Parkers Piece and Blesywick's Bank

Restoration Proposals

ELP May 2008

On Behalf of the

Little Ouse Headwaters Project

Parkers Piece and Blesywick's Bank

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Contents

1. INTRODUCTION AND AIMS

The Little Ouse Headwaters Project acquired Bleswyicks Bank and Parkers Piece in 2007. The planted woodland on Besywocks Bank was removed, except for a few ash along the southern margin, later that year. The land is shown on Figure 1.

The land has had a mixed management history, including arable cultivation, pig rearing, periods of fallow and most recently tree planting or abandonment. None of these practises benefited the nature conservation interest of the land which was once a part of the Thelnetham and Blo' Norton fens complex. The remaining parts of these fens have been designated SAC and SSSI for their rich-fen communities and range of associated rare fen plants and animals. Parts of Parkers Piece were designated SSSI as buffer land to Middle Fen, in order to protect the hydrological integrity of the site.

The two land parcels have comparatively low conservation value with no SSSI or SAC features and no known plants of conservation interest. The dry sandy and elevated land on Parkers Piece carries rank species-poor grassland, while the low lying peatland has lesser pond sedge and reed communities which are eutrophic and ruderalised. Willow scrub is also present.

In 2003/4, ELP undertook a broadscale topographic and soils survey of the whole upper Little Ouse Valley, including the land which is the subject of restoration proposals. This data was used in the development of current proposals, but was supplemented with more soil coring to improve the targetting of excavations.

The aims of this report are:

1. Identify the fen types which will be the target of restoration works.
2. Present topographic and soils information.
3. Examine available hydrological information.
4. Provide a restoration proposal.
5. Identify a method of work and disposal of arisings which would minimise consenting issues.
6. Identify broad costs.

2. TARGET FEN TYPES

The targets for fen restoration are given below. They are key features already present on the SSSI/SAC adjacent. They constitute a suite of plant communities which are typically associated with base-rich low niutrient valley fens, some associated with groundwater supply, and all species-rich with rare fen plants.

Fen Pools

The aquatic phase of the fen succession, where the water table is above ground all year, but not especially deep. 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 may drop to surface levels in late summer. Swampy fen, characteristically a species-rich *Cladium mariscus* community, should colonise, with a variable range of associates depending upon hydrological and management regimes. In NVC terms this group could include:

S2 *Claidum mariscus* swamp
S24 *Phragmites australis-Pecedanum palustre* fen, especially the *Cladium* sub-community.
S25 *Phragmites australis-Eupatorium cannabinum* fen, the *Cladium mariscus* sub-community.

A second community in this group might form where calcareous groundwater flows laterally through the peat close to or just above the surface. Bryophyte-rich fens of geat species diversity can form in such conditions. Target communities include:

M13 *Schoenus nigricans-Juncus subnodulosus* mire in flushed areas
M9 *Carex rostrata-Calliergon spp* mire in swampier hollows.

Fen Meadow

Essentially a management variant of species rich tall herb fens, the follwing two fen meadows may develop:

M24 *Molinia caerulea-Cirsium dissectum* fen meadow on slightly more elevated peats than the next community, in more calcareous lower nutrient situations.
M22 *Juncus subnodulosus-Cirsium palustre* fen meadow in swampier or wetter, higher nutreint situations.

Other fen communities may also develop but they will not be targeted specifically for restoration.

3. TOPOGRAPHIC AND SOIL DATA

Topography

Topography of the area is shown on Figure 1. The lowest lying land is on Parkers Piece, between 21.75 and 22.0m AOD, and is on average 21.85m AOD. Most of Blesywick's Bank is 22.0-22.25m AOD with a narrow strip along the river higher.

Middle Fen, a component of the SAC with some\ of the best quality M13, M24 and M22 vegetation in Suffolk, is just to the south. The M13/M24 areas to the south of the site are around 22.05m AD although defining an average on this hummock and hollow topography is difficult. The hollows tend toward M13 with the more elevated areas M24, but this is a broad generalisation. To the north, the ground drops to around 21.85m AOD, very similar to Parkers Piece. Species-rich M22 is predominant here.

Ground and surface water drains south-north towards the river, although the topographic map suggests there would be a significant sub-surface down-valley flow which might push water from the Middle Fen area into the low area Parkers Piece.

Soil Survey

3.2.1Methodology

The survey was undertaken on 3rd-4th April 2008 in cool, often bright conditions following a wet early Spring, using a hand-held Dutch Edelmann auger.

Fifty four cores were taken during the survey, with a further nineteen cores available from the previous survey, to give a total of seventy three cores. The locations of sample cores were deliberately evenly spaced in a number of transects to and from the river boundary, and were tied in to the lines taken by the previous survey, so that the existing core locations could readily be incorporated into the current survey. Thirteen transects were thus created to provide coverage of the whole survey area, including the marginal terrace. Core locations were recorded using a GPS reading and are shown on Figure 2.

3.2.2 Results

The current survey confirms the presence of deep peats over much of the survey area, sometimes associated with bodies of silt and local outcrops of shelly and algal marl. Where the base of the peat was proved, it was found to be underlain by a uniform sandy basal layer, which is exposed as the marginal terrace in the southwest corner of Parkers Piece. The modern course of the River Little Ouse forms the northern boundary of the study area, and a shallow bund of mixed peat and sand masks the former land surface next to the river. A sinuous, low-lying belt of recent, gel-like organic material may mark an earlier course of the river, and here the watertable was proved to be at or near the ground surface. Where the eastern part of Parkers Piece contains extensive very wet areas, the western part and Bleyswycks Bank are composed of moderately firm to firm silts, peats and sands.

Core data are presented in Appendix 1. The log also contains unamended details of the relevant 2003-04 cores. Details of all cores are recorded to show the sequence of geological materials from the surface to a depth where basal sands were encountered, or to a maximum of 200 cm below ground level (bgl) where this is not the case. Particular attention was paid to locating different kinds of peat and marl. In practice, the cores taken from the

marginal terrace and from the narrow skirt of thin peats and peaty sands were shallow, sufficient to establish the character of the surficial materials, and to find the depth at which the inorganic substrate prevailed.

Depth measurements are generally considered to be accurate within +/- 1 cm, though in many cases the boundaries between types of peat are diffuse and these measurements should be treated as indicative. The watertable heights were all taken within two minutes of the core being completed and can be regarded as providing a good indication of the relative watertable heights for the time of year, and the antecedent weather conditions. They do not provide an indication, though, of the annual regime of watertable movements, and should only be interpreted with care.

A general classification of all geological materials found is given in Table 1. The order of materials is indicative of the sequences in which they were proved by coring. Materials with a limited distribution in the study area are identified.

Table 1. Field disposition and characters of geological materials

Relative position	Geological material	Field character
Surface	Sandy spoil	In core 11, a body of yellow surficial sand (thickness 48 cm) overlies the peaty sand found elsewhere along the skirtland. It is likely that this is related to ditch clearance in past times, or to an attempt to extend the upland margin onto the valley floor.
Surface	Peaty sandy spoil	This spoil type is restricted to a number of locations near the riparian bank, and is attributed to river clearance operations. While the relative proportions of sand and peat are variable, the material is distinct from the underlying silts (and peats) and often forms a distinct low bund by the river margin. The samples proved a thickness of 16-62 cm.
Surface	Peaty shell Marl	The third material to be recorded only from the soil surface, this marl appears as a peat with shell fragments in the upper part, but the bulk of the materials is a complex of grey shell pieces mixed with sand, some silt, and variable proportions of comminuted peat. This marl is located within the study area in a discrete zone in the south-east corner of Parkers Piece, in a situation near the margin of the wettest and lowest part of the site.
Surface (and buried)	Silt	Although often obscured by riparian spoil, two discrete zones of surficial silt were proved from the eastern part of Parkers Piece, and from a large area of Bleyswycks Bank. In Parkers Piece, the silt was stained a dark grey by the intrusion of comminuted peat, and was largely saturated. In Bleyswycks Bank, the silt was visually of solely inorganic composition, and was typically a yellow grey colour, becoming somewhat darker with depth. Field-testing suggests that the material is largely composed of silt-sized particles, though bands of fine-medium sand are present. The thickness of this material varies markedly from about 10 cm (cores 31 and 45) to over 60 cm (core 24).
Surface and	Earthy peat	On the floodplain, the remaining (non-silt) surface is

buried		mantled by a degraded fen peat, markedly dark-red to black in colour, sometimes with individual sand grains prominent. This earthy material also subtends the silt bodies where they occur. The lower boundary of this peat grades gradually into raw peat at its base, and the depths below surface are only approximate. The consistency of the peat is also greatly affected by the height of the watertable and, it is assumed, by the management history. Much of the peaty material in the western half of Parkers Piece is degraded and structureless, often with no subtending raw peat, which is restricted to the wetter samples such as cores 18 and 19. In the eastern half of Parkers Piece this earthy peat normally gives way to an aqueous solution of degraded fen peat which is included as earthy peat in the log.
Buried	Sand	One of the 2003/4 samples (core 49) taken from the field south of Bleyswycks Bank contains a bed of sand within the peats; this feature was not located within the study area.
Surface and buried	Raw peat – fen, woody and recent peat	The term 'raw peat' refers to three types of much less degraded peat: fen peat, woody peat and recent peat. Coring revealed the presence of all three materials, but their saturated condition, usually beneath the watertable, made extraction of the materials impossible by auger. This was particularly the case along a broad track of the lowest lying ground, where quite firm surface peats overly a watery suspension of fen and woody peats. Recent peat and the watery suspension (affected cores are indicated in the core log) are restricted to the tract of land across the eastern half of Parkers Piece. Fen peat, present to depth in Bleyswycks Bank as a firm material, appears to surround the lowest-lying land and to form the base of the recent peat. Fragments of woody peat was only encountered at depth, though coring indicated that pockets rather than a continuous thick layer is present beneath Bleyswycks bank and the eastern half of Parkers Piece.
Buried	Marl mud	A small body of marl mud was proved from cores 21 and 22 at depth. This whitish, carbonate-rich mud is very distinctive, and appears to mark an area of groundwater upwelling where the basal peats are descending to depth near the floodplain margin.
Surface and buried	Peaty sand	Records for peaty sand represent the area of skirtland where the basal sands descend beneath thickening peat, and are restricted to the western half of Parkers Piece. In this transition zone, cores recorded a material with a variable mixture of peat and sand, but with the latter predominating. Thicknesses of peaty sand vary between 15-46 cm, and often grade sharply into the inorganic basal sand beneath.
Surface and buried	Basal sand	It is assumed that sands underlie the entire study area, either as surficial material at and above the skirtland, or as the floor of the valley peats. In fact, limits to coring meant that the sand was not proved beneath the deeper

		peats. When encountered at depth, this coarse-grained sand was uniformly grey in colour. Core 14 was the sole exception, where a layer of light-grey silty medium sand with small chalk stones was encountered.

3.3 Implications for Fen Restoration

The key materials for fen restoration are:

Earthy peat: This degraded form of peat is unlikely to be suitable for the restoration of fen because of the release of nutrients produced as a result of the mineralization process. The comminuted peat, when wet, is structureless and would form a slurry. Where possible this material should be removed to allow target fen types to re-establish. It is relatively shallow in the low-lying areas of Parkers Piece, but deep along the river margin and in Blesywick's Bank where it was to up to 2m deep, perhaps as a consequence of tree growth.

Raw Peat: this good quality peat is the layer that excavations should target, as it is well structured and likely to be relatively low in nutrients. It would form a suitable substrate for the target fen types.

In the low lying area of Parkers Piece, this raw peat is mostly less than 50cm below ground level (bgl), on average around 30-40cm bgl. This gives a very approximate boundary between the two at 21.50m AOD.

Surface Peaty Shell Marl and Buried Marl Mud. These extremely valuable substrates are highly calcareous and low nutrient and often underlie some of the most valuable target fen types, particularly those including *Cladium mariscus*. They may represent the bottom of old fen pools. They should never be excavated.

The surface layers (**topsoil**, to c.15cm) including the shallow rooting zone is also a cause for concern as this layer often has high concentrations of available nutrients and wholly degraded peat. It should be removed from all areas except those with surface marl.

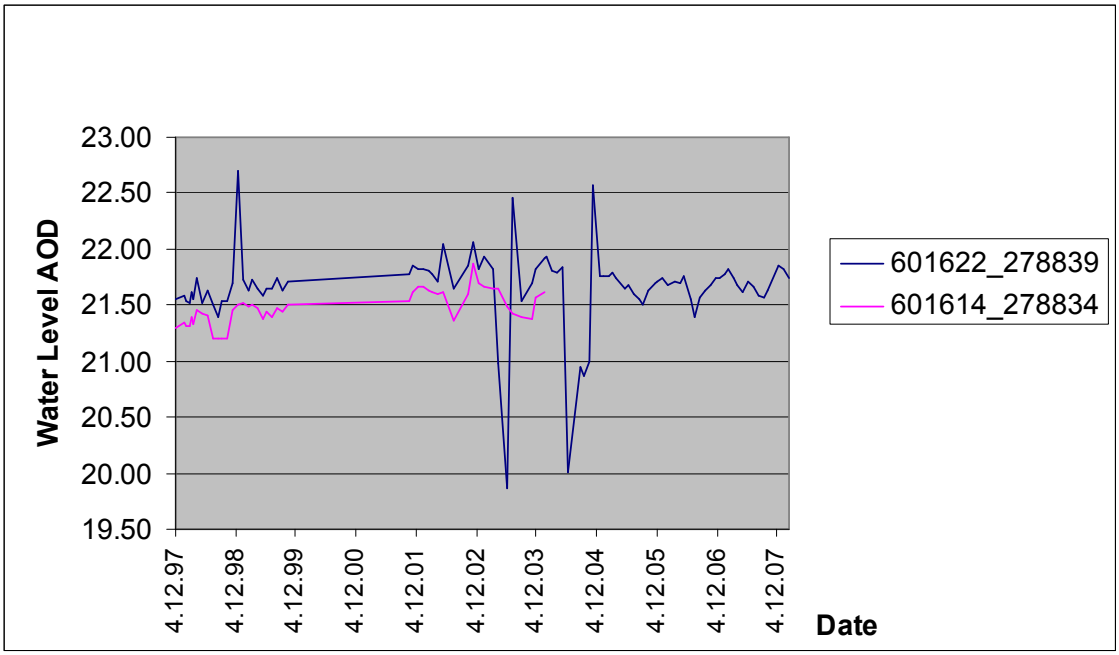
4. HYDROLOGY

Water tables were very high (at surface or within 20cm) in significant areas of the east part of Parkers Piece in mid-April during coring, suggesting these areas would be highly suitable for scraping. Water tables were much lower around the area of the new ditch, on the western area of Parkers Piece and in Blesywick's Bank. This partly reflects topographic levels, but also the possible existence of a former route of the river, or at least a sub-surface water trackway, in the centre-east of Parker's Piece. Cores in this area also frequently had a "watery suspension" (see Appendix 1).

Restoration of target fen types requires a reasonable hydrological regime. There are no dipwells in the site itself but there are dipwells close-by whose levels are read to Ordnance Datum and can therefore be related to the topography of the site. These are shown on Figure 1.

The water monitoring boreholes between Middle Fen and Blesywick's Bank consist of a pair of piezometers presumably reading different components of the water table. Data is shown in Figure 3.

Figure 3 : Groundwater Levels Between Middle Fen and Blesywicks Bank. Data courtesy of Environment Agency.



It is assumed that the blue line is the upper superficial groundwater table, the pink line the lower groundwater table which could be either chalk or drift sands and gravels – the precise unit is not currently known. The two units have very similar levels. Water levels in the upper unit vary between 21.50m AOD and around 21.80m AOD, with a mean summer level

(between April and September inclusive) calculated at 21.53m AOD for the recording period. The lower pink line has a mean summer level of 21.42m AOD.

The dipwells are close to the eastern part of Parker's Piece and at around the same topographic level and in similar substrates. It is assumed they provide a reasonable representation of the groundwater levels in Parkers Piece.

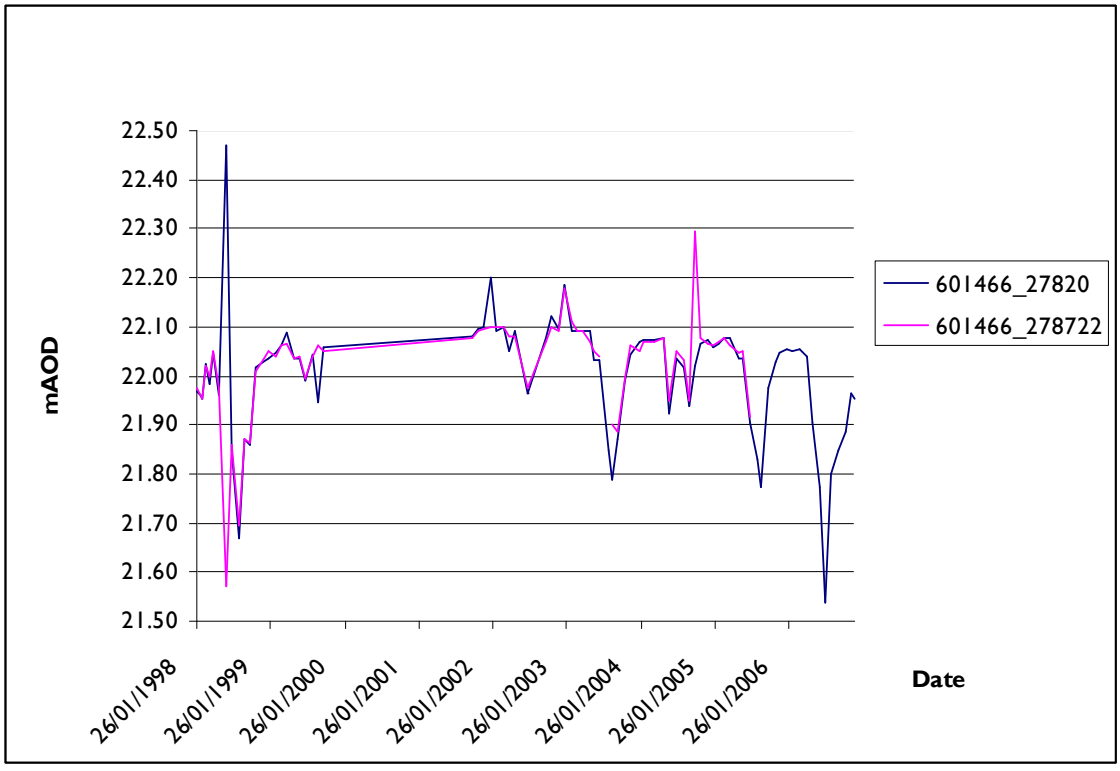
The mean summer level of 21.53m AOD ties in surprisingly closely with the boundary between the degraded and raw peats described above, at 21.50m AOD. Any peat above the mean summer water table appears to have mineralised.

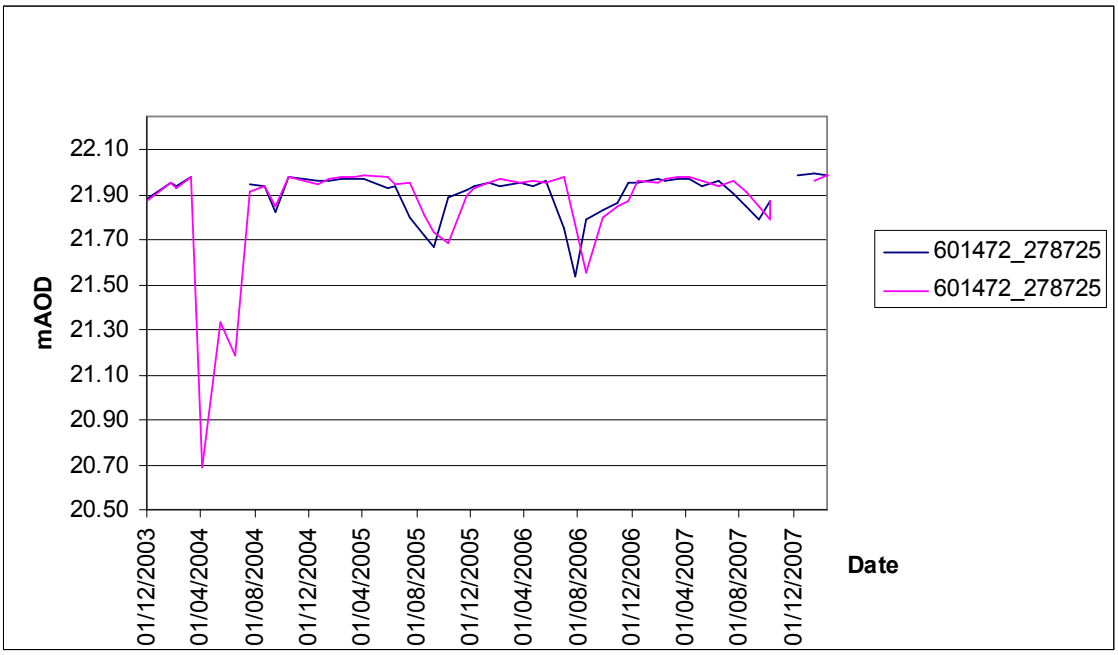
Taken together, the data suggests that scraping away the rotted surface peat would provide a water table at surface level on raw peat.

Figure 4 shows the data from two sets of paired peizometers in close proximity in the M13/M24 fen at the south side of Middle Fen. This area is thought to be supplied by calcareous ground water. The ground is thought to vary around a mean level of 22.05m AOD.

The first pair shown in Figure 4 have an average water level of around 22.05m AOD, at ground level. The groundwater here is around 30cm higher than the previous levels. The two boreholes have more or less co-incident water levels, with sharp drops in most years in later summer, around 20-30cm.

Figure 4 : Paired Piezometer Readings for the M13/M24 Areas In Middle Fen





The second pair of boreholes have a mean level of around 21.95m AOD, a little lower than the previous pair. They too are coincident, although there is a very clear lag between the two, suggesting the two are recording different groundwater units.

Comparison of Figures 3 and 4 suggest a declining groundwater slope from north to south, consistent with a progression towards the river which is the base drainage line.

The central part of the project site is a little closer to the river and may therefore have a slightly lower groundwater table than that indicated by Figure 3.

5. RESTORATION PROPOSALS

5.1 Parameters and Constraints

The brief from LOHP was to restore not less than 1.6 ha as part of the proposals.

The work should take place to the east of the new ditch diversion. This excludes the shallow peats and sandy ground to the west of Parkers Piece.

Material should be disposed of outside of the boundary of the floodplain as determined by the Environment Agency (shown on Figure 5, re-drawn from maps on the EA website) in order to minimise concerns regarding EA consents.

Note that excavations in the floodplain that do not fill naturally with water (except in times of flood) constitutes an *increase* in flood storage. This can be balanced against decreases in flood storage brought about by deposition of material elsewhere in the floodplain. Only ground which is excavated below the mean groundwater table, where soil is expected to be replaced with groundwater and therefore unavailable to store flood water, is flood storage neutral.

5.2 Scraping Options

The following scraping is recommended, achieving 2.48ha of restored fen.

5.2.1 Surface Scraping

It is proposed to scrape the whole of the area bounded by the outer line on Figure 5 by 20cm including surface litter and tree roots. This extends over most of the site except the edges or the area where there is surface marl. It is 1.53 ha in extent.

On Parkers Piece, this would bring the surface to around 21.65m AOD, around 15cm above the mean summer water table. It is expected that fen meadow target fen types (M22 and M24) could recolonise on these areas, depending on actual water table level in the summer and the nutrient status of the substrate.

This excavation represents an increase in flood storage because it will be above the natural groundwater table and will not be permanently flooded.

The area of Blesywick's Bank is likely to yield the poorest result because of the depth of rotted peat and the proximity to the river. If budgets are tight, this would be the area to delete from the project.

5.2.2 Peat Scrape

The aim of this excavation is to remove the degraded peat and to produce conditions suitable for wet fen types.

Scraping of all of the degraded peat within the zone indicated on Figure 5 should be undertaken. The target depth of scraping is 50cm; an additional 30cm in addition to the surface scraping should therefore be removed. This area is 0.83ha in extent.

This would bring average marsh level down to 21.35mAOD, creating wet fen suitable for *Cladium*-rich communities S2, S24 and S25.

For the purposes of calculations relating to changes in flood storage, it is assumed that the material between surface level (21.85m) and the average water table level (21.53m) is extra flood storage, a depth of 0.32m.

5.2.3 Fen Pool Scrape

A deeper area of excavation (total depth of 1m) targets the buried marl layer and is intended to form fen pool habitat. During excavation, if marl is encountered, excavation should stop.

This area is likely to a summer water level 68cm above the base of the pool. It is 0.12 ha in size.

5.3 Disposal

Material that is excavated will bulk-up by around 50%, representing air within the broken-up materials. This will resettle to its in-situ volume relatively rapidly.

The organic material scraped from the first 20cm has very little mineral material and therefore will rot down to a relatively small fraction of its original volume. For calculation purposes, 25% is used in Table 2.

The peat, also essentially an organic material, will also degrade significantly as it is mineralised at the disposal site. As the material from the 50cm scrape is essentially already degraded it is assumed it will settle to a volume equivalent to the in-situ volume.

Material excavated from the fen pool will be raw peat and will mineralise to half its in-situ volume.

These assumptions produce the quantities of material to be disposed of identified in Table 2.

Table 2 : Peat Quantities For Excavation and Disposal

Layer	**Area (m^2)**	**Depth (m)**	**In-situ Volume (m^3)**	**Deposition Volume (volume after disposal and settlement) m^3**
Surface	15,330	0.2	3066	766.5
Peat Scrape	8,288	0.5	4144	4144
Fen Pool Scrape	1,165	1	1165	582.5
Total	**24,783**		**8,375**	**5,493**

Quantities determined in the fourth column *In-situ volume* are used to calculated the approximate cost of the work.

The last column indicates the volume of the material once it has been fully degraded. It represents the *permanent* disposal volume.

Two areas for disposal have been identified at the west end of Parkers Piece. They are both west of the new ditch so that any exudant from the piles of peat does not enter the new scrapes[1]. The southern Disposal Area 1 is outside of the floodplain. It is the ideal disposal area from a flood defence viewpoint. If of all material was deposited here the raising of land level may have landscape and therefore planning issues. If so, some of the material could be deposited north of the floodplain line in Disposal Area 2. Although it would remove flood storage capacity, this should be acceptable as long as the deposition volume did not exceed the flood capacity gain from the excavations themselves.

The settled volume for disposal is around 5,500m^3. Disposal Area 1 is approximately 0.75ha. If it were all disposed on this land, it would create a layer 0.73m deep. Once grassed over, this would not be a significant intrusion on the landscape.

Disposal Area 2 is approximately equal in size. Using this whole area would create a layer around 0.35m deep.

This would deposit 2,750m^3 on the floodplain but this is more than compensated for by the excavation from the scrapes themselves.

5.4 Increase In Flood Storage

The following indicates the increase in flood storage associated with each scrape:

Surface:	0.2m
Peat Scrape	0.32m
Fen Pool	0.32m

Total volume of extra capacity would be 6091m^3, greatly exceeding any quantity likely to be re-deposited on the floodplain.

[1] Note however that none of the scrapes at Redgrave and Lopham Fen or at Blo' Norton appear to suffer from eutrophication due to discharge of nutrient from the adjacent bunds.

6. COSTS

The following costs are predicated upon a four year project period, with the main capital works taking place in year one, with three years of aftercare management.

The restoration proposals require at least double handling and movement to a disposal site.

Costs have been based on £5/m^3 for material in-situ. This produced a total excavation cost of £41,875.

The disposal site will need treatment – levelling and reseeding, and then subsequent management to establish a sward and prevent inundation by ruderals. For a five year period costs have been estimated as:

Levelling after 12 months:	£750.
Reseeding:	£300
Cutting, twice/year for 3 years, no removal of arisings:	£1800
Total	**£2850**

It is expected that the scraped areas would need no management for the first 4 years except removal of scrub and occasional and patchy cutting of ruderals. The scale of work would be achievable by volunteers (subject to other commitments on the LOHP land), but if this was to be undertaken by contractors, an allowance of £500/yr or £2,000 total should be made.

Appendix 1 : Soil Cores

Core no.		Sandy spoil	Peaty sandy spoil	Peaty shell marl	Silt	Earthy peat	Sand	Raw peat	Marl mud	Peaty sand	Basal sand	Water table	Watery suspension
Cores given in red are those taken from the 2003/4 survey													
5											0		
4											0		
1											0		
2											0		
3										0	46	84	
3										0	36		
4						0				23	45		
5										0	44		
6										0	34		
12											0		
11											0		
10											0		
9						0				22	42		
8										0	33		
7						0					104	61	
13											0		
14						0					49	39	
15						0					67	39	
16						0				52	67	46	

Core no.		Sandy spoil	Peaty sandy spoil	Peaty shell marl	Silt	Earthy peat	Sand	Raw peat	Marl mud	Peaty sand	Basal sand	Water table	Watery suspension
Cores given in red are those taken from the 2003/4 survey													
17						0				72	77	35	
19						0		74			122	40	
13						0		50			108	23	
18						0		53			85	37	
14			0			19		34			100	39	
11		0								48	94		
12						0		40			74	29	
20						0		41			137	23	
21						0		38	115		140	22	
22						0		39	116		142	29	
23						0		43			191	31	
24					0	63		79				63	
29						0		34				10	
28						0		37				12	
27						0		36				15	
26						0		28				17	x
25					0	52						52	x
26						0		51			108	20	
25						0		64			114	9	
35						0						4	x
34						0						2	x

Core no.		Sandy spoil	Peaty sandy spoil	Peaty shell marl	Silt	Earthy peat	Sand	Raw peat	Marl mud	Peaty sand	Basal sand	Water table	Watery suspension
Cores given in red are those taken from the 2003/4 survey													
33						0						7	x
32					0	42		47				19	x
24								0				9	
31					0	10		25				20	x
30						0						43	
40				0		27		39				5	x
39								0				11	x
38								0				14	x
37						0		40				17	x
36						0						29	x
32								0				0	
33								0				0	
41				0				145				4	x
34				0				32				21	
42						0		20				12	x
35						0		36				25	
43						0						56	x
36			0		16			60				39	
46						0						25	x
45					0	11						33	x
44			0		42	62						69	x

Core no.		Sandy spoil	Peaty sandy spoil	Peaty shell marl	Silt	Earthy peat	Sand	Raw peat	Marl mud	Peaty sand	Basal sand	Water table	Watery suspension
Cores given in red are those taken from the 2003/4 survey													
47						0						27	x
48					0	37						26	x
49			0		51	69						66	x
52						0						27	x
51					0	37						25	x
50			0		54	86						65	x
50						0		42				44	
49						0	27	48				31	
48			0		17			51				32	
53					0	36		53				26	
47			0		41			81				85	
54			0		62	101						65	x

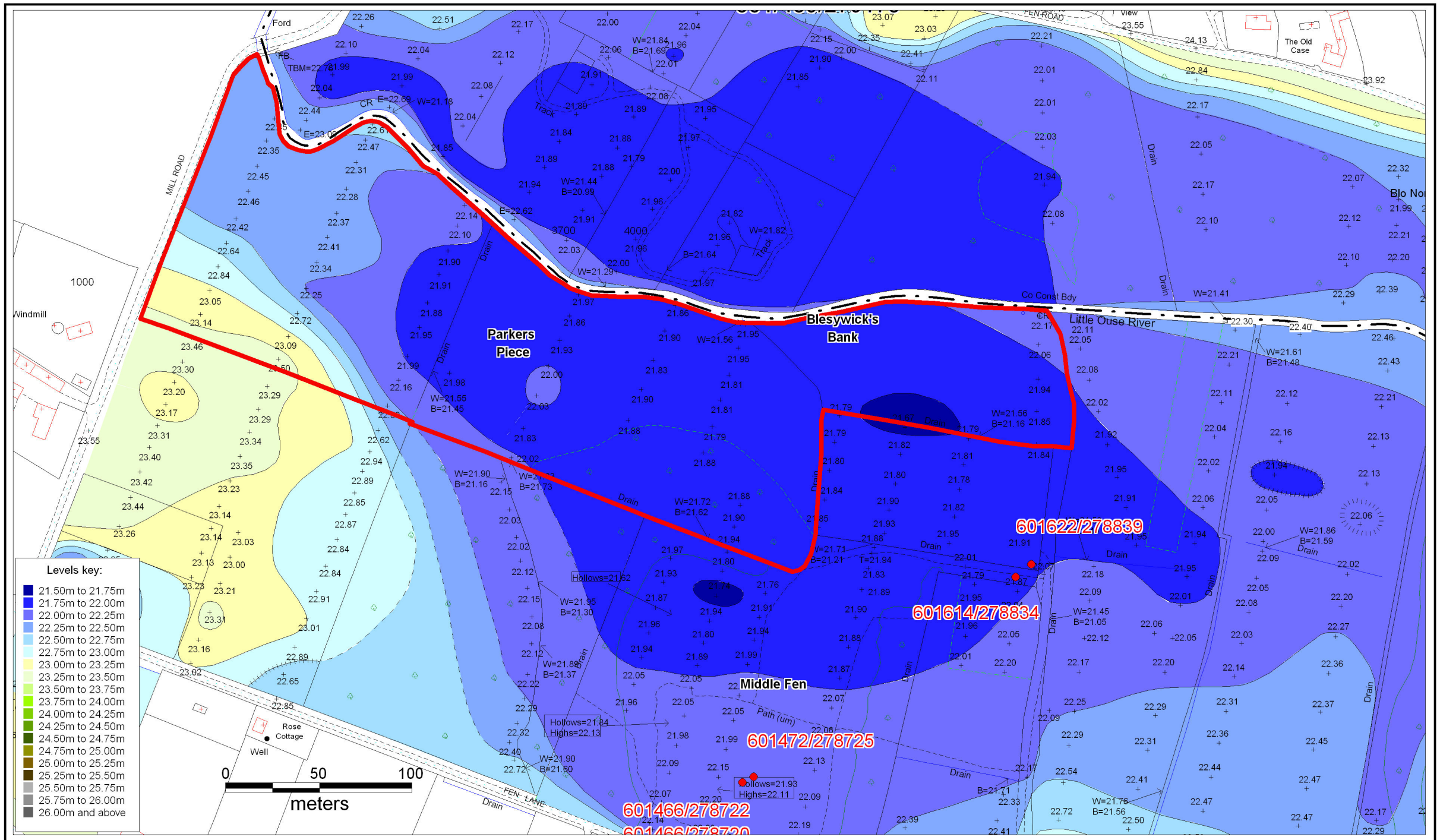


Figure 1: Project Area, Location of Water Monitoring Boreholes and Topographic Levels.

= Groundwater monitoring borehole

= Project area

All levels to Ordnance Datum

elp Ecology Land and People
3 Tokio Road
Ipswich
Suffolk
IP4 5BE

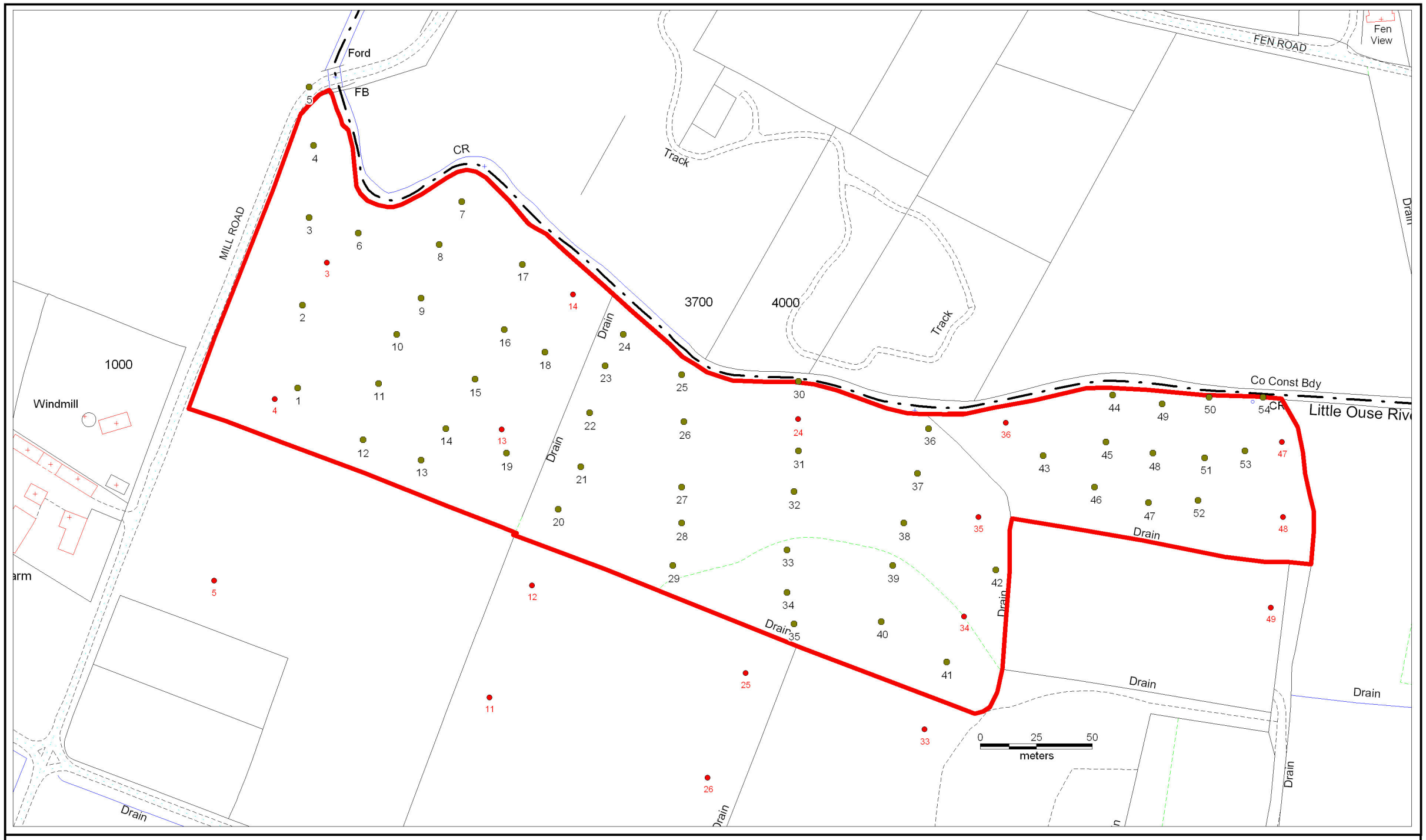


Figure 2: Location of Soil Cores

= 2003/4 Soil Core

= 2008 Soil Core

= Project Area

elp Ecology Land and People
3 Tokio Road
Ipswich
Suffolk
IP4 5BE

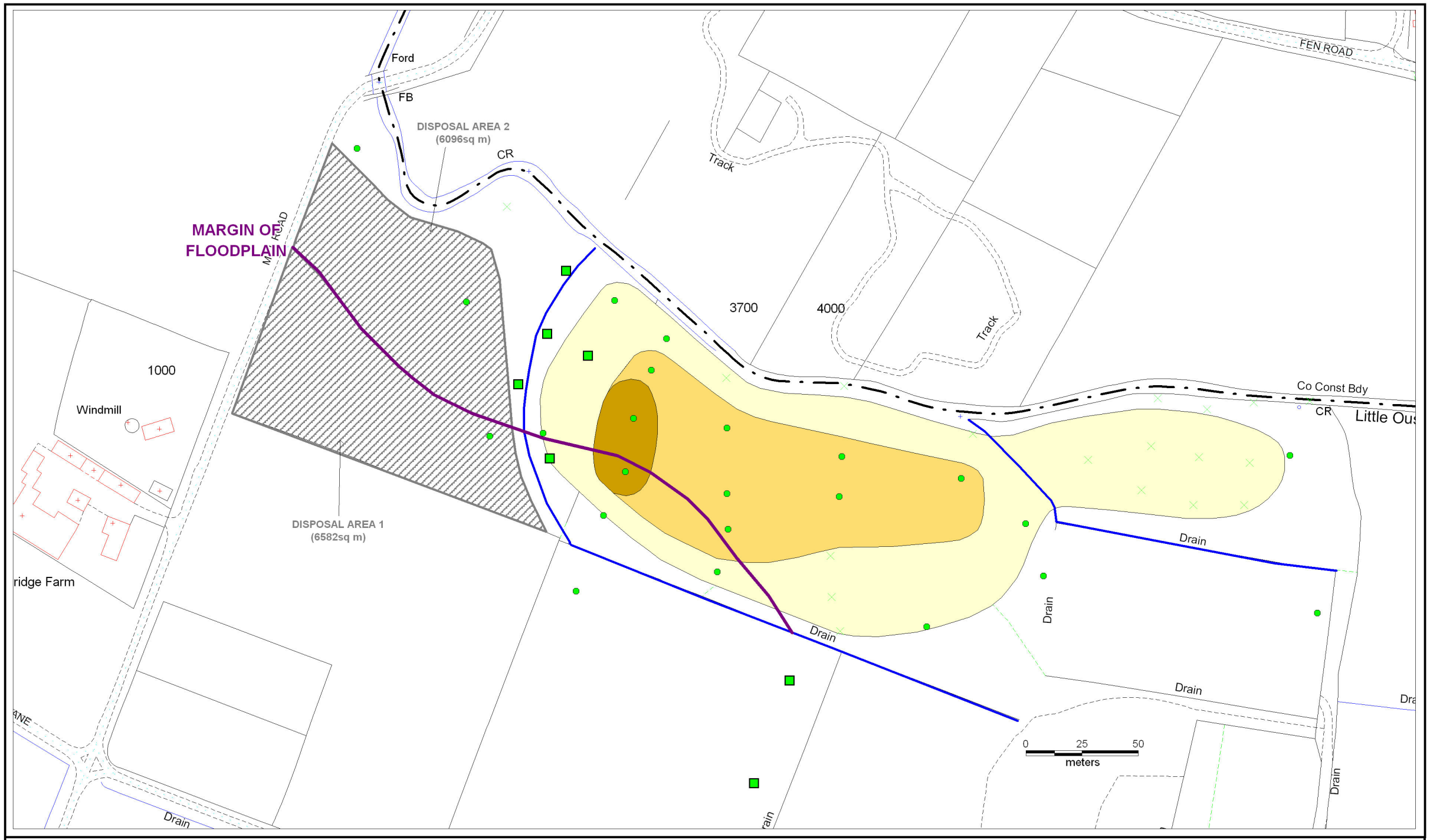


Figure 5: Restoration Proposals

- = Old soil core
- = 2008 soil core
- = Depth of earthy peat <50cm
- = Depth of earthy peat <1m
- = Depth of earthy peat & slurry >1m, c.2m
- = Ditch
- = Surface scrape at 20cm (15,330sq m)
- = Peat scrape at 50cm (8,288sq m)
- = Fen pool at 100cm (1,165sq m)

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