incorporating

Little Ouse Headwaters Project

Parkers Piece and Bleyswycks's Bank

Fen Restoration
Vegetation Monitoring Programme

Monitoring Plan 2010

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Prepared by ELP, part of OHES Environmental

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SUMMARY

1. The Little Ouse Headwaters Project (LOHP) has initiated the ecological restoration of Bleyswyck's Bank and Parkers Piece on the banks of the Little Ouse at Blo-Norton in Norfolk.

2. A Vegetation Monitoring Programme has been developed by ELP, now part of OHES Environmental, to assess the recovery of the disturbed vegetation, especially in the early years of restoration, and inform the development of appropriate practical management.

3. This Monitoring Plan sets out the aim of the Programme and the target conditions of the restored areas of fenland vegetation. The Plan provides a record of where six permanent recording plots have been established and how the vegetation can be monitored on an annual basis. Details are also given of how the Programme can be continued, and the ways in which the monitoring results can assist the Project in managing the restored areas.

4. The Monitoring Plan sets out clear survey protocols for undertaking a 'full survey', including specifications for providing a photographic record of the fen vegetation and making a detailed assessment of the structural features and floristic composition of the monitoring plots. This type of survey is recommended for the early years of the project, when the progress of the restored vegetation needs to be monitored closely.

5. Following this initial effort, the 'full survey' is replaced, in part, by a 'rapid survey', which follows only part of the survey protocol. This version of the survey is intended to provide a 'watching brief' over the subsequent development of the fen vegetation, and ensure that the management effort continues to be appropriate and beneficial. This abbreviated version of the survey protocol provides an effective 'snapshot' of restoration progress and can readily be carried out by Project members. The 'full survey' is then undertaken periodically, to make a detailed assessment of vegetation condition in relation to the targets for successfully restoring the vegetation.

6. The Monitoring Plan has been developed so that annual Fieldwork Reports are produced that include details of management and other records, and can provide an effective assessment of vegetation changes. The Reports are intended to assist the LOHP Project in reporting on the successes of this project, and to ensure that it is well-placed to identify the best management and site safeguard for the restored area.

7. The Plan also recommends periodic reviews of the Vegetation Monitoring Programme that would provide summative records of the development of each monitoring plot, and ensure that the Programme remains a useful tool in restoring the vegetation associated with East Anglian calcareous valley fens.

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1. THE VEGETATION MONITORING PROGRAMME

1.1 Introduction

The Little Ouse Headwaters Project (LOHP) has initiated the ecological restoration of Bleyswyck's Bank and Parkers Piece, land parcels located on the southern bank of the Little Ouse at Blo-Norton in Norfolk (Grid Ref: 601364/278940). The area (approximately 5.3 ha) was acquired by the Project in 2007, when it consisted of areas of dry grassland and woodland, with degraded forms of open fen and scrub.

A programme of restorative measures developed in collaboration with Ecology Land and People (ELP), was carried out during 2008 and the early months of 2009 with the intention of restoring areas to species-rich open fen and wet woodland.

In 2009, LOHP asked ELP, now part of OHES Environmental, to develop a Vegetation Monitoring Programme to assess the recovery of the disturbed vegetation, especially in the early years of restoration, and inform the development of appropriate practical management. A pilot survey was undertaken in 2009 and, in combination with this Monitoring Plan and the first formal survey conducted in 2010, provides a template for further surveys. In the longer term, the monitoring programme can be employed to assess the success of the project in restoring the target vegetation types identified by ELP.

This Monitoring Plan sets out the aim of the Programme and the target conditions of the restored areas of fenland vegetation. The Plan provides a record of where permanent recording plots have been established and how the vegetation can be monitored. Details are also given of how the Programme can be continued, and the ways in which the monitoring results can assist the Project in managing the restored areas.

1.2 Roles of the Vegetation Monitoring Programme

The restoration proposals involved excavating areas of the damaged peat ground surface, and were developed by Ecology Land and People (ELP) based on topographic and soils data. Following the excavations, the area is to be grazed.

ELP also conducted an Extended Phase 1 habitat survey of the area to ensure that no existing features of high conservation value were destroyed, or that they would be incorporated into the restoration plan. The survey also provided an assessment of the pre-restoration condition of the vegetation.

In principle, the success of the habitat restoration techniques are largely dependent on:

1. Re-establishing appropriate ground conditions in the restoration area.

Three key factors affecting the development of the fen vegetation are substrate type, levels of fertility and groundwater behaviour and character. Their re-establishment has been achieved by:

- Removing surficial peats that had been degraded by drying out and cultivation, to reveal less damaged subsoils of peat or lacustrine deposits with lower levels of available nutrients;
- Lowering the ground surface in these areas to bring more extensive areas of the fen into contact with the groundwater watertable.

One role of vegetation monitoring is to provide field information to allow a judgement to be made on the success of the excavation techniques used, and thus the potential for target plant communities to establish.

2. Encouraging effective colonisation of the restored area by appropriate fen species.

   The excavations have been designed to reveal subsurface materials containing plant roots and rhizomes, and potentially buried seed. Restoration of fen vegetation is expected to be achieved by encouraging these species as well as fenland plants that colonise the restored area from the surrounding areas of the valley floor.

3. Enabling the development of plant communities that increasingly resemble the target vegetation types.

   It is anticipated that successful restoration will be achieved in broad terms if appropriate ground conditions and populations of suitable fenland species can be sustained by appropriate management.

4. Adapting management to suit the changes in vegetation and ground conditions.

   The primary role of monitoring is to ensure that the development of the restored fen is maintained towards the target condition. Monitoring of the fen vegetation vegetation needs to provide relevant and useful information about the changing character of the vegetation, ground conditions and depth of watertable. This is to allow decisions to be made about the need for management interventions. These may include adjusting the timing and intensity of grazing, or providing evidence for the Environment Agency that water levels are too low in the summer months, for example.

5. Recognising when the target habitats have been successfully restored.

   A further role of monitoring is to provide the information necessary to make a judgement on the success of the restoration programme in achieving its aims. Subsequent surveys using the monitoring method may also be used to determine whether the restored vegetation is being maintained in a favourable condition.

1.3 Aim of the Vegetation Monitoring Programme

The Vegetation Monitoring Programme has arisen out of the need to provide not only an immediate assessment of the impact of management works within the lifetime of the funded project but also a

permanent baseline for future studies of the development of fenland vegetation in the restored area over the long term.

One inspiration for the approach taken comes from 'Bellamy's plots' – a series of permanent vegetation plots established in 1959 at Redgrave Fen (Suffolk Wildlife Trust reserve) by David Bellamy (Bellamy 1967; Bellamy and Rose 1961). The 'baseline' provided by these plots has provided an enduring fixed point against which subsequent sampling can be compared (eg. Fojt and Harding 1995; Parmenter 1995a,b; Stone et al. 2004). Both the impact of long-term hydrological changes on the reserve, and the effect of land management practices, can be interpreted against changes to the flora of these permanent plots.

The aim of the programme is therefore:

to establish permanent locations and a methodology for short- and long-term vegetation monitoring, which is used to enable effective assessment of the condition of developing fenland vegetation in the restored areas of Parkers Piece and Bleyswyck's Bank, supporting the restoration of Blo'Norton and Thelnetham Fens SSSI.

1.4 Outline of the Monitoring Plan

The Monitoring Plan has been developed to provide a record of the initiation of the Vegetation Monitoring Programme and its integration into the management of Bleyswyck's Bank and Parkers Piece. As summarised in ***Table 1***, the Plan is divided into five sections, each with a specific objective:

Table 1. Outline of the Monitoring Plan

Monitoring Plan Section	Objective
1. The Vegetation Monitoring Programme	The Monitoring Plan provides a clear justification for the need for monitoring, and defines the aim of the programme.
2. Vegetation states and target conditions	The Plan sets out the phases of vegetation development and identifies restoration success in terms of the target condition of the plant communities.
3. Establishing permanent monitoring plots	The Plan provides a record of how and where the permanent monitoring plots were set-up, and how they can be re-established in future surveys.
4. Fieldwork protocols	The Plan details how individual surveys should be conducted, and the field data that can be collected in a full survey or partial assessment.
5. Reporting on the Monitoring Programme	The Plan indicates how the Programme reports can be integrated with other site records and used to inform decision-making.

2. VEGETATION STATES AND TARGET CONDITIONS

2.1 Landscape position and potential vegetation types

Parkers Piece and Bleyswyck's Bank lie in the valley of the Little Ouse River between its southern bank and the upland. Bleyswyck's Bank and the eastern half of Parker's Piece are situated on up to 2 metres of organic mud or peat, which include limited areas of shell marl. The western half of Parker's Piece grades through thinning peats to the sandy upland soils. The whole restoration area lies within a shallow basin bisected by the modern course of the Little Ouse River.

The eastern half of Parker's Piece forms Unit 3 of Blo' Norton and Thelnetham Fen SSSI. This was assessed by Natural England in 2001as being in Favourable Condition, which is the last publicly available assessment[1]. Nonetheless, it was recognised that though the Unit was recovering from prior disturbance the growth of nettle *Urtica dioica* was profuse. In addition, the restoration area lies adjacent to SSSI Units within the Waveney and Little Ouse Valley Fens Special Area of Conservation.

While it is important to acknowledge the potential of the restoration area to contribute to the natural values recognised in the national and European designations, the restoration targets for vegetation recovery, as defined in ***section 2.4***, are unlikely to replicate the existing designated conservation features in undisturbed areas of the SSSI and SAC. Rather, the target conditions are likely to fall within appropriate habitat types, such as open water and rich fen, but to have distinct attributes of recovered, rather than undisturbed habitats. These habitats are also likely to be affected bythe proximity of the restored area to the Little Ouse, where fluctuations in water levels are more pronounced than in areas further away from the river.

2.2 Pre-restoration conditions and potential species composition

Prior to the restoration being conducted, the vegetation assemblages were assessed using standard Phase I Habitat Survey Methodology (ELP 2008). Eight habitat-types were recorded by the survey, and are summarised in ***Table 2***.

From the information given in the table, it is possible to identify a suite of typical and common fen species, which are likely to form the bulk of the target vegetation. ***Table 2*** also provides a list of species that may also occur in low numbers in rich-fen, and perhaps also in reed-fen, but are more commonly associated with grazed fen meadow (including rush pasture). The table also identifies a number of undesirable species, which may be regarded as negative indicators of the target condition. These three types of species are extracted from this table and listed in ***Table 3***.

It should be noted that the Phase I Habitat survey provides a more comprehensive list of species that are commonly associated with rich-fen, reed-fen and rush pasture and were present within or near the restoration area at the time of survey.

[1] Natural England web-site, accessed 19th Octover 2010

The species listed in ***Table 3*** provide an excellent 'first approximation' of the anticipated components of the post-restoration vegetation. In the wettest areas of the restoration design, open water is likely to be colonised by denizens of reed-fen, particularly the tall grasses and plants such as yellow flag-iris. The surrounding areas, with the watertable at or close to the surface, are likely to attract species commonly associated with rich-fen, such as purple loosestrife and wild angelica.

Table 3. Potential target rich-fen, reed-fen and rush pasture species and indicative negative indicator species

Target species	Negative indicators	
Rich-fen/Reed-fen	Rush pasture	Various
Common reed	Marsh thistle	Nettle
Lesser pond sedge	Tufted hair-grass	Cleavers
Greater pond sedge	Rough meadow-grass	Grey willow saplings
Wild Angelica	Soft rush	Elder
Yellow flag-iris	Hard rush	White willow saplings
Purple loosestrife	Yorkshire-fog	Ground ivy
Hemp-agrimony	Common mouse-ear	Hop
Water mint	Silverweed	Bramble
Gypsywort	Creeping buttercup	False oat-grass
Water figwort		Creeping thistle
Greater reedmace		Hemlock
Branched Bur-reed		Hogweed
Lesser water-parsnip		
Jointed rush		
Creeping bent		
Water chickweed		

The left-hand column of ***Table 3*** is therefore likely to include the more desirable common wetland species already present in and near the restoration area and to provide a number of early colonisers of post-restoration ground. In time, it is also likely that these species may make up the bulk of the target vegetation.

The central column of the Table is also useful for identifying where rather drier conditions exist, or where disturbance by trampling is affecting species composition. A further indication of ground conditions provided by this group of species is the potential for rainwater to pond on the ground surface. This can often be picked out in East Anglia by the switch from hard rush to soft rush.

The right-hand column of the Table contains representatives of several species groups, indicating the kind of under-managed, dry fen conditions that the restoration has replaced. Although these species may still form a component of the vegetation of remaining banks and margins, their presence within the remainder of the restoration area would indicate that further intervention is required.

The central and right-hand columns of ***Table 3*** therefore represent suites of non-target species that would not form more than a minor part of a successful restoration of the fen. The table therefore provides a valuable indication of the species expected to form part of the target and non-target floristic composition of the post-restoration fen.

Table 2. Summary of Phase I Habitats, from ELP (2008)

Fen	1.21 ha	Open fen was recorded in the eastern half of Parker's Piece. The sward is tall and rank, being dominated by Common reed, Lesser pond sedge, Greater pond sedge and Nettle. Limited associates included frequent tall fen species of Wild Angelica, Cleavers, Water chickweed and Marsh thistle.
Scrub	0.69 ha	At the southern edge of Parker's Piece, an area of dense Grey willow scrub was recorded, which was supplemented by occasional Elder, Hawthorn and Blackcurrant as well as some White willow standards. The field layer received little light and the sparse vegetation was predominantly Common reed, Common nettle, Ground ivy and Rough meadow-grass. Some shallow depressions were present which were still holding water. In these areas Wood sedge, Yellow flag-iris, Tufted hair-grass and Greater pond sedge were sometimes present. Two other small areas of scrub were recorded in Parker's Piece, both of which consisted of Elder and Grey willow scrub, under which Common nettle, Common reed, Lesser pond sedge, Hop and Bramble were recorded.
Recently felled woodland	0.49 ha	The area has been colonised in places by species such as Smooth meadow-grass, Ground ivy, Greater plantain, Soft rush and Hard rush. This is supplemented by a varied list of associates including wetland species such as Wild angelica, Purple loosestrife, Hemp-agrimony, Water mint and Gypsywort, as well as short ephemerals such as Scented mayweed, Winter-cress, Canadian fleabane, Fat hen and Common chickweed.
Improved grassland	0.45 ha	This sward is dominated by Smooth meadow-grass and Yorkshire-fog, supplemented by Ground ivy, Creeping thistle, Dove's-foot Cranesbill and Common mouse-ear.
Poor semi-improved grassland	1.39 ha	This sward covers a large area of the western part of Parker's Piece, including the floodplain terrace. It is only semi-improved in terms of nutrient enrichment and is dominated by False oat-grass, supplemented by Creeping thistle, Yorkshire-fog, Smooth meadow-grass and Common chickweed.
Marshy grassland	0.04 ha	There is one small area of marshy grassland amongst the semi-improved grassland, in which wetland species such as Lesser pond sedge, Wild angelica, Hemp agrimony and Tufted hair-grass was recorded.
Tall ruderal	-	Along the edge of the Little Ouse, and on the eastern boundary of the site, a tall ruderal community persists which is dominated by Common Nettle, supplemented by species such as Hemlock, Common reed, Creeping thistle, White dead-nettle and Hogweed. It is typically species-poor and of low conservation interest. Where the stand becomes wider, on the northern edge of Bleyswyck's Bank, it contains a greater proportion of wet grassland/marsh species such as Soft rush, Yorkshire-fog, Water figwort and Marsh thistle.
Ditches	-	Several ditches surround and intersect the site which typically contain shallow water dominated by Common reed and Lesser pond sedge. These species are supplemented by Greater reedmace, Yellow flag-iris, Branched Bur-reed, with Lesser water-parsnip and Brooklime. One dry ditch was recorded, which appears to have recently been dug. Vegetation was still establishing over the bare earth of the ditch bed and contained species such as Silverweed, Jointed rush, Creeping bent, Creeping buttercup and White campion.

2.3 Initial post-restoration development

In the early years after the initial restoration, particularly the first five years, plant propagules[2] will colonise the disturbed areas from four potential sources, defined in ***Table 4***. Typically, initial species establishment will largely derive from a combination of within-site sources and highly mobile ephemeral colonists from the surrounding fields.

Table 4. Potential sources of plant propagules

On-site seed-bank	Populations of seeds, spores and the seed-like 'oospores' of stoneworts that can lie dormant in the soil for many years, and germinate when brought to the surface following disturbance.
On-site propagation from plant fragments	Many species are able to regenerate from plant fragments, such as roots and rhizomes. Common reed, for example, would be expected to regenerate very freely from its extensive root system within areas only lightly scraped during the initial restoration.
Adjacent habitats	A proportion of the seed-bank and other propagules from adjacent areas would be expected to arrive in the disturbed areas in the years immediately after earth-moving. They may be blown in by wind or carried on the body of animals. Species would include denizens of all surrounding habitats that are able to seed, including woodland, fenland, open water and grassland habitats.
Regional vectors	The regional species pool able to reach the restored site is likely to be dominated by arable and other ruderal species dependent upon wind-blown seed, though may include representatives from the habitats listed above.

In zones of the restored area subject to shallow scraping, the regeneration of plant fragments, particularly roots, would be anticipated. In this, the vegetation of this zone would go through the early stages of recolonization via the dominant species of the pre-restoration open fen that possess regenerative root systems. These species are likely to include nettle, as well as reed. Early monitoring surveys will be able to determine, for example, whether the shallow scraping had removed nettle roots systems or whether the lowered ground surface has brought the watertable within the root zone of this species and prevented its regeneration. If nettle, or other species of drier fens, is checked by the changed conditions they may subsequently fail through shading by the fen dominants.

Although viable seed is likely to remain in the seed-bank, many fenland species have short-lived seed, and the seed-bank over the shallow scrapes may have been at least partially destroyed by previous disturbances.

In the deeper scrapes, or where the pond has been dug, regeneration from plant fragments is likely to be reduced, and to occur either from deep layers of the original root systems, or from plant fragments left on the surface. In these areas, regeneration from the open fen dominants is likely to be set back. However, buried seed banks may have an opportunity to germinate and the early monitoring surveys will record them. There is the potential for species not recently recorded from

[2] Propagules are regenerative plant organs, such as seeds and rhizomes, that can be transported by various vectors, such as by wind or animal movements.

the site to re-appear. This will be of particular significance if such appearances are restricted to limited areas of the site, either due to particular characters of the substrate, or to the topographical variations introduced in the restoration design.

The contribution from adjacent habitats in the initial post-restoration is difficult to predict. While the seed-rain may prove to be substantial, the ingress of desirable fenland species, which would be included in the target species composition, may be a matter simply of chance. Nonetheless, if such species are able to reach the site during the establishment phase, they may prove to be more successful in establishing viable populations than would be the case once a fen canopy has formed. The initial monitoring surveys of the shallow and deep scraped areas, as well as the pond, are therefore particularly important for identifying that species potentially from this source have arrived.

As with species from buried seed-banks, the appearance of desirable fenland species from adjacent habitats provides a good positive indication of the potential for restoration success.

The contribution of species with mobile seed sources from adjacent and distant locations typically allows for the initial establishment of ruderal species, which subsequently fail. While many of these species succumb to soil wetness and shading, their continued presence may be an indication that ground conditions still favour them, rather than obligate fenland plants, particularly in the shallow scrape areas. Monitoring is therefore an important means to establish whether the initial development of vegetation is following a desirable trajectory towards the target conditions.

Monitoring of the initial post-restoration conditions is therefore particularly important, and the data gathered by each survey needs to inform restoration management. While one function of the fieldwork reports is to interpret the data gathered by these early surveys, it is also important to make recommendations for timely interventions in the management of the site during this colonisation phase. Interventions may simply include changes in the intensity of grazing, or altering the timing of mowing. However, the recognition by the monitoring programme of likely problems in achieving success in restoring the valley fen vegetation may include hydrological or soil compaction issues that are more easily resolved early in the life of the restoration project.

2.4 Vegetation target conditions

After several years following the restoration, it is anticipated that the rate of successful plant colonization will decline markedly as the newly assembled plant communities establish themselves and shade out regeneration gaps. Monitoring would act less as a reactive system to direct the trajectory of vegetation development. Instead, the role of monitoring would be to ensure the maintenance of appropriate environmental conditions and to provide information on changes to vegetation physiognomy (the attributes of vegetation appearance) and floristics (the plant species composition).

Key to both phases is the establishment of vegetation target conditions. These cannot be proscribed in more than general terms as ‘habitat types’ at the start of the restoration project and should be refined through the monitoring reports and project aspirations.

Target conditions need to be set for key environmental conditions, the physiognomy of the vegetation and for its floristic composition:

1. This initial Monitoring Plan reviews the requirements for target conditions as they are known.

2. Subsequent monitoring reports, on the vegetation *per se* and on watertable movements (see ***section 2.4.2***) will enable pragmatic targets to be developed and refined as the restored area develops.

3. In addition, more aspirational targets will evolve in response to potential developments, such as those related to the SAC through the EU Water Framework Directive, or to the potential vegetation associated with East Anglian calcareous valley fens (see ***section 2.4.4***).

2.4.1 Habitat types

The targets for fen restoration are given as habitat types by ELP (2008). They constitute a suite of plant communities which are typically associated with base-rich low nutrient valley fens and are key features already present on the SSSI/SAC. Each habitat type is described in relation to its environmental situation (especially with regard to hydrology), the target plant community and typical species. The habitat-type descriptions provide a valuable approximation of the target conditions. ***Table 5*** gives a summary of the habitat targets set by ELP.

With the exception of the open copse habitat, the development of each of these habitats has been initiated by the groundworks that constitute the 'starting conditions' of fen habitat restoration. Their occurrence is dependent upon the environmental situations that have been created. In the initial colonisation phase, surveys of the monitoring plots will assess the environmental conditions and vegetation characters in terms of these broad-scale targets.

2.4.2 Environmental conditions

In the development of the design for restoring Parkers Piece and Bleyswyck's Bank, measurements were taken of the depth and character of the organic soils and of the depth at which the watertable was located (ELP 2008). The design re-set the hydrological conditions by excavating to different depths within the surficial peats, and two piezometers have been established within the restoration area to monitor movements of the groundwater surface. The vegetation monitoring plots have been located in relation to these installations.

The target hydrological regime for the restored area can only be established once average watertable depths have been calculated from data collected from the piezometers. A target hydrological regime cannot be set for each monitoring plot, and the piezometer readings will act as a proxy regime.

Within the plots themselves, local readings can be taken of the ground wetness at the time of survey. Over much of the restoration area, this will provide a record of previous rainfall conditions and the ability of the ground surface to absorb rainwater. The target ground wetness conditions are for the surface to remain moist throughout the growing season.

2.4.3 Vegetation physiognomy

The appearance of the vegetation is typically assessed by its overall height, ground cover and amount of plant litter and also by the contributions of the types of species of which it is composed, in terms of their canopy layer height and cover. Typically, species groups such as tall, grass-like plants, rushes and bryophytes can be distinguished. These attributes are readily measured and are important in describing each vegetation community. In combination with the floristics of the fen communities (see

section 2.4.4), vegetation physiognomy is a key determinant of community type within the National Vegetation Classification (NVC).

Table 5. Summary habitat targets for fen restoration (ELP 2008)

Habitat-type	Environmental situation	Vegetation-types
Fen Pools	This is the aquatic phase of the fen succession, where the water table is above ground all year, but is not especially deep.	The main species groups are aquatics such as charaphytes and *Utricularia* species and semi-aquatic fen plants such as *Potamogeton coloratus*.
Wet Fen	The water table is characteristically above ground, although it may drop to surface levels in late summer.	Swampy fen should develop, characteristically either a species-rich *Cladium mariscus* community, or bryophyte-rich fen, with a variable range of associates depending upon hydrological and management regimes.
Fen Meadow	Essentially a management variant of species-rich tall herb fens, fen meadows may develop: (1) On slightly elevated peats in more calcareous lower nutrient situations (2) In swampier,higher nutrient situations	(1) Purple moor-grass vegetation (2) Blunt-flowered rush vegetation
Schwingmoor	Floating fen, hovering over a body of watery peat	Associated with several of the above vegetation-types
Open Copse Habitat	On drier ground of the valley floor margin	Shrubby trees with grassy glades.

Depending on the contributions of different species to the overall physiognomy of the fen vegetation, and the intensity of management, monitoring will allow an assessment of three properties:

1. ***The physiognomic trends (and issues)***. Most attributes, such as the presence of a thick plant litter layer, a very thin canopy of reed or the presence of scattered rushes, provide an indication of the potential for a community to change and develop. In most cases, a change in management intervention can be recommended to promote or deflect a physiognomic trend in a desirable direction.

2. ***The potential to attain the target fen communities***. In addition to their distinct floristics, the fen habitat-types summarized in ***Table 5*** possess readily distinguishable physiognomies, which are the product of the hydrological regime, substrate type (fertility) and history of management. This is also true of less desirable fen communities, including the 'open fen' vegetation identified during the production of the fen restoration design. While it may take decades for a community to develop the characters of a target NVC community, the presence

of a developing bryophyte layer, or a canopy of reed, may help distinguish the community as an immature form of the target community and appropriate management recommendations can be developed.

3. ***The tendency to drift away from target conditions***. Some parts of the restored area may support vegetation which consistently displays physiognomic trends that may represent an underlying issue related to the potential for the vegetation to achieve an appropriate target condition. This may be related to an overlying fertile substrate, the tendency of the surface soil to dry out during the growing season, or to some other factor. Here, a specific intervention may be recommended in the monitoring report.

2.4.4 Floristics of fen communities

In addition to the desirable Target Species listed in ***Table 3***, the post-restoration plant communities may also occupy environmental situations not present before the restoration, or include desirable species not recorded from the site by the Phase 1 survey.

In constructing a pond in an area known to be calcium-rich, for example, the restoration is attempting to re-create an area of open water that may not have been present in this part of the valley floor for a long time. It is therefore anticipated that, in both its early and later stages of development, the pond will favour small suites of additional species specifically adapted to these conditions. In the early stages, macro-algae (stoneworts) and aquatic macrophytes (such as pondweeds) may establish from buried propagules or by introductions from populations in the locale. Later, it is possible that calcareous valley fen species may also colonise this area. Saw-sedge and black bog-rush are both included in the SSSI notification.

The list of desirable wetland species may therefore be subject to additions by potential or actual colonisation of parts of the restored area. The addition of calcareous valley fen species to the list of desirable fenland species, such as stoneworts and saw sedge, would seem to be appropriate if it could be demonstrated that the right conditions for such species are present on the site.

In addition to monitoring the floristic composition of the fen communities against desirable fenland species, it is also important to record the presence of undesirable species. These plants may act as indicators of environmental conditions that fall short of the target, of the need for amending the management regime, or of the requirement of a particular management intervention.

The types of species-group relevant in determining the target fenland flora and negative indicators are listed in ***Table 6***. Each group has been referred to elsewhere in this section.

Table 6. Target fenland flora and negative indicators

Target Species (desirable fenland species)	Previously recorded on-site
	Potential contribution from buried propagules
	Potential contribution from off-site
	Potential 'flagship' calcareous valley fen species
Negative indicators	Rush pasture
	Under-management
	Dryland ruderals

3. ESTABLISHING PERMANENT MONITORING PLOTS

3.1 Principles of monitoring design

The technique for monitoring the developing fen vegetation involves establishing a series of permanent plots within the main environmental situations created by implementation of the restoration design.

The total number of plots was determined to provide coverage of the different fen habitats that are expected to develop, and to ensure that the survey protocols (see section 4) can be properly conducted in a single, day-long session. Experience of the intensity of surveying suggests that 6 plots per day is a realistic upper limit.

The size of plots has been established at 10 m x 10 m. The factors determining this decision are:

1. The distribution and density of existing ground features of the restored area, including the disposition of the anticipated restored fen communities.

2. The distribution and density of vegetation patterns within the various fen habitats, including the patterns of response to ground surface features, the varying density of initial vegetation colonisation, shade/light patterns exerted by the dominant canopy within each community, and also the clonal patterns of some developing species.

3. The standard size range of the samples collated by the National Vegetation Classification, with which the developing fen vegetation is likely to be compared.

The location and marking of the permanent plots included consideration of the following:

1. ***The need for typicalness***. Although the size of the plot is designed to reduce the significance of small ground and vegetation features when the baseline survey was conducted, plots were placed in homogeneous areas away from obvious boundaries or atypical areas. When the sampled area itself is a mosaic of distinct vegetation stands, however, the plot is located in such a position that representative proportions of the different stands are included.

2. ***The need for permanence***. Large, treated wooden stakes have been selected that are sunk into the ground and cannot easily be removed.

3. ***The need for relocability***. The tops of the stakes are judged to be above the height of some stands where reed is not anticipated to be the overwhelming dominant, and are painted white. Attention has been paid to a protocol for GPS recording, and the lodging of location data within accessible working literature used in the management of the site.

4. ***Relation to piezometers***. Attention has been made to locating plots in relation to that of the installed piezometers. Where practicable, plots lie along transects across the floodplain, in relation to the primary axis of watertable variation.

5. ***Access for future surveys***. Although the plots are scattered through the restoration area, attention has been paid to the need for future access to the plots, and markers are located in relation to relatively permanent access routes and features.

The design of the plots incorporates an over-riding consideration in managed areas accessible to the public. That is, that disturbance to the actual monitoring plot by the following factors should be minimised:

1. ***Livestock***. The anticipation of management by grazing livestock means that the grouping of posts has been avoided. Groups of posts, by being unusual features and useful rubbing posts, may encourage stock to congregate amongst them.

2. ***Site managers***. Similarly, posts have been located outside of, or on the edge of mowing compartments, where they are more easy to locate, and to avoid.The presence of a group of posts may also alter the management within them.

3. ***Visitors***. Similarly, the posts give away their purpose when disposed in obvious pairs of groups, and may encourage curious visitors to interact with them or even to damage them.

For these reasons, it has been determined that pairs of marker posts set more than 25 metres apart would act to reduce the possibility of disturbance to the monitoring plots themselves. Minor sources of error in reconstructing the plots were thought to outweigh the consequences of disturbance to the representativeness of plots by the factors discussed above.

The actual plot is constructed by stretching a 50 metre tape between the posts. In practice, the height of the posts means that the tape can be held above the canopy of rushes and many fen species, or be drawn through stands of reed. From known lengths along this baseline, the plot is reconstructed at right angles to it.

An estimate has been made of the potential for repeatability in locating the exact plot dimensions. The primary source of error was not in establishing the baseline of the plot, if the tape measure was held taut, but in failing to establish plot sides at right angles. The margin of error is reduced to within acceptable limits using a rigid 1 metre-sided frame on the baseline at the junctions with the plot sides in order to produce a right angle between them. The size of the plot, at 100 m^2, and the sub-sampling technique specified in ***section 4.2.4***, ensure that errors in sampling replication are minimal.

3.2 Method of installation

1. The location of the intended positions of permanent plot markers were established using temporary markers.
2. GPS readings were taken of each permanent marker, and marked on an aerial photograph.
3. Lines were stretched between pairs of the permanent markers, and used to locate the position of two monitoring plot corners along this baseline.
4. The remaining plot corners were established at right-angles to the baseline.
5. GPS readings were taken of each plot corner.
6. A photograph was taken of the monitoring plot from a known permanent marker, viewed along the baseline.

7. A tractor-mounted post-hole borer was aligned over the hole left by the markers used to establish the baseline.
8. Posts of 12 cm diameter and 1.75 m length were inserted to a target depth of 0.75 m and backfilled. Leaving 1 m above ground (***see Figure 1***). The top of each stake was painted white.

Figure 1. Permanent plot marker – example from the Suffolk Sandlings monitoring programme. The post was emplaced during the late spring of 2006, and after 4 years in this environment, a vertical crack is evident. The life of the post would be extended if the top of the post was strapped after installation.

4. MONITORING SURVEY PROTOCOLS

4.1 Monitoring principles

4.1.1 Effective use of the monitoring plots

Each monitoring plot is intended to provide a permanent sample of the type of vegetation it represents. Once established, a plot can be re-visited any number of times over many years and the survey data used to provide both a short-term assessment of that type of vegetation and a long term analysis of the changes it has undergone.

While the monitoring plots have an important function, they occupy only a small proportion of the restoration area. When the fen vegetation has established, the Monitoring Plan strongly recommends that a compartment map is drawn up that divides the restoration area up into clearly recognised units based on the distribution of the main types of fen vegetation. This will allow the monitoring results and all other records, to be co-ordinated. For example, records of all biological finds, management and events occurring in the new excavated pond would provide useful information for interpreting the condition and development of the vegetation being recorded in the monitoring plot. Four other sources of site recording information are also valuable:

1. ***Piezometer readings***. These are taken from the two piezometers and will be an essential tool for interpreting the vegetation monitoring results.

2. ***Management records***. A detailed record of all forms of management affecting the compartments with monitoring plots is also an essential tool for interpreting the monitoring results, and a comparison of the two will allow effective recommendations to be made. Management includes not only livestock grazing and mowing, but also any planned management event, such as clearance of scrub or a stock feeding area.

3. ***Site event records***. While taking many forms, site events, such as flooding episodes, unplanned fires or a guided tour that tramples particular compartments, can have a significant effect on the fen vegetation. When these have been recognised, it is important to note when and in which site units they occurred.

4. ***Biological records***. In addition to the detailed plant records made within the monitoring plots, it is particularly useful if records for 'significant' biological finds include the site units where they were found. An occurrence of a new desirable fenland plant, or the development of a muntjac run across a particular part of the fen are both examples of biological records that would be significant to making assessment of a vegetation stand containing a monitoring plot.

4.1.2 Adherence to fieldwork protocols

Each plot should be sampled according to the protocols established in ***section 4.2***. These protocols are an important aspect of effective and meaningful monitoring. In addition, the range of attributes sampled is selected to produce a source of data for subsequent analysis of a number of potential changes to stand vegetation following management treatments. Lastly, future replication of the vegetation survey can only be informative if the same sampling methods are employed.

The full survey protocol is divided into four fieldwork elements:

1. Re-location of monitoring plots
2. Photographic record
3. Vegetation structural characters
4. Vegetation floristics

Each fieldwork element is described in ***section 4.2***.

4.1.3 Frequency of monitoring surveys

The Monitoring Plan recommends that the full monitoring survey is carried out in each of the first five years of the restoration project. This period is intended to cover the initial post-restoration development of the fen vegetation (***section 2.3***). During these early years of the restoration programme, this frequency of monitoring is required to provide a clear assessment of changes in the vegetation, which may be rapid and somewhat unpredictable. With this information, clear recommendations can be made to maintain or adjust the management regime and to specify additional interventions if these are required.

Beyond this period, it is assumed that a sustainable management programme is in place and that the vegetation has a reduced rate of species turnover, and is not subject to 'weed' problems from aggressive species. The Monitoring Plan then recommends that the intensity of monitoring be reduced. This can be achieved by adopting the 'rapid survey' protocol as an annual information-gathering tool (see ***section 4.1.4***) and reserving the full survey protocol as a periodic, detailed assessment.

4.1.4 Requirements for full and rapid surveys

During the early years of the Monitoring Programme, it is essential that the full survey protocols are observed. The vegetation surveyor should possess strong plant identification skills and be experienced at assessing vegetation physiognomy and floristics. The surveyor should also have a thorough understanding of the potential development trajectories that young fen vegetation may undergo, and the likely environmental and management conditions that may affect this development. This will ensure that, in the early years of the restoration project, sound and practical advice can be given on the most desirable courses of action by the Project Managers.

In subsequent years, the full survey protocol may be regarded as a desirable, but not essential, tool for steering management of the restored area. In particular, the full protocol is required as an effective reporting tool for the periodic assessment of the success of the restoration programme, and the means to undertake comparative analyses of the results of the Vegetation Monitoring Programme.

In its place, assessment of the monitoring plots may be undertaken by a 'rapid survey', employing only part of the survey protocol. The Monitoring Plan recommends this as an annual requirement, regarded as an essential tool for informing management and providing a record of vegetation change and development. While fieldwork element 1 remains essential, the rapid survey can produce a very useful assessment of the vegetation by following fieldwork element 2 in producing a photographic record of the plot. The images provide an effective 'snapshot' of the physiognomic condition and floristic composition of the vegetation. Provided the images are taken from the monitoring plot itself,

the photographs can be compared with those of previous years and are invaluable in supporting management decisions.

4.2 Fieldwork element 1: Re-locating monitoring plots

Sampling should take place at approximately the same stage in the growing season in each of the monitoring years. It is recommended that both full and rapid surveys are planned to occur in July each year, and undertaken at a time in the month determined by the preceding weather conditions. Previous photographic records will provide a guide according to the species that are flowering.

A corollary to this recommendation is the effect of management operations on the appearance of the vegetation. While light grazing would not affect the timing of the surveys, mowing, or extensive trampling, would reduce the effectiveness of the assessment. A 'safe' time of year should therefore be selected and adhered to, though it should be recognised that mid-June to late-August is the stage of the growing season where most information can be gathered.

Plot markers are relocated using ***Map 1*** and the GPS readings given in ***Appendix 1***. Sight-lines between marker posts are checked and cleared of obstruction before monitoring fieldwork[3]. The boundaries of the 10 m x 10 m monitoring plots are re-established to replicate the arrangements shown in ***Appendix 1***. The plot corners should be marked by canes linked by a tape or thin rope. The tops of the canes should be painted or have a brightly coloured ribbon attached, to aid visibility.

4.3 Description of plots

4.3.1 Fieldwork Element 2: Photographic record

Each plot is photographed from a designated corner, typically on the southern side, diagonally across the plot. This is to record the general structure of the plot's vegetation from an oblique angle. See ***Figure 2***. In practice, the photograph should attempt to replicate the bearing and angle of that produced in the first Fieldwork Report of the Monitoring Programme for each plot. Experience has demonstrated that different cameras produce different results, and that the differences between surveys are magnified if the surveyors are of different height. Nonetheless, it is important to ensure that the angle of view from the horizontal produces a photograph that includes not only an oblique view of the vegetation but also captures recognisable features on the skyline.

Four approximately vertical photographs are the taken from areas of representative vegetation, one from each quarter of the plot. Although cameras vary, the standard height should be c.1.5 metre and the photograph taken using outstretched arms. Experience has demonstrated that the height of the shot in fen vegetation is effective in showing not only features on the ground, but also the presence of vegetation layers. See ***Figure 3***. The photographs should attempt to 'focus' on typical patches of ground, and to give an impression of the relative extent of the various canopy covers and extent of plant litter and bare ground in order to record the overall physiognomy of the vegetation. These photographs are an important record of the character of the plot at the time of survey.

[3] In this vegetation, obstructions do not include tall reed, and this caveat is intended to ensure that scrub, in particular, does not block the line of sight between marker posts.

Further photographs may be useful to show particular features or areas of the plot, including 'close-up' shots of mosses or fenland species recorded for the first time in the monitoring plot. Only a few photos are used in the report, but all photos should be stored for future reference.

Figure 2. Plot vegetation physiognomy – viewpoint with an oblique angle

4.3.2 Fieldwork element 3: Vegetation structural characters

In the first Fieldwork Report, the character of the ground surface of the whole plot is described and photographed, to provide a record of the initial conditions. In each subsequent survey, this description should be checked against the current conditions, and any deviation from the initial description noted.

All assessments in this fieldwork element are conducted at 4 sample sites within the monitoring plot and recorded on a Monitoring Plot Field Form (***Table 7***). It is usually practicable to assess each of the four sample locations used to take the vertical photographs (one in each quarter of the plot), and to treat each location as a 1 x 1 metre square[4]. This fieldwork element should be carried out after the photographs have been taken, to avoid taking a picture of trampled vegetation!

The initial test carried out at each sample site is for soil wetness. Pinching the top centimetre of the soil between thumb and forefinger, a subjective assessment is made of soil wetness, using the following scale (all four test assessments have been recorded).

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

[4] This is an approximate area and does not need to be marked out.

All remaining attributes can be regarded as having an average height or cover in the plot.

Figure 3. Plot vegetation physiognomy – viewpoint approximately vertical

Heights are measured from the ground surface to the typical upper surface of the attribute. For example, the reed canopy may vary in height from 175 cm to 190 cm in a sample, but the typical, or median, height may be 180 cm, with a few taller or shorter outliers. The median height of 180 cm would be recorded in the Plot Field Form. When all four reed heights have been assessed and entered, the average (mean) height for the reed canopy layer, rounded to the nearest 5 cm, is then entered in the form.

Cover values are an estimate of the proportion of each 1 x 1 metre sample that is occupied by the attribute. Cover values are given in per cent terms, judged to the nearest 5 per cent. Cover values that are clearly less than 5 per cent can be marked as present only ('+').

This generalised assessment is made by considering each layer in turn and estimating the proportion of the plot covered. This is not a precise measure, but provides a rapid assessment of the relative significance of each layer. For example, bryophyte cover may change markedly between survey years, with high covers having a significant effect in reducing the number of seedlings establishing in that year. Similarly, where seedlings have established, a high bryophyte cover may be beneficial in conserving moisture in the soil root zone during drought periods.

The coverage of the ground surface provides a good example of the cover system For example, when viewed from overhead, the ground surface layer of a sample is judged to be composed of 10 per cent bryophytes, 5 per cent plant litter and 55 per cent (i.e. just over half the sample area) bare ground. The remaining area of the plot is occupied by the plant stems of other vegetation layers. These values for the first sample are entered in the Plot Field Form, followed by the values for the

Table 7. Monitoring Plot Field Form – Vegetation structural characters

Monitoring Plot	
Recorder	
Survey Date	

Character of the ground surface

Soil wetness

Dry, dusty	Dry, firm	Slightly damp	Moist	Wet	Saturated

	ATTRIBUTE		SAMPLE								AVERAGE
			1		2		3		4		
Layer height	Standing water (cm)										
	Plant litter (cm)										
	Woody seedlings (cm)										
	Large sedges / rushes (cm)										
	Reed-like grasses (cm)										
	Woody saplings (cm)										
Cover value	Standing water (%)										
	Trampling (%)										
	Dunging (%)										
	Bare ground (%)										
	Plant litter (%)										
	Bryophytes (%)										
	Woody seedlings (%)										
	Large sedges / rushes (%)										
	Reed-like grasses (%)										
	Woody saplings (%)										

remaining three samples. The average per cent values for bryophytes, plant litter and bare ground are each rounded to the nearest 5 per cent and entered in the form.

It should be noted that the cover value of any one layer is always less than 100 per cent, but that the sum of values given for each layer may add up to more than 100 per cent.

Table 8 lists the attributes to be estimated, usually in terms of both height (i.e. the thickness of the attribute) and cover (shade cast). A note is given defining each attribute or measurement technique.

Table 8. Attributes of the vegetation physiognomy

Standing water	This attribute requires a different approach when measured in the excavated pond and on the fen surface. In the pond, it is the typical depth from the water surface to the top of the (probably very soft) sediment. The cover may be 100 per cent. On the fen surface, the cover may be less than 5 per cent (rainwater collecting in hoof marks). The depth is measured to the nearest centimetre which, if clearly much less than 1 cm, should be recorded as '+'.
Trampling	Plots may vary widely in the proportion covered by obvious hoof prints. The assessment is primarily to distinguish heavily from lightly poached ground. A separate note should be made if heavily trampled areas occur elsewhere in the plot.
Dunging	As above, this is a measure of obvious dunging within the sample sites. A separate note should be made if heavily dunged areas occur elsewhere in the plot.
Bare ground	This is a measure of unvegetated ground that is not covered by plant litter. When viewed at close quarters, it is simply a measure of the proportion of visible bare soil.
Plant litter	This is a measure of the ground surface that is obscured by dead plant material that is thick enough to form a thatch. It does not include lodged or trampled living material. Litter depth should be estimated as the depth of the litter layer down to a subtending mineral or organic soil layer.
Bryophyte canopy	This attribute refers to ground-dwelling mosses and liverworts (rather than those growing on living stems above ground). When viewed at close quarters, the bryophyte cover in different sample locations may vary widely, from absent to over 70 per cent.
Woody seedlings	Young woody seedlings are often unnoticed by general observation, yet are important indicators of vegetation condition. Record woody plants as seedlings if they appear to be two years old or younger, and have not formed branches that cast shade. Cover values are usually '+'.
Large sedges and rushes	The height and cover of large sedges and rush tussocks can be an important structural feature of fenland vegetation. Viewed from above, the cover value is determined by the ground shaded by these plants.
Reed-like grasses	Tall grasses, most commonly reed, often form a canopy above other plants, casting a deep shade. Often too tall to view from above, the canopy is estimated by the shade it casts.
Woody saplings	If ungrazed, woody seedlings more than 2 years old begin to cast shade as they develop into saplings and their cover value is a measure of this.

Cover values and layer heights from each Plot should be collated into a summary form, shown in ***Table 9***.

Table 9. Vegetation Monitoring Plots Summary Form

Site	
Recorder	
Survey Date	

	Monitoring Plot number												
			1		2		3		4		5		6
Layer height	Standing water (cm)												
	Plant litter (cm)												
	Woody seedlings (cm)												
	Large sedges / rushes (cm)												
	Reed-like grasses (cm)												
	Woody saplings (cm)												
Cover value	Standing water (%)												
	Trampling (%)												
	Dunging (%)												
	Bare ground (%)												
	Plant litter (%)												
	Bryophytes (%)												
	Woody seedlings (%)												
	Large sedges / rushes (%)												
	Reed-like grasses (%)												
	Woody saplings (%)												
	Phragmites communis												
	Woody saplings												
	Rushes												
	Sedges and allies												
	Grasses												
	Forbs												
	Bryophytes												
	Other												

4.4 Fieldwork element 4: Floristic sub-sampling

The protocol for recording the species comprising the vegetation is based on their presence or absence within a representative proportion of the plot area. Twenty 1 m x 1 m sub-samples are taken per plot, which equates to 20 per cent of the total plot area. Each square metre quadrat is examined carefully for all plant species, including bryophytes and lichens. Epiphytic bryophytes on plant stems should also be identified. The determination of crust-forming algal species is not required, though their presence should be noted.

The authority for all vascular plants is Stace (1997)[5]; for bryophytes, Hill et al (2008) is the standard reference. Stonewort nomenclature follows John et al (2002) and lichen nomenclature follows Dobson (2005).

The sub-sample records should be entered in the field into a working table, shown in ***Table 10***. The completed Plot Field Forms should be collated into a summary form, shown in ***Table 9***, in the Fieldwork Report. This summary provides an overview of the types of species represented in each plot, and allows a simple form of comparison between plots.

The early Fieldwork Reports should refine the list of Target Species given in ***Table 3***.

[5] The Third Edition of Stace's standard flora was published during 2010. In line with the Botanical Society of the British Isles, it is recommended that this edition is adopted as the standard reference from 1st January 2011.

Table 10. Monitoring Plot Field Form - Floristics

Monitoring Plot	
Recorder	
Survey Date	

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		

5. Reporting on the Vegetation Monitoring Programme

5.1 Fieldwork Reporting

Fieldwork reporting should routinely address four issues:

1. Maintenance of the permanent plot markers;
2. Adherence to the survey protocols described in ***section 4***;
3. Descriptions of the fen vegetation, derived from (a) rapid survey (photographs), or (b) full survey (photographs, physiognomy and floristics);
4. Recommendations regarding the condition of the fen vegetation, the effectiveness of monitoring its development and changing character, and the impact of management and reported events.

The reports are intended to be brief, providing a permanent record of the state of the vegetation and pertinent recommendations for consideration by the LOHP Project (***section 5.2***). This record, if maintained in a standard form, will contribute to a 'rolling programme' of interpretation and provide the raw material for future analysis of the monitoring results (***section 5.3***).

The report should contain a standard Title Page, clearly stating that the report forms part of the Parker's Piece and Bleyswyck's Bank Fen Restoration Vegetation Monitoring Programme. This page should also clearly display the number of the Fieldwork Report sequence, and the year of recording. Contact details should be provided of the Little Ouse Headwaters Project monitoring manager, and the report author.

The report should follow a standard format, including the following details.

5.1.1 Vegetation Monitoring Programme, [current year] Fieldwork Report

Introduction
This section should include a statement of the purpose of the monitoring programme managed by the Project, the function of the fieldwork report, and who has carried it out.

Permanent Monitoring Plots
This section should:
State the purpose and dimensions of the monitoring plots and either confirm they are re-locatable or amend location details. Locations should be reproduced, with a map, in ***Appendix 1***.
Confirm that recommendations raised in previous reports have been adopted.
State any issues surrounding the condition of the permanent plot markers. In particular, it is important to confirm that all posts are present.
Confirm that the plots have been monitored following either the full or rapid survey protocols given in the Monitoring Plan.

Survey results
Photographs and data should be collated as an Appendix 2. The survey results section of the Fieldwork Report should provide a text-based table for each Monitoring Plot, as shown in ***Table 11***. It should be noted that the results from one year are reported in relation to the preceding year's results and to the target condition of the fen vegetation monitored by the plot.

Table 11. Monitoring Plot Report

Plot code	**P-01**
Treatment type	**Summary of preceding Monitoring Plot Report**
	To cover: • Vegetation structure • Floristics • Records and events • Vegetation condition

Vegetation structure [Undertaken for both full and rapid survey protocols.] • Ground conditions • Bare ground / litter / bryophytes • Veg structure • Dunging and trampling
Floristics [Intended for the full protocol, but can include observations from the rapid survey] • Fenland plant species • Rush pasture • poached ground • Arable weeds • Other
Summary of records and events [This section should provide a summary of records and events associated with the areas of fen vegetation monitored by each plot.] • •
Relation to past and target conditions [Provided in general terms following the rapid survey protocol, and more formerly using the full survey protocol.] • •

Fieldwork Report recommendations
Each fieldwork report should include recommendations regarding:

- Management of the Vegetation Monitoring Programme (such as amendments to the survey and reporting methodologies; repair or replacement of the permanent marker posts; timing of the fieldwork survey; appropriate provision of records].
- Condition of the fen vegetation [in relation to progress towards target conditions; amendments to current management and events].
- Additions to the list of target species (see ***Table 3 and 6***) used to characterize the target communities described in ***Table 5***.

It should be stated whether recommendations are directed specifically to the manager of the Monitoring Programme, or are directed to the managers of the Restoration Area itself.

Appendix 1
This appendix should include details of the location and management of the plots.

Appendix 2
This appendix should contain the set of plot photographs and the plot summary form of physiognomic and floristic results (if undertaken). These details are intentionally separated from the main report.

5.2 Management of annual monitoring reports

It is recommended by the Monitoring Plan that surveys are commissioned annually.

- In the first years of the programme, the full survey protocol should be adopted, in order to generate a detailed data set sufficient to provide a firm information-base for decision-making. A key role of these surveys should be to refine and specify the target conditions used to steer annual management recommendations and to formerly assess the progression of the fen vegetation through the periodic reviews.

- In subsequent years, the rapid survey protocol is recommended is the primary form of monitoring. This technique provides a clear 'snapshot' of vegetation development and condition, particularly as each survey is assessed in relation to the ones before and after.

- Further full protocol surveys are recommended at five-yearly intervals. Rapid surveys should be undertaken in the intervening years. In addition to providing a more detailed assessment of vegetation condition and constituting a 'benchmark' for progress of the restoration project, the data gathered by the full protocol surveys will contribute to periodic reviews of the Monitoring Programme (see ***section 5.3***)

The Monitoring Plan recommends that the Fieldwork Reports are reviewed in the autumn, with the intention of accommodating the recommendations within the upcoming work programme. The results and recommendations provided by the reports should be considered under three areas of work:

Vegetation Monitoring Programme. Here, the maintainence and effectiveness of the programme should be reviewed, incorporating recommendations made by the fieldwork report. Of particular importance are the provision of records for the consideration of the surveyor (see ***section 4.1.1***), and ensuring that the plot marker posts are maintained or replaced when required.

Fen restoration management. Here, the results of the survey are intended to demonstrate the changing physiognomy and floristic composition of the fen vegetation. It is important to make full use of the survey results in planning appropriate management. Coupled with a knowledge of previous management and the trajectory of changes, the fieldwork recommendations should provide a transparent mechanism to alter and supplement the management regime.

Restoration Programme Achievements. The Vegetation Monitoring Programme provides a formal mechanism for collating and disseminating progress reports on the results of fen restoration. In addition to the plot data, the drawing in of species records, and relating vegetation development to management practices, provides a solid platform for reporting to the wider community. In particular, the role of periodic reviews should be considered (***section 5.3***) in formal reporting.

5.3 Periodic reviews

In addition to the management of annual monitoring reports, the Fieldwork Reports should be reviewed periodically to make a formal assessment of the progression of the fen vegetation towards the target conditions. In the early years of the project, the targets should be progressively defined in terms of the attributes of the vegetation listed in ***Tables 6 and 7***. Following this process, the Monitoring Plan recommends that Periodic Reviews are conducted every five years. Experience with other programmes suggests that this is best done as part of the commission for a full survey. As with that work, the review should be carried out by an experienced vegetation surveyor (see ***section 4.1.4***), with a good working knowledge of fen vegetation to National Vegetation Classification (NVC) standards.

In a periodic review, summarised forms of photographic and vegetation data should be assembled to form a summative record of the development of each monitoring plot. This would form the basis for analysis. Data analysis, perforce, be rudimentary. Within-plot changes should be assessed for each plot. Between-plot differences should also be systematically identified.

A discussion section should develop the conclusions that can be reached regarding the role of particular species and species assemblages in indicating community development and, where appropriate, the drivers of such changes. It should also highlight the potential significance of identified vegetation changes in relation to restoration management. Discussions of vegetation should refer to the framework for description provided by the NVC, and use as a context the SSSI and SAC valley fen communities.

The report should conclude with a series of justified recommendations regarding future surveillance of the permanent plots. These should be developed following discussion with the LOHP Project, and largely address issues relating to the management of future monitoring.

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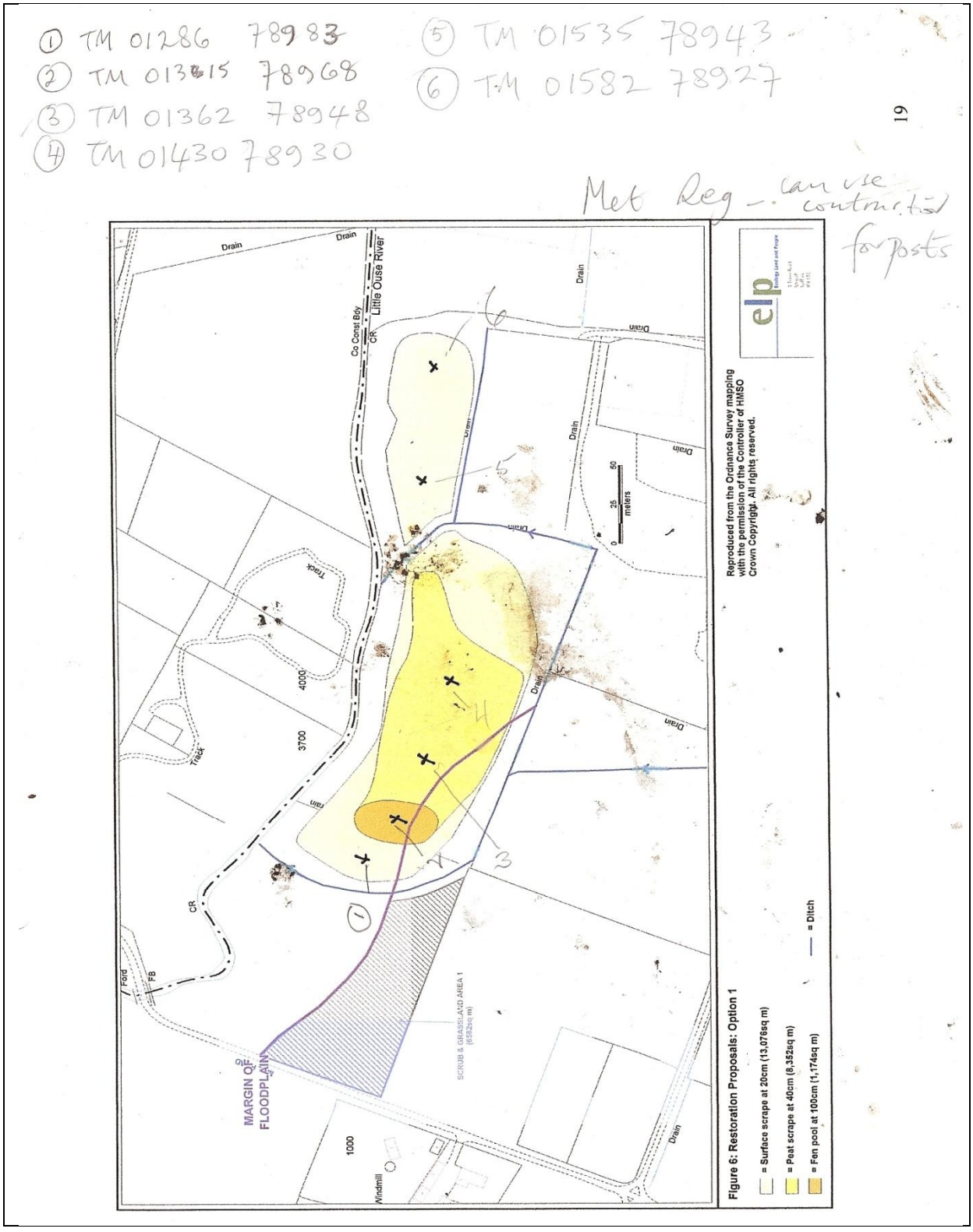
Map 1. Location of permanent markers posts



Appendix 1. DETAILS OF PERMANENT PLOTS

This Appendix should be included in all Fieldwork Reports.

The following table provides a summary of the compartments including management treatments, for which permanent plots have been established.

Information is provided on the following attributes:

Column heading	Explanation
Site	Fen vegetation of Parker's Piece and Bleyswyck's Bank is monitored by 4 and 2 plots respectively. These two sites incorporate the area subject to restoration works during 2008-9. See ***Map 1***.
Treatment area	Plots represent zones of vegetation distinguished by their location within the restoration area, and by their treatment. [Boundaries of different treatment areas should be included on Map 1.]. The LOHP maintains a record of the locations and extent of treatment areas.
Treatment type	A simple description of the type of treatment applied, and the habitat-type. Additional treatments applied to all or any area should also be listed.
Plot code	Code referring to individual permanent monitoring plots forming part of the Vegetation Monitoring Programme.
GPS reading from National Grid 100 km square = TM	Ten figure grid reference of the permanent marker posts, all taken from within the TM 100 km Ordnance Survey grid square. The location of each marker post used to established the monitoring plot location is also recorded photographically (Photos A1P01-A1B02)

SITE	TREATMENT AREA	TREATMENT TYPE	PLOT CODE	POST 1 EASTING	POST 1 NORTHING	POST 2 EASTING	POST 2 NORTHING
Parker's Piece			P-01				
			P-02				
			P-03				
			P-04				

Additional treatments:

P-01	

P-02	

P-03	

P-04	

SITE	TREATMENT AREA	TREATMENT TYPE	PLOT CODE	POST 1 EASTING	POST 1 NORTHING	POST 2 EASTING	POST 2 NORTHING
Bleyswyck's Bank			B-01				
			B-02				

Additional treatments:

B-01	

B-02	

Photo A1-P-01
Photo A1-P-02

Photo A1-P-03

Photo A1-P-04

Photo A1-B-01
Photo A1-B-02