

# **Snipe Marsh, Catfield, Norfolk**

## **Botanical Walkover Survey**

Produced for Andrew Alston

By Applied Ecology Ltd

December 2014

Document Control:

Version	Date	Version Details	Prepared by	Checked by	Approved by
1.0	05.12.2014	Draft	RJH	DP	DP
2.0	15.12.2014	Final (with minor amendment)	RJH	-	-

Prepared for: Andrew Alston  
Title: Snipe Marsh, Catfield, Norfolk – Botanical Walkover Survey  
Project number: 933  
Document version: 2.0  
Document status: Final  
Document date: 15 December 2014

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# 1 Introduction

## Background

- 1.1 Applied Ecology Ltd (AEL) was appointed by Andrew Alston, in September 2014, to undertake a site visit and botanical walkover survey of part of Snipe Marsh (3.4 ha), Catfield, Norfolk (central grid reference **TG 37994 20083**). The location of the study area is shown by **Figure 1.1**.
- 1.2 The purpose of the survey was to complete a general botanical appraisal of the site, and specifically to confirm (or not) the presence and extent of **S24 *Phragmites australis*-*Peucedanum palustre*** tall-herb fen community<sup>1</sup>. The S24 community is of significance as it is one of the key interest features of The Broads Special Area of Conservation (see below for more details) and is one of the communities forming the 'Alkaline fens' component (7230).

## Site Status

- 1.3 The study site comprises the eastern end of Snipe Marsh, and is part of The Ant Broads and Marshes Site of Special Scientific Interest (SSSI) and The Broads Special Area of Conservation (SAC). The key features of these statutory designations are summarised below.

### The Ant Broads and Marshes SSSI

- 1.4 The SSSI covers a total area of 1834.32 ha, and includes the flood-plain of the middle Ant valley, one of the 5 principal river valley systems constituting Broadland. The SSSI citation is provided in **Appendix 1**.
- 1.5 In summary, the citation states that the site *“supports one of the most extensive remaining areas of undeveloped primary fen habitats in Britain, and is considered to form the finest example of unpolluted valley fen in Western Europe. Nationally important stands of carr woodland are also present, principally in the vicinity of Barton Broad, and the wide range of wetland habitats has given rise to an associated fauna of exceptional interest.”*

### The Broads SAC

- 1.6 The Broads SAC covers a total area of 5889.66 ha. A summary of the key SAC interest features is provided below.

#### *Annex I habitats that are a primary reason for selection of this site*

- **3140 Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.** - The Broads is the richest area for charophytes in Britain (Stewart 1996). Twenty species

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<sup>1</sup> As defined by Rodwell, J.S. (ed.) 1995. *British Plant Communities. Volume 4. Aquatic communities, swamps and tall-herb fens*. Cambridge University Press.



have been recorded, which represents over 65% of the British flora. The core of this interest is the Thurne Broads and particularly Hickling Broad which is the richest site in the UK. Sixteen species have been recorded within Hickling Broad, a large shallow brackish lake. Within the Broads examples of *Chara* vegetation are also found within fen pools (turf ponds) and fen and marsh ditch systems. The Broads supports a number of rare and local charophyte species, including *Chara aspera*, *C. baltica*, *C. connivens*, *C. contraria*, *C. curta*, *C. intermedia*, *C. pedunculata*, *Nitella mucronata*, *Nitellopsis obtusa*, *Tolypella glomerata* and *T. intricata*.

- **3150 Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation** - The Broads in East Anglia contain several examples of southern natural eutrophic lakes. Although artificial, having arisen from peat digging in medieval times, these lakes and the ditches in areas of fen and drained marshlands support relict vegetation of the original Fenland flora, and collectively this site contains one of the richest assemblages of rare and local aquatic species in the UK. The stonewort – pondweed – water-milfoil – water-lily *Characeae* – *Potamogeton* – *Myriophyllum* – *Nuphar* associations are well-represented, as are club-rush – common reed *Scirpo* – *Phragmitetum* associations. Some Broads, such as Martham North, Martham South and Upton Broad, have escaped the problem of enrichment that has so affected the flora and fauna on many of the other Broads. Others, such as Hickling Broad, are recovering from these effects as a result of remedial measures. Martham North, Martham South, Upton and Hickling Broad contain holly-leaved naiad *Najas marina*, a national rarity. The dyke (ditch) systems support vegetation characterised by water-soldier *Stratiotes aloides*, whorled water-milfoil *Myriophyllum verticillatum* and broad-leaved pondweed *Potamogeton natans*.
- **7140 Transition mires and quaking bogs** - The Broads contain examples of transition mire in a flood plain in the south-eastern part of the UK, where the habitat is rare. The areas of transition mire, mainly of M5 *Carex rostrata* – *Sphagnum squarrosum* mire, M9 *Carex rostrata* – *Calliargon cuspidatum/giganteum* mire and S27 *Carex rostrata* – *Potentilla palustris* tall-herb fen, are relatively small, having developed in re-vegetated peat-cuttings as part of a complex habitat mosaic of fen, carr and open water.
- **7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae***  
**\*Priority feature** - This flood plain mire site in East Anglia has the largest example of calcareous fens in the UK and possibly the largest occurrence in the EU outside Sweden. The *Cladium* habitat occurs in a diverse set of conditions that maintain its species-richness, including managed *Cladium* fen, contacts between *Cladium* beds and small sedge mires, and situations where *Cladium* occurs at the limits of its ecological range. The habitat type forms large-scale mosaics with other fen types, open water and woodland, and important associated plant species are the Annex II 1903 Fen orchid *Liparis loeselii* (found at Upton Fen), marsh helleborine *Epipactis palustris*, lesser tussock-sedge *Carex diandra*, slender sedge *C. lasiocarpa* and fibrous tussock-sedge *C. appropinquata*.
- **7230 Alkaline fens** - The Broads is one of two sites selected for Alkaline fens in East Anglia, in eastern England, where a main concentration of lowland fen occurs. There are areas of short sedge fen (both M13 *Schoenus nigricans* – *Juncus subnodulosus* mire and M9 *Carex rostrata* – *Calliargon cuspidatum/giganteum* mire), which in places form a mosaic with S24 *Phragmites australis* – *Peucedanum palustris* fen. There are complex



zonations present and many differences exist between the individual fens that comprise the site. The fens are principally of the flood plain mire type. The site contains a range of rare and local plant species, including the Annex II 1903 Fen orchid *Liparis loeselii*, lesser tussock-sedge *Carex diandra* and slender sedge *C. lasiocarpa*.

- **91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)** \*Priority feature - The complex of sites in the Broads of East Anglia contains the largest blocks of alder *Alnus glutinosa* wood in England. Within the complex complete successional sequences occur from open water through reedswamp to alder woodland, which has developed on fen peat. There is a correspondingly wide range of flora, including a number of uncommon species such as marsh fern *Thelypteris palustris*.

***Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site***

- **6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)**

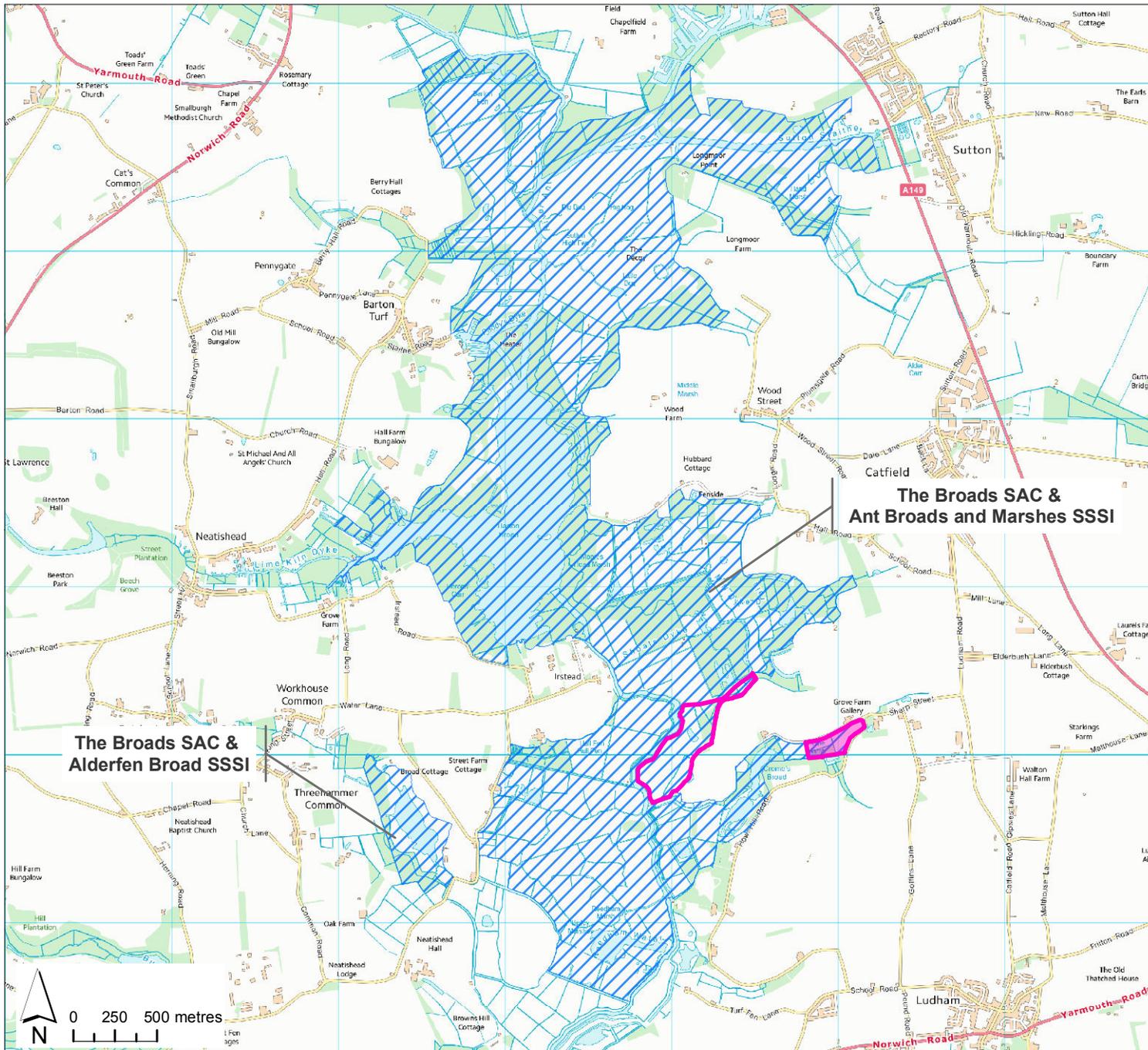
***Annex II species that are a primary reason for selection of this site***

- **1016 Desmoulin's whorl snail *Vertigo moulinsiana*** - The Broads is the main stronghold of Desmoulin's whorl snail *Vertigo moulinsiana* in East Anglia and is one of several sites selected in this part of its range. Several large populations are known, associated with standing and flowing water and ditch systems. This is a very important area for its wetland invertebrate fauna, and many Red Data Book and Nationally Scarce species occur here.
- **1903 Fen orchid *Liparis loeselii*** - The Broads in eastern England provide representation of the Fenland form of fen orchid *Liparis loeselii* in the eastern part of its UK range. Three small populations of var. *loeselii* are known to occur on this site, and 242 plants were found in 1996.
- **4056 Ramshorn snail *Anisus vorticulus*** - *Anisus vorticulus* occurs across a range of sites in southern and eastern England. The Broads is one of the three main population centres for this species in the UK.

***Annex II species present as a qualifying feature, but not a primary reason for site selection***

- **1355 Otter *Lutra lutra*.**





# Snipe Marsh

## Site Location

-  SAC and SSSI
-  SSSI unit 4
-  Snipe Marsh

**The Broads SAC & Ant Broads and Marshes SSSI**

**The Broads SAC & Alderfen Broad SSSI**

**Figure 1.1**

**Map Scale @ A4: 1:35,000**

Surveyed by: -	 Applied Ecology Ltd
Survey date: -	
Drawn by: RAH	
Checked by: RJH	
Status: Draft	

## 2 Summary of Plant Communities

### Plant Communities – 1991/5

- 2.1 Snipe Marsh was described by the Fen Resource Survey (Parmenter, 1995)<sup>2</sup>, as follows:
- “Snipe Marsh is a small area of rather eutrophic fen situated to the northeast of Crome’s Broad. It was originally grazing marsh but was allowed to become flooded and gradually reverted to fen after the war. It is dominated by Calamagrostis canescens, Glyceria maxima and Sparganium erectum with abundant Urtica dioica. Scrub and bramble are invading the site.”*
- 2.2 A vegetation map based on 1991 data<sup>3</sup> shows that the central area of eastern compartment of the study site supported **S24** *Phragmites australis* – *Peucedanum palustre* tall-herb fen, including the **S24b** *Glyceria maxima* and **S24d** typical sub-communities. The central area of northern-west compartment supported a mix of **S4b** *Phragmites australis* swamp and reed-beds, *Galium palustre* sub-community, and **S5** *Glyceria maxima* swamp.
- 2.3 The marginal areas around these compartments, and the entire southwest compartment, were not sampled in 1991 presumably due to the dominance of woodland/scrub habitat in these locations.
- 2.4 This southwest compartment is still dominated by woodland/scrub and was not sampled by the 2009 or 2014 surveys.

### Plant Communities - 2009

- 2.5 The Fen Plant Communities of Broadland (ELP, 2010)<sup>4</sup> present’s vegetation data for the study site as 13 individual sample points each assigned to appropriate NVC community types.
- 2.6 The findings show that a significant change in the vegetation communities had occurred within this area of Snipe Marsh over the period 1991-2009.
- 2.7 **S24** vegetation was no longer present in the eastern compartment, which was dominated by **M22d** *Juncus subnodulosus*-*Cirsium palustre* fen-meadow, *Iris pseudocorus* sub-community, with all six sample points in this area appearing to be assigned to this sub-community type.
- 2.8 The north-western compartment supported a mosaic of **S24d** (3 samples), **M22d** (2 samples) and transitions between **S24** and **S25** *Phragmites australis*-*Eupatorium cannabinum* tall-herb fen (2 samples). No evidence was recorded to suggest the continued presence of **S4b** or **S5** in this location.

<sup>2</sup> Parmenter, J. (1995). *Fen Resource Survey*. For Broads Authority.

<sup>3</sup> The vegetation map is based on 1991 Parmenter data (amec pers. comm 2014).

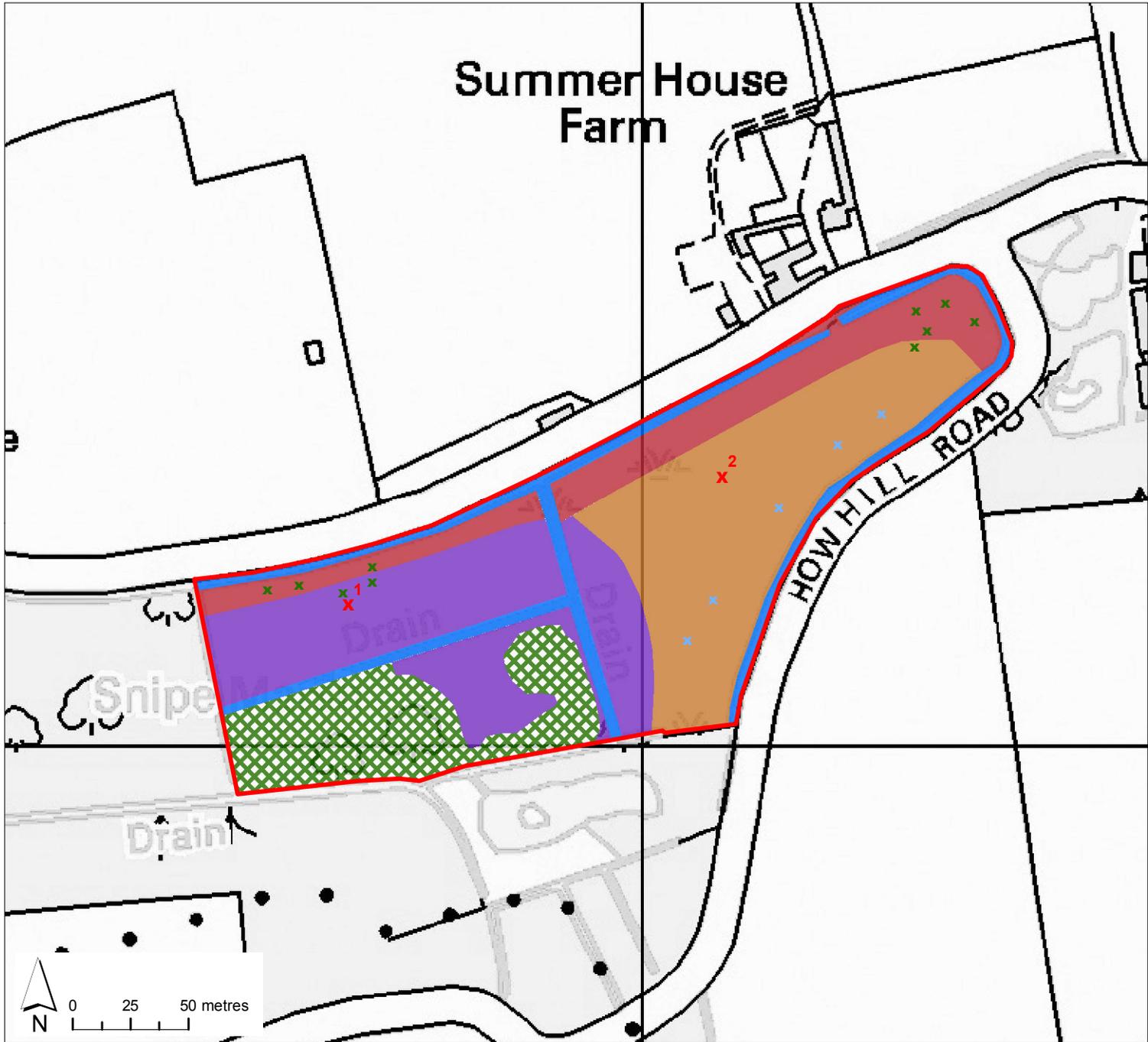
<sup>4</sup> Ecology, Land and People (2010). *The Fen Plant Communities of Broadland. Results of a Comprehensive Survey 2005-2009*. Undertaken on behalf of the Broads Authority and Natural England.



## Plant Communities - 2014

- 2.9 The results of the 2014 walkover survey are summarised by the vegetation map (**Figure 2.1**), and associated quadrat sample data (**Appendix 2**).
- 2.10 The results of the 2014 walkover are consistent with the ELP 2009 findings, and confirm the continued presence of **S24d** and **M22d** mosaics in the northwest compartment, and the dominance of **M22d** in the eastern compartment. During the 2014 survey scattered individual plants of milk-parsley *Peucedanum palustre* were noted from areas of **M22** vegetation, but these individual plants were considered insufficient in their number and/or coverage to ascribe the vegetation to the **S24** community type.
- 2.11 The only notable difference between the 2009 and 2014 findings is the recorded presence of some small areas of **MG10** *Holcus lanatus*-*Juncus effusus* rush-pasture alongside the dominant **M22** fen-meadow community in the eastern compartment in 2014.
- 2.12 It is of note that this area of Snipe Marsh, which is part of SSSI Unit 4, is currently assessed as being in Favourable Condition by Natural England (assessment date 29 January 2010).





# Snipe Marsh

## NVC Map

- site boundary
- Communities:**
- OV24
- M22d/MG10c
- S24d/M22d
- drain
- dense scrub
- x scattered milk parsley plants
- x scattered scrub
- x quadrat locations

**OV24:** *Urtica dioica-Galium aparine* community

**M22d:** *Juncus subnodulosus-Cirsium palustre* fen-meadow, *Iris pseudocorus* sub-community

**MG10c:** *Holcus lanatus-Juncus effusus* rush-pasture, *Iris pseudocorus* sub-community

**S24d:** *Phragmites australis-Peucedanum palustre* tall-herb fen, typical sub-community.

**Figure 3.1**

**Map Scale @ A4: 1:2,500**

Surveyed by: RJH
Survey date: 17 Sept 2014
Drawn by: RAH
Checked by: RJH
Status: Final



## 3 Discussion

### Summary of Vegetation Changes 1991-2014

- 3.1 On the basis of the available vegetation data for this area of Snipe Marsh, there appears to have been a significant change in the distribution of plant communities over the period 1991-2009. The potential causes of this vegetation change are discussed in turn below.

### Possible Causes of Vegetation Change

#### Ground Water Abstraction

##### *Rates of Ground Water Abstraction*

- 3.2 The combined rates of ground water abstraction from nearby locations, namely the Anglian Water abstraction point at Goffins Lane, Ludham (TG 3852 1988), and the Alston abstraction point at Ludham Road (TG 3860 2059) may have changed over the 1991-2014 period, and could potentially have triggered changes in plant communities through on-site hydrological effects.
- 3.3 However, details of abstraction rates are not known, and therefore the importance of abstraction rate changes cannot be assessed. However, our current understanding indicates that there was an increase in Anglian Water's licenced quantity prior to 2002, with a subsequent reduction in their licence from 680,000 to 512,000 in 2011 (Andrew Alston pers. comm. 2014). The licenced quantities of the Alston abstraction point have not changed over the 1991-2014 period.

##### *Evidence of Water Level Changes*

- 3.4 Using Environment Agency commissioned research data (Wheeler *et al*, 2004)<sup>5</sup>, which outlines water-level requirements for lowland wetland plant communities of European Importance, the vegetation changes summarised in Chapter 2 do not indicate that significant changes in water-levels have occurred. For instance, the S4b and S5 communities (present in the northwest compartment in 1991) are associated with mean water levels of -0.1 m below ground level (bgl) and -0.19 m bgl, respectively. The S24 community (now present alongside M22 fen meadow in this area) is associated with a mean water level of -0.16 m bgl. The change from S4/S5 to S24/M22 does not therefore indicate a significant change in ground water levels in this area of the marsh.
- 3.5 Specific water-level requirements for M22 fen meadow and MG10 grassland (the two plant communities which appear to have increased in extent since 1991) are not given by Wheeler *et al* (2004). However, in light of the above, and given both communities are dependent on grazing or mowing management, their presence and apparent spread is most

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<sup>5</sup> B.D. Wheeler, D.J.G. Gowing, S.C. Shaw, J.O. Mountford, and R.P. Money (2004). *Ecohydrological Guidelines for Lowland Wetland Plant Communities*. (Eds. A.W. Brooks, P.V. Jose, and M.I. Whiteman,). Environment Agency (Anglian Region).



likely to be associated with the effects of grazing management undertaken annually since 2001 (see below for more details), and not changes in site water level.

- 3.6 Observations by the Broads Authority and Andrew Alston (as cited in amec, 2014)<sup>6</sup> provide anecdotal evidence that the site has become drier in recent years, but given the lack of evidence to suggest that changes in site water levels have occurred, this perceived drying may well relate to changes in surface water conditions and a reduction in surface flooding, rather than changes in ground water.

### Ditch Management

- 3.7 Details of ditch management over the period 1991-2009 that could have caused the recorded vegetation change are not known.
- 3.8 The ditches around Snipe Marsh are however reported to have been cleared out by a machine excavator in 2011/12 in order to dry the marsh surface and enable continued grazing of the site. This routine management work, in combination with the construction of flood control structures (see below), is likely to have reduced the extent of surface water flooding in recent years and may explain changes to the perceived wetness of the site.

### Flood Control Structures

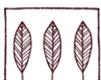
- 3.9 A new water control structure was constructed on the drainage channel to the west of the study site in 2008 in order to prevent flooding of residential properties to the east. The water levels within the marsh are not therefore variable with the river, and alongside ditch clearance operations in 2011/12, this new control structure is likely to have resulted in a reduction in surface water flooding across the marsh.

### Vegetation Management

- 3.10 The marsh is reported to have originally been a grazing marsh, and is shown as open marshland with no evidence of tree cover by the 1938 OS map. The site was allowed to flood and reverted to fen after the war, although it is thought to have been cut for hay in the 1960's and cleared of scrub and trees in the 1970's (Mrs Jean Clarke, pers. comm. Andrew Alston, 2014), but was reported by S. Tolhurst in 1987 (as cited in amec, 2014) as follows "*Vegetation was very tall. No signs of management in recent years, but still rather diverse habitat. A very wet fen on the whole.*"
- 3.11 The marsh was probably unmanaged between the 1970's and 2001, when around this time it was cleared of trees and scrub. The marsh is currently horse grazed, and has been subject to light summer grazing management annually (May-October) by four welsh horses since 2001 (Sue Stephenson, pers. comm. 2014).
- 3.12 The eastern compartment appears, in general, to be preferentially grazed, when compared to the north-western compartment, and supports a distinct mosaic of shorter sward wet grassland and fen (often coincident with paths of horse trodden ground) and rank tussocky fen meadow. M22 fen meadow and MG10 rush pasture grassland are both communities

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<sup>6</sup> Amec (2014). *Environment Agency Anglian Region. Report on the assessment of abstraction within the Ludham-Catfield area in the vicinity of Ant Broads and Marshes SSSI.* Appendum Report 1, Issues 1. 13 November 2014.



that are likely to be favoured by grazing management and the replacement of the S24 community in the eastern compartment since 1991 is likely to be the direct result of annual grazing. There is no evidence to suggest that this change has been triggered by changes to site water level (as discussed above).

- 3.13 The reasons for the apparent vegetation change in the north-western compartment with the replacement of S4/S5 communities in 1991 with mosaics of S24/M22 in 2009/14 are not known, but there is no evidence to suggest this change is linked to changes in water level. The continued presence of the S24 community in this area is however probably reliant on maintaining low levels of horse grazing, and an increase in grazing intensity above current levels is likely to favour other vegetation types, such as M22 and MG10, over S24.

## Conclusions

- 3.14 Snipe Marsh does support the S24 community, although there appears to have been a significant change in the distribution of this plant community over the period 1991-2009.
- 3.15 Details of local water abstraction rates are not known, but the vegetation changes recorded over this period do not appear to indicate a change in site water levels based on the water level requirements of specific community types present. Anecdotal evidence that the site has become drier in recent years probably relates to a perceived reduction in surface water flooding due to ditch management and new flood control structures.
- 3.16 Although the causes of the reported vegetation change at Snipe Marsh are not fully understood, the change from S24 to M22/MG10 vegetation in the eastern compartment is likely to be the direct result of annual horse grazing since 2001. It is considered entirely possible that the vegetation changes reported could have occurred as a direct result of grazing management alone, and in the absence of other influencing factors.



# Appendix 1

## SSSI Citation





COUNTY: Norfolk

SITE NAME: ANT BROADS & MARSHES

DISTRICT: North Norfolk

Status: Site of Special Scientific Interest (SSSI) notified under Section 28 of the Wildlife and Countryside Act 1981

Local Planning Authority: Broads Authority

National Grid Reference: TG 362 213

Area: 742.64 (ha) 1834.32 (ac)

Ordnance Survey Sheet 1:50,000: 134

1:10,000: TG 32 SW SE, TG 31 NE

Date Notified (Under 1949 Act):

1954 Barton Broad

Sutton Broad

1971 Ant Marshes

Date of Last Revision:

1968 – Barton Broad

1974 – Sutton Broad

– Ant Marshes

Date Notified (Under 1981 Act): 1989

Date of Last Revision: –

Other Information:

This is a composite site made up of the 3 former separate SSSIs known as Sutton Broad, Barton Broad and Ant Marshes. The site is listed in "A Nature Conservation Review" (Ratcliffe 1977) and is included within the Broads Environmentally Sensitive Area.

#### **Reasons for Notification:**

The flood-plain of the middle Ant valley, one of the 5 principal river valley systems constituting Broadland, supports one of the most extensive remaining areas of undeveloped primary fen habitats in Britain, and is considered to form the finest example of unpolluted valley fen in Western Europe. Nationally important stands of carr woodland are also present, principally in the vicinity of Barton Broad, and the wide range of wetland habitats has given rise to an associated fauna of exceptional interest.

In contrast with other Broadland river valleys, there are extensive areas of species-rich mixed fen communities that are still regularly cut for reed and sedge. Past management coupled with local hydrological and substrate variations has resulted in the development of the most diverse pattern of fen vegetation of all the Broadland valleys, and provides the only known sites for several plant communities and uncommon species that were once more widespread in Broadland. Further particularly distinctive features of the Ant Valley wetlands include the presence of numerous pools and turf ponds within the fen, plus a diversity of woodland types which exhibit similarities to those of the Bure Valley. The site also supports a wide range of breeding birds and insects including the majority of the broadland specialities.

#### **Open Water and Marginal Swamp**

The River Ant runs the length of the site and is extensively utilised by boat traffic. Closely associated with the river are three areas of open water created by the flooding of medieval peat-diggings, namely Sutton Broad, Cromes Broad and Barton Broad. Formerly, these areas supported a very rich flora and fauna, but nutrient enrichment over the last three decades has resulted in a marked deterioration in water quality and consequent disappearance of most aquatic plants. Algal blooms occur in summer, and the broads support only small amounts of aquatic macrophytes such as Yellow Water-Lily *Nuphar lutea* and White Water Lily *Nymphaea alba*.

Active measures are now being taken to reduce phosphate levels and restore a more diverse flora in Barton Broad. At the turn of the century, Sutton Broad was a large area of open water, but has now been reduced to a central navigable channel surrounded by a floating raft of fen vegetation. Crome's Broad, which lies in a small side-valley, is more isolated

from the river than the other three areas, and supports a less impoverished aquatic flora. Rigid Hornwort *Caratophyllum demersum* dominates, with small amounts of Water Starwort *Callitriche* spp present. Together with Barton Broad it attracts moderate numbers of wintering wildfowl, including Mallard, Teal, Wigeon, Shoveler, Pochard and Tufted Duck.

Area of Reedswamp dominated by Common Reed *Phragmites australis*, Lesser Reedmace *Typha angustifolia*, and more locally, Common Club-rush *Schoenoplectus lacustris*, occur around the margins of the Broads, providing a nesting habitat for wildfowl such as Gadwall, Pochard, Teal, Shoveler and Tufted Duck. Near Barton Broad, tussocks of Tussock-sedge *Carex paniculata* have gained a hold within areas of reedbed, depressing the vegetation and recreation swampy hollows between them. Here, a tall-fen vegetation has developed on the tops of tussocks, and this is prone to invasion by tree saplings with consequent development to swamp carr. Swamp vegetation also occurs in association with pools in the fen vegetation, locally dominated by Saw Sedge *Cladium mariscus* or Tufted Sedge *Carex elata*.

A network of species-rich dykes support an abundance of aquatic plants, including Frogbit *Hydrocharis morsus-ranae*, Water Violet *Hottonia palustris*, Spiked Water-milfoil *Myriophyllum spicatum* and the local Broadland species, Water Soldier *stratiotes aloides*.

#### Fen

Extensive areas of fen vegetation have developed on flat waterlogged floodplains on peat alongside the river, and show an outstanding range of variation, including plant communities almost wholly restricted to Broadland. These species-rich fens are principally dominated by Common Reed, and associates include Great Fen-sedge *Cladium mariscus*, Purple Small-reed *Calamagrostis canascens*, Yellow Loosestrife *Lysimachia vulgaris*, Purple Loosestrife *Lythrum salicaria*, Common Valerian *Valeriana officianalis*, Yellow Iris *Iris pseudacorus*, Water Dock *Rumex hydrolapathum*, and a large population of Milk Parsley *Peucedanum palustre*. Associated with these, is a diverse understorey of Blunt-flowered Rush *Juncus subnodulosus*, Marsh Cinquefoil *Potentilla palustris*, and Purple Moor-grass *Molinia caerulea*, together with a variety of herbs such as Marsh Bedstraw *Galium palustre*, Water Mint *Mentha aquatica* and occasional Marsh Helleborine *Epipactis palustris*.

Within this tall-fen community there is considerable variation, and several distinct vegetation types can be recognised. Fairly extensive areas are managed as commercial sedge-beds cut on a three to four year rotation so that Great Fen-sedge has attained prominence. Black Bog-rush *Schoenus nigricans* is an important component of the understorey throughout much of the cut areas, and in derelict mowing-marshes, woody species such as Bog-myrtle *Myrica gale*, have invaded the open fen. Ferns are especially abundant and include Royal Fern *Osmunda regalis*, the uncommon Marsh Fern *Thelypteris palustris* and populations of the nationally rare Crested Buckler-fern *Dryopteris cristata*. In contrast, wetter areas remain as unmown primary fen, often developed as a floating mat of vegetation which has colonised open water, as at Sutton Broad. Cyperus sedge *Carex pseudocyperus*, Greater Spearwort *Ranunculus lingua* and Slender Sedge *Carex lasiocarpa*, are all markedly more frequent here than in other fen areas, and particularly notable species include Greater Water Parsnip *Sium latifolium*, Cowbane *Cicuta virosa*, and Fibrous Tussock-sedge *Carex appropinquata*.

An interesting community occurs along the edge of the fens where they back onto the valley slopes of the adjoining upland. Here, Purple Moor-grass is generally dominant with frequent Meadow Thistle *Cirsium dissectum* and Heather *Calluna vulgaris*, Cross-leaved Heath *Erica tetralix*, Mat Grass *Nardus stricta* and Tormentil *Potentilla erecta*.

Small pools and stands of mire vegetation occur in shallow depressions as an intimate mosaic within the tall fen, and are largely associated with nineteenth century peat-diggings and turf ponds. Such areas are relatively isolated from the influence of nutrient-rich river

water and support a number of plant communities not found elsewhere in Broadland. The numerous permanent pools attest to the high water levels throughout the year, and support a diversity of aquatic plants including the local species: Lesser Water-plantain *Baldellia ranunculoides*, Fen Pondweed *Potamogeton coloratus*, Marsh St John's wort *Hypericum elodes* and three species of Bladderwort *Utricularia* spp. These pools, together with associated wetter areas of fen, are of exceptional interest for their aquatic coleoptera (water-beetles), and indeed the site is considered to be the most important in Britain for this group. The many rare relict fen species present are indicative of an undisturbed post-glacial history, and include *Agabus striolatus*, *Hydranea palustris* and *Hypdoporus scalesciarius*.

Hydroseral succession has resulted in the development of particularly species rich communities in old turf-ponds, characterised by Slender Sedge, Bottle Sedge *Carex rostrata* and the notable Lesser Tussock Sedge *Carex diandra* over a carpet of bryophytes such as the uncommon mosses *Cinclidium stygium* and *Scorpidium scorpiodes*. Other species present include Common Cotton-grass *Eriophorum angustifolium*, Bogbean *Meyanthes trifoliata*, Grass-of-Parnassus *Parnassia palustris*, Great Sundew *Drosera anglica*, Bogsedge *Carex limosa*, Early Marsh-orchid *Dactylorhiza incarnata*, Marsh Lousewort *Pedicularis palustris* and the notable Narrow-leaved Marsh-orchid *Dactylorhiza traunsteineri*. The nationally rare Fen Orchid *Liparis loeselii* also grows here at one of its few British stations.

The site is of national importance for its fenland invertebrate fauna, and a considerable number of rare or notable species have been recorded from several groups. There is a large population of the Swallow-tail Butterfly *Papilio machaon britannica*, whose larvae feed on Milk-Parsley, and it is the only known site in Britain for *Trogus lapidator*, a wasp parasite on the Swallowtail. 45 species of moth considered rare or notable are present, including the only British localities for the Small Dotted Footman *Pelosia obtusa*, whose larvae depend on algae attached to Reed litter. The weevil, *Ceutorhynchus querceti* is one of several rare coleoptera in addition to the water-beetles, and a particularly large number of rare or notable Diptera (Trueflies) has been recorded.



# Appendix 2

## Quadrat data





## Snipe Marsh – AEL quadrat data

Plant species	DOMIN Quadrat 1 (4x4m)	DOMIN Quadrat 2 (4x4m)
<i>Agrostis stolonifera</i>	5	-
<i>Alnus glutinosa</i> (sapling)	1	-
<i>Angelica sylvestris</i>	-	2
<i>Brachythecium rutabulum</i>	2	-
<i>Calamagrostis canescens</i>	7	-
<i>Cirsium palustre</i>	4	2
<i>Equisetum palustre</i>	2	2
<i>Eupatorium cannabinum</i>	4	3
<i>Festuca rubra</i>	-	4
<i>Galium palustre</i>	4	-
<i>Glyceria fluitans</i>	1	2
<i>Glyceria maxima</i>	-	5
<i>Holcus lanatus</i>	4	8
<i>Iris pseudocorus</i>	5	6
<i>Juncus acutiflorus</i>	2	1
<i>Juncus effusus</i>	7	4
<i>Juncus subnodulosus</i>	3	6
<i>Lotus pedunculatus</i>	2	3
<i>Lycopus europaeus</i>	3	-
<i>Mentha aquatica</i>	4	-
<i>Persicaria maculosa</i>	1	-
<i>Peucedanum palustre</i>	3	-
<i>Phragmites australis</i>	5	-



Plant species	DOMIN Quadrat 1 (4x4m)	DOMIN Quadrat 2 (4x4m)
<i>Poa trivialis</i>	3	-
<i>Ranunculus flammula</i>	-	2
<i>Ranunculus repens</i>	1	3
<i>Rumex hydrolapathum</i>	-	1
<i>Sparganium erectum</i>	1	-
Vegetation height (cm) – range (average)	30-130 (70)	0-110 (50)
Open water (%)	0	0
Moss (%)	<5	0
Bare ground (%)	0	0





