (<10%), but this obscures local effects (and 10% overall would be an extraordinarily high figure). More than 10% was observed locally at 'pinch-points' and cattle loitering areas, but the areas affected were not sensitive basin fen habitats. Very locally, on dried-out mud supporting the OVx provisional community with *Rorippa islandica*, disturbance probably contributes to regeneration (Figure 7).

Poaching was also observed around some dry, preferentially-grazed grassland areas, but the effect was confined to narrow buffer zones between grassland and very wet mire or swamp. There are some examples of wet heath in such zones where the dwarf shrubs had been grazed off completely. It is not possible to say whether these zones are increasing or stable under current management. Some effects of historic poaching – large grassy tussocks with deep, wet runnels - were observed in areas now lightly grazed or not grazed.

Cover of litter estimated for SCM (≤10%) was within target (≤25%). However there was a higher cover of up to 25% in some stands of M13. Cover was negligible in M5, M9, S27 and other swamp communities whether grazed or not. Herbage removal by grazing was very varied between compartments. For instance in the north-west compartment, six Aberdeen Angus cattle were ranging widely, effectively grazing sedges and grasses on firmer ground and also browsing reed in deep water (see target notes TN3 and TN4 and Figure 4), but apparently not venturing into *Sphagnum*-rich M5. In the southern part of the basin a much larger group of Continental breed appeared reluctant to leave the dry grassland of the Skooant and its immediate environs. In another area south-west of the Loch of Isbister, it appeared that cattle in some numbers had been confined to wetland for some time and grazed off much of the vegetation of all kinds.

*Figure 7.* Cattle loitering on OVx *Juncus bufonius-Gnaphalium uliginosum* provisional new community (see target note 1, Annex 4).

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

The extent of accessible reed-beds was delimited on 22 October 2012 by walking the perimeter of each reed-bed and recording Ordnance Survey national grid references (NGR) of waypoints with a GPS device. Photographs were taken from nearby viewpoints. The inaccessible reed-beds were wholly or partially in open water.

Grid references for waypoints and photograph points are detailed in Annex 7. An outline of each reed-bed and all photograph points have been plotted onto copies of aerial photographs and this information, together with the photographs of the reed-beds, is contained in electronic files held by SNH (see Annex 8 for further details of data files supplementary to this report).

There are five reed-beds with Common Reed *Phragmites australis* overwhelmingly abundant. In NVC terms these are almost entirely S4 *Phragmites australis* swamp and reed-beds, mainly the S4c *Menyanthes trifoliata* sub-community though the S4c *Galium palustre* sub-community also occurs. Edges of stands are usually sharply defined from adjacent vegetation (or open water), though there is sometimes a band of thinning reed cover on the landward side. For the purposes of setting a baseline for future monitoring the edge of a reed-bed has been taken to be the point where the cover of reed falls below 50%. Thus some edge areas within the perimeter of the reed-bed as delimited may comprise non-S4 NVC vegetation and will be shown as such on the map of NVC communities. Similarly, within the reed-bed perimeter there may also be patches of other NVC communities, where reed is co-dominant with other swamp and mire plants. Such communities have necessarily been included in the delimited area of the reed-bed.

There is a sixth area where reeds form a patchy cover of open and closed stands. Much of this area has been assigned to NVC communities other than S4. It was surveyed along with the four other accessible reed-beds.

### 3.9 Supplementary comments on vegetation

It is possible to make some further, cautious comments about the vegetation of this northern basin fen. A more comprehensive analysis of the overall state of the basin fen is not possible without further investigations and improved understanding of the relations between the often unusual vegetation of the site and the determining factors and processes, especially the hydrology, natural succession and the history of management. A thorough review of the vegetation of similar sites in the geographical area would also be useful in providing a context for assessing the quality of the site. Such studies are well beyond the scope of this report, so what follows are some inferences from the present study made with the benefit of the author's knowledge, especially as BSBI Vice-County Recorder, of the flora and vegetation of Orkney.

The swamp and reed-bed habitats, including S4, S10 and other communities, but excepting S27 for the moment, comprise a range of vegetation types in favourable condition. The S4 reed-beds represent moderately species-rich forms of the community, indicating that the level of nutrient enrichment is not high. Indeed, no signs of obvious nutrient enrichment were observed on the site as whole, except very locally on the perimeter (at Spurdagrove ditch outlet and the extreme western corner). The atypical *Menyanthes* variant of S10 swamp (S10bi) has apparently been found elsewhere in Scotland and is not unusual in Orkney – where it may in fact be the most common form of this type of swamp.

S27 is more problematic. On the one hand, stands of the community associated with *Phragmites* on the fringes of reed-beds and with *Carex rostrata* at the north-east of the site, near Spurdagrove, and at several locations west of the Loch of Isbister, are good examples of the community. On the other hand, much vegetation assigned to this community found elsewhere on the site conforms less well to the type – mainly because of the over-representation of grasses and the absence or poor representation of some key cyperaceous species. Some of the species comprising the latter group are absent from or very rare in Orkney, but the explanation for the poor representation of the group as a whole, and the presence of the grasses, is most likely to lie in an unfavourable water regime: in short, conditions are not consistently wet enough. In NVC terms, this vegetation is closest to S27 but transition to another, or more than one other, community is suggested, most likely a form of MCxn *Carex nigra* mire (Dargie [*op.cit*.] identified a *Comarum palustre* variant of his Mx *Carex nigra* mire). Similar vegetation commonly occurs elsewhere in the county, but the great areas of it at Loch of Isbister and the Loons are certainly unusual.

The M5 is unusual. The prominence of *Empetrum nigrum* is especially odd, though as noted in the introductory section of this report, this species occurs much more widely in a range of vegetation types in Orkney (and, from personal observation, in Shetland and along the north coast of Scotland) than is indicated in the NVC. In relation to other vegetation types present this M5 is intermediate between the M9 described at the site, with which it is often closely associated, and the drier M6-M15 intermediate. Possibly it represents a successional stage in the development of vegetation in some more ombrotrophic parts of the basin. The author cannot recall seeing anything quite like it elsewhere.

There are good examples of M9 in parts of the site but as in the case of S27 there is more often a poor representation of the key cyperaceous species. Two of the 'missing' species, *Carex diandra* and *C. limosa*, are rare in the county but not absent– in fact these two may be found c.5 km away at Glims Moss & Durkadale SSSI. Also on the negative side the bryophyte flora is characterised by a generally overwhelming abundance of *Calliergonella*

*cuspidata* and a generally scarce and patchy occurrence of such species as *Campylium stellatum, Scorpidium revolvens/cossonii, Calliergon giganteum* and Mniaceous mosses that in greater abundance would characterise better examples of the community. However, on the positive side the M9 present has on the whole a rich vascular plant flora with little untoward variation in species composition, and apparently has a more stable and favourable water regime to support it.

The species-rich and somewhat atypical M10b described here is similar to M9a and part of the fine variation in rich fen communities present. It is unusual in Orkney. The form of M13 described occurs elsewhere in the county, notably at the Loch of Banks SSSI.

Other significant mire communities not subject to SCM include M6, M15, M6-M15, M25, M27, M28 and MCxn, and the mire-related SD17 and OVx. These comprise a varied and interesting range of vegetation types, notably the M6-M15, unusual in any context; the OVx, apparently unusual except in Orkney and possibly more extensive at this site than anywhere else; and the herb-rich M15a and M25x.

### 3.10 Changes since 1991 baseline

There are some apparent changes from the 1991 baseline, but caution is required in comparing the results of the earlier survey and this one. There is reasonable consistency between the two surveys in recognising the key basin fen communities M9, M13, S4, S10 and S27. (The M5 of the present survey is the exception, it being treated in 1991as part of a more inclusive M6-M15.) However the 1991 survey was much less exhaustive in distinguishing vegetation types and found 19 compared to the 42 of the present one. The method of mapping communities was also much broader-brush. One effect of this approach which is problematic when making comparisons is the apparent amalgamation of some mosaics and transitional types of mire vegetation into two or three collective communities of wet grassland and 'rush pasture', especially atypical forms of MG8 and M23 (without large rushes). This is clear from the NVC map and is also indicated by the relevant community descriptions and tables of the 1991 report and the representation of some especially complex areas of vegetation on the NVC map. Significant also in this respect is the remarkable similarity in the depiction of some of these complex areas between the map of the present NVC survey and the annotated non-NVC maps drawn by Brunt (*op.cit*.) in 1981. It is very likely that some M9, M10, M13, M25, MCxn and others, and transitions between them, were included in the wet grassland and rush pasture communities of 1991. Some of the areas concerned are peripheral to the core, central area of the basin fen, but they do include a substantial area of basin fen communities at the western side of the basin identified and mapped in the present survey. However it is possible that these larger areas of wet grassland and rush pasture found in 1991 may partly represent differences in the balance of species dominance brought about by heavier grazing pressure at that time. That no M27 was found in 1991 does suggest higher grazing pressure at that time: *Filipendula ulmaria*, which is characteristically abundant in that community, is one of the first species to be suppressed by grazing (and to recover in its absence).

With reservations therefore, some conclusions and observations regarding changes in the key basin fen communities form the 1991 baseline are possible:

I. the combined area of M9, M13, S4 and S27 found in the present survey is not less than in 1991; it may be substantially larger at the expense of rush pasture communities, especially M23a, but this is unclear;

II. S4 reed-beds have increased in area in all reed-bed locations, except the one at the south-west of the Loch of Isbister now surrounded by open water. If other communities with an overstorey of reed, especially S27, are included in the definition

of reed-bed then the situation is less clear but there still appears to have been an overall increase in area in all locations except one;

III. there has been a loss in area of reed-bed, M9 and associated swamp communities, to open water and mud, at the south end of the Loch of Isbister;

IV. due to differences in survey methodology and reporting it is not possible to conclude anything about relative areas of M10 or M5, neither of which was found in 1991;

V. there have not been obvious changes in the species composition of key communities, though accurate comparison is not possible for the reasons stated.

## 4. GRAZING MANAGEMENT MONITORING PROTOCOL

### 4.1 Background

The RSPB have recently implemented a grazing regime to support their management objectives for the site, which primarily relate to maintenance or creation of optimal habitat for breeding waders and other birds. This involves an increase in late summer grazing with cattle to enhance structural diversity in the vegetation (Knight, Leitch & Dow, 2010). SNH are concerned to ensure that the grazing regime is fully compatible with the conservation objectives for the notified SSSI basin fen habitat. In order to determine whether this is so, and whether modifications to the grazing would be advisable, information on the effects of the grazing on the basin fen is required. The next cycle of SCM is at least six years hence and will determine the overall condition of the basin fen feature. The focus of the work reported here is on interim monitoring of grazing and its effects, both to inform management and to assist in interpretation of future SCM.

### 4.2 Objectives and requirements

The SCM report notes considerable variation in management and grazing impacts between the various compartments. Extensive sampling is needed to encompass such variation. It is important also that sufficient resources are readily available at the most appropriate time of year on a regular basis. These considerations indicate the recording of a small number of basic habitat attributes. If these are some of the same broad attributes used for SCM they will provide a sequence of data that will dovetail with SCM.

As suggested in the SCM report, variation in grazing impacts results from the behaviour of livestock in response to their environment. In particular, poaching in wetlands is always localised by the behaviour of cattle in relation to the distribution and size of areas of dry ground, improved grassland and other preferentially grazed vegetation, by the natural barriers presented by very wet areas and by the location of gateways. The reaction of cattle to these resources and constraints and the degree to which they move around also varies between different groups. One of the aims of RSPB management is to get cattle grazing more widely across the site. It would be desirable to monitor and record this grazing activity as well as its effects. A better understanding of the relations between numbers of cattle, the ways they are managed and their effects on habitats and vegetation would help greatly with making decisions about management.

### 4.3 Protocol

After preliminary discussions between the contractor and SNH staff a meeting was convened between the contractor; Kate Thompson and Andrew McBride from SNH; Andy Knight, RSPB Orkney Team Leader; Alan Leitch, RSPB Orkney Mainland Reserves Warden; and Heather McCallum, RSPB Reserves Ecologist. A framework for a workable grazing management protocol based on the requirements and objectives outlined was in principle agreed.

Attributes to monitor would be:

- Bare ground (as in SCM)
- Cover of litter (as in SCM)
- Vegetation height (additional to SCM)

Observations would be made in quadrats placed along transects beginning at points around boundary of the site and extending across it. Quadrats would be photographed and grid references recorded.

The precise number and placement of transects will be determined in further discussions between SNH and RSPB, but it is recommended that there should be no less than five and they should be at or near:

HY24742428 (north of Loons hide) ESE to HY25072412
HY25102447 (north of Netherdale) SE to H25282432
HY25342386 (western edge of Skooant) NW to HY25112423
HY25542442 (Spurdagrove Standing Stone) SW to HY25372405
HY25472336 (south west shore of Loch of Isbister) NW to HY25232351

Along the transects, the distance between quadrats used to monitor grazing may be decided at a later date but it is suggested that every 50m would be appropriate. Data collection should be as near the same time of year as possible and ideally when grazing impacts are most readily observable - near the end of the grazing season but before winter rains and rising water levels. It is suggested that the monitoring should be carried out biennially after the first year.

Finally, cattle movements would be recorded by means of tracking devices in collars fitted to some of the animals.

### 4.4 Integration with SCM

The sampling regime outlined may readily be integrated with that used for SCM and will support interpretation of SCM findings. This may be achieved through the creation of site-specific targets for the attributes covered by the grazing management protocol, and by collecting the data required for future SCM of relevant NVC communities in quadrats along the same transects as used for grazing monitoring. The quadrats used for SCM should be positioned in consistent stands of the relevant NVC communities. Some of the grazing monitoring quadrats are likely to be already appropriately positioned and these will comprise at least part of the sample required for the purpose of SCM. However, it is likely that additional quadrats will be required to achieve a sufficient number. It is advisable that expert advice is taken in choosing these quadrat positions and identifying the NVC communities present. The positions should be selected during summer and be permanently marked. It is expected that most, if not all, of the quadrats for SCM will be located along the transects used for grazing monitoring, but any shortfall can addressed through positioning further permanent quadrats elsewhere with reference to the SCM results and NVC map presented in this report.

Measurements of bare ground on the scale proposed, and repeated over a period of years, will give a clear indication of the current impact and distribution of poaching and of any increases in these associated with increased grazing. Significant increases in severity and/or extent of poaching, particularly if these extend into swamp or rich fen (M9) communities, could be evidence for reviewing management. Such evidence may be supported, or otherwise, by results from tracking cattle movements.

Measurements of the other two attributes, vegetation height and litter, at the proposed scale and frequency will provide further indications of grazing pressure, and also the effectiveness of the grazing management in achieving RSPB objectives. Evidence of any changes in vegetation composition will be provided by SCM monitoring of vegetation composition of selected quadrats representing the key basin fen NVC communities, along transects and elsewhere. Results from tracking cattle movements may be correlated with the results of all these monitoring exercises, indicating a causal link, or otherwise, between grazing pressure and changes in vegetation structure and composition.

It is expected also that results of tracking cattle movements will help in implementing the objectives of grazing management, especially by indicating locations of natural barriers to movement within the site. Actions may be taken to ease barriers where it is determined that an increase in grazing is compatible with the conservation objectives for the notified SSSI basin fen habitat.

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## ANNEX 1: NVC COMMUNITY TABLES

The layout of these tables is the same as that in Rodwell (1991 *et seq*.).

Nearly all tables for the communities have frequency classes and abundance values arranged in columns for the species, the exceptions being that frequency scores have not been calculated nor results included in tables that summarise fewer than three samples.

'Frequency' refers to how often a plant is found in samples, irrespective of how much of that species is present. This is summarised in the tables as classes denoted by the Roman numerals I to V:

| Frequency | Class |
|---|---|
| 1-20% (i.e. up to one sample in five) | I |
| 21-40% | II |
| 41-60% | III |
| 61-80% | IV |
| 81-100% | V |

Abundance is recorded using the Domin scale:

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

Domin values are included in all tables.

The species are arranged in blocks in the tables according to their pattern of occurrence among the different sub-communities. The first group comprises community constants (classes IV and V). A lower group entitled 'Companion species' lists the general associates of the community, while intervening blocks comprises species distinctly more frequent within one or more of the sub-communities (if there are sub-communities). The bottom group in the table entitled 'Additional species' comprises species recorded in samples in this survey that are not listed in the table for the relevant community in Rodwell (*ibid.*).

Finally, in order to abbreviate tables that would otherwise have been over-large, 'Additional species', as defined above, which were recorded in a single sample only have been excluded from the main table. This applies to any table summarising three or more samples, and in these cases the additional species have been listed, without Domin values, at the foot of the table. Tables that summarise less than three samples include all recorded species

**Mires and heaths**

**M5 *Carex rostrata-Sphagnum squarrosum* mire**

| | |
|---|---|
| *Comarum palustre* | V (4-7) |
| *Aulacomnium palustre* | V (4-9) |
| *Carex nigra* | V (4-5) |
| *Eriophorum angustifolium* | IV (1-4) |
| *Succisa pratensis* | III (3-4) |

| **Companion species** | |
|---|---|
| *Luzula multiflora* | V (2-3) |
| *Holcus lanatus* | V (1-3) |
| *Sphagnum subnitens* | IV (3-7) |
| *Silene flos-cuculi* | IV (1-3) |
| *Agrostis vinealis* | III (3) |
| *Menyanthes trifoliata* | III (1-3) |
| *Epilobium palustre* | III (1-3) |
| *Sphagnum palustre* | II (4-5) |
| *Rumex acetosa* | II (4) |
| *Molinia caerulea* | II (3) |
| *Hydrocotyle vulgaris* | II (1) |
| *Rhytidiadelphus squarrosus* | I (3) |
| *Calliergonella cuspidata* | I (4) |
| *Viola palustris* | I (1) |
| *Equisetum palustre* | I (1) |
| *Cardamine pratensis* | I (1) |

| **Additional species** | |
|---|---|
| *Empetrum nigrum nigrum* | V (4-5) |
| *Anthoxanthum odoratum* | V (2-3) |
| *Potentilla erecta* | V (1-3) |
| *Festuca vivipara* | IV (3-4) |
| *Carex panicea* | III (1-2) |
| *Dicranum scoparium* | II (1-4) |
| *Sphagnum capillifolium* | II (1-3) |
| *Nardus stricta* | II (1) |

| | |
|---|---|
| Number of samples | 5 |
| Number of species per sample | 13-24 |

The following additional species were recorded in a single quadrat only: *Hylocomium splendens, Festuca filiformis, Calliergon cordifolium, Carex dioica, Cirsium palustre, Plagiomnium undulatum, Polygala serpyllifolia.*

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

| | **b** | **M6-M15** | **M6** |
|---|---|---|---|
| *Potentilla erecta* | V (3-5) | V (4) | V (3-5) |
| *Molinia caerulea* | V (1-8) | IV (1-3) | V (1-8) |
| *Sphagnum palustre* | III (4) | IV (4-7) | IV (4-7) |
| *Polytrichum commune* | IV (1-4) | IV (4-5) | IV (1-5) |
| *Viola palustris* | IV (2-3) | - | III (2-3) |
| *Carex echinata* | IV (1-3) | II (3) | III (1-3) |
| *Sphagnum denticulatum* agg. | I (2) | - | I (2) |
| *Menyanthes trifoliata* | I (2) | - | I (2) |
| *Comarum palustre* | I (1) | - | I (1) |
| *Eriophorum angustifolium* | V (3-4) | IV (4-7) | V (3-7) |
| *Luzula multiflora* | III (2-3) | V (2-3) | IV (2-3) |
| *Nardus stricta* | V (1-5) | III (1-2) | IV (1-5) |
| *Carex nigra* | IV (1-4) | III (3-4) | IV (1-4) |
| *Festuca ovina* agg. | III (1-3) | IV (3) | IV (1-3) |
| *Carex panicea* | IV (3-5) | II (3) | III (3-5) |
| *Cardamine pratensis* | I (1) | - | I (1) |
| *Rumex acetosa* | II (1-4) | IV (1-4) | III (1-4) |
| **Companion species** | | | |
| *Anthoxanthum odoratum* | V (3) | V (2-3) | V (2-3) |
| *Aulacomnium palustre* | V (4-6) | III (4-6) | IV (4-6) |
| *Holcus lanatus* | IV (2-5) | II (1-3) | IV (1-5) |
| *Sphagnum subnitens* | II (5) | III (4-6) | III (4-6) |
| *Rhytidiadelphus squarrosus* | IV (1-5) | I (2) | III (1-5) |
| *Hypnum jutlandicum* | I (4) | II (3) | II (3-4) |
| *Hydrocotyle vulgaris* | II (1-3) | - | II (1-3) |
| *Sphagnum capillifolium* | - | II ( 6) | I (6) |
| *Epilobium palustre* | I (3) | - | I (3) |
| *Galium palustre* | I (2) | - | I (2) |
| *Calliergonella cuspidata* | I (1) | - | I (1) |
| *Carex pulicaris* | I (1) | - | I (1) |
| **Additional species** | | | |
| *Agrostis vinealis* | III (2-4) | V (2-3) | IV (2-4) |
| *Empetrum nigrum nigrum* | II (1-4) | V (5-7) | IV (1-7) |
| *Hylocomium splendens* | II (1-3) | III (3-6) | III (1-6) |
| *Calluna vulgaris* | II (1-3) | IV (1-4) | III (1-4) |
| *Pleurozium schreberi* | - | III (3-4) | II (3-4) |
| *Mnium hornum* | II (2-4) | - | II (2-4) |
| *Plagiothecium undulatum* | II (2-3) | II (4) | II (2-4) |
| *Pseudoscleropodium purum* | I (2) | II (3) | II (2-3) |
| *Hypericum pulchrum* | II (1-3) | - | II (1-3) |
| *Agrostis stolonifera* | - | III (1-3) | II (1-3) |
| *Juncus conglomeratus* | III (1-2) | - | II (1-2) |

| | | | |
|---|---|---|---|
| *Polygala serpyllifolia* | - | II (1-2) | II (1-2) |
| *Plagiothecium undulatum* | I (1) | II (1) | II (1) |
| *Sagina procumbens* | II (1) | - | II (1) |
| | | | |
| Number of samples | 5 | 4 | 9 |
| Number of species per sample | 16-30 | 16-18 | 16-30 |

The following additional species were recorded in a single quadrat only: *Kindbergia praelonga, Pedicularis sylvatica, Danthonia decumbens, Silene flos-cuculi, Equisetum fluviatile, Festuca rubra, Scapania undulata, Senecio aquaticus.*

**M9 *Carex rostrata-Calliergonella cuspidata/Calliergon giganteum* mire**

| | a | b | M9 |
|---|---|---|---|
| *Calliergonella cuspidata* | 8 | V (5-10) | V (5-10) |
| *Menyanthes trifoliata* | 8 | V (2-5) | V (2-8) |
| *Eriophorum angustifolium* | | III (3) | III (3) |
| *Comarum palustre* | | IV (1-8) | III (1-8) |
| *Carex rostrata* | | II (5) | II (5) |
| *Galium palustre* | | II (2-3) | II (2-3) |
| *Scorpidium cossonii* | 3 | II (2-3) | III (2-3) |
| *Campylium stellatum* | 4 | I (4) | II (4) |
| *Potamogeton polygonifolius* | 4 | | I (4) |
| *Triglochin palustris* | | I (1) | I (1) |
| *Juncus bulbosus* | 2 | | I (2) |
| *Dactylorhiza purpurella* | | I (1) | I (1) |
| *Caltha palustris* | | V (2-4) | V (2-4) |
| *Epilobium palustre* | | V (2-3) | V (2-3) |
| *Silene flos-cuculi* | | V (1-4) | V (1-4) |
| *Holcus lanatus* | 1 | V (1-3) | V (1-3) |
| *Mentha aquatica* | 3 | III (1-3) | IV (1-3) |
| *Cardamine pratensis* | | III (3) | III (3) |
| *Filipendula ulmaria* | | II (3) | II (3) |
| *Ranunculus acris* | | II (1) | II (1) |
| *Calliergon giganteum* | | I (4) | I (4) |
| *Plagiomnium affine* | | I (1) | I (1) |
| **Companion species** | | | |
| *Carex nigra* | 5 | V (3-8) | V (3-8) |
| *Equisetum fluviatile* | 3 | V (1-4) | V (1-4) |
| *Agrostis stolonifera* | 4 | IV (2-4) | IV (2-4) |
| *Bryum pseudotriquetrum* | 4 | III (1-3) | IV (1-4) |
| *Hydrocotyle vulgaris* | 2 | III (1-3) | IV (1-3) |
| *Cratoneuron filicinum* | 3 | II (2-4) | III (2-4) |
| *Juncus articulatus* | | III (2-3) | III (2-3) |
| *Equisetum palustre* | | III (1-3) | III (1-3) |
| *Succisa pratensis* | | III (1-3) | III (1-3) |
| *Ranunculus flammula* | 3 | II (1) | III (1-3) |
| *Cirsium palustre* | | III (1) | III (1) |
| *Molinia caerulea* | 4 | I (4) | II (4) |
| *Schoenus nigricans* | 1 | I (5) | II (1-5) |
| *Pedicularis palustris* | | II (1-3) | II (1-3) |
| *Rhizomnium pseudopunctatum* | | II (1-3) | II (1-3) |
| *Carex panicea* | | I (4) | I (4) |
| *Plagiomnium undulatum* | | I (3) | I (3) |
| *Hylocomium splendens* | | I (1) | I (1) |
| *Carex flacca* | | I (1) | I (1) |
| **Additional species** | | | |
| *Festuca rubra* | 5 | V (2-4) | V (2-5) |

| | | | |
|---|---|---|---|
| *Sagina nodosa* | 4 | III (3) | IV (3-4) |
| *Fissidens adianthoides* | 4 | II (2) | III (2-4) |
| *Brachythecium rivulare* | | II (2-3) | II (2-3) |
| *Senecio aquaticus* | | II (1-2) | II (1-2) |
| *Anagallis tenella* | 6 | | I (6) |
| | | | |
| Number of samples | 1 | 6 | 7 |
| Number of species per sample | 21 | 16-29 | 16-29 |

The following additional species were recorded in a single quadrat only: *Equisetum arvense, Lophocolea bidentata, Mnium hornum, Poa trivialis, Rhinanthus minor, Riccardia multifida, Taraxacum* sp.

**M10b *Carex dioica-Pinguilica vulgaris* mire**

| | |
|---|---|
| *Carex panicea* | 4-5 |
| *Campylium stellatum* | 3 |
| *Bryum pseudotriquetrum* | 2-4 |
| *Scorpidium revolvens* | 1-5 |
| *Juncus articulatus* | 1-2 |
| *Aneura pinguis* | 0-2 |
| *Selaginella selaginoides* | 0-1 |
| | |
| *Eriophorum angustifolium* | 4 |
| *Succisa pratensis* | 4 |
| *Ctenidium molluscum* | 3-5 |
| *Carex hostiana* | 3-4 |
| *Carex nigra* | 3 |
| *Carex pulicaris* | 3 |
| *Fissidens adianthoides* | 0-4 |
| *Potentilla erecta* | 0-3 |
| *Ranunculus acris* | 0-3 |
| *Molinia caerulea* | 0-3 |
| *Anthoxanthum odoratum* | 0-1 |
| | |
| *Festuca ovina agg.* | 3-4 |
| *Agrostis stolonifera* | 1-3 |
| *Cratoneuron filicinum* | 0-3 |
| | |
| *Juncus bulbosus* | 0-3 |
| | |
| *Calliergonella cuspidata* | 6-8 |
| *Carex flacca* | 3 |
| *Pedicularis palustris* | 2 |
| *Caltha palustris* | 1-2 |
| *Cirsium palustre* | 1-2 |
| *Holcus lanatus* | 1-2 |
| *Euphrasia officinalis agg.* | 0-3 |
| *Prunella vulgaris* | 0-3 |
| *Sagina nodosa* | 0-3 |
| *Angelica sylvestris* | 0-2 |
| *Cardamine pratensis* | 0-2 |
| *Equisetum palustre* | 0-1 |
| *Plantago maritima* | 0-1 |
| *Ranunculus flammula* | 0-1 |
| *Scorzoneroides autumnalis* | 0-1 |
| | |
| *Nardus stricta* | 0-3 |

**Additional species**

| | |
|---|---|
| *Aulacomnium palustre* | 2-4 |

| | |
|---|---|
| *Hydrocotyle vulgaris* | 2 |
| *Silene flos-cuculi* | 2 |
| *Potamogeton polygonifolius* | 1-4 |
| *Mnium hornum* | 0-4 |
| *Brachythecium rivulare* | 0-3 |
| *Calluna vulgaris* | 0-2 |
| *Comarum palustre* | 0-2 |
| *Empetrum nigrum* | 0-2 |
| *Philonotis fontana* | 0-2 |
| *Senecio aquaticus* | 0-2 |
| *Thuidium tamariscinum* | 0-1 |
| *Danthonia decumbens* | 0-1 |
| *Equisetum fluviatile* | 0-1 |
| *Mentha aquatica* | 0-1 |

| | |
|---|---|
| Number of samples | 2 |
| Number of species per sample | 31-36 |

**M13 *Schoenus nigricans-Juncus subnodulosus* mire**

| | |
|---|---|
| *Schoenus nigricans* | V (7-9) |
| *Molinia caerulea* | V (4-7) |
| *Succisa pratensis* | V (3-4) |
| *Calliergonella cuspidata* | IV (4-7) |
| *Potentilla erecta* | IV (2-3) |
| *Campylium stellatum* | III (3-7) |
| *Carex panicea* | III (3-4) |
| | |
| *Scorpidium revolvens* | III (3-8) |
| *Fissidens adianthoides* | III (2-3) |
| *Aneura pinguis* | III (2-3) |
| *Equisetum palustre* | II (1-3) |
| *Sphagnum subnitens* | I (4) |
| *Ctenidium molluscum* | I (2) |
| *Angelica sylvestris* | I (1) |
| *Pedicularis palustris* | I (1) |
| | |
| *Festuca rubra* | II (3-4) |
| *Anthoxanthum odoratum* | II (3) |
| *Holcus lanatus* | II (1-2) |
| | |
| *Carex pulicaris* | V (1-3) |
| *Calluna vulgaris* | III (3-4) |
| *Hypericum pulchrum* | III (1-2) |
| *Agrostis stolonifera* | II (2-3) |
| *Ranunculus flammula* | II (1-3) |
| *Parnassia palustris* | II (1) |
| *Luzula multiflora* | II (1) |
| *Juncus articulatus* | I (4) |
| *Carex flacca* | I (3) |
| *Pinguicula vulgaris* | I (2) |
| *Carex hostiana* | I (1) |
| *Dactylorhiza purpurella* | I (1) |
| *Triglochin palustris* | I (1) |
| *Plantago maritima* | I (1) |
| | |
| *Caltha palustris* | IV (1-3) |
| *Menyanthes trifoliata* | III (1-5) |
| *Filipendula ulmaria* | II (1-4) |
| *Eriophorum angustifolium* | II (1-3) |
| *Pseudoscleropodium purum* | I (4) |
| *Silene flos-cuculi* | I (3) |
| | |
| **Companion species** | |
| *Carex nigra* | IV (3-4) |
| *Equisetum fluviatile* | IV (1-3) |
| *Hydrocotyle vulgaris* | IV (1-2) |
| *Aulacomnium palustre* | III (1-5) |
| *Epilobium palustre* | II (1-3) |
| *Erica tetralix* | II (1-2) |

| | |
|---|---|
| *Lophocolea bidentata* | I (2) |
| *Taraxacum agg.* | I (1) |

**Additional species**

| | |
|---|---|
| *Hylocomium splendens* | III (4-6) |
| *Rhytidiadelphus squarrosus* | III (3-4) |
| *Agrostis vinealis* | III (3-4) |
| *Festuca vivipara* | III (1-2) |
| *Empetrum nigrum nigrum* | II (4) |
| *Mnium hornum* | II (3-4) |
| *Comarum palustris* | II (2-4) |
| *Juncus bulbosus* | II (3) |
| *Carex echinata* | II (2) |
| *Narthecium ossifragum* | II (1) |
| *Senecio aquaticus* | II (1) |
| *Riccardia multifida* | II (1) |

| | |
|---|---|
| Number of samples | 6 |
| Number of species per sample | 23-32 |

The following additional species were recorded in a single quadrat only: *Hypnum jutlandicum, Thalictrum alpinum, Brachythecium rivulare, Erica cinerea, Poa humilis, Potamogeton polygonifolius, Calypogeia fissa, Dicranum scoparium, Epilobium parviflorum, Pedicularis sylvatica, Pellia epiphylla, Sphagnum capillifolium, Thuidium tamariscinum.*

**M15 *Trichophorum germanicum-Erica tetralix* wet heath**

| | a | No sub-community |
|---|---|---|
| *Calluna vulgaris* | 5 | 5 |
| *Potentilla erecta* | 4 | 5 |
| *Molinia caerulea* | 6 | 3 |
| *Eriophorum angustifolium* | 3 | 3 |
| *Narthecium ossifragum* | 4 | - |
| *Sphagnum palustre* | - | 4 |
| *Carex nigra* | 3 | 3 |
| *Carex panicea* | 3 | - |
| *Succisa pratensis* | 3 | - |
| *Carex pulicaris* | 3 | - |
| *Carex echinata* | 2 | - |
| *Juncus bulbosus* | 2 | - |
| *Campylium stellatum* | 2 | - |
| *Hypnum cupressiforme s.l.* | 2 | 3 |
| *Erica cinerea* | 1 | - |
| *Anthoxanthum odoratum* | 3 | 3 |
| *Luzula multiflora* | 3 | 2 |
| *Polytrichum commune* | - | 4 |
| *Nardus stricta* | - | 3 |
| **Companion species** | | |
| *Empetrum nigrum nigrum* | - | 6 |
| *Hylocomium splendens* | - | 5 |
| *Festuca ovina agg.* | - | 3 |
| *Juncus conglomeratus* | 2 | - |
| *Pedicularis sylvatica* | 1 | - |
| *Hypericum pulchrum* | 1 | - |
| *Sphagnum subnitens* | - | 1 |
| **Additional species** | | |
| *Agrostis vinealis* | 3 | 3 |
| *Pseudoscleropodium purum* | 3 | 1 |
| *Calliergonella cuspidata* | 4 | - |
| *Carex hostiana* | 4 | - |
| *Rumex acetosa* | - | 4 |
| *Thalictrum alpinum* | 3 | - |
| *Ctenidium molluscum* | 2 | - |
| *Fissidens adianthoides* | 2 | - |
| *Holcus lanatus* | 1 | 1 |
| *Isothecium myosurioides* | 1 | - |
| *Ranunculus acris* | 1 | - |
| Number of samples | 1 | 1 |
| Number of species per sample | 29 | 19 |

**M23b *Juncus effusus/acutiflorus-Galium palustre* rush-pasture**

| | |
|---|---|
| *Juncus effusus* | 5-8 |
| *Holcus lanatus* | 4-5 |
| *Galium palustre* | 0-1 |
| | |
| *Deschampsia cespitosa* | 4-5 |
| *Kindbergia praelonga* | 3-5 |
| *Carex panicea* | 1-4 |
| *Ranunculus acris* | 1-3 |
| *Potentilla erecta* | 1-2 |
| *Filipendula ulmaria* | 1-2 |
| *Molinia caerulea* | 0-4 |
| | |
| **Companion species** | |
| *Agrostis stolonifera* | 3-4 |
| *Agrostis capillaris* | 3-4 |
| *Anthoxanthum odoratum* | 3 |
| *Festuca rubra* | 3 |
| *Rumex acetosa* | 1-3 |
| *Rhtytidiadelphus squarrosus* | 0-4 |
| *Senecio aquaticus* | 0-3 |
| *Comarum palustre* | 0-3 |
| *Caltha palustris* | 0-2 |
| *Cirsium palustre* | 0-2 |
| *Angelica sylvestris* | 2 |
| *Carex nigra* | 0-2 |
| *Juncus conglomeratus* | 0-2 |
| *Ranunculus flammula* | 0-1 |
| *Ranunculus repens* | 0-1 |
| *Hydrocotyle vulgaris* | 0-1 |
| *Lophocolea bidentata* | 0-1 |
| *Carex ovalis* | 0-1 |
| | |
| **Additional species** | |
| *Eriophorum angustifolium* | 0-3 |
| *Poa humilis* | 0-3 |
| *Nardus stricta* | 0-1 |
| | |
| Number of samples | 2 |
| Number of species per sample | 21-23 |

**M25 *Molinia caerulea-Potentilla erecta* mire**

| **Sub-community** | **a** | **b** | **x** | **M25** |
|---|---|---|---|---|
| *Molinia caerulea* | 9 | V (4-8) | V (7-9) | V (4-9) |
| *Potentilla erecta* | 1 | V (1-4) | IV (1-3) | V (1-4) |
| | | | | |
| *Eriophorum angustifolium* | | III (3-4) | III (2-3) | III (2-4) |
| *Narthecium ossifragum* | | I (1) | V (1) | III (1) |
| *Aulacomnium palustre* | | II (1-3) | | I (1-3) |
| *Hypnum jutlandicum* | 2 | | | I (2) |
| | | | | |
| *Anthoxanthum odoratum* | | IV (3-4) | IV (1-3) | IV (1-4) |
| *Luzula multiflora* | | V (1-3) | IV (1-3) | IV ((1-3) |
| *Holcus lanatus* | | V (2-5) | II (1) | III (1-5) |
| *Festuca rubra* | 1 | II (3) | IV (1-4) | III (1-4) |
| *Pseudoscleropodium purum* | | I (3) | III (2-4) | II (2-4) |
| *Carex flacca* | | II (1-2) | III (2-4) | II (1-4) |
| *Rumex acetosa* | | I (4) | | I (4) |
| *Agrostis capillaris* | | I (2) | | I (2) |
| *Viola palustris* | | II (1-2) | | I (1-2) |
| | | | | |
| *Angelica sylvestris* | | II (1-3) | IV (1-3) | III (1-3) |
| *Filipendula ulmaria* | | I (3) | IV (1-2) | III (1-3) |
| *Equisetum palustre* | | II (3) | II (1) | II (1-3) |
| *Cirsium palustre* | | III (1-2) | II (1) | II (1-2) |
| *Schoenus nigricans* | 5 | | | I (5) |
| *Mentha aquatica* | | | II (1) | I (1) |
| *Cardamine pratensis* | | | II (1) | I (1) |
| | | | | |
| **Companion species** | | | | |
| *Carex panicea* | | V (1-5) | IV (3-4) | IV (1-5) |
| *Succisa pratensis* | | IV (1-3) | V (1-4) | IV (1-4) |
| *Carex nigra* | | V (1-7) | I (4) | III (1-7) |
| *Agrostis stolonifera* | | II (3-5) | IV (1-3) | III (1-5) |
| *Agrostis canina agg.* | 1 | III (1-3) | II (4) | III (1-4) |
| *Carex echinata* | | III (1-3) | III (3) | III (1-3) |
| *Calliergonella cuspidata* | | II (3-4) | III (3) | II (3-4) |
| *Rhytidiadelphus squarrosus* | | III (3-4) | II (3) | II (3-4) |
| *Hydrocotyle vulgaris* | | II (2-5) | III (1-3) | II (1-5) |
| *Festuca ovina agg.** | 1 | 1(2) | II (3) | II (1-4) |
| *Menyanthes trifoliata* | | I (4) | III (1-4) | II (1-4) |
| *Nardus stricta* | | III (1-4) | II (2) | II (1-4) |
| *Deschampsia cespitosa* | 1 | I (3) | II (1) | II (1-3) |
| *Calluna vulgaris* | 2 | I (1) | II (1) | II (1-2) |
| *Dactylorhiza maculata ericetorum* | | | II (2) | I (2) |
| *Ranunculus flammula* | | | | I (2) |
| *Hyperichum pulchrum* | | | | I (1-2) |

| | | | | |
|---|---|---|---|---|
| *Ranunculus acris* | | | II (1) | I (1) |
| *Kindbergia praelonga* | | I (1) | | I (1) |
| *Lophocolea bidentata* | | | II (1) | I (1) |
| **Additional species** | | | | |
| *Juncus conglomeratus* | | IV (1-5) | IV (1-2) | IV (1-5) |
| *Carex pulicaris* | | I (2) | V (3) | III (1-3) |
| *Equisetum fluviatile* | | IV (1-3) | IV (1-3) | IV (1-3) |
| *Comarum palustre* | | II (4-5) | III (1-2) | II (1-5) |
| *Caltha palustris* | | II (3-4) | III (2) | II (2-4) |
| *Silene flos-cuculi* | | II (1-3) | II (2) | II (1-3) |
| *Carex hostiana* | | | IV (1-3) | II (1-3) |
| *Thalictrum alpinum* | | | IV (1-3) | II (1-3) |
| *Equisetum arvense* | 4 | | | I (4) |
| *Triglochin maritimum* | | | III (2-3) | I (2-3) |
| *Senecio x ostenfeldii* | | II (1-4) | | I (1-4) |
| *Empetrum nigrum nigrum* | 1 | I (1) | | I (1) |
| *Sagina nodosa* | | I (1) | II (1) | I (1) |
| *Hylocomium splendens* | 1 | | II (1) | I (1) |
| Number of samples | 1 | 5 | 4 | 10 |
| Number of species per sample | 13 | 16-27 | 18-32 | 13-32 |

The following additional species were recorded in a single quadrat only: *Campylium stellatum, Carex dioica, Mnium hornum, Calliergon cordifolium, Carex lepidocarpa, Dicranum scoparium, Juncus bulbosus, Scorzoneroides autumnalis, Galium saxatile, Triglochin palustris.*

**M27 *Filipendula ulmaria-Angelica sylvestris* mire**

| | **a** | **b** | **c** | **M27** |
|---|---|---|---|---|
| *Filipendula ulmaria* | V (7-10) | 5 | V (5-6) | V (5-10) |
| *Carex nigra* | V (2-7) | | V (4) | V (2-7) |
| *Rumex acetosa* | IV (2-3) | 1 | V (2-4) | V (2-4) |
| *Calliergonella cuspidata* | II (1-4) | | V (3-4) | V (1-4) |
| *Rhytidiadelphus squarrosus* | | | V (2-4) | III (2-4) |
| *Lophocolea bidentata* | II (3) | | IV (2) | III (2-3) |
| *Poa trivialis* | IV (2) | 2 | | III (2) |
| *Carex panicea* | II (2) | | V (1-4) | III (1-4) |
| *Silene flos-cuculi* | II (1) | | V (2-3) | III (1-3) |
| *Caltha palustris* | IV (1) | | | III (1-3) |
| *Galium palustre* | IV (1-2) | | II (3) | III (1-3) |
| *Ranunculus acris* | IV (1-2) | | IV (2-3) | III (1-3) |
| *Plagiomnium undulatum* | II (3) | | IV (1-3) | III (1-3) |
| *Cardamine pratensis* | IV (1-2) | | IV (2-3) | III (1-3) |
| *Angelica sylvestris* | IV (1) | 1 | II (1) | III (1) |
| *Brachythecium rutabulum* | | | IV (3) | II (3) |
| *Kindbergia praelonga* | II (3) | | II (3) | II (3) |
| *Succisa pratensis* | IV (1-2) | | | II (1-2) |
| *Carex rostrata* | II (3) | | | I (3) |
| *Urtica dioica* | | 7 | | I (7) |
| *Elytrigia repens* | | 4 | | I (4) |
| *Arrhenatherum elatius* | | 3 | | I (3) |
| *Molinia caerulea* | V (1-5) | | V (3-4) | V (3-4) |
| *Holcus lanatus* | IV (3) | 2 | V (3) | V (2-3) |
| *Agrostis stolonifera* | II (3) | | V (3-4) | III (3-4) |
| *Anthoxanthum odoratum* | II (1) | | V (3-4) | III (1-4) |
| *Senecio aquaticus* | | | V (1-3) | III (1-3) |
| *Iris pseudacorus* | | 5 | | I (5) |
| *Hydrocotyle vulgaris* | II (1) | | | I (1) |
| *Festuca rubra* | V (1-4) | 1 | V (3-4) | V (1-4) |
| *Comarum palustre* | II (1) | | V (1-8) | III (1-8) |
| *Equisetum fluviatile* | III (2-5) | | III (1) | III (1-5) |
| *Juncus conglomeratus* | | | V (1-4) | III (1-4) |
| **Additional species** | | | | |
| *Deschampsia cespitosa* | II (1) | | IV (4-5) | III (1-5) |
| *Luzula multiflora* | III (1-3) | | II (2) | II (2-3) |
| *Menyanthes trifoliata* | II (1) | | II (3) | II (2-3) |
| *Potentilla erecta* | II (3) | | II (1) | II (1-3) |
| Number of samples | 3 | 1 | 3 | 7 |
| Number of species per sample | 12-29 | 10 | 20-24 | 10-29 |

The following additional species were recorded in a single quadrat only: *Eriophorum angustifolium, Agrostis capillaris, Pseudoscleropodium purum, Nardus stricta, Carex pulicaris, Trifolium repens, Brachythecium rivulare, Juncus bufonius, Juncus bulbosus, Scorzoneroides autumnalis, Galium saxatile.*

**M28a *Iris pseudacorus-Filipendula ulmaria* mire**

| | |
|---|---|
| *Iris pseudacorus* | 9-10 |
| *Poa trivialis* | 3 |
| *Filipendula ulmaria* | 0-3 |
| | |
| *Epilobium palustre* | 2-3 |
| *Angelica sylvestris* | 0-4 |
| *Lophocolea bidentata* | 0-4 |
| *Calliergonella cuspidata* | 0-2 |
| *Anthoxanthum odoratum* | 0-2 |
| *Ranunculus acris* | 0-1 |
| *Rumex acetosa* | 0-1 |
| *Cirsium palustre* | 0-1 |
| *Caltha palustris* | 0-1 |
| | |
| | |
| | |
| *Festuca rubra* | 1-3 |
| *Holcus lanatus* | 1 |
| *Agrostis stolonifera* | 0-3 |
| *Mentha aquatica* | 0-3 |
| *Deschampsia cespitosa* | 0-3 |
| *Kindbergia praelonga* | 0-2 |
| *Ranunculus repens* | 0-2 |
| *Equisetum palustre* | 0-2 |
| | |
| **Additional species** | |
| *Epilobium parviflorum* | 0-4 |
| *Brachythecium rutabulum* | 0-2 |
| | |
| Number of samples | 2 |
| Number of species per sample | 10-17 |

***MCxn Carex nigra* mire – provisional community**
(In order of SD17)

| | |
|---|---|
| *Carex nigra* | V (3-8) |
| *Calliergonella cuspidata* | V (2-9) |
| *Agrostis stolonifera* | III (3) |
| *Festuca rubra* | III (2-6) |
| *Carex panicea* | III (2-3) |
| *Ranunculus repens* | II (3) |
| *Trifolium repens* | II (1-3) |
| *Carex flacca* | II (1-2) |
| *Parnassia palustris* | II (1-2) |
| *Poa humilis* | I (3) |
| *Epilobium palustre* | V (2-3) |
| *Caltha palustris* | V (1-4) |
| *Holcus lanatus* | IV (1-5) |
| *Silene flos-cuculi* | IV (1-4) |
| *Rhinanthus minor* | IV (1-2) |
| *Equisetum fluviatile* | III (2-5) |
| *Anthoxanthum odoratum* | II (3) |
| *Rumex acetosa* | II (2-4) |
| *Poa trivialis* | II (1-3) |
| *Cerastium fontanum* | II (1) |
| *Pedicularis palustris* | I (1) |
| **Companion species** | |
| *Juncus articulatus* | III (2-4) |
| *Angelica sylvestris* | III (1-4) |
| *Comarum palustre* | II (3-5) |
| *Hydrocotyle vulgaris* | II (3-4) |
| *Cardamine pratensis* | II (3) |
| *Galium palustre* | II (3) |
| *Agrostis capillaris* | II (3) |
| *Eriophorum angustifolium* | II (3) |
| *Equisetum palustre* | II (2-3) |
| *Ranunculus flammula* | II (1-4) |
| *Mentha aquatica* | II (1-3) |
| *Kindbergia praelonga* | II (1-3) |
| *Cratoneuron filicinum* | I (5) |
| *Rhytidiadelphus squarrosus* | I (3) |
| *Plagiomnium rostratum* | I (1) |
| *Juncus effusus* | I (1) |
| *Alopecurus geniculatus* | I (1) |
| **Additional species** | |
| *Cirsium palustre* | IV (1) |
| *Senecio aquaticus* | III (1-2) |
| *Deschampsia cespitosa* | II (3-4) |
| *Juncus bulbosus* | II (3) |

| | |
|---|---|
| *Sagina nodosa* | II (2-4) |
| *Brachythecium rivulare* | II (2-4) |
| *Luzula multiflora* | II (2-3) |
| *Succisa pratensis* | II (1-4) |
| *Ranunculus acris* | II 1-3) |
| *Potentilla erecta* | II (1-2) |
| | |
| Number of samples | 8 |
| Number of species per sample | 12-27 |

The following additional species were recorded in a single quadrat only: *Bryum pseudotriquetrum, Senecio x ostenfeldii, Juncus conglomeratus, Plagiomnium undulatum, Potamogeton polygonifolius, Carex hostiana, Epilobium parviflorum, Glyceria fluitans, Pseudoscleropodium purum, Schoenus nigricans.*

***Juncus conglomeratus* rush pasture – non-NVC**

| | |
|---|---|
| *Hylocomium splendens* | 8 |
| *Juncus conglomeratus* | 5 |
| *Comarum palustre* | 5 |
| *Carex nigra* | 5 |
| *Holcus lanatus* | 4 |
| *Carex echinata* | 3 |
| *Anthoxanthum odoratum* | 3 |
| *Carex panicea* | 3 |
| *Carex pulicaris* | 3 |
| *Epilobium palustre* | 3 |
| *Eriophorum angustifolium* | 3 |
| *Festuca rubra* | 3 |
| *Luzula multiflora* | 3 |
| *Potentilla erecta* | 3 |
| *Rhytidiadelphus squarrosus* | 3 |
| *Rumex acetosa* | 3 |
| *Senecio x ostenfeldii* | 3 |
| *Calliergonella cuspidata* | 2 |
| *Hydrocotyle vulgaris* | 2 |
| *Pseudoscleropodium purum* | 1 |
| *Silene flos-cuculi* | 1 |
| *Cirsium palustre* | 1 |
| *Succisa pratensis* | 1 |
| | |
| Number of samples | 1 |
| Number of species per sample | 23 |

**Grasslands**

**MG5c *Cynosurus cristatus-Centaurea nigra* grassland**

| | |
|---|---|
| *Festuca rubra* | 7 |
| *Plantago lanceolata* | 5 |
| *Trifolium repens* | 5 |
| *Agrostis capillaris* | 4 |
| *Holcus lanatus* | 3 |
| *Anthoxanthum odoratum* | 3 |
| *Cynosurus cristatus* | 1 |
| *Trifolium pratense* | 1 |

| | |
|---|---|
| *Scorzoneroides autumnalis* | 4 |
| *Luzula campestris* | 3 |
| *Prunella vulgaris* | 1 |

| **Companion species** | |
|---|---|
| *Rhinanthus minor* | 5 |
| *Ranunculus acris* | 4 |
| *Rumex acetosa* | 3 |
| *Rhytidiadelphus squarrosus* | 3 |
| *Taraxacum officinalis agg.* | 2 |
| *Ranunculus repens* | 2 |
| *Cerastium fontanum* | 1 |
| *Vicia cracca* | 1 |

| **Additional species** | |
|---|---|
| *Silene flos-cuculi* | 1 |
| *Deschampsia cespitosa* | 1 |
| *Lophocolea bidentata* | 1 |
| | |
| Number of samples | 1 |
| Number of species per sample | 22 |

**MG6 *Lolium perenne-Cynosurus cristatus* grassland**

No quadrat sample collected. Species list from part of the Skooant

*Agrostis capillaris*
*Holcus lanatus*
*Festuca rubra*
*Cynosurus cristatus*
*Anthoxanthum odoratum*
*Lolium perenne*
*Agrostis stolonifera*
*Plantago lanceolata*
*Trifolium repens*
*Ranunculus acris*
*Cerastium fontanum*
*Rumex acetosa*
*Bellis perennis*
*Prunella vulgaris*
*Senecio aquaticus*
*Kindbergia praelonga*

**MG9a *Holcus lanatus-Deschampsia cespitosa* grassland**

| | |
|---|---|
| *Deschampsia cespitosa* | V (6-8) |
| *Holcus lanatus* | V (3-5) |
| | |
| *Ranunculus acris* | IV (3) |
| *Anthoxanthum odoratum* | IV (1-2) |
| *Filipendula ulmaria* | II (5) |
| *Carex nigra* | II (4) |
| *Calliergonella cuspidata* | II (4) |
| *Poa trivialis* | II (3) |
| *Juncus effusus* | II (2) |
| *Senecio aquaticus* | II (1) |
| *Taraxacum officinale agg.* | II (1) |

**Companion species**

| | |
|---|---|
| *Rumex acetosa* | IV (4-5) |
| *Angelica sylvestris* | IV (3-5) |
| *Festuca rubra* | IV (2-6) |
| *Ranunculus repens* | IV (2-3) |
| *Potentilla anserina* | II (4) |
| *Agrostis stolonifera* | II (3) |
| *Vicia cracca* | II (1) |

**Additional species**

| | |
|---|---|
| *Kindbergia praelonga* | V (2-3) |
| *Epilobium palustre* | V (1-3) |
| *Equisetum palustre* | V (1-3) |
| *Equisetum fluviatile* | IV (4-5) |
| *Galium palustre* | IV (3) |
| *Caltha palustris* | IV (2-4) |
| | |
| Number of samples | 3 |
| Number of species per sample | 12-22 |

The following additional species were recorded in a single quadrat only: *Brachythecium rivulare*, *Calliergon cordifolium, Carex flacca*, *Juncus conglomeratus.*

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

| | |
|---|---|
| *Agrostis stolonifera* | 6 |
| *Holcus lanatus* | 5 |
| *Ranunculus repens* | 3 |
| *Angelica sylvestris* | 2 |
| *Juncus articulatus* | 1 |
| *Filipendula ulmaria* | 3 |
| *Silene flos-cuculi* | 1 |
| **Companion species** | |
| *Festuca rubra* | 7 |
| *Anthoxanthum odoratum* | 4 |
| *Rumex acetosa* | 4 |
| *Potentilla anserina* | 3 |
| *Calliergonella cuspidata* | 3 |
| *Caltha palustris* | 3 |
| *Trifolium repens* | 2 |
| *Equisetum palustre* | 2 |
| *Mentha aquatica* | 2 |
| *Cardamine pratensis* | 2 |
| *Poa trivialis* | 1 |
| *Ranunculus acris* | 1 |
| *Lathyrus pratensis* | 1 |
| **Additional species** | |
| *Deschampsia cespitosa* | 4 |
| Number of samples | 1 |
| Number of species per sample | 21 |

**MG13 *Agrostis stolonifera-Alopecurus geniculatus* grassland**

| | |
|---|---|
| *Agrostis stolonifera* | 4-8 |
| *Alopecurus geniculatus* | 1-10 |
| | |
| *Holcus lanatus* | 3-6 |
| *Caltha palustris* | 1-4 |
| *Ranunculus repens* | 1-3 |
| *Poa trivialis* | 0-4 |
| *Glyceria fluitans* | 0-4 |
| *Mentha aquatica* | 0-1 |
| | |
| **Additional species** | |
| *Equisetum fluviatile* | 1-3 |
| *Comarum palustre* | 0-2 |
| *Angelica sylvestris* | 0-1 |
| *Cardamine pratensis* | 0-1 |
| *Equisetum arvense* | 0-1 |
| *Menyanthes trifoliata* | 0-1 |
| | |
| Number of samples | 2 |
| Number of species per sample | 7-12 |

**U4b *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland**

| | |
|---|---|
| *Agrostis capillaris* | V (3-7) |
| *Anthoxanthum odoratum* | V (3-5) |
| *Potentilla erecta* | V (1-5) |
| *Holcus lanatus* | IV (1-4) |
| *Trifolium repens* | III (1-3) |
| *Cynosurus cristatus* | II (1-3) |
| *Achillea millefolium* | II (1) |
| *Poa pratensis agg.** | I (2) |
| *Cerastium fontanum* | I (1) |
| *Taraxacum agg.* | I (1) |
| *Carex panicea* | IV (3-5) |
| *Lotus corniculatus* | IV (2-3) |
| *Luzula multiflora* | III (2-3) |
| *Carex echinata* | II (2-3) |
| *Deschampsia cespitosa* | II (1-5) |
| *Succisa pratensis* | II (1-3) |
| *Nardus stricta* | III (3-5) |
| **Companion species** | |
| *Festuca rubra* | IV (3-5 |
| *Rumex acetosa* | IV (2-6) |
| *Ranunculus acris* | IV (2-4) |
| *Rhytidiadelphus squarrosus* | IV (1-8) |
| *Carex nigra* | III (3-5) |
| *Agrostis vinealis* | III (3) |
| *Pseudoscleropodium purum* | II (2-3) |
| *Lophocolea bidentata* | II (2-3) |
| *Plantago lanceolata* | II (1-4) |
| *Molinia caerulea* | II (1-3) |
| *Mnium hornum* | I (4) |
| *Juncus effusus* | I (3) |
| *Luzula campestris* | I (2) |
| **Additional species** | |
| *Kindbergia praelonga* | III (3-4) |
| *Hypochaeris radicata* | II (3-4) |
| *Scorzoneroides autumnalis* | II (3-4) |
| *Calliergonella cuspidata* | II (2-4) |
| *Epilobium palustre* | II (2-3) |
| *Senecio x ostenfeldii* | II (2-3) |
| *Angelica sylvestris* | II (2) |
| *Equisetum palustre* | II (1) |
| *Achillea ptarmica* | I (3) |

| | |
|---|---|
| *Agrostis stolonifera* | I (3) |
| *Equisetum arvense* | I (3) |
| *Cirsium palustre* | I (1) |
| | |
| Number of samples | 5 |
| Number of species per sample | 16-30 |

The following additional species were recorded in a single quadrat only: *Glyceria fluitans, Juncus conglomeratus, Lychnis flos-cuculi, Scapania undulata, Brachythecium rutabulum, Rhinanthus minor, Pedicularis sylvatica, Peltigera* sp.*, Plagiomnium undulatum, Polytrichum juniperinum, Ranunculus flammula, Sagina procumbens.*

**Swamps and tall-herb fens**

**S4 *Phragmites australis* swamps and reed-beds**

| | **b** |
|---|---|
| *Phragmites australis* | 9 |
| | |
| *Galium palustre* | 3 |
| | |
| *Mentha aquatica* | 3 |
| *Calliergonella cuspidata* | 9 |
| *Agrostis stolonifera* | 2 |
| *Equisetum fluviatile* | 3 |
| | |
| **Additional species** | |
| *Calliergon cordifolium* | 3 |
| *Caltha palustris* | 3 |
| *Cardamine pratensis* | 3 |
| *Epilobium palustre* | 3 |
| *Lophocolea bidentata* | 3 |
| | |
| Number of samples | 1 |
| Number of species per sample | 11 |

| | **c** |
|---|---|
| *Phragmites australis* | V (10) |
| | |
| *Menyanthes trifoliata* | V (4-9) |
| *Equisetum fluviatile* | V (2-3) |
| | |
| *Comarum palustre* | II (1) |
| | |
| ***Additional species*** | |
| *Mentha aquatica* | III (3-5) |
| *Myosotis scorpioides* | III (3) |
| *Poa trivialis* | III (2-3) |
| *Cardamine pratensis* | II (3) |
| *Carex nigra* | II (2) |
| *Epilobium palustre* | II (2) |
| *Caltha palustris* | II (1) |
| *Epilobium parviflorum* | II (1) |
| | |
| Number of samples | 3 |
| Number of species per sample | 3-10 |

**S9b *Carex rostrata swamp***

| | |
|---|---|
| *Carex rostrata* | 8 |
| | |
| *Menyanthes trifoliata* | 7 |
| *Comarum palustre* | 4 |
| *Eleocharis palustris* | 1 |
| *Ranunculus flammula* | 1 |
| | |
| Number of samples | 1 |
| Number of species per sample | 5 |

**S10 *Equisetum fluviatile* swamp**

| | **a** | **b** | **b (Mt)** | **10** |
|---|---|---|---|---|
| *Equisetum fluviatile* | 9-10 | 8 | IV (1-3) | V (1-10) |
| | | | | |
| *Lemna minor* | | 4 | | I (4) |
| | | | | |
| *Menyanthes trifoliata* | 1 | 5 | V (9) | V (1-9) |
| *Comarum palustre* | | 2 | | I (2) |
| *Epilobium palustre* | | 2 | | I (2) |
| *Galium palustre* | | 1 | | I (1) |
| *Caltha palustris* | | 1 | | I (1) |
| *Angelica sylvestris* | | 1 | | I (1) |
| | | | | |
| **Additional species** | | | | |
| *Holcus lanatus* | | 1 | | I (1) |
| *Mentha aquatica* | 1 | | | I (1) |
| *Potamogeton pusillus* | 1 | | | I (1) |
| | | | | |
| Number of samples | 2 | 1 | 3 | 6 |
| Number of species per sample | 1-4 | 9 | 1-2 | 1-9 |

No additional species were recorded in a single quadrat only.

**S19a *Eleocharis palustris* swamp**

| | |
|---|---|
| *Eleocharis palustris* | 9 |
| | |
| | |
| | |
| **Additional species** | |
| *Chara* sp. | 4 |
| | |
| Number of samples | 1 |
| Number of species per sample | 2 |

***S27 Carex rostrata-Comarum palustre* tall-herb fen**

| | |
|---|---|
| *Comarum palustre* | V (6-10) |
| *Galium palustre* | V (1-4) |
| *Menyanthes trifoliata* | III (2-8) |
| *Carex rostrata* | I (2-9) |
| | |
| *Equisetum fluviatile* | III (1-5) |
| *Ranunculus flammula* | II (1-2) |
| *Rhizomnium pseudopunctatum* | I (3) |
| *Ranunculus repens* | I (3) |
| *Senecio aquaticus/ x ostenfeldii* | I (2) |
| *Stellaria alsine* | I (1-3) |
| *Brachythecium rivulare* | I (1) |
| | |
| *Carex nigra* | V (1-4) |
| *Eriophorum angustifolium* | III (3-4) |
| *Silene flos-cuculi* | II (1-3) |
| *Phragmites australis* | I (4) |
| *Angelica sylvestris* | I (1-3) |
| **Companion species** | |
| *Agrostis stolonifera* | V (2-7) |
| *Epilobium palustre* | V (2-6) |
| *Caltha palustris* | IV (1-5) |
| *Holcus lanatus* | IV (1-5) |
| *Cardamine pratensis* | IV (1-4) |
| *Calliergonella cuspidata* | III (2-7) |
| *Poa trivialis* | III (1-5) |
| *Mentha aquatica* | II (2-4) |
| *Calliergon cordifolium* | II (1-5) |
| *Juncus articulatus* | II (1-3) |
| *Equisetum palustre* | II (1-3) |
| *Myosotis scorpioides* | I (3) |
| *Filipendula ulmaria* | I (3) |
| *Juncus effusus* | I (3) |
| *Hydrocotyle vulgaris* | I (2-3) |
| *Lophocolea bidentata* | I (2-3) |
| *Cirsium palustre* | I (1) |
| **Additional species** | |
| *Festuca rubra* | IV (1-5) |
| *Rumex acetosa* | II (3-4) |
| *Anthoxanthum odoratum* | II (1-3) |
| *Carex panicea* | I (1-4) |
| | |
| Number of samples | 16 |
| Number of species per sample | 9-20 |

The following additional species were recorded in a single quadrat only: *Epilobium parviflorum, Plagiomnium ellipticum, Succisa pratensis, Deschampsia cespitosa, Juncus bulbosus, Narthecium ossifragum, Potentilla erecta, Pseudoscleropodium purum, Alopecurus geniculatus, Hylocomium splendens, Juncus conglomeratus, Luzula multiflora, Molinia caerulea, Rhinanthus minor, Plagiomnium undulatum*

**S28a *Phalaris arundinacea* tall-herb fen, *Phalaris arundinacea* sub-community**

| | |
|---|---|
| *Phalaris arundinacea* | 8 |
| *Galium palustre* | 2 |
| *Callitriche stagnalis* | 1 |
| *Kindbergia praelonga* | 3 |
| *Deschampsia cespitosa* | 2 |
| *Holcus lanatus* | 1 |
| *Filipendula ulmaria* | 4 |
| *Mentha aquatica* | 2 |
| *Angelica sylvestris* | 1 |
| *Equisetum fluviatile* | 1 |
| **Additional species** | |
| *Iris pseudacorus* | 5 |
| *Festuca rubra* | 4 |
| *Cardamine pratensis* | 3 |
| *Hydrocotyle vulgaris* | 3 |
| *Calliergonella cuspidata* | 3 |
| *Brachythecium rutabulum* | 3 |
| *Caltha palustris* | 2 |
| Number of samples | 1 |
| Number of species per sample | 17 |

**Maritime communities and open habitats**

**SD17 *Potentilla anserina-Carex anserina* dune-slack**

| | **d** |
|---|---|
| *Potentilla anserina* | V (3-5) |
| *Carex nigra* | V (2-8) |
| *Agrostis stolonifera* | V (2-5) |
| *Calliergonella cuspidata* | IV (1-3) |
| *Ranunculus repens* | I (4) |
| *Poa trivialis* | I (4) |
| *Eleocharis palustris* | IV (2-7) |
| *Galium palustre* | IV (2-4) |
| *Hydrocotyle vulgaris* | I (2) |
| *Ranunculus flammula* | I (2) |
| *Mentha aquatica* | I (2) |
| **Companion species** | |
| *Comarum palustre* | V (1-8) |
| *Juncus articulatus* | II (3) |
| *Juncus bufonius* | II (2-3) |
| *Alopecurus geniculatus* | I (4) |
| **Additional species** | |
| *Persicaria amphibia* | I (8) |
| *Calliergon cordifolium* | I (3) |
| *Gnaphalium uliginosum* | I (1) |
| *Myosotis scorpioides* | I (1) |
| Number of samples | 5 |
| Number of species per sample | 6-13 |

No additional species were recorded in a single quadrat only.

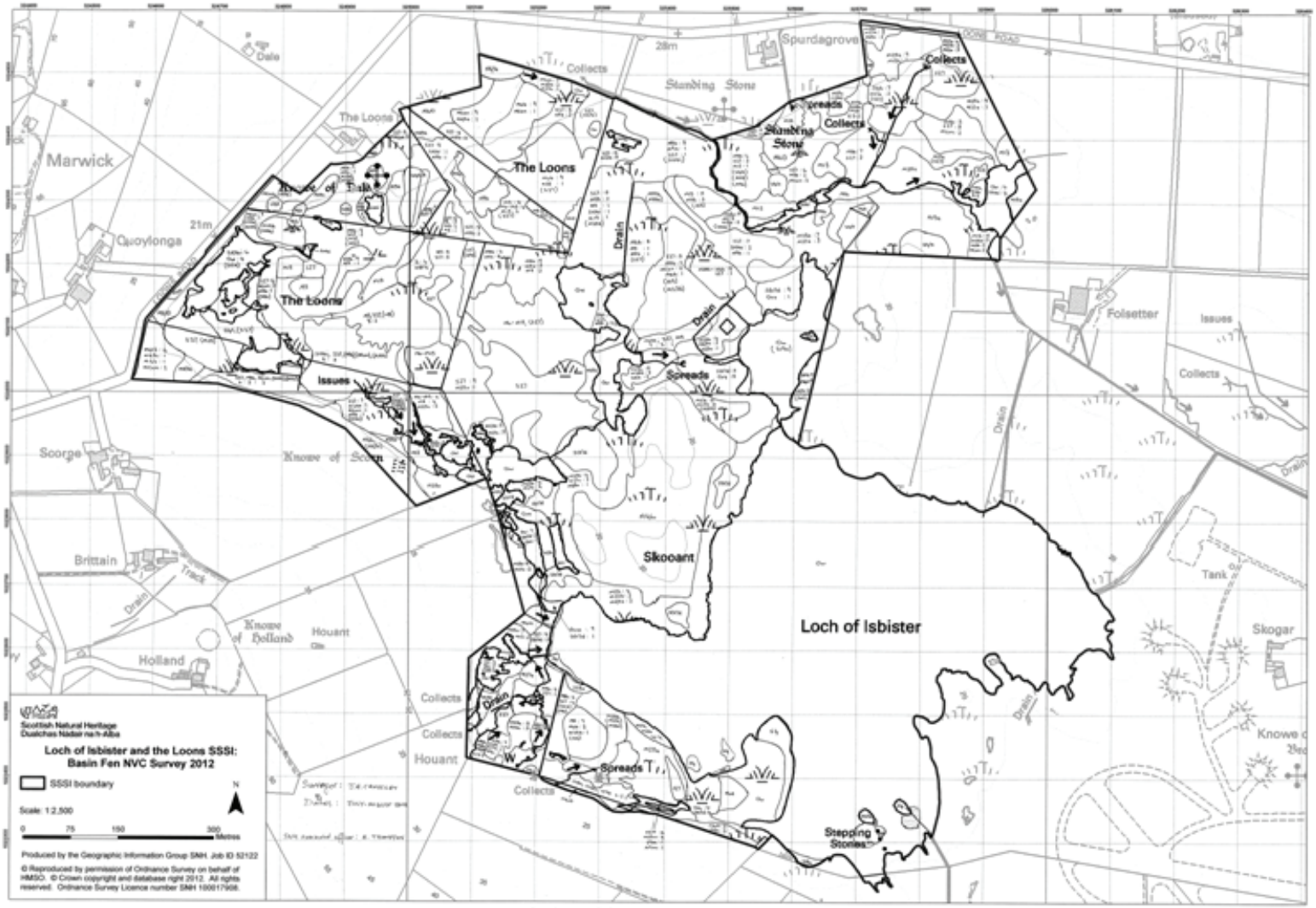
**OVx *Juncus bufonius-Gnaphalium uliginosum* provisional new community**

| | |
|---|---|
| *Juncus bufonius* | V (5-10) |
| *Gnaphalium uliginosum* | V (2-5) |
| *Rorippa islandica* | V (1-4) |
| *Tortula truncata* | IV (3-5) |
| *Persicaria amphibia* | III (1-3) |
| *Senecio aquaticus* seedling | III (1-3) |
| *Potentilla anserina* | II (3-5) |
| *Callitriche stagnalis* | II (3-4) |
| *Myosotis laxa* seedling | II (1-3) |
| *Ranunculus repens* seedling | II (1) |
| *Agrostis stolonifera* | I (4) |
| *Stellaria alsine* | I (4) |
| *Poa annua* | I (3) |
| *Plantago major* seedling | I (2) |
| *Alopecurus geniculatus* | I (1) |
| *Polygonum aviculare* | I (1) |
| Number of samples | 5 |
| Number of species per sample | 6-10 |

No additional species were recorded in a single quadrat only.

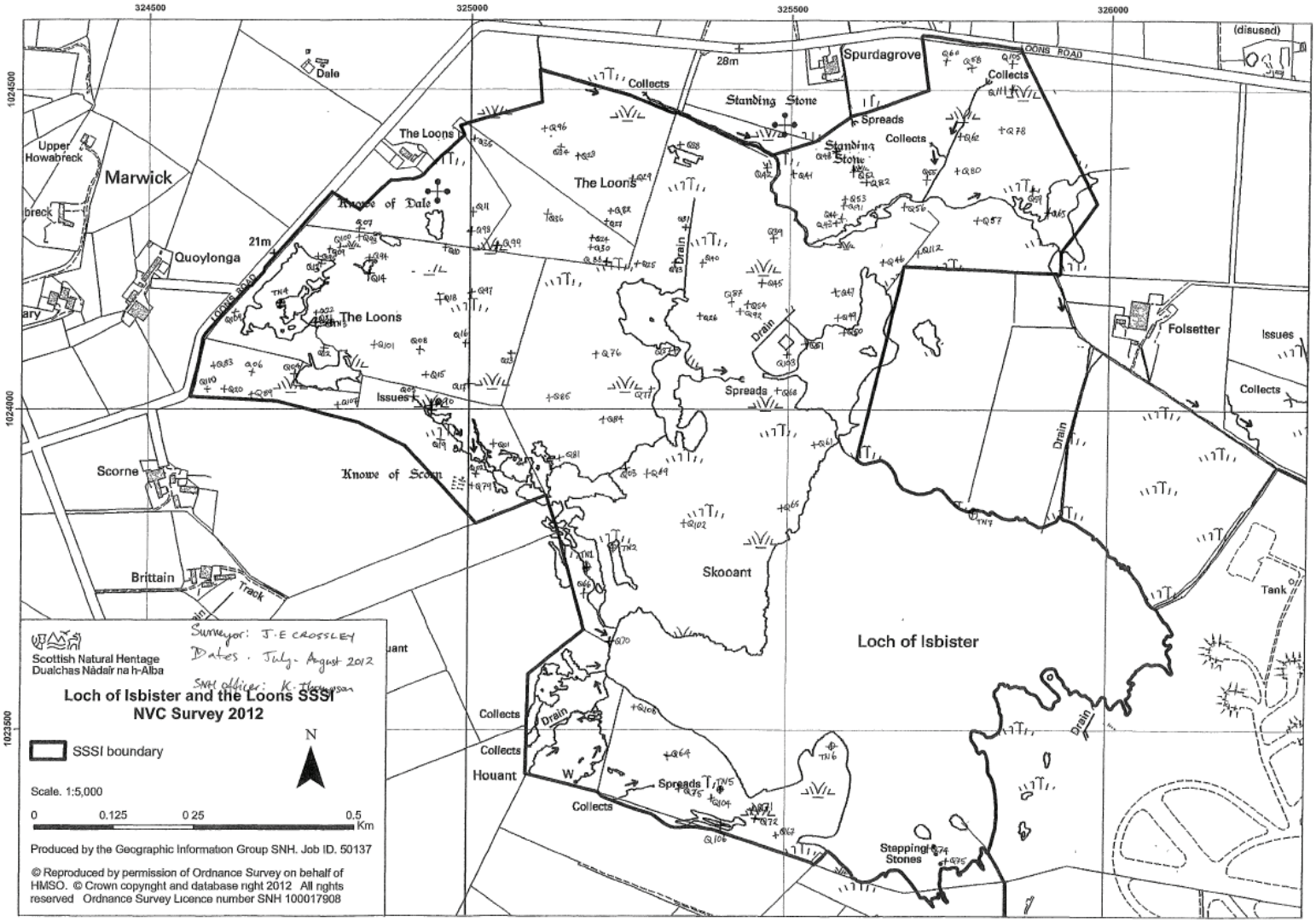
**ANNEX 2: NVC MAP**

*Note that this is a reduced image of an A3 black and white scan of the original A1 colour map and is included here for illustrative purposes only.*



## ANNEX 3: MAP SHOWING LOCATIONS OF NVC QUADRATS AND TARGET NOTES

*Note that this is a reduced image of a black and white scan of the original A3 map and is included here for illustrative purposes only.*



**ANNEX 4: TARGET NOTES**

| UID | Easting | Northing | Place | Date | Photo no. | Note |
|---|---|---|---|---|---|---|
| TN1 | 325189 | 1023747 | W of Skooant | 13/07/2012 | P100[3] | Photo of cattle on poached OVx community |
| TN2 | 325228 | 1023771 | W of Skooant | 13/07/2012 | | *Rorippa islandica*, locally abundant |
| TN3 | 32470 | 102415 | Loons hide reed-bed | 29/07/2012 | P101 | Photo of cattle in reeds |
| TN4 | 32467 | 102418 | Loons hide pool | 30/07/2012 | P102[4] | Photo cattle in deep water |
| TN5 | 325397 | 1023392 | SW of Loch of Isbister | 03/08/2012 | | Hierochloe odorata. 15m x 100m patch |
| TN6 | 32557 | 102347 | S Loch of Isbister | 03/08/2012 | | Reed bed in open water, with small stand of *Hippuris vulgaris*. Shown on OS map as larger area not detached from loch shore. |
| TN7 | 32580 | 102384 | N shore of Loch of Isbister | 30/08/2012 | | Stony edge to northern loch shore - narrow inundation zone. Sparse vegetation at water's edge with C*arex oederi, Scorzoneroides autumnalis, Juncus articulatus, Agrostis stolonifera, Potentilla anserina;* higher up a richer community with these plus *Rhinanthus minor, Pedicularis palustris, Carex panicea, Linum catharticum, Calliergonella cuspidata, Dreplanocladus cossonii, Cratoneuron filicinum.* |

[3] Reproduced as Figure 7 in main report text
[4] Reproduced as Figure 4 in main report text

## ANNEX 5: PLANT SPECIES LIST

| | |
|---|---|
| *Achillea millefolium* | Yarrow |
| *Achillea ptarmica* | Sneezewort |
| *Agrostis capillaris* | Common Bent |
| *Agrostis stolonifera* | Creeping Bent |
| *Agrostis vinealis* | Brown Bent |
| *Alopecurus geniculatus* | Marsh Foxtail |
| *Anagallis tenella* | Bog Pimpernel |
| *Angelica sylvestris* | Wild Angelica |
| *Bellis perennis* | Daisy |
| *Callitriche hermaphroditica* | Autumnal Water-starwort |
| *Callitriche stagnalis* | Common Water-starwort |
| *Calluna vulgaris* | Heather |
| *Caltha palustris* | Marsh-marigold |
| *Cardamine flexuosa* | Wavy Bitter-cress |
| *Cardamine pratensis* | Cuckooflower |
| *Carex binervis* | Green-ribbed Sedge |
| *Carex demissa* | Common Yellow-sedge |
| *Carex dioica* | Dioecious Sedge |
| *Carex echinata* | Star Sedge |
| *Carex flacca* | Glaucous Sedge |
| *Carex hostiana* | Tawny Sedge |
| *Carex lepidocarpa* | Long-stalked Yellow-sedge |
| *Carex nigra* | Common Sedge |
| *Carex oederi* | Small-fruited Yellow-sedge |
| *Carex panicea* | Carnation Sedge |
| *Carex pulicaris* | Flea Sedge |
| *Carex rostrata* | Bottle Sedge |
| *Cerastium fontanum subsp. vulgare* | Common Mouse-ear |
| *Cirsium palustre* | Marsh Thistle |
| *Comarum palustre* | Marsh Cinquefoil |
| *Cynosurus cristatus* | Crested Dog's-tail |
| *Dactylorhiza maculata subsp. ericetorum* | Heath Spotted-orchid |
| *Dactylorhiza purpurella* | Northern Marsh-orchid |
| *Dactylorhiza x formosa* | D. maculata x purpurella |
| *Danthonia decumbens* | Heath-grass |
| *Deschampsia cespitosa subsp. cespitosa* | Tufted Hair-grass |
| *Deschampsia flexuosa* | Wavy Hair-grass |
| *Drosera rotundifolia* | Round-leaved Sundew |
| *Eleocharis palustris* | Common Spike-rush |
| *Elytrigia repens* | Common Couch |
| *Empetrum nigrum subsp. nigrum* | Crowberry |
| *Epilobium montanum* | Broad-leaved Willowherb |
| *Epilobium palustre* | Marsh Willowherb |
| *Epilobium parviflorum* | Hoary Willowherb |

| | |
|---|---|
| *Equisetum arvense* | Field Horsetail |
| *Equisetum fluviatile* | Water Horsetail |
| *Equisetum palustre* | Marsh Horsetail |
| *Erica cinerea* | Bell Heather |
| *Erica tetralix* | Cross-leaved Heath |
| *Eriophorum angustifolium* | Common Cottongrass |
| *Euphrasia arctica* | Eyebright |
| *Festuca filiformis* | Fine-leaved Sheep's-fescue |
| *Festuca rubra* | Red Fescue |
| *Festuca vivipara* | Viviparous Sheep's-fescue |
| *Filipendula ulmaria* | Meadowsweet |
| *Galium verum* | Lady's Bedstraw |
| *Glyceria fluitans* | Floating Sweet-grass |
| *Gnaphalium uliginosum* | Marsh Cudweed |
| *Heracleum sphondylium* | Hogweed |
| *Hierochloe odorata* | Holy Grass |
| *Hippuris vulgaris* | Mare's-tail |
| *Holcus lanatus* | Yorkshire-fog |
| *Hydrocotyle vulgaris* | Marsh Pennywort |
| *Hypericum pulchrum* | Slender St John's-wort |
| *Hypochaeris radicata* | Cat's-ear |
| *Iris pseudacorus* | Yellow Iris |
| *Juncus articulatus* | Jointed Rush |
| *Juncus bufonius* | Toad Rush |
| *Juncus bulbosus* | Bulbous Rush |
| *Juncus conglomeratus* | Compact Rush |
| *Juncus effusus* | Soft-rush |
| *Juncus x surrejanus* | J. acutiflorus x articulatus |
| *Lathyrus pratensis* | Meadow Vetchling |
| *Lemna minor* | Common Duckweed |
| *Linum catharticum* | Fairy Flax |
| *Littorella uniflora* | Shoreweed |
| *Lotus corniculatus* | Common Bird's-foot-trefoil |
| *Luzula campestris* | Field Wood-rush |
| *Luzula multiflora* | Heath Wood-rush |
| *Mentha aquatica* | Water Mint |
| *Menyanthes trifoliata* | Bogbean |
| *Molinia caerulea* | Purple Moor-grass |
| *Montia fontana* | Blinks |
| *Myosotis discolor* | Changing Forget-me-not |
| *Myosotis laxa* | Tufted Forget-me-not |
| *Myosotis scorpioides* | Water Forget-me-not |
| *Nardus stricta* | Mat-grass |
| *Narthecium ossifragum* | Bog Asphodel |
| *Odontites vernus* | Red Bartsia |
| *Parnassia palustris* | Grass-of-Parnassus |
| *Pedicularis palustris* | Marsh Lousewort |
| *Pedicularis sylvatica* | Lousewort |

| | |
|---|---|
| *Persicaria amphibia* | Amphibious Bistort |
| *Persicaria maculosa* | Redshank |
| *Phalaris arundinacea* | Reed Canary-grass |
| *Phragmites australis* | Common Reed |
| *Pinguicula vulgaris* | Common Butterwort |
| *Plantago lanceolata* | Ribwort Plantain |
| *Plantago major* | Greater Plantain |
| *Plantago maritima* | Sea Plantain |
| *Poa annua* | Annual Meadow-grass |
| *Poa humilis* | Spreading Meadow-grass |
| *Poa trivialis* | Rough Meadow-grass |
| *Polygala serpyllifolia* | Heath Milkwort |
| *Polygonum aviculare* | Knotgrass |
| *Potamogeton filiformis* | Slender-leaved Pondweed |
| *Potamogeton natans* | Broad-leaved Pondweed |
| *Potamogeton perfoliatus* | Perfoliate Pondweed |
| *Potamogeton polygonifolius* | Bog Pondweed |
| *Potamogeton pusillus* | Lesser Pondweed |
| *Potentilla anserina* | Silverweed |
| *Potentilla erecta* | Tormentil |
| *Prunella vulgaris* | Selfheal |
| *Ranunculus acris* | Meadow Buttercup |
| *Ranunculus ficaria* | Lesser Celandine |
| *Ranunculus flammula* | Lesser Spearwort |
| *Ranunculus repens* | Creeping Buttercup |
| *Ranunculus trichophyllus* | Thread-leaved Water-crowfoot |
| *Rheum x hybridum* | Rhubarb |
| *Rhinanthus minor subsp. stenophyllus* | Yellow-rattle |
| *Rorippa islandica* | Northern Yellow-cress |
| *Rorippa nasturtium-aquaticum* | Water-cress |
| *Rumex acetosa* | Common Sorrel |
| *Rumex crispus* | Curled Dock |
| *Rumex obtusifolius* | Broad-leaved Dock |
| *Sagina nodosa* | Knotted Pearlwort |
| *Sagina procumbens* | Procumbent Pearlwort |
| *Salix pentandra* | Bay Willow |
| *Salix repens* | Creeping Willow |
| *Schoenus nigricans* | Black Bog-rush |
| *Scorzoneroides autumnalis* | Autumn Hawkbit |
| *Selaginella selaginoides* | Lesser Clubmoss |
| *Senecio aquaticus* | Marsh Ragwort |
| *Senecio x ostenfeldii* | S. jacobea x aquaticus |
| *Silene flos-cuculi* | Ragged-Robin |
| *Sonchus arvensis* | Perennial Sow-thistle |
| *Stachys palustris* | Marsh Woundwort |
| *Stachys x ambigua* | Hybrid Woundwort (S. palustris x sylvatica) |

| | |
|---|---|
| *Stellaria graminea* | Lesser Stitchwort |
| *Stellaria media* | Common Chickweed |
| *Stellaria uliginosa* | Bog Stitchwort |
| *Succisa pratensis* | Devil's-bit Scabious |
| *Taraxacum agg.* | Dandelion |
| *Thalictrum alpinum* | Alpine Meadow-rue |
| *Trifolium pratense* | Red Clover |
| *Trifolium repens* | White Clover |
| *Triglochin maritimum* | Sea Arrowgrass |
| *Triglochin palustre* | Marsh Arrowgrass |
| *Urtica dioica* | Common Nettle |
| *Utricularia minor* | Lesser Bladderwort |
| *Veronica officinalis* | Heath Speedwell |
| *Veronica serpyllifolia* | Thyme-leaved Speedwell |
| *Vicia cracca* | Tufted Vetch |
| *Vicia sepium* | Bush Vetch |
| *Viola palustris* | Marsh Violet |
| *Viola riviniana* | Common Dog-violet |

## ANNEX 6: SCOTMEC FORM

SCM Wetland Hydro-ecology audit form: Functionality/pressures/damage

| | | |
|---|---|---|
| Site name: Loch of Isbister & the Loons SSSI / Loch of Isbister SAC | Date: 31/07/2012 | Assessor: J E Crossley |
| Weather: Fine, sunny | Weather in preceding season (Normal / wet / dry for time of the year): Dry | |

| | |
|---|---|
| Wetland Interest feature(s) (Highlight features that are unfavourable | Basin fen: comprising poor fen (M5), sedge- and *Schoenus*-dominated rich fen (**M9**, M10, **and M13**), swamps (S4, S10) and **tall-herb fen (S27).** |
| Wetland supporting feature(s) (highlight supporting features that are not in good condition) | Poor fen (M6), fen meadow and rush pasture (M25) and wet heath (M15) |

**Functionality:**

| **Landscape setting of the wetland** | Hillslope | Valleyhead | Valleyhead trough/ basin | Trough (valley-bottom) | **Basin X** | Lakeside | Flood plain | Coastal plain | Plateau plain | River side |
|---|---|---|---|---|---|---|---|---|---|---|

| **Base Richness** | ~~Highly acidic (<4.0)~~ | **Acidic (4.0 – 5.5)** | **Sub-neutral (5.5 – 6.5) X** | **Base-rich (>6.5)** |
|---|---|---|---|---|
| **Fertility** | **Oligotrophic** | **Mesotrophic** | **Eutrophic** | ~~Hypertrophic~~ |

| **Management** | ~~Unmanaged~~ | ~~Winter grazed~~ | ~~Winter mown~~ | **Summer grazed** | **(Summer mown) (Very local)** | ~~Burnt~~ | ~~Tree felling / coppice~~ | ~~Bank-side vegetation clearance~~ |
|---|---|---|---|---|---|---|---|---|

| | |
|---|---|
| **Geology** | Middle Old Red Sandstone, Stromness Flags |
| **Drift** | Clay, clay marl, shell marl, silt. + peat |

**How does water feed the wetland features:** Direct precipitation; surface water (overland flow, bank overtopping, high water tables in ditches) / groundwater (spring / seepage line /seepage slope)

**Pressures**

**Visible water management structures / hydrological pressures**
Grips (surface /spacing / depth / state of maintenance): none
Ditches (dimensions): ditches in several places around north of basin. 1m wide x 0.2- 0.5m deep, grown in with vegetation. Apparently natural shallow water channels elsewhere in basin. 2 major outlet ditches off site, 2-3m wide x 1+ m deep, growing in.
Sluices/ dams: None on site (one reportedly off site, not investigated)

**Water level management** (river) (lake) (reservoir) + magnitude of fluctuation: no management on site

**Pollution pressures**
Nutrient pressures: **surface water** / groundwater / air-borne: diffuse-source enrichment likely but not obvious. One point source (Spurdagrove) may be historical only
Silt: none
Other chemical pollution (specify): none

**Grazing/site management pressures**
**Development pressures**
Housing estate/road/industry/other: none

**Damage**
Evidence of unfavourable condition (species/structure/drying of peat: There is no evidence of activities that contribute to some plant communities failing to pass SCM targets

**Record the water table in each wetland feature (are there any water measurement structures on site?):** There are water measurement structures, installed and monitored by site owners RSPB : 3 water level gauge boards in standing water, at Loons hide pool, pool in central basin and south Loch of Isbister; and dipwells

| Feature | Estimated water table (at surface, in cattle/ foot prints) | measured water table (level below ground + method of measurement ( |
|---|---|---|
| M5 | At or just below peat surface | Unmeasured |
| M9 | At surface | Unmeasured |
| M10 | At or just below surface | Unmeasured |
| M13 | Just below surface | Unmeasured |
| S4 | Above surface. Vegetation growing in standing water, 10 – 30cm deep where accessible, also in inaccessible deeper water | Unmeasured |
| S10 | Above surface. Mainly in shallow pools 10-20 cm deep. Also deeper in inaccessible swamps and some pools | Unmeasured |
| S27 | Variable. Mainly at surface but up to 10-20 cm deep in places. | Unmeasured |

Site sketch

See NVC map

## ANNEX 7: BOUNDARIES OF REED-BEDS

| **Reed-bed 1. Spurdagrove. HY257244**<br>S4b reed-bed, with M15a, M27a and S27. Complete perimeter delimited | |
|---|---|
| **Waypoints or photos** | **Grid References** |
| Photo point 1 - 2 photos | HY25772 24575 a[5]<br>HY25772 24575 b |
| Photo point 2 - 1 photo | HY25691 24430 |
| Photo point 3 - 2 photos | HY25777 24391 a<br>HY25777 24391 b |
| Photo point 4 - 2 photos | HY25841 24485 a<br>HY25841 24485 b |
| Waypoints | HY25717 24498<br>HY25705 24479<br>HY25717 24457<br>HY25709 24437<br>HY25731 24415<br>HY25768 24409<br>HY25787 24430<br>HY25805 24426<br>HY25817 24447<br>HY25804 24472<br>HY25818 24486<br>HY25815 24503<br>HY25805 24530<br>HY25778 24528<br>HY25749 24536<br>HY25757 24503 |

| **Reed-bed 2. Loons hide. HY247241**<br>S4c reed-bed with S27. Complete perimeter delimited | |
|---|---|
| **Waypoints or photos** | **Grid References** |
| Photo point 1 - 2 photos | HY24774 24190 a<br>HY24774 24190 b |
| Photo point 2 - 2 photos | HY24863 24036 a<br>HY24863 24036 b |
| Photo point 3 - 1 photo | HY24849 24019 |
| Photo point 4 - 2 photos | HY24633 24118 a<br>HY24633 24118 b |
| Waypoints | HY24756 24182<br>HY24845 24047<br>HY24831 24023<br>HY24803 24042<br>HY24712 24030<br>HY24664 24100 |

[5] a and b after identical NGRs refer to two photos of different views taken from a single point.

**Reed-bed 3. Central. HY252241**

S4c reed-bed with M9b and S27. The reed-bed is in two parts, both of which skirt open water of the same pool. Complete perimeter delimited.

| Waypoints or photos | Grid References |
|---|---|
| Photo point 1 - 2 photos | HY25259 24104 a<br>HY25259 24104 b |
| Photo point 2 - 2 photos | HY25339 24185 a<br>HY25339 24185 b |
| Photo point 3 - 1 photo | HY25278 24201 |
| Waypoints – large section (north) | HY25280 24090<br>HY25293 24100<br>HY25310 24122<br>HY25326 24160<br>HY25331 24183<br>HY25297 24192 |
| Waypoints – small section (south | HY25288 24060<br>Hy25341 24073 |

**Reed-bed 4. South-west. HY252235**

S4c reed-bed fringing open water and extending a short distance into Loch of Isbister. Landward side delimited.

| Waypoints or photos | Grid References |
|---|---|
| Photo point 1 - 2 photos | HY25202 23581 a<br>HY25202 23581 b |
| Photo point 2 - 1 photo | HY25237 22569 |
| Waypoints | HY25209 23586<br>HY25247 22569 |

**Partial Reed-bed 5. South-west. HY251235**

Mixed swamp and mire vegetation with *Phragmites* patchily dominant. Comprises S4c, S10bi, S27, M9b and M13. Perimeter delimited except for part along site boundary

| Waypoints | Grid References |
|---|---|
| Waypoints | HY25097 23542<br>HY25226 23491<br>HY25204 23520<br>HY25206 23546<br>HY25174 23571<br>HY25147 23602 |

**Reed-bed 6. South. H5255234.**

In open water. Not accessible

## ANNEX 8: DATA FILES HELD BY SNH

**Electronic files**

| File name | Description | Location |
|---|---|---|
| Isbister & Loons NVC 2012 - Qs &TNs photo ref - rcv 7 Jan 2013 | Excel file catalogue of quadrat and target note photographs held in Isbister_Loons Qs & TNs photos folder on CD (see below) | eRDMS[6] – A834361 |
| Isbister & Loons NVC 2012 - quadrats data - rcv 7 Jan 2013 | Excel file containing raw data for NVC quadrats (arranged by NVC communities) | eRDMS – B1194269 |
| Isbister & Loons NVC 2012 - quadrats ref - rcv 7 Jan 2013 | Excel file listing NVC quadrats and essential information (grid reference, survey date, surveyor etc) | eRDMS – A834383 |
| Isbister & Loons NVC 2012 - target notes - rcv 7 Jan 2013 | Target notes (duplicate of Annex 4 in xls format for future digitisation) | eRDMS – B1194264 |
| Isbister & Loons NVC 2012 - SCM quadrats - rcv 7 Jan 2013 | References for the NVC quadrats used for SCM (see section 3.3) | eRDMS – B1194266 |
| Isbister-Loons NVC 2012 - SCM reed-beds aerial photos - rcv 4 Dec 2012 | File containing copies of aerial photos with outlines of reed-beds and photograph points marked on them | eRDMS – B1181190 (also on CD – see below) |
| Isbister and Loons NVC 2012 - single sheet B&W scan of NVC map - 27 Nov 2012 | B&W single sheet scan of original NVC map | eRDMS – B1176108 (original paper copy also held - see below) |
| Isbister and Loons NVC 2012 - multi-sheet colour scan of NVC & target notes maps - 27 Nov 2012 | Colour multi-sheet scan of NVC and quadrats/target notes maps. | eRDMS – B1176107 (original paper copies also held - see below) |

**On CD (2 copies kept in SNH Kirkwall office library)**

| | |
|---|---|
| Isbister-Loons Qs & TNs photos | JPG photos of NVC quadrat and Target notes |
| Isbister-Loons SCM reed-beds photos | JPG photos of reed-beds for SCM |
| Isbister-Loons SCM reed-beds.docx | File containing copies of aerial photos with outlines of reed-beds and photograph points marked on them (also stored on eRDMS – see above) |

**Paper Maps (kept in SNH Kirkwall office)**

| | |
|---|---|
| Isbister_Loons NVC Map | Original A1 NVC map (see Annex 2 and notes above on scanned copies) |
| Isbister-Loons NVC Quadrats Map | Original A3 map showing locations of quadrats and target notes (see Annex 3 and notes above on scanned copies) |

[6] eRDMS is SNH's electronic document management system

www.snh.gov.uk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