

Fieldwork to Support Habitat Restoration Work at Thelnetham New Fen, Thelnetham



Habitat Species Lists and initiation of Vegetation Monitoring Programme July 2017

Undertaken on behalf of the Little Ouse Headwaters project

Prepared by: Jonny Stone
**Prepared for: Rowena Langston, LOHP Trustee and
chair of the Monitoring Working Group**

This report was prepared by Jonny Stone Vegetation Advisor solely for use by Little Ouse Headwaters Project. This report is not addressed to and may not be relied upon by any person or entity other than Little Ouse Headwaters Project for any purpose without the prior written permission of Little Ouse Headwaters Project. Jonny Stone Vegetation Advisor accepts no responsibility or liability for reliance upon or use of this report (whether or not permitted) other than by Little Ouse Headwaters Project for the purposes for which it was originally commissioned and prepared.

Jonny Stone Vegetation Advisor, Lavender Cottage, The Street, Easton, Woodbridge Suffolk IP13 0ED

This page has been left blank intentionally

SUMMARY

1. The core of the Little Ouse Headwaters Project (LOHP) area lies within the Blo' Norton and Thelnetham Fens SSSI, which forms part of the Waveney and Ouse Valley Fens Special Area of Conservation (SAC). Thelnetham New Fen is situated on the western margin of Thelnetham Middle Fen SSSI, which is part of the Special Area of Conservation. It also adjoins the LOHP Parkers Piece site and forms the western extension of LOHP holdings on the southern side of the Little Ouse river.
2. LOHP has requested a formal record of plant species from New Fen, distinguishing the floristic characters of the dry and wet areas of the site. The Vegetation Monitoring Programme is also extended onto New Fen, with the recording of two permanent plots providing a baseline for assessing the development of open habitats released from shading during site restoration.
3. Species lists were made of the drier valley margin and also the fen vegetation on the wetter floodplain peats. Using CEH's 'Wetness Indicator Value', a marked difference was confirmed between the two areas. The 'Locally Scarce' Tufted Sedge *Carex elata* was recorded from the floodplain peats, which showed a strong response in the areas released from the dense shade of Sallow scrub that had colonised the wedge of wetter peat between Parker's Piece and Middle Fen. The drier soils of the sandy terrace and peats fringing the upland were found to support a high proportion of ruderal species, notably the 'phosphate-loving' group identified for woodland by Oliver Rackham.
4. **Monitoring Plot N01 Sandy terrace** has been located in a disturbed area where recent restoration works has opened up the canopy. This baseline survey recorded a high proportion of annual and perennial ruderals with, as yet, few secondary woodland species. The floristic composition is likely to reflect the past history of this part of New Fen as arable and broadleaf plantation. The potential target vegetation may therefore be the ruderal flora of secondary woodland on a fertile substrate.
5. **Monitoring Plot N02 Peaty Floodplain** crosses the boundary between dense sallow scrub and a recent restoration clearing. The strong response of the fen flora is likely to be restricted to these wetter peats of the area sampled, though some fen species, notably Hemp Agrimony, may extend southwards into the drier peats near the valley margin. The post-restoration target for the vegetation monitored by the N02 Peaty Floodplain plot is therefore likely to be either reed-fen or fen-meadows, depending on the style and intensity of management and, as assessed by this survey, either would seem to be achievable.
6. The Fieldwork Report makes three recommendations, that:
 - a) The Vegetation Monitoring Programme is adopted at Thelnetham New Fen as an aid to management decision-making;
 - b) Target conditions for each part of New Fen should be devised, based on the initial descriptions of the habitat types and their character given in the Fieldwork Report;
 - c) Monitoring surveys should be repeated regularly, and the results incorporated into management decision-making.

CONTENTS

1. INTRODUCTION	1
1.1 Background	1
1.2 Survey requirements and objectives	1
1.3 Survey reporting	2
2. SURVEY METHODOLOGIES	3
2.1 Habitat plant lists	3
2.2 Vegetation monitoring survey methodology	5
2.3 Limitations to the surveys	5
3. HABITAT PLANT LIST RESULTS	6
3.1 Character of the survey area	6
3.2 Survey results	7
3.3 Potential post-restoration changes	8
4. EVALUATION OF NOTABLE PLANT SPECIES	10
5. VEGETATION MONITORING PROGRAMME – FIELDWORK REPORT	11
5.1 Locating the Monitoring Plots	11
5.2 Monitoring Plot Report – N01 Sandy Terrace 2017	15
5.3 Monitoring Plot Report – N02 Peaty Floodplain 2017	20
5.4 Interpretation of the Monitoring Plot surveys	25
5.5 Recommendations of the Vegetation Monitoring Programme	26
6. REFERENCES	27

Figure 1. The location of Thelnetham New Fen and surrounding land

Figure 2. Location of Plant List survey areas

Figure 3. Location of permanent marker posts

Figure 4 Location of marker post N01-N

Figure 5. Location of marker post N01-S

Figure 6 Location of marker post N02-N

Figure 7 Location of marker post N02-S

Appendix 1. Plant species recorded and weighted wetness average

Appendix 2. Field record for N01 Sandy Terrace monitoring plot

Appendix 3. Field record for N02 Peaty Floodplain monitoring plot

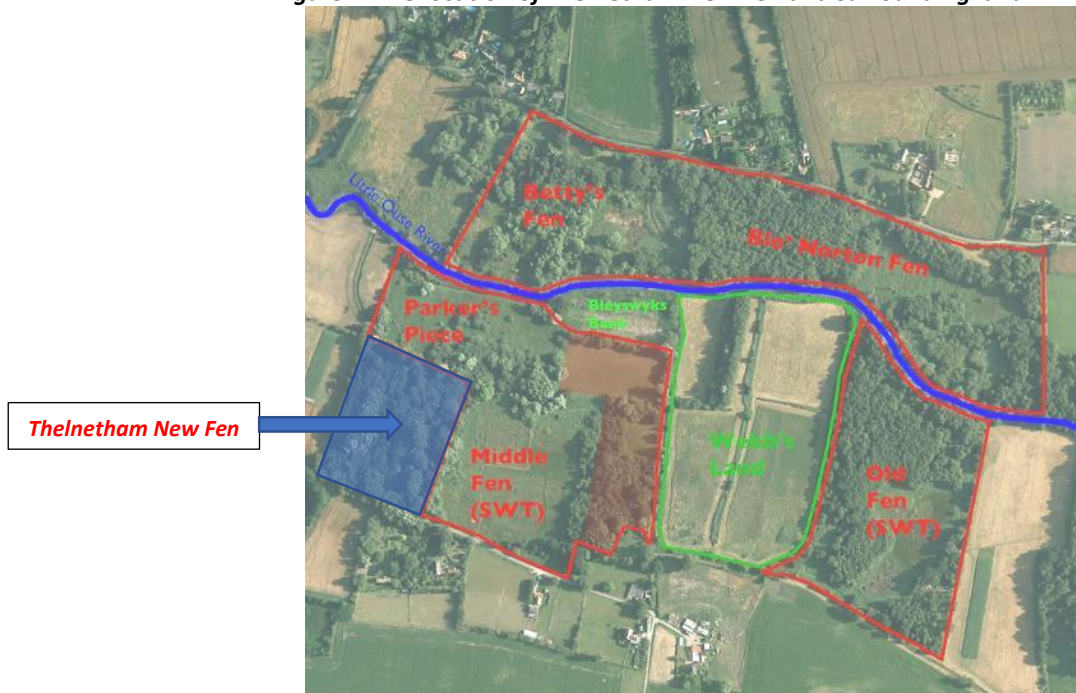
1. INTRODUCTION

1.1 Background

The Little Ouse Headwaters Project (LOHP) was formally constituted as a Charitable Company in 2002 to restore and link fenland remnants along the upper Little Ouse Valley, and to promote access and enjoyment of the wildlife and landscape of the valley. The core of the project area lies within the Blo' Norton and Thelnetham Fens SSSI, which forms part of the Waveney and Ouse Valley Fens Special Area of Conservation (SAC). These valley fens are remnants of what was formerly more extensive habitat, for which East Anglia had one of the most important concentrations in Western Europe.

Thelnetham New Fen is a 2.2 ha block of unrestored fen and valley margin purchased by LOHP in 2014. It comprises part of the western margin of the former Thelnetham Fen together with higher, sandier ground to the west. As shown in Figure 1, New Fen is situated on the western margin of Thelnetham Middle Fen SSSI, which is part of the Special Area of Conservation. It also adjoins the LOHP Parker's Piece site and forms the western extension of LOHP holdings on the southern side of the Little Ouse river.

Figure 1. The location of Thelnetham New Fen and surrounding land



1.2 Survey requirements and objectives

Following the initiation of a programme of restoration works, LOHP have requested that two vegetation surveys are carried out on this land-holding.

The first requirement is for the provision of plant species lists for the different landscape elements of New Fen, with the objective of providing an initial assessment of the habitat characters of the site.

The second requirement is to extend the vegetation monitoring programme established on other LOHP sites by establishing two permanent plots on New Fen, with the objective of providing a baseline for assessing the development of open habitats released from shading during site restoration.

1.3 Survey reporting

Jonny Stone has been commissioned by LOHP to undertake these vegetation surveys on Thelnetham New Fen. The plant list and vegetation monitoring methodologies are summarised in Section 2. The habitat plant list results and their evaluation are given in Sections 3 and 4. The results of the initial survey for the new vegetation monitoring plots are given in the 2017 Fieldwork Report in section 5.

2. SURVEY METHODOLOGIES

2.1 Habitat plant lists

The presence and frequency of occurrence of plant species within defined areas provides an initial means to assess the character of each area in terms of its floristics. The usefulness of the assessment is partly dependent upon the selection of areas with distinct and significant differences compared to their surroundings, and partly on their internal homogeneity.

The approach taken at New Fen was threefold:

1. A brief desk study was conducted to identify internal site divisions based on geology and hydrology.
2. A walkabout survey of the site to identify further levels of variation - particularly in ground topography – that are likely to persist irrespective of habitat management.
3. A walkabout survey to list plant species within each defined area to which a measure of ‘frequency of occurrence’ was ascribed.

2.1.1 Defined survey areas

The New Fen survey area was divided into two units based on the presence of hydrophytic plant species following an assessment of the distribution of geological, topographical and hydrological variables, as set out in Section 3.1. The survey units are shown in **Figure 2. Location of Plant List survey areas**¹. The Fen Vegetation survey unit was originally extended to the southeast corner of the site, following the area of mapped peat (British Geological Survey 1989) but, following field inspection, the area was reduced to encompass only that part of the site supporting obligate wetland species. No further sub-divisions were made in either the Valley Margin or Fen Vegetation units as the internal variation within each unit at the time of survey appeared to be largely accounted for by the degree of shade that had developed in recent decades. It should be noted that the internal boundary between the survey units is typically evident in the field through an abrupt change in floristic composition over a few metres.

2.1.2 Plant recording

All species of vascular plants, mosses and liverworts found directly on the ground, or on decaying organic matter lying on the ground, were recorded. All vascular plants are named following Stace (2010); the bryophyte flora follows Hill et al. (2008). No ground lichens were observed.

The frequency of occurrence of species in each recording unit was assessed and scored according to the DAFOR scale. This scale for recording species frequency in an area is widely used where a whole site is being assessed (Kent 2012) and was the standard frequency measure for NCC Phase 2 woodland surveys (Kirby 1988). As noted by Rodwell (2006), this ordinal scale has no agreed quantitative meaning, and this survey follows guidance given to surveyors by the Scottish Wildlife Trust², given in Table 1. In addition to the primary code, the prefix 'L' as in **LF** (locally frequent) is

¹ The basemap for this figure is the 1994 aerial photograph (Suffolk County Council), which shows the general line of the internal ditch that had recently been excavated. The northern section of the ditch provides a definitive boundary between part of the two survey units.

² <http://www.botanical-society-scotland.org.uk/sites/default/files/guidance-notes-and-example-target-notes.pdf>

employed sparingly, and restricted to species that were recorded in part of the survey unit at a much higher frequency than elsewhere.

Figure 2. Location of Plant List survey areas



1994 Aerial photograph (courtesy Suffolk County Council)

Table 1. DAFOR frequency of occurrence scale

Code	Value	Cover guidance	Explanation
D	Dominant	51-100 %	Abundant and tending to restrict the development of other species
A	Abundant	31-50 %	Common throughout the survey area; found everywhere
F	Frequent	16-30 %	Often found throughout most or all of the survey area
O	Occasional	6-15 %	Sometimes occurring but usually absent
R	Rare	0-5 %	Present but only occasionally found

Adapted from: Nature Conservancy Council (1990)

2.2 Vegetation monitoring survey methodology

Documentation for a Vegetation Monitoring Programme was initially developed for LOHP to aid the ecological restoration of Bleyswyck's Bank and Parkers Piece in 2010. The development, methodology and functions of the programme were described in detail in the Monitoring Plan (ELP 2010) for those sites and is not repeated here.

The methodology was applied to Thelnetham New Fen to establish two permanent plots, with the following objectives:

1. To establish permanent monitoring plots in two specified vegetation types, using the protocols developed in the Monitoring Plan.
2. To undertake the initial monitoring survey, using the 'full' Fieldwork Protocols.
3. To interpret the fieldwork results, and provide guidance on the establishment of initial target conditions.

This initial fieldwork report followed the prescriptions of the Monitoring Plan (ELP 2010) and records the 'full' survey protocol, using the four Fieldwork Elements summarised in Table 2.

Table 2. Summary of survey techniques

Survey intensity	Fieldwork Element	Function within the Survey
Rapid	1 Locating Monitoring Plots	To establish locations for the Monitoring Plots
	2 Photographic Record	To produce a record of surveillance images showing the condition of the developing vegetation
Full	3 Vegetation structural characters	To record features of the vegetation structure against which management requirements can be established.
	4 Floristic sub-sampling	To record the floristic composition of the plot in order to judge to success of the restoration measures against target floristic conditions.

In addition to the photographic record, the structural characters of the vegetation were assessed from each quarter of the two 10 x 10 m plots. Floristic composition was tabulated by stratified sub-sampling of the monitoring plots using twenty 1 x 1 metre sub-samples. The field records for floristic sampling are given in Appendices 2 and 3.

2.3 Limitations to the surveys

Both surveys were carried out in July 2017 at an optimal time of year for woodland and fen vegetation. No access issues were encountered. Although it is possible that some plant species were not recorded by the walkabout survey, this is not considered to have significantly affected the conclusions of this report.

The general locations of each permanent monitoring plot were established during on-site discussions with LOHP. The subsequent emplacement of permanent marker posts matched the locations of the temporary posts used to carry out the baseline survey.

3. HABITAT PLANT LIST RESULTS

3.1 Character of the survey area

Thelnethan New Fen occupies part of the southwest corner of the original Thelnetham Fen (Tallentire 1969; West 2009) and overlaps onto slightly raised Terrace sands to the west. The fen peats vary in soil moisture along a south-north hydrocline, with only the northern part wet enough to support hydrophytes. The approximate boundary between fen peat and terrace sands is marked by a sinuous ditch, constructed in the mid-1990s, which drains from the upland.

A sequence of aerial photographs (LOHP 2014; OHES 2015) has recorded land use changes since 1945. In 1945, the entire survey area was treeless, with a few scattered shrubs and trees on its boundary. The terrace and floodplain appear to be in different land-uses. By 1981, the floodplain fen was scrubbing over and the invading willow scrub had largely coalesced by 1994. In 1981, the terrace was in its last years of arable production and a block of broadleaved plantation appears to have been established by 1986. Block planting continued until by 1998 only a small central glade on the terrace remained open.

In the following decades, both the tree plantations and willow scrub have matured. Notwithstanding, the division between the two woodland types is abrupt: they are readily distinguished by the different shrub and canopy species. The ground flora of the terrace and drier peats is largely shaded, but wherever skylight levels are sufficient, the group of Rackham's (1980) 'phosphate plants' occur (Table 3).

Table 3. Phosphate-loving plants (Rackham 1980)

<i>Urtica dioica</i>	Nettle
<i>Galium aparine</i>	Cleavers
<i>Silene dioica</i>	Red Campion
<i>Poa trivialis</i>	Rough Meadow-grass
<i>Anthriscus sylvestris</i>	Cow Parsley
<i>Glechoma hederacea</i>	Ground-ivy

On the terrace sands, where phosphate levels remain elevated following agricultural fertilization, these are typically associated, in lit conditions, by a ruderal flora. Even in shade, the woodland ground flora is typically of immature secondary woodland on fertile soils.

On the drier floodplain peats, surface drying has promoted the development of an earthy eutrophic topsoil flushed with accumulated phosphate from breakdown of the peat.

These two areas have an overlapping flora which lacks 'wetland' species, hydrophytes that tolerate or require waterlogged conditions. These are restricted to the area of wetter peats in the area indicated in Figure 2. In deep shade, very little of the fen flora is evident, but wherever ground disturbance accompanies a shade gap, a flush of the fen flora results.

There is therefore a fundamental floristic difference between the terrace and dry peats and the wet peats supporting a fen flora – and this forms the basis for the two survey units used to produce the habitat plant lists.

3.2 Survey results

In summary, 129 plant species were recorded from the ground at New Fen; 96 of these were from the Valley Margin unit and 68 from the Floodplain unit. The full species list is given in Appendix 1.

As shown in Table 4, forb species accounted for over half of the floristic diversity (57 %) recorded at New Fen. Bryophyte moss species were comparatively few and only pleurocarp mosses were identified from the ground. This profile of life-forms is typical of secondary woodland developing from both cultivated land and heavily shaded fen.

Table 4. Life-form types of recorded species

Life-form	Total species		Valley Margin		Fen vegetation	
Woody plants	19	(15%)	19	(20%)	8	(12%)
Grassoids	26	(20%)	16	(17%)	18	(26%)
Forbs	72	(57%)	52	(54%)	38	(56%)
Bryophytes	10	(8%)	9	(9%)	4	(6%)

The recorded flora in each unit is assessed in terms of the Wetness Values given by the CEH Environmental Indicator Value (EIV) system (Hill et al., 2004; Hill et al. 2007). This use of plant attributes to indicate environmental conditions was originally derived from the work of Heinz Ellenberg in Central Europe, and the British system gives analogue values for a number of variables including, in this case, soil wetness. Table 5 lists the Wetness EIV scale.

Table 5. The Wetness EIV scale (Hill et al., 2004; Hill et al. 2007)

EIV Scale	Moisture
12	Submerged plant, permanently or almost constantly under water
11	Plant rooting under water, but at least for a time exposed above, or planting floating on the surface.
10	Indicator of shallow-water sites that may lack standing water for extensive periods
9	Wet-site indicator, often on water-saturated, badly-aerated soils
8	Between 7 and 9
7	Dampness indicator, mainly on constantly moist or damp, but not on wet soils
6	Between 5 and 7
5	Moist-site indicator, mainly on fresh soils of average dampness
4	Between 3 and 5
3	Dry-site indicator, more often found on dry ground than in moist places
2	Between 1 and 3
1	Indicator of extreme dryness, restricted to soils that often dry out for some time

The recorded species at New Fen range from EIV 4 to 10, as shown in Appendix 1. The proportion of species assigned each value is given in Table 6. Here, it is evident that much of the Valley Margin flora consists of species favouring conditions found in periodically moist, free draining soils, exhibiting neither waterlogging or parching (EIV 5). These conditions would be typical of the cultivated Brown Sands of the valley terraces. A smaller proportion of the flora is associated with mesic conditions (EIV 6 and 7) where the soil is typically damp, and is likely to reflect the low-lying, shaded conditions of the sandy terrace woodland.

The remaining flora of the Valley Margin is separated by the EIV scores into a group of species restricted either to drier, usually well-lit areas of the terrace woodland (EIV 4) or the relatively dry peat topsoils of the fen edge in the southeast corner of New Fen (EIV 8 and 9).

Table 6. Wetness EIVs recorded from the Valley Margin and Fen units

	Valley Margin	Fen
No. of species	98	68
Moisture values		
10	0.0 (%)	2.9 (%)
9	1.0 (%)	11.8 (%)
8	9.4 (%)	30.9 (%)
7	5.2 (%)	7.4 (%)
6	21.9 (%)	23.5 (%)
5	49.0 (%)	23.5 (%)
4	13.5 (%)	0.0 (%)
Weighted Wetness Average	5.5	7.0

On the wetter peats of the floodplain, the distribution of EIV scores is bimodal. Nearly half of the recorded flora (45.6 %) consists of species typically recorded from moist to saturated surface soils (EIV 8-10). These include a suite of fenland species including Greater Pond-sedge and Common Reed, several of which are the most frequently occurring species in the unit. However, there are also many other species normally found in drier conditions. A large proportion of these are casual colonists, but two species, in particular, are strong indicators of soil fertility: Common Nettle and Rough Meadow-grass. They are both recognised as part of Oliver Rackham’s (1980) ‘phosphate-loving plants’.

Table 6 also gives the weighted average for wetness. This accounts for the different frequency of occurrence amongst recorded species in the two survey units by converting the DAFOR scores to an ordinal scale (given in Table 7). Details of the calculation are given in Appendix 1. The Weighted Wetness Average scores are 5.5 (Valley Margin vegetation) and 7.0 (Fen vegetation). As defined in Table 5, this distinction separates the Valley Margin (comprising the sandy terrace and dry floodplain peats) from the wet peats of the floodplain, although the value for the wet floodplain peats may be sub-optimal.

Table 7. Conversion of DAFOR values to an ordinal scale

Abundant	5
Frequent	4
Locally Frequent	3
Occasional	2
Rare	1

3.3 Potential post-restoration changes

The current floristic composition of Thelnetham New Fen is made up of:

- a) a large suite of ruderal species, containing both annuals and perennials;
- b) a group of woody species – largely planted – and an associated secondary woodland flora; and
- c) a relict fen flora with a limited distribution.

One of the objectives given in the Conservation Statement (LOHP 2014) is “to restore wet fen on the lower eastern ground” (p.9), and that “... restoration is likely to involve removal of scrub, clearing of the ground surface and management of the regenerating scrub, ruderals and proto-fen vegetation” (p.11). In addition to providing more favourable conditions on the wet peat, this should also favour the recovery of proto-fen vegetation to the south of the Floodplain unit.

A second objective relates to structural changes to the terrace vegetation, through maintenance of a glade and walkway and diversification of the woodland structure.

Changes to the floristic composition are therefore likely to be:

Ruderals (annual). This group of species may partly have been recorded as a consequence of recent disturbances to the soil seed bank in sufficiently well-lit conditions to permit germination. Most species are likely to be inhibited by a reduction in germination gaps and by the shade cast by taller plants. Flushes of annuals are therefore expected to be a periodic and temporary feature of New Fen, restricted to subsequently disturbed patches with sufficient skylight.

Ruderals (perennial). Forming the bulk of the ground flora on the drier soils, perennial ruderals – most notably Rackham's 'phosphate plants' - are likely to flourish in well-lit locations and persist in all but strong shade. Nettle and Rough Meadow-grass are very frequent members of this group and are likely to remain as constants of post-restoration vegetation for the foreseeable future.

Secondary woodland flora. This is a very small group of species, best represented by Herb Robert and Remote Sedge, with a few mosses that colonize bark. The development of this flora is likely to be arrested on the floodplain peats, but may develop on the sandy terrace.

Fen flora. As demonstrated in the N02 Peaty Floodplain monitoring plot, fen species may recover rapidly when released from shade. This may be anticipated throughout the area of wetter peat in the northeast corner of New Fen. Some recovery should also be expected to the south – on the drier peats nearer the upland margin. However, the floristic composition of the resulting flora – and the proportion of perennial ruderals present – may depend upon the duration of saturation by groundwater within the rooting zone for these species (Londo 1988). The potential shift in the occurrence of hydrophytes would be detected by re-recording the habitat lists with the intention of identifying the ingress of 'wetland' species into the dry peat area.

4. EVALUATION OF NOTABLE PLANT SPECIES

One notable plant species was recorded during the survey, Tufted Sedge *Carex elata*. This species is on the Rare Plant Register for Suffolk (Suffolk Biological Records Centre 2005). As such, it is classified as 'Locally Scarce'. The Register notes "about 30 records from fens and marshes mainly in Breckland and the Waveney/Ouse valley". Nationally, it is classified as "Near Threatened" due to a reduction in its 'extent of occurrence' in England.

Tufted Sedge *Carex elata* All.

Status¹ - none

GB Red List² - Threat Status: Least Concern

England Red List³ - Threat Status: Near Threatened

¹ Stewart et al. (1994)

² Cheffings et al. (2005)

³ Stroh et al. (2014)

5. VEGETATION MONITORING PROGRAMME – FIELDWORK REPORT

Fieldwork to establish the permanent plots and undertake the initial vegetation survey was undertaken on 28th July 2017.

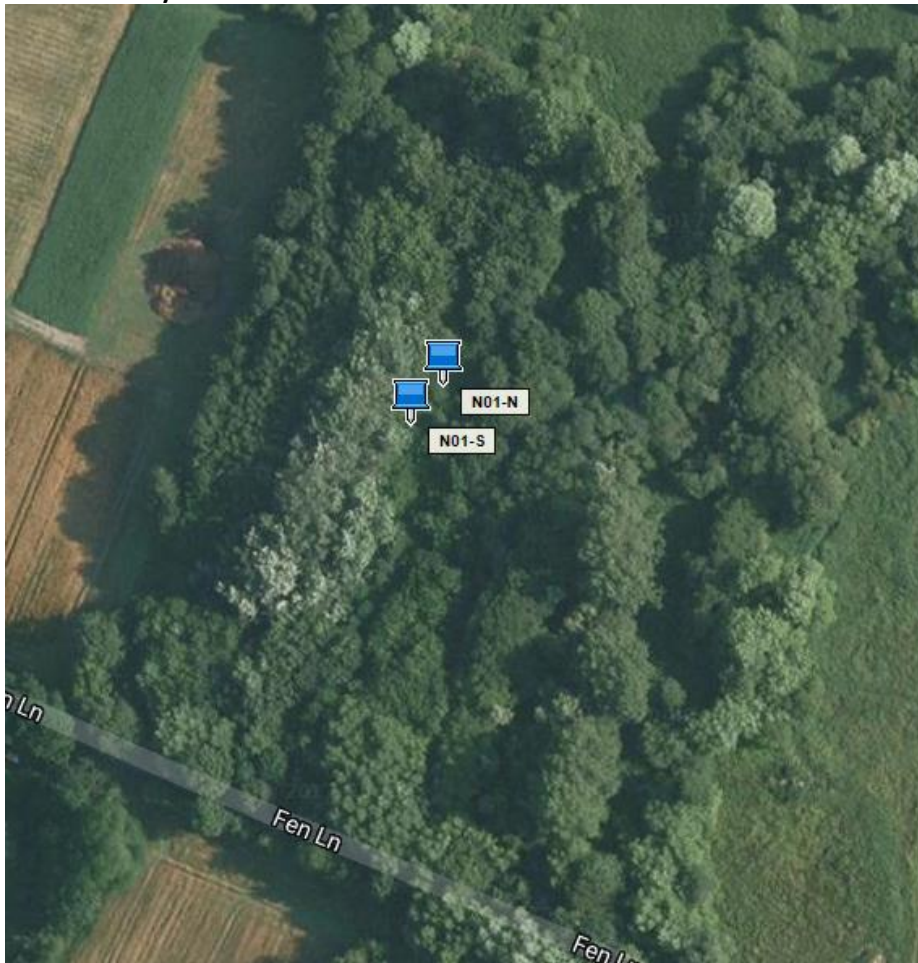
5.1 Locating the Monitoring Plots

Monitoring plots were established in agreed locations on the sandy terrace and peaty floodplain. Both locations were set up to sample vegetation that had recently been disturbed following the initiation of habitat restoration measures. Both plots are located in ungrazed areas, and permanent marker posts are situated directly on two corners of each 10 m x 10 m monitoring plots. The post locations were established using either existing fence posts or free-standing temporary marker posts which were subsequently replaced by permanent posts by LOHP. The location of the permanent marker posts is given in Figure 3. In both instances, the marker posts lie on a baseline for each plot, which is reconstructed at right angles to it, as indicated in Table 8.

Figure 3. Location of permanent marker posts

Source: Map data c 2017 Google Imagery, GigitalGlobe, Getmapping plc, Infoterra Ltd & Bluesky

Plot N01 Sandy terrace



Plot N02 Peaty floodplain

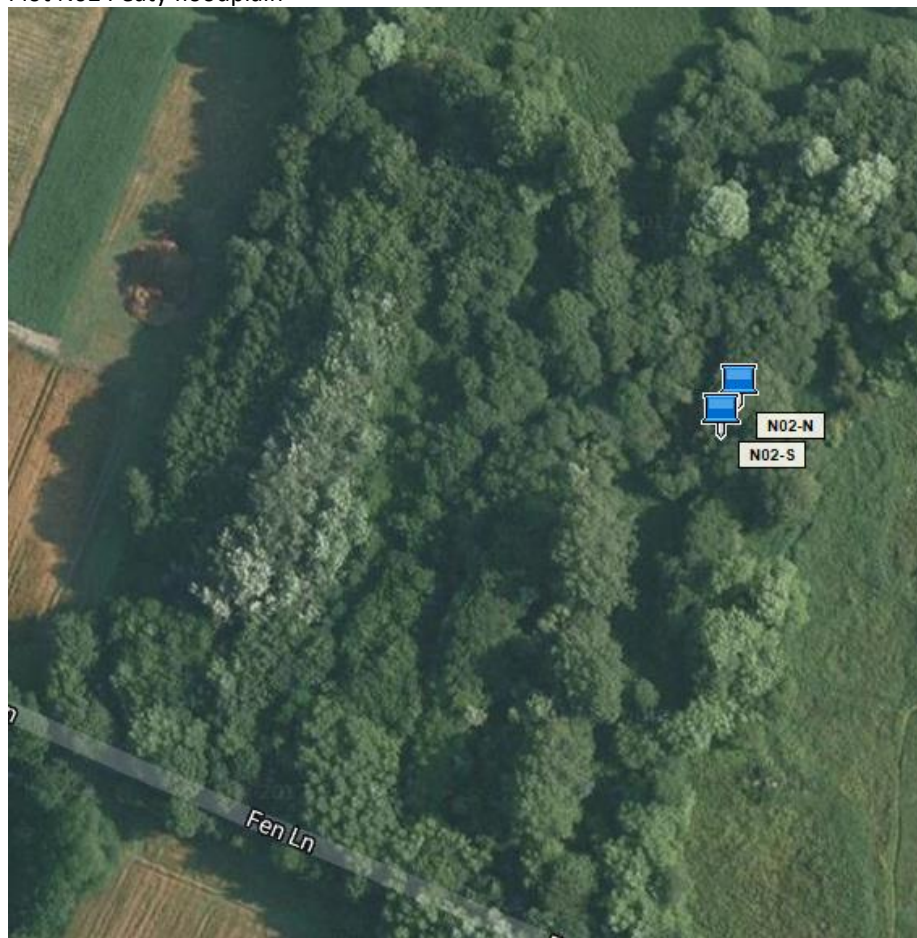


Table 8. Details of permanent monitoring plot locations

VEGETATION TYPE	PLOT CODE	MARKER POSTS	Marker Post Location	EASTING	NORTHING	Plot location
Sandy terrace	N01	N01-N	The marker post (Figure 4) is located on the fenceline using an existing fence post.	601308	278842	The permanent plot uses the two marker posts as one side of a square with 90° corners
		N01-S	The permanent plot corner is 10 m southward from N01-N on the fenceline, near to an existing fence post, shown in Figure 5.	601301	278833	
Peaty floodplain	N02	N02-N	This free-standing marker is located 10 m north of N02-S (Figure 6).	601381	278840	The permanent plot uses the baseline between marker posts as the western side of the plot.
		N02-S	The free-standing marker post (Figure 7) forms the southwest corner of the permanent plot.	601377	278833	

Figure 4 Location of marker post N01-N



Figure 5. Location of marker post N01-S



Figure 6 Location of marker post N02-N



Figure 7 Location of marker post N02-S



5.2 Monitoring Plot Report – N01 Sandy Terrace 2017

Plot code	N01 Sandy Terrace
Treatment type	Summary of preceding Monitoring Plot Report
Alluvial Meadow	This is the initial Monitoring Plot Report

Vegetation structure

- The vegetation occurs on largely disturbed ground, where fence construction, vehicle movements, log-piling and burning have all occurred.
- Along the fenceline and beside the two log-piles, vigorous stands of Nettle and Creeping Thistle have developed.
- Amongst this vegetation, a small group of shrubs have been planted (Hawthorn and Hazel).
- Suckers of Dogwood and Blackthorn (only a few inches tall) accompany a suite of scattered ruderals over about half of the plot; here, bare ground is very evident
- In this vegetation, a discrete bonfire circle has been created; it has been colonised by two bryophytes, Bonfire-moss and Redshank.
- The plot also covers part of the trackway established from the northwest perimeter; here, a greater proportion of annual species are present.

Floristics

- The plot supports a ruderal vegetation associated with recent disturbances. Although species-rich, the flora is predominantly that associated with fertile ground conditions following abandonment from cultivation, and, with exceptions, is associated with the recovery of vegetation cover following these disturbances. Few species are tolerant of shade (e.g. Remote Sedge) or are restricted to woodland gaps.
- The most frequently occurring species are Nettle and Creeping Thistle (vigorously spreading by rhizomes through less compacted topsoils), and a thin carpet of Rough Meadow-grass and Creeping Bent.
- Two less common species of note are Corn Mint (often found in woodland rides) and Water Chickweed (associated with damp, peaty soils along the Little Ouse valley corridor).
- Ash is the only canopy species.

Summary of records and events

- Not available at the time of reporting.
- Field evidence suggests that the fenceline provides a 'browsing boundary' between the sampled vegetation and the unmanaged broadleaf plantation to the west. The sample plot itself has undergone a period of multiple disturbances, including some tree felling, and future influences are likely to include continued use of the track and the development of some shade cover from planted shrubs.

Relation to past and target conditions

- This survey initiates the Vegetation Monitoring Programme and provides a baseline for assessing subsequent meadow vegetation development.
- Vegetation characters suggest that the plot can be regarded as a recent clearing on fertile sandy loam soil, which may support ride and ride-side habitats.



Monitoring Plot Field Form – Vegetation structural characters

Monitoring Plot	N01 Sandy Terrace
Recorder	Jonny Stone
Survey Date	28th July 2017

Character of the ground surface

- The monitoring plot is situated on a sandy loam soil with a humic topsoil and slightly impeded drainage. The ground surface is slightly rutted from vehicle movements.
- There are patches of disturbed earth, which may have originated from stump removal, and there is a single discrete bonfire site.
- Recent traffic across the plot indicate that about two-thirds of the ground surface is compacted by vehicle movements or underlies log piles or the burn site. The remainder is loose, deriving from possible stump removal or proximity to the fence-line.

Soil wetness

Dry, dusty	Dry, firm	Slightly damp	Moist	Wet	Saturated
I	II	I			

ATTRIBUTE		SAMPLE from each plot quarter				AVERAGE
		1	2	3	4	
Layer height	Standing water (cm)	0	0	0	0	0 cm
	Plant litter (cm)	1	0	0	1	0.5 cm
	Woody suckers (cm)	5	8	0	0	3.2 cm
	Large sedges / rushes (cm)	0	0	0	0	0 cm
	Reed-like grasses (cm)	0	0	0	0	0 cm
	Woody saplings (cm)	0	0	12	0	3 cm
Cover value	Standing water (%)	0	0	0	0	0 %
	Trampling (%)	80	70	30	40	55 %
	Dunging (%)	1	1	0	0	0.5 %
	Bare ground (%)	5	5	30	20	15 %
	Plant litter (%)	5	0	0	5	2.5 %
	Bryophytes (%)	1	1	10	2	3.5 %
	Woody seedlings (%)	0	2	15	5	5.5 %
	Large sedges / rushes (%)	0	0	0	0	0 %
	Reed-like grasses (%)	0	0	0	0	0 %
	Woody saplings (%)	0	0	4	0	1 %

Monitoring Plot Field Form – Floristic sub-sampling – all survey years

Monitoring Plot N01 Sandy terrace
 Recorder Jonny Stone
 Survey Date 28th July 2017

This data is collated from the 20 1x1 m sub-samples given in Appendix 2.

Species		2017
		[ex 20]
Woody plants		
<i>Cornus sanguinea</i>	Dogwood	7
<i>Prunus spinosa</i>	Blackthorn	3
<i>Crataegus monogyna</i>	Hawthorn	2
<i>Salix caprea</i>	Goat Willow	2
<i>Fraxinus excelsior</i>	Ash	1
<i>Corylus avellana</i>	Hazel	1
Grassoids		
<i>Agrostis stolonifera</i>	Creeping Bent	16
<i>Poa trivialis</i>	Rough Meadow-grass	15
<i>Elytrigia repens</i>	Common Couch	4
<i>Dactylis glomerata</i>	Cock's-foot	2
<i>Holcus lanatus</i>	Yorkshire Fog	2
<i>Poa annua</i>	Annual Meadow-grass	2
<i>Carex remota</i>	Remote Sedge	1
<i>Juncus inflexus</i>	Hard Rush	1
Forbs		
<i>Urtica dioica</i>	Common Nettle	20
<i>Cirsium arvense</i>	Creeping Thistle	16
<i>Silene latifolia</i>	White Campion	7
<i>Plantago major</i>	Greater Plantain	6
<i>Mentha arvensis</i>	Corn Mint	4
<i>Ranunculus repens</i>	Creeping Buttercup	4
<i>Sonchus arvensis</i>	Perennial Sow-thistle	4
<i>Sonchus oleraceus</i>	Smooth Sow-thistle	4
<i>Cirsium palustre</i>	Marsh Thistle	3
<i>Cirsium vulgare</i>	Spear Thistle	3
<i>Galium aparine</i>	Cleavers	3
<i>Sonchus asper</i>	Prickly Sow-thistle	3
<i>Taraxacum agg. sect. ruderale</i>	Dandelion	3
<i>Alliaria petiolata</i>	Garlic Mustard	2
<i>Anagallis arvensis</i>	Scarlet Pimpernel	2
<i>Chenopodium album</i>	Fat-hen	2
<i>Conyza canadensis</i>	Canadian Fleabane	2
<i>Fraxinus excelsior seedling</i>	Ash	2
<i>Myosotis arvensis</i>	Field Forget-me-not	2
<i>Trifolium repens</i>	White Clover	2
<i>Conium maculatum</i>	Hemlock	1
<i>Crepis capillaris</i>	Smooth Hawk's-beard	1
<i>Epilobium ciliatum</i>	American Willowherb	1
<i>Epilobium hirsutum</i>	Great Willowherb	1
<i>Matricaria discoidea</i>	Pineapple-weed	1

<i>Myosoton aquaticum</i>	Water Chickweed	1
<i>Rosa arvensis</i>	Field Rose	1
<i>Rubus fruticosus agg.</i>	Bramble	1
<i>Rumex crispus</i>	Curled Dock	1
<i>Rumex sanguineus</i>	Wood Dock	1
<i>Senecio vulgaris</i>	Groundsel	1
<i>Solanum nigrum</i>	Black Nightshade	1
<i>Veronica persica</i>	Common Field-speedwell	1
Bryophytes		
<i>Brachythecium rutabulum</i>	Rough-stalked Feather-moss	4
<i>Funaria hygrometrica</i>	Bonfire-moss	3
<i>Amblystegium serpens</i>	Creeping Feather-moss	2
<i>Brachythecium velutinum</i>	Velvet Feather-moss	2
<i>Ceratodon purpureus</i>	Redshank	2
<i>Kindbergia praelonga</i>	Common Feather-moss	2
<i>Hypnum resupinatum</i>	Supine Plait-moss	1

Floristic character	2017
Woody plants	5
Grassoids	8
Forbs	33
Bryophytes	7
Total	53

5.3 Monitoring Plot Report – N02 Peaty Floodplain 2017

Plot code	N02 – Peaty Floodplain
Treatment type	Summary of preceding Monitoring Plot Report
Ordinary Damp Meadow	This is the initial Monitoring Plot Report

Vegetation structure

- The ground surface was slightly damp to moist and covered in a thin litter layer – largely of tree leaves and twigs.
- At this stage in the growing season, few species were wholly represented on the ground layer, and the field layer over half of the plot was thick with immature and mature flowering stems amongst a scatter of sedge tussocks.
- In deeper shade along the northern side of the plot the field layer became very thin, with long, etiolated stems of Hemp Agrimony and sedge tufts.
- On the southern side, in full sun, the field and ground layers were populated with a much higher proportion of seedlings, basal rosettes and short flowering shoots.
- Although some clearance has been undertaken on the southern side, much of the plot was overstood by mature Grey Willows.

Floristics

- The plot takes in fully-lit to deeply shaded vegetation; a diverse suite of fen species occurs throughout, and a smaller group of common ruderals occurs along the southern, well-illuminated fringe of the plot.
- Several species occur with a high frequency: Grey Willow, Rough Meadow-grass, Hemp Agrimony, Water Mint, Skullcap and Marsh Thistle. As a group, these indicate that the plot is sampling vegetation transitional from reed-fen / fen-meadow to W5 Alder-Greater Tussock Sedge woodland.
- Associated with these species are a large group of common of other fen species, including Common Reed, Tufted Sedge and Fen Bedstraw; hyper-fertile indicators (such as Common Nettle) are occasional in the monitoring plot.
- The common ruderals in the drier, southern part of the plot include Reed Canary-grass and Creeping Thistle, which tend to occur at the driest part of the hydrosere.

Summary of records and events

- Not available at the time of reporting.
- Field evidence suggests that the plot includes the edge of a recently cleared area and extends into unmanaged mature sallow scrub.

Relation to past and target conditions

- This survey initiates the Vegetation Monitoring Programme and provides a baseline for assessing subsequent meadow vegetation development.
- Vegetation characters suggest that the plot can be regarded as mature sallow scrub demonstrating vigorous regeneration of fen species with some canopy clearance.



Monitoring Plot Field Form – Vegetation structural characters

Monitoring Plot	N02 Peaty Floodplain
Recorder	Jonny Stone
Survey Date	28th July 2017

Character of the ground surface

- The ground surface was slightly damp to moist, with soil moisture generally increasing to the northeast, and concentrated in slight hollows.
- The ground surface was mantled in a thin layer of tree litter – leaves and twigs – and there was no standing water.
- No sand was found on the surface, suggesting that the peat was sufficiently deep to mask the terrace sands from tree-throw and mole activity.

Soil wetness

Dry, dusty	Dry, firm	Slightly damp	Moist	Wet	Saturated
		II	II		

ATTRIBUTE		SAMPLE from each plot quarter				AVERAGE
		1	2	3	4	
Layer height	Standing water (cm)	0	0	0	0	0 cm
	Plant litter (cm)	1	0	0	1	0.5 cm
	Woody seedlings (cm)	0	0	0	0	0 cm
	Large sedges / rushes (cm)	70	110	105	60	86.3 cm
	Reed-like grasses (cm)	130	160	160	140	147.5 cm
	Woody saplings (cm)	0	0	0	0	0 cm
Cover value	Standing water (%)	0	0	0	0	0 %
	Trampling (%)	10	0	20	0	7.5 %
	Dunging (%)	0	0	0	0	0 %
	Bare ground (%)	5	20	30	5	15 %
	Plant litter (%)	5	80	80	5	42.5 %
	Bryophytes (%)	1	0	0	0	0.3 %
	Woody seedlings (%)	0	0	0	0	0 %
	Large sedges / rushes (%)	15	10	15	20	15 %
	Reed-like grasses (%)	5	20	25	30	20 %
	Woody saplings (%)	0	0	0	0	0 %

Monitoring Plot Field Form – Floristic sub-sampling – all survey years

Monitoring Plot

N02 Peaty Floodplain

Recorder

Jonny Stone

Survey Date

28th July 2017

This data is collated from the 20 1x1 m sub-samples given in Appendix 3.

Species		2017
		[ex 20]
Woody plants		
<i>Salix cinerea</i>	Grey Willow	17
Grassoids		
<i>Poa trivialis</i>	Rough Meadow-grass	17
<i>Phragmites australis</i>	Common Reed	8
<i>Agrostis stolonifera</i>	Creeping Bent	6
<i>Deschampsia cespitosa</i>	Tufted Hair-grass	5
<i>Brachypodium sylvaticum</i>	False-Brome	4
<i>Carex acuta</i>	Slender Tufted-sedge	3
<i>Carex elata</i>	Tufted Sedge	2
<i>Carex remota</i>	Remote Sedge	2
<i>Carex riparia</i>	Greater Pond-sedge	2
<i>Holcus lanatus</i>	Yorkshire Fog	2
<i>Juncus inflexus</i>	Hard Rush	2
<i>Juncus subnodulosus</i>	Blunt-flowered Rush	2
<i>Phalaris arundinacea</i>	Reed Canary-grass	2
<i>Carex otrubae</i>	False Fox-sedge	1
Forbs		
<i>Eupatorium cannabinum</i>	Hemp Agrimony	20
<i>Mentha aquatica</i>	Water Mint	17
<i>Scutellaria galericulata</i>	Skullcap	14
<i>Cirsium palustre</i>	Marsh Thistle	12
<i>Galium uliginosum</i>	Fen Bedstraw	6
<i>Geranium robertianum</i>	Herb-Robert	5
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil	5
<i>Ranunculus repens</i>	Creeping Buttercup	5
<i>Iris pseudacorus</i>	Flag Iris	4
<i>Cirsium arvense</i>	Creeping Thistle	3
<i>Urtica dioica</i>	Common Nettle	3
<i>Equisetum palustre</i>	Marsh Horsetail	2
<i>Hypericum tetrapterum</i>	Square-stemmed St John's-wort	2
<i>Lycopus europaeus</i>	Gipsywort	2
<i>Alliaria petiolata</i>	Garlic Mustard	1
<i>Lythrum salicaria</i>	Purple Loosestrife	1
<i>Thalictrum flavum</i>	Common Meadow-rue	1
Bryophytes		
<i>Brachythecium rutabulum</i>	Rough-stalked Feather-moss	2
<i>Calliergonella cuspidata</i>	Pointed Spear-moss	1
<i>Hypnum resupinatum</i>	Supine Plait-moss	1

Floristic characters	2017
Woody plants	1
Grassoids	14
Forbs	17
Bryophytes	3

5.4 Interpretation of the Monitoring Plot surveys

The two monitoring plots were established in locations intended to represent parts of the Valley Margin and Floodplain units of New Fen where restoration activities had been carried out or were planned. Although, in both units, the general land-use history was evident from the aerial photograph record and from field evidence, the ability of plant species to re-establish or to colonise to form target habitats was unknown.

Plot N01 Sandy Terrace

For this reason, the N01 Sandy Terrace plot was located in an area where vegetation response was anticipated following partial glade widening, without a defined target condition. Although the baseline survey has recorded a lengthy plant list, the great majority of species are common ruderals that may have been present in the seed bank, or are likely to be ready colonists. Many of these species may persist with continued disturbance, though subsequent surveys should anticipate a rapid turnover of species in favour of tall, competitive species in less disturbed areas (unless these are mantled by Bramble) verging an annual-rich assemblage restricted to the trackway. A flora of the shade-forms of woodland is unlikely to assemble in the short term, as most potential species are absent from the immediate surroundings. The potential target may therefore be the ruderal flora of secondary woodland on a fertile substrate.

Plot N02 Peaty Floodplain

The N02 Peaty Floodplain plot has also had a strong response from species assembling to form the field layer. In contrast to the Terrace vegetation – and potentially the flora of the drier peats near the edge of the floodplain – this response has been the immediate recovery of elements of a reed-fen / fen meadow flora. Although still depauperate in the strongly shaded northern half of the monitoring plot, the response has been vigorous in the well-lit southern half.

Although a large group of fen species are present, the most abundant species is Hemp Agrimony. The species gave a similar vigorous response when a section of fen-edge canopy was cleared from Hinderclay Fen. In some phytosociological classifications, stands of Hemp Agrimony are distinguished as a distinct community (e.g. *Eupatorietum cannabini* association R. Tüxen 1937) and placed with other tall, competitive species amongst communities found in woodland clearings (*Epilobietea angustifolii* class R. Tüxen et Preising in R. Tüxen 1950). At New Fen, such vegetation would not persist if it were overstood by the regrowth of Grey Willow, or by repeated clearance, mowing or grazing. Other elements of the fen flora would come into prominence, increasingly resembling reed-fen (dominated by Common Reed) or fen-feadow, where rushes or sedges attain dominance.

The post-restoration target for the vegetation monitored by the N02 Peaty Floodplain plot is therefore likely to be either reed-fen or fen-meadows, depending on the style and intensity of management and, as assessed by this survey, either would seem to be achievable.

5.5 Recommendations of the Vegetation Monitoring Programme

It is recommended that:

1. ***The Vegetation Monitoring Programme is adopted*** at Thelnetham New Fen by those responsible for ensuring appropriate management of the grasslands. This first Fieldwork Report provides details of the successful installation of the permanent plot markers, and the completion of a baseline survey of each plot using the ‘full’ survey method (photographs, physiognomy and floristics). The Monitoring Plan (ELP 2010) proposes several means to integrate vegetation monitoring as a management decision-making tool.
2. ***Target conditions for each part of New Fen should be devised***, based on the primary subdivision of New Fen as indicated in Figure 2. This separates the Valley Margin (dry soils) from the wetter floodplain peats. Note that the Valley Margin is also split into the sandy terrace area and the area of dry peats south of the Fen vegetation survey unit. Target conditions for the three areas are described in general terms in Little Ouse Headwaters Project (2014) and supported in section 3 of this report. More specific target conditions for the two monitoring plots are discussed in section 5.4.
3. ***Monitoring surveys should be repeated regularly***, and the results incorporated into management decision-making. As recommended in the Monitoring Plan, the ‘rapid survey’ technique (plot photographs) is a useful annual device to assess gross changes in the monitoring plots. This should ideally be supplemented by a rapid walkover survey of the surrounding vegetation to identify the presence of colonising plant species, particularly when these can be interpreted as indicators of positive (or negative) change. The ‘full survey’ should provide a summative statement of the floristic and physiognomic changes that have occurred over a period of several years in each plot, and should be integrated into a periodic review of restoration progress.

6. REFERENCES

- British Geological Survey (1986) Diss Sheet 175, Solid and Drift Geology Edition. 1:50 000 Series.
- Cheffings C.M. & Farrell L. (Eds), Dines T.D., Jones R.A., Leach S.J., McKean D.R., Pearman D.A., Preston C.D., Rumsey F.J. & Taylor I. (2005) The Vascular Plant Red Data List for Great Britain. Species Status 7: 1-116. Joint Nature Conservation Committee, Peterborough.
- ELP (2010) Fen restoration vegetation monitoring programme for Parker's Piece and Bleywyck's bank. Monitoring Plan 2010. Unpublished report to Little Ouse Headwaters Project.
- Hill M.O., Preston C.D. & Roy, D.B. (2004) PLANTATT: attributes of British and Irish plants: status, size, life history, geography and habitats. Centre for Ecology & Hydrology, Monks Wood, Cambridge.
- Hill M.O., Preston C.D., Bosanquet S.D.S. & Roy D.B. (2007) BRYOATT Attributes of British and Irish Mosses, Liverworts and Hornworts. With Information on Native Status, Size, Life Form, Life History, Geography and Habitat. Centre for Ecology & Hydrology, Monks Wood, Cambridge.
- Hill M.O., Blackstock T.H., Long D.G. and Rothero G.P. (2008) A Checklist and Census Catalogue of British and Irish Bryophytes. British Bryological Society, Middlewich.
- Kent M. (2012) Vegetation Description and Data Analysis, Second Edition. Wiley-Blackwell, Chichester.
- Kirby K.J. (1988) A Woodland Survey Handbook. Research & Survey in Nature Conservation No.11. Nature Conservancy Council, Peterborough.
- Little Ouse Headwaters Project (2014) Conservation Statement for Thelnetham New Fen. January 2014 – December 2016 Version 2 August 2014. Internal Report.
- Londo G. (1988) Nederlandse Freatofyten. Pudoc Wageningen
- Nature Conservancy Council (1990) Handbook for Phase 1 Habitat Survey: a technique for environmental audit; a field manual. Nature Conservancy Council, Peterborough.
- OHES (2015) Thelnetham New Fen – colonisation of willows on surrounding fen. OHES Project Reference No. 9067. Unpublished Report to Little Ouse Headwaters Project.
- Rackham O. (1980) Ancient Woodland, its History, Vegetation and Uses in England. Edward Arnold, London.
- Rodwell J.S. (2006) National Vegetation Classification: Users' Handbook. Joint Nature Conservation Committee, Peterborough.
- Stace C.A. (2010) New Flora of the British Isles. Third Edition. Cambridge University Press, Cambridge.
- Stewart A., Pearman D.A. & Preston C.D. (1994) Scarce Plants in Britain. JNCC, Peterborough.
- Stroh P.A., Leach S.J., August T.A., Walker K.J., Pearman D.A., Rumsey F.J., Harrower C.A., Fay M.F., Martin J.P., Pankhurst T., Preston C.D. & Taylor, I. (2014) A Vascular Plant Red List for England. Botanical Society of Britain and Ireland, Bristol.
- Suffolk Biological Records Centre (2005) Rare Plant Register for Suffolk.
- Tallentire P.A. (1969) Three more nameless meres from the Ouse-Waveney valley. Transactions of the Norfolk and Norwich Naturalists' Society, 21: 262-268.
- West R. (2009) From Brandon to Bungay: an exploration of the geology and landscape history of the Little Ouse and Waveney rivers. Healeys, Ipswich.

Appendix 1. PLANT SPECIES RECORDED and WEIGHTED WETNESS AVERAGE

The species recorded are sub-divided into woody plants, grassoids (grasses, sedges and rushes), forbs (all herbs) and bryophytes (mosses and liverworts).

Frequency: frequency of occurrence (DAFOR scale) in the survey unit

Score: conversion of DAFOR scale to ordinal units

F: (German *Feuchtigkeit* for 'moisture') – Wetness Indicator Value from Hill et al. (2004) and Hill et al. (2007)

Weight(ing): Sum of 'Score x F'

Valley Margin				Floodplain			
Frequency	Score	F	Weight	Frequency	Score	F	Weight

Woody plants

Species	Common Name	Frequency	Score	F	Weight	Frequency	Score	F	Weight
<i>Acer campestre</i>	Field Maple	LF	3	5	15				
<i>Acer pseudoplatanus</i>	Sycamore	F	4	5	20				
<i>Betula pendula</i>	Silver Birch	O	2	5	10				
<i>Carpinus betulus</i>	Hornbeam	O	2	5	10				
<i>Cornus sanguinea</i>	Dogwood	O	2	5	10				
<i>Corylus avellana</i>	Hazel	O	2	5	10	O	2	5	10
<i>Crataegus monogyna</i>	Hawthorn	O	2	5	10	O	2	5	10
<i>Euonymus europaeus</i>	Spindle	O	2	5	10				
<i>Fraxinus excelsior</i>	Ash	F	4	6	24	O	2	6	12
<i>Ligustrum vulgare</i>	Wild Privet	R	1	5	5				
<i>Populus alba</i>	White Poplar	LF	3	6	18				
<i>Prunus cerasifera</i>	Cherry Plum	O	2	5	10	R	1	5	5
<i>Prunus spinosa</i>	Blackthorn	F	4	5	20				
<i>Quercus robur</i>	Pedunculate Oak	O	2	5	10	R	1	5	5
<i>Salix caprea</i>	Goat Willow	O	2	7	14				
<i>Salix cinerea</i>	Grey Willow	LF	3	8	24	A	5	8	40
<i>Salix fragilis</i>	Crack Willow	R	1	8	8	O	2	8	16
<i>Sambucus nigra</i>	Elder	F	4	5	20	O	2	5	10
<i>Tilia x europaea</i>	European Lime	R	1	5	5				

Grassoids

Species	Common Name	Frequency	Score	F	Weight	Frequency	Score	F	Weight
<i>Agrostis gigantea</i>	Black Bent	R	1	6	6				
<i>Agrostis stolonifera</i>	Creeping Bent	O	2	6	12	O	2	6	12
<i>Alopecurus myosuroides</i>	Black-grass	R	1	5	5				
<i>Anisantha sterilis</i>	Barren Brome	O	2	5	10				
<i>Arrhenatherum elatius</i>	False Oat-grass					R	1	5	5
<i>Brachypodium sylvaticum</i>	False-Brome	R	1	5	5	O	2	5	10
<i>Bromus hordeaceus</i>	Common Soft-brome	O	2	4	8				
<i>Carex acuta</i>	Slender Tufted-sedge					R	1	9	9
<i>Carex acutiformis</i>	Lesser Pond-sedge					R	1	8	8
<i>Carex elata</i>	Tufted Sedge					LF	3	10	30
<i>Carex flacca</i>	Glaucous Sedge					R	1	5	5
<i>Carex otrubae</i>	False Fox-sedge					R	1	8	8
<i>Carex remota</i>	Remote Sedge	R	1	8	8	R	1	8	8
<i>Carex riparia</i>	Greater Pond-sedge					LF	3	8	24
<i>Dactylis glomerata</i>	Cock's-foot	O	2	5	10				
<i>Deschampsia cespitosa</i>	Tufted Hair-grass	R	1	6	6	R	1	6	6
<i>Elytrigia repens</i>	Common Couch	O	2	5	10				
<i>Holcus lanatus</i>	Yorkshire Fog	O	2	6	12	R	1	6	6
<i>Juncus articulatus</i>	Jointed Rush					R	1	9	9
<i>Juncus inflexus</i>	Hard Rush	O	2	7	14	R	1	7	7
<i>Juncus subnodulosus</i>	Blunt-flowered Rush					O	2	9	18

		Valley Margin				Floodplain			
		Frequency	Score	F	Weight	Frequency	Score	F	Weight
<i>Lolium perenne</i>	Perennial Rye-grass	R	1	5	5				
<i>Phalaris arundinacea</i>	Reed Canary-grass	R	1	8	8	R	1	8	8
<i>Phragmites australis</i>	Common Reed					LF	3	10	30
<i>Poa annua</i>	Annual Meadow-grass	O	2	5	10				
<i>Poa trivialis</i>	Rough Meadow-grass	F	4	6	24	F	4	6	24
Forbs									
<i>Alliaria petiolata</i>	Garlic Mustard	O	2	6	12	R	1	6	6
<i>Anagallis arvensis</i>	Scarlet Pimpernel	O	2	4	8				
<i>Arctium minus agg.</i>	Lesser Burdock	R	1	4	4				
<i>Artemisia vulgaris</i>	Mugwort	R	1	4	4				
<i>Calystegia sepium</i>	Hedge Bindweed					R	1	8	8
<i>Capsella bursa-pastoris</i>	Shepherd's-purse	O	2	5	10				
<i>Cardamine flexuosa</i>	Wavy Bitter-cress					O	2	7	14
<i>Cerastium fontanum</i>	Common Mouse-ear	R	1	5	5				
<i>Chenopodium album</i>	Fat-hen	O	2	5	10				
<i>Cirsium arvense</i>	Creeping Thistle	R	1	6	6	R	1	6	6
<i>Cirsium palustre</i>	Marsh Thistle	R	1	8	8	O	2	8	16
<i>Cirsium vulgare</i>	Spear Thistle	R	1	5	5	R	1	5	5
<i>Conium maculatum</i>	Hemlock	R	1	5	5	R	1	5	5
<i>Conyza canadensis</i>	Canadian Fleabane	O	2	4	8				
<i>Crepis capillaris</i>	Smooth Hawk's-beard	R	1	4	4				
<i>Epilobium ciliatum</i>	American Willowherb	O	2	6	12				
<i>Epilobium hirsutum</i>	Great Willowherb	R	1	8	8	R	1	8	8
<i>Epilobium palustre</i>	Marsh Willowherb					R	1	8	8
<i>Epilobium parviflorum</i>	Hoary Willowherb	R	1	9	9	R	1	9	9
<i>Equisetum palustre</i>	Marsh Horsetail					R	1	8	8
<i>Erysimum cheiranthoides</i>	Treacle Mustard	O	2	5	10				
<i>Eupatorium cannabinum</i>	Hemp Agrimony					O	2	8	16
<i>Filipendula ulmaria</i>	Meadowsweet					R	1	8	8
<i>Galium aparine</i>	Cleavers	O	2	6	12	R	1	6	6
<i>Galium uliginosum</i>	Fen Bedstraw					R	1	9	9
<i>Geranium robertianum</i>	Herb-Robert	R	1	6	6	O	2	6	12
<i>Glechoma hederacea</i>	Ground-ivy	F	4	6	24	R	1	6	6
<i>Heracleum sphondylium</i>	Hogweed	R	1	5	5				
<i>Hypericum tetrapterum</i>	Square-stemmed St John's-wort	R	1	8	8	R	1	8	8
<i>Iris pseudacorus</i>	Flag Iris					O	2	9	18
<i>Lapsana communis</i>	Nipplewort	O	2	4	8				
<i>Lathyrus pratensis</i>	Meadow Vetchling					R	1	6	6
<i>Lotus pedunculatus</i>	Greater Bird's-foot-trefoil					R	1	8	8
<i>Lycopus europaeus</i>	Gipsywort					R	1	8	8
<i>Lythrum salicaria</i>	Purple Loosestrife					R	1	9	9
<i>Matricaria discoidea</i>	Pineapple-weed	R	1	5	5				
<i>Mentha aquatica</i>	Water Mint					O	2	8	16
<i>Mentha arvensis</i>	Corn Mint	R	1	7	7				
<i>Myosotis arvensis</i>	Field Forget-me-not	O	2	5	10				
<i>Myosoton aquaticum</i>	Water Chickweed	R	1	8	8				
<i>Papaver dubium</i>	Long-headed Poppy	R	1	5	5				
<i>Papaver rhoeas</i>	Common Poppy	R	1	5	5				
<i>Persicaria maculosa</i>	Redshank					R	1	6	6
<i>Plantago lanceolata</i>	Ribwort Plantain	R	1	5	5				

Valley Margin			
Frequency	Score	F	Weight

Floodplain			
Frequency	Score	F	Weight

Forbs (cont'd)

<i>Plantago major</i>	Greater Plantain	O	2	5	10
<i>Polygonum aviculare</i>	Knotgrass	R	1	5	5
<i>Potentilla reptans</i>	Creeping Cinquefoil	O	2	5	10
<i>Prunella vulgaris</i>	Selfheal				
<i>Pulicaria dysenterica</i>	Common Fleabane				
<i>Ranunculus flammula</i>	Lesser Spearwort				
<i>Ranunculus repens</i>	Creeping Buttercup	O	2	7	14
<i>Rosa arvensis</i>	Field Rose	R	1	4	4
<i>Rubus fruticosus</i> agg.	Bramble	O	2	6	12
<i>Rumex conglomeratus</i>	Clustered Dock	O	2	8	16
<i>Rumex crispus</i>	Curled Dock	R	1	6	6
<i>Rumex sanguineus</i>	Wood Dock	R	1	7	7
<i>Scutellaria galericulata</i>	Skullcap				
<i>Senecio jacobaea</i>	Common Ragwort	R	1	4	4
<i>Senecio vulgaris</i>	Groundsel	R	1	5	5
<i>Silene latifolia</i>	White Campion	O	2	4	8
<i>Solanum nigrum</i>	Black Nightshade	R	1	5	5
<i>Sonchus arvensis</i>	Perennial Sow-thistle	O	2	6	12
<i>Sonchus asper</i>	Prickly Sow-thistle	R	1	5	5
<i>Sonchus oleraceus</i>	Smooth Sow-thistle	R	1	5	5
<i>Stachys palustris</i>	Marsh Woundwort				
<i>Stellaria media</i>	Chickweed	O	2	5	10
<i>Taraxacum</i> agg. sect. <i>ruderales</i>	Dandelion	F	4	5	20
<i>Thalictrum flavum</i>	Common Meadow-rue				
<i>Trifolium dubium</i>	Lesser Trefoil	R	1	4	4
<i>Trifolium repens</i>	White Clover	O	2	5	10
<i>Urtica dioica</i>	Common Nettle	A	5	6	30
<i>Veronica persica</i>	Common Field-speedwell	O	2	5	10

R	1	5	5
R	1	5	5
R	1	5	5
R	1	5	5
R	1	7	7
R	1	9	9
O	2	7	14
O	2	6	12
R	1	8	8
R	1	5	5
R	1	8	8
R	1	8	8
F	4	6	24

Bryophytes

<i>Amblystegium serpens</i>	Creeping Feather-moss	R	1	6	6
<i>Brachytheciastrum velutinum</i>	Velvet Feather-moss	R	1	5	5
<i>Brachythecium rutabulum</i>	Rough-stalked Feather-moss	O	2	6	12
<i>Calliergonella cuspidata</i>	Pointed Spear-moss				
<i>Ceratodon purpureus</i>	Redshank	R	1	4	4
<i>Funaria hygrometrica</i>	Bonfire-moss	R	1	5	5
<i>Hypnum resupinatum</i>	Supine Plait-moss	R	1	4	4
<i>Isoetecium myosuroides</i>	Slender Mouse-tail Moss	R	1	6	6
<i>Kindbergia praelonga</i>	Common Feather-moss	O	2	6	12
<i>Oxyrrhynchium hians</i>	Swartz's Feather-moss	R	1	5	5

F	4	6	24
R	1	7	7
O	2	6	12
R	1	5	5

No. of species	
Species weighted average	
Weighted Wetness Average	

96
166
5.5

68
104
7.0

Appendix 2. FIELD RECORD FOR N01 SANDY TERRACE MONITORING PLOT P = present in sub-plot

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
<i>Urtica dioica</i>	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
<i>Agrostis stolonifera</i>	P	P	P	P	P	P	P	P	P	P	P			P			P	P	P		16
<i>Cirsium arvense</i>	P	P	P	P			P	P	P	P	P	P	P	P			P	P		P	16
<i>Poa trivialis</i>	P	P	P	P	P	P	P	P	P	P				P	P			P	P	P	15
<i>Cornus sanguinea</i>											P	P	P	P	P		P	P			7
<i>Silene latifolia</i>		P						P		P					P		P	P		P	7
<i>Plantago major</i>	P	P				P			P		P										6
<i>Elytrigia repens</i>																	P	P	P	P	4
<i>Mentha arvensis</i>								P	P	P			P								4
<i>Ranunculus repens</i>			P	P		P		P													4
<i>Sonchus arvensis</i>														P		P	P	P			4
<i>Sonchus oleraceus</i>	P	P					P				P										4
<i>Brachythecium rutabulum</i>												P					P		P	P	4
<i>Prunus spinosa</i>													P	P	P						3
<i>Cirsium palustre</i>																	P	P		P	3
<i>Cirsium vulgare</i>					P				P			P									3
<i>Galium aparine</i>																P		P	P		3
<i>Sonchus asper</i>				P		P					P										3
<i>Taraxacum agg. sect. ruderale</i>		P	P				P														3
<i>Funaria hygrometrica</i>												P		P	P						3
<i>Crataegus monogyna</i>										P	P										2
<i>Salix caprea</i>							P						P								2
<i>Dactylis glomerata</i>																	P	P			2
<i>Holcus lanatus</i>																	P	P			2
<i>Poa annua</i>				P		P															2
<i>Alliaria petiolata</i>																	P			P	2
<i>Anagallis arvensis</i>		P							P												2
<i>Chenopodium album</i>												P				P					2
<i>Conyza canadensis</i>				P		P															2
<i>Fraxinus excelsior seedling</i>	P				P																2
<i>Myosotis arvensis</i>																	P	P			2
<i>Trifolium repens</i>									P	P											2

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
<i>Amblystegium serpens</i>											P							P			2
<i>Brachytheciastrum velutinum</i>													P						P		2
<i>Ceratodon purpureus</i>														P	P						2
<i>Kindbergia praelonga</i>																P				P	2
<i>Corylus avellana</i>											P										1
<i>Carex remota</i>																	P				1
<i>Juncus inflexus</i>		P																			1
<i>Conium maculatum</i>																P					1
<i>Crepis capillaris</i>						P															1
<i>Epilobium ciliatum</i>				P																	1
<i>Epilobium hirsutum</i>																		P			1
<i>Matricaria discoidea</i>							P														1
<i>Myosoton aquaticum</i>																			P		1
<i>Rosa arvensis</i>																				P	1
<i>Rubus fruticosus agg.</i>																	P				1
<i>Rumex crispus</i>			P																		1
<i>Rumex sanguineus</i>																P					1
<i>Senecio vulgaris</i>								P													1
<i>Solanum nigrum</i>					P																1
<i>Veronica persica</i>														P							1
<i>Hypnum resupinatum</i>																	P				1
No. of species	7	10	7	9	6	9	7	9	9	8	9	9	6	10	7	11	14	14	9	10	Av. 9.0

Appendix 3. FIELD RECORD FOR N02 PEATY FLOODPLAIN MONITORING PLOT P = present in sub-plot

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
<i>Eupatorium cannabinum</i>	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	20
<i>Salix cinerea</i>		P	P	P	P			P	P	P	P	P	P	P	P	P	P	P	P	P	17
<i>Poa trivialis</i>	P	P	P	P	P	P	P	P	P	P		P		P	P		P		P	P	17
<i>Mentha aquatica</i>	P		P	P	P	P		P	P	P	P	P	P	P		P	P	P	P	P	17
<i>Scutellaria galericulata</i>			P	P		P	P	P	P	P		P	P	P		P	P	P	P		14
<i>Cirsium palustre</i>	P	P	P	P	P	P	P	P	P	P	P					P					12
<i>Phragmites australis</i>									P	P			P	P		P				P	8
<i>Agrostis stolonifera</i>	P	P			P	P	P	P													6
<i>Galium uliginosum</i>									P	P		P			P					P	6
<i>Deschampsia cespitosa</i>	P		P	P		P	P														5
<i>Geranium robertianum</i>											P		P		P		P				5
<i>Lotus pedunculatus</i>								P	P	P			P								5
<i>Ranunculus repens</i>	P		P	P		P	P														5
<i>Brachypodium sylvaticum</i>					P				P		P	P									4
<i>Iris pseudacorus</i>													P		P						4
<i>Carex acuta</i>								P			P						P	P			3
<i>Cirsium arvense</i>	P	P				P															3
<i>Urtica dioica</i>			P						P			P									3
<i>Carex elata</i>				P		P															2
<i>Carex remota</i>					P			P													2
<i>Carex riparia</i>															P		P				2
<i>Holcus lanatus</i>		P	P																		2
<i>Juncus inflexus</i>			P				P														2
<i>Juncus subnodulosus</i>					P	P															2
<i>Phalaris arundinacea</i>			P							P											2
<i>Equisetum palustre</i>											P						P				2
<i>Hypericum tetrapterum</i>				P	P																2
<i>Lycopus europaeus</i>												P		P							2
<i>Brachythecium rutabulum</i>			P					P													2
<i>Carex otrubae</i>										P											1
<i>Alliaria petiolata</i>	P																				1

Sub-plots	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	2017
<i>Lythrum salicaria</i>											P										1
<i>Thalictrum flavum</i>												P									1
<i>Calliergonella cuspidata</i>																	P				1
<i>Hypnum resupinatum</i>									P												1
No. of species	9	7	13	10	10	11	8	11	12	11	14	10	8	7	7	9	10	7	6	6	Av. 9.3