Landscape Evolution in the Middle Thames Valley
Heathrow Terminal 5 Excavations Volume 2

Charred and Waterlogged Plant Remains

(Section 14)

by Wendy Carruthers

SECTION 14

CHARRED AND WATERLOGGED PLANT REMAINS

by Wendy Carruthers

Contents

Figures (on separate Excel files)

Tables

CHARRED AND WATERLOGGED PLANT REMAINS FROM MESOLITHIC/NEOLITHIC TO LATE NEOLITHIC/EARLY BRONZE AGE CONTEXTS

Evidence for major alterations to the landscape during this period comes primarily from the construction of monuments such as the Stanwell Cursus, and the C2 and C3 cursus. This began shortly after the 'Elm Decline', with the Stanwell Cursus ditches probably being dug around 3600-3300 BC (Framework Assessment Document 95008.01). Pollen (*CD Section 16*) and mollusc (*CD Section 18*) evidence from the cursus ditch showed that woodland had probably already been cleared for some time before construction, and that grassland dominated the landscape at the time of ditch infilling. Alder carr and lime/hazel/pine woods grew in the vicinity of the monuments. The pollen evidence suggested that cereal cultivation may have been taking place close to the sampling point. Alternatively, if cereal-based foods or processed grain were being brought to the site for ritual purposes, cereal pollen could have been brought in on food offerings or feasting material.

Unfortunately, from a plant macrofossil point of view, very few deposits were available for sampling and, where samples were taken, the flots were found to contain very few charred or waterlogged plant remains. The state of preservation of the few charred plant remains present was particularly poor, as described below, presenting problems in identification. There was also evidence from the radiocarbon results that contamination had occurred in some areas.

Of the 15 samples dated to this period that were assessed, six samples from PSH02, TEC05 and Bedfont Court (BCU02) were selected for full analysis.

sample	context	feature	Feature type	Waterlogged/charred plant remains
20006	807015	Tufa layer	Probably Mesolithic/Neolithic tufa layer	WL
20000	802008	Peat layer	Probably prehistoric	WL
16056	558059	558057	E. Neolithic treethrow	CH
17090	527224	527233	E. Neolithic gully	ch
29113	833073	833067	Late Neolithic pit	WL
15506	541015	529313	L.Neo/EBA ditch	ch

ch = 11-40 frags; CH = >40 frags

Results

The charred and waterlogged plant remains recovered from the samples are listed in Table 1. Nomenclature and most of the habitat information follows Stace (1997). Other texts used for habitat information and details of plant ecology were Ellenberg (1988) and Hill *et al* (1999).

Discussion

I. Bedfont Court (BCU 02)

Tufa layer 807015, sample 20006 – probably Mesolithic/Neolithic

The presence of tufa and frequent stonewort algae oospores (Characeae) in this sample indicated that a calcium-rich, fenland habitat had existed along the river valley. The plant remains suggested that areas of open, slow-flowing to still water existed, supporting aquatic and semi-aquatic plants such as yellow water-lily (*Nuphar lutea*), pondweed (*Potamogeton* sp.), crowfoot buttercups (*Ranunculus* subg. *Batrachium*), common club rush (*Schoenoplectus lacustris*) and bogbean (*Menyanthes trifoliata*). The only evidence of woody taxa was a couple of elderberry seeds (*Sambucus nigra*). These and the presence of a few fat hen (*Chenopodium album*) and stinging nettle (*Urtica dioica*) seeds may indicate some human disturbance or nutrient enrichment by grazing animals. Thistles (*Cirsium/Carduus* sp.), buttercups (*Ranunculus repens/acris/bulbosus*) and sedges (*Carex* spp.) were growing in slightly drier areas of marsh or damp grassland.

Peat deposit 802008, sample 20000 – probably prehistoric

Woody material was more in evidence in the peat deposit, including twigs, leaf fragments and a few alder (*Alnus glutinosa*) seeds and catkins. The presence of aquatics such as horned pond weed (*Zannichellia palustris*), narrow-leaved water parsnip (*Berula erecta*) and celery-leaved buttercup (*Ranunculus sceleratus*) indicated that fenland conditions existed, since these taxa prefer more alkaline conditions. Wetland taxa such as branched bur-reed (*Sparganium erectum*), sweet-grass (*Glyceria* sp.) and fool's watercress (*Apium nodiflorum*) are characteristic of reed swamps with slow-flowing water, such as occur along streams (Ellenburg, 1988). Sedge nutlets (*Carex* spp.) were also frequent in this sample. The peat probably accumulated, therefore, as a flood plain fen peat, in an environment consisting of some alder carr, areas of more-open sedge swamp with reed beds, and some areas of drier land where buttercups, stinging nettles, brambles, docks and chickweed were growing. This latter group of plants is often found in places where there has been disturbance and enrichment of the soil.

As with the previous sample, although the numbers of the disturbed ground taxa were not large, the taxa could derive from small areas of disturbance by humans or animals. The frequency of woody material, in particular alder remains, suggests that the peat could date from the Neolithic up to the Middle Iron Age Periods, since alder carr persisted in the valley bottom for this length of time.

II. PSH 02

Charred plant remains from 3 features – Early Neolithic to Late Neolithic/Early Bronze Age

Bulk (40 litres) soil samples were taken from three dry features in the central area of PSH02, close to the Stanwell Cursus (Cursus C1). The features included an Early Neolithic gully, 527233 (sample 17090, context 527224), an Early Neolithic treethrow hollow 558057 (sample 16056, context 558059) and a LN/EBA ditch 529313 (sample 15506, fill 541015). Sample 15506 was located at the southern end of the excavated section, near the shallowest area of ditch.

In all cases only small quantities of very poorly preserved charred plant remains were recovered. The cereal grains and hazelnut shell fragments were eroded, fragmented, and impregnated with minerals. Where identifiable, some of the charred plant remains gave cause for concern, since a stinking chamomile (*Anthemis cotula*) seed was present in sample 15506. Stinking chamomile has only been recovered from Bronze Age and later deposits in the British Isles, and is thought to be associated with the cultivation of spelt wheat and bread-type wheat on heavier clay soils (Jones, 1981). In addition, the presence of frequent modern uncharred seeds (particularly in sample 17090), slaggy material and coal in the flots demonstrated that modern material had become incorporated into the archaeological deposits. Since the charred cereals from both samples were unusually biased towards free-threshing bread-type wheat (*Triticum aestivum*-type), albeit in small numbers, it was considered to be important to submit one of these grains for C14 dating. A well-preserved grain of bread-type wheat from sample 17090 was accelerator dated to 1185-1275 cal. AD (Wk18580, NZA-25144) demonstrating that contamination had taken place.

Because of the scarcity of sites of this period, and the fact that early sites tend to produce very few charred plant remains, the status of bread-type wheat in the Neolithic and EBA is still poorly understood. Occasional free-threshing-type wheat grains are fairly common on Neolithic and Early Bronze Age sites, but chaff is scarce and emmer wheat, hulled and naked barley tend to be dominant numerically. A few sites have produced larger quantities of free-threshing wheat grains (e.g. Hazleton long cairn, Straker, 1990; Balbridie, Grampian, Fairweather & Ralston, 1993). Because these are either ritual in nature or have been preserved in catastrophic fires, it is likely that free-threshing wheats are probably very much under-represented in more commonly occurring, domestic waste-type assemblages. Ritual burnings and catastrophic fires tend to preserve high-status, highly valued food remains or materials that rarely become preserved as a result of day-to-day activities such as crop cleaning and food preparation. However, since a medieval date was recovered from the bread-type wheat grain in sample 17090, all of the charred material must remain suspect, even though some of it (particularly the hulled wheat chaff) may have been more ancient.

The assemblage in sample 16056 was more typical of early prehistoric contexts, comprising primarily hazelnut shell fragments (*Corylus avellana*) with a few emmer/spelt wheat (*Triticum dicoccum/spelta*) grains. This sample came from a charcoal-rich deposit in the top of the treethrow hollow, which also contained Neolithic pot and a flint blade. Perhaps it represents the remains of a cooking fire, in which case it demonstrates that both wild and cultivated plants were being exploited.

III. TEC 05

Late Neolithic pit fill

A poorly preserved sample from the fill of pit 833067 (sample 29113, context 833073) produced a small assemblage that primarily contained waterlogged hazelnut shell fragments. The few other identifiable remains comprised some weeds of disturbed and nutrient-enriched soils, such as nettles (*Urtica dioica* and *U. urens*) and fat hen *(Chenopodium album*), and a small fragment that was probably from a sloe stone (*Prunus* sp.). These remains lend further support to the suggestion that wild, gathered foods were important to the occupants of the site throughout the Neolithic period. They also suggest that the degree of disturbance of the local environment was sufficient to encourage nutrient-loving plants to become established in some areas.

Summary

At Bedfont Court the undated prehistoric deposits associated with the palaeochannel suggested the transition of fenland into reedswamp and alder carr, with possible slight evidence for human disturbance.

It is difficult to draw general conclusions about the Neolithic to Early Bronze Age environment and economy at PSH02 and TEC05, since the charred and waterlogged plant macrofossil assemblages from these few samples were poorly preserved and contaminated, and they mainly relate to conditions in the immediate vicinity of specific features. In addition, the features were scattered widely across the excavated area. Scant evidence for the possible use of barley and emmer/spelt wheat (most likely emmer) was recovered from features close to the Stanwell Cursus, but this could represent cereals brought onto site to be burnt for ritual purposes, or as provisions, rather than locally grown crops. The recovery of both charred and waterlogged hazelnut shell fragments and a possible sloe stone fragment from two features located away from the cursus demonstrates that wild food resources were still important. Clearly, sufficient woodland margins, or clearings within woodland, existed in the area to enable shrubs such as hazel, sloe, elderberry and blackberries to flower and produce nuts and fruits.

CHARRED AND WATERLOGGED PLANT REMAINS FROM THE MIDDLE BRONZE AGE TO LATE BRONZE AGE/EARLY IRON AGE DEPOSITS

Fifty-five samples from mainly MBA (including a few MBA or LBA) ditches, pits and waterholes were analysed, as listed in Table 2. In addition, four LBA samples are listed in Table 3.

Methods

The fifty-nine samples included in this report were selected from around a hundred and twenty samples of this period assessed by the author during the excavations. Both charred and waterlogged plant macrofossil preservation were often not as good as at Perryoaks (Carruthers 2006) and there was some evidence to suggest that waterlogged remains in the PSH02 and TEC 05 samples had deteriorated over the two to four years of storage. However, this appeared to be limited to bacterial surface erosion and fragmentation, so species diversity was probably not significantly affected. Where assemblages primarily contained woody fruits and seeds, this is likely to indicate that fully anaerobic conditions had not be maintained throughout antiquity, so the assemblages are unlikely to reflect the true range of taxa originally present.

Sorting of the flots and plant macrofossil identification were carried out using an Olympus SZX7 stereoscopic microscope. Where organic preservation was particularly good, subsampling was necessary, and this information is given at the bottom of Tables 2 and 3. Anaerobically preserved flots were sorted in water, but if charred plant remains were also present in the subsampled contexts, the remaining flot was dried and fully sorted for charred plant remains.

Results

Tables 2 (MBA and MBA or LBA) and 3 (LBA and LBA or EIA) present the results of the analysis (charred remains in brackets, waterlogged remains without brackets).

Symbol * denotes seeds used for radiocarbon dating (see discussion below and *CD Section 20*). Nomenclature and most of the habitat information follow Stace (1997). Other texts consulted with regards to ecological information included Ellenburg (1988) and Hill *et al* (1999). Site and context information were retrieved from the Framework Project Design document and Freeview database.

Middle Bronze Age

Sample	context	feature	Feature type	Waterlogged/charred plant remains
MBA				
17005	527076	539096	Ditch	wl & CH
17013	"	"	"	CH
17031	"	"	"	wl & CH
17014	527085	"	"	wl & CH
17015	"	"	"	wl & CH
17033	"	"	"	(wl) & CH
16663	539284	539283	Ditch	WL & CH
15052	581027	581045	Ditch	WL & ch
15083	582083	582095	Ditch	WL & (ch)
17001	529015	583160	Ditch	CH
17002	"	"	"	WL & ch
19174	615047	615043	Ditch	
19173	615046	615051	Ditch	WL & (ch)
16053	562040	510047	Waterhole	WL & (ch)
18113	559324	559328	Waterhole	WL
16523	563056	563060	Waterhole	WL & CH
16524	563058	"	"	CH
16549	"	"	"	WL & ch
25037	641104	641097	Waterhole	WL
27042	693004	693006	Waterhole	WL & (ch)
27205	711027	711024	Waterhole	WL & (ch)
27207	711029	"	"	CH
29058	827096	815041	Waterhole	Scanned only – WL
29059	"	"	"	" – WL
29061	"	"	"	" – WL
29060	"	"	"	WL
29062	"	"	"	WL
29045	816045	816042	Waterhole	Scanned only – WL
29047	816048	"	"	WL
29049	816052	"	"	WL
29135	823191	823181	Waterhole	WL
29141	823192	"	"	WL
29064	830061	830056	Waterhole	WL
29065	830060	"	"	WL
29066	820060	"	"	WL
29067	830058	"	"	WL
29140	835061	835044	Waterhole	WL & (ch)
29118	836054	836052	Waterhole	WL
17032	527081	527078	Pit	WL & CH
17524	543204	543201	Pit	CH
17532	543212	"	"	CH
16577	546204	546202	Pit	WL & CH
16519	557039	557027	Pit	WL & ch
17076	557029	"	"	WL & ch
19029	568091	568092	Pit	WL & (ch)
16569	615012	615008	Pit	WL & (ch)
16575	615015	"	"	WL & CH

26055	646069	646068	Pit	WL
29037	821066	821063	Pit	WL & (ch)
29038	“	“	“	WL & CH
29039	“	“	“	WL & CH

(ch) = 1 to 10 frags ; ch = 11 to 40 frags ; CH = >40 frags

Ditch 539096, samples 17005, 17013, 17031, context 527076; samples 17014, 17015, 17033, context 527085

These extremely rich and well-preserved samples came from two lower fills of an east-west ditch at what may have been a busy access point in Farmstead 1. A fragment of hazelnut shell was radiocarbon dated to 1450-1370 cal BC (Wk-18457) and emmer/spelt grains were dated to 1460-1370 cal BC (Wk-18577), 1420-1320 cal BC (Wk-18579) and 1410-1300 cal BC (Wk-18578).

Where the deposits were waterlogged, the protection afforded ensured that delicate remains such as fragments of weed seed heads and paper-thin glumes remained intact. These samples are important, therefore, in providing the least-biased evidence of factors such as the emmer/spelt balance, and the grain to chaff ratio in the MBA period. High temperature charring and post-depositional damage often cause differential destruction of delicate remains such as straw and chaff, thus affecting these types of ratios. It is probably for this reason that these assemblages produced the most abundant evidence for straw nodes and stem bases ever seen by the author, as these highly flammable items are usually amongst the first to be lost during charring (Boardman & Jones, 1990).

All of the samples were rich in what appeared to be cereal processing waste of several types, including coarse material such as straw and weed seed heads that are usually removed at an early stage in the processing by coarse sieving and raking. These large but easily broken items are rarely recovered in a recognisable form from dry-land, charred deposits. Once crushed, they are hard to distinguish from the later forms of processing waste, i.e. fine chaff frags (glume bases, spikelet forks, rachis fragments) and weed seeds that are removed at later stages by winnowing and fine-sieving. The presence of frequent culm bases in all six samples indicated that the cereals had been uprooted rather than cut. Weed seeds were abundant, and cereal grains were frequent, so it was considered possible that some whole unprocessed sheaves had been burnt. However, calculations of ratios for each sample given below (listed from the lowest sample 17033, moving upwards) suggest that the deposits were probably too mixed and varied to be certain;

sample no.	17033†	17015	17014	17031	17013	17005†
culm bases	496	52	104	10	20	576
emmer/spelt wheat glume bases *	2296	426	287	94	53	464
emmer/spelt grain	816	24	44	94	61	320
barley rachis frags	500	53	56	1	17	144
barley grain	628	46	28	60	33	196
Wheat/barley/oat %	55/44/1	32/63/0	61/39/0	60/39/1	65/35/0	62/38/0
charred weed seeds	3136	395	247	605	231	996
approximate culm base:chaff:grain:weed seed ratio	1:6:3:6	1:9:1:8	1:3:1:2	1:10:15:61	1:4:5:12	1:1:1:2
frags of weed seed heads (H) & legume pod frags (P) present	HHP	HH	HP			P

† figures corrected for 25% subsample

* figures corrected as follows: 1 spikelet fork = 2 glume bases

Comparisons with uncharred whole plant ratios are complicated by many factors, for example the unknown amount of tillering (number of stems bearing ears per stem base). This can vary widely, depending on the density of sowing and other crop husbandry factors. In addition some of the culm bases may have fragmented into several pieces. Using van der Veen and Palmer's (1997) average numbers of ears (adjusted to give an emmer/spelt average), and grains per ear, a ratio of roughly 1:70:70 culm bases to glume bases (chaff) to emmer/spelt wheat grains could be expected. None of the above samples came anywhere near this figure (culm bases were always too frequent), even though charring is more likely to increase the numbers of grains and chaff than culm bases. It is probable that mixed early- and late-stage processing waste was represented in the samples, with variations at different levels in the feature suggesting that a number of separate dumping episodes had taken place, rather than a single large dumping of homogeneous burnt waste.

Grain was less frequent than chaff and weed seeds in most samples, but was more frequent than might be expected in pure processing waste (unless threshing had been very inefficient). Perhaps spoilt grain and/or infected spikelets or ears were mixed in with the processing waste. It is also possible that, as suggested earlier, some whole plants were burnt, either because they were infected with pests or diseases, or for ritual purposes. Offerings of this sort are commonly found in ditch terminals.

The increased number of fragments of weed seed head and legume pod fragments in the bottom three samples probably reflects the more protected conditions of the lower deposits. Weed seeds were notably frequent in most of the samples, and these would have been present in early-stage waste as seed heads and twining weeds clinging to the straw (e.g. black bindweed and cleavers), and in the later-stage fine sieving and winnowing waste as loose small seeds. The most abundant taxa in all of the samples were common chickweed (*Stellaria media*), black bindweed (*Fallopia convolvulus*), cleavers (*Galium aparine*), scentless mayweed (*Tripleurospermum inodorum*) and especially small-seeded legumes (*Medicago lupulina* and *Vicia/Lathyrus* sp.). These are all common weeds of cultivated and waste places, and several of them twine through the crop to reach the light. The abundance of leguminous weed seeds suggests that soil impoverishment was likely to have been a problem (Moss, 2004). In contrast, chickweed grows in nutrient-rich soils, so this could be an indication that manuring was taking place in some areas, or for certain crops. Perhaps the supply of manure was insufficient to prevent the leguminous weeds from becoming established in some areas, or maybe only some of the crops were being manured. Unfortunately the assemblages were too mixed to determine which crops were being manured, but it is likely that demanding crops destined to be for human consumption, such as spelt wheat, would have been favoured.

A few other weeds provided clues as to the types of soils being cultivated, although, of course, this assumes that the seeds were burnt amongst arable waste rather than in other type of refuse, for example, waste hay. Acid soil indicators (e,g. corn spurrey (*Spergula arvensis*)) were present but rare, and in some cases (e.g. sheep's sorrel) the remains could have been burnt with bedding rather than arable waste, since a few bracken frond fragments were also present. In fact, sheep's sorrel seeds were more commonly found as waterlogged remains in pits (4 samples) than as charred remains (2 samples), so this weed of acid grasslands and waste probably grew in poor meadows and was burnt amongst hay. Damp soil weeds could also have been burnt amongst meadow hay or as crop weeds growing along ditches and field margins. Fruits from plants such as spike-rush (*Eleocharis* subg. *Plaustres*) and sedges (*Carex* spp.) were common but not abundant in the samples. However, the fact that they were more often recovered as charred rather than uncharred fruits (despite the frequency of samples from wet features) suggests that they were mainly growing in damp areas of arable fields. The contrasting information from the weed taxa appears to indicate that the waste originated from crops grown on a range of soils, i.e. that a fairly varied area (in terms of soil properties) was under cultivation at the time. With the Late Glacial/Early Holocene channel being located a short distance to the west of the Bronze Age field systems, damp soils were likely to occur nearby on a seasonal basis at least. However, it is notable that the Bronze Age, through to the Medieval, field systems avoided the area closest to the channel which was probably too wet to be cultivated at any time of year. This area was likely to have been used as hay meadow and late summer grazing, with periodic flooding helping to maintain fertility.

There were small differences between the samples in the percentages of cereal types (hulled wheat, hulled barley and oats) with a slight trend towards an increased percentage of wheat in the top two samples. Oats were scarce enough to have been growing as a weed rather than a crop during this period. Emmer was by far the dominant wheat, with emmer chaff outnumbering spelt by 46:1. Once again, the impression given was that the deposits were of mixed origin, with enough variation to suggest that they came from different processing episodes, but with enough similarities in, e.g. weed compositions, to suggest that they had been grown on the same soils and been deposited over a relatively short period of time. In general, the range and balance of crops was very similar to that in the other MBA charred assemblages, including the presence of flax (*Linum usitatissimum*). Charred flax capsule fragments and seeds were found in five of the six samples, making this feature the richest in terms of flax remains as well as cereals. However, in view of the fragile nature of charred flax remains, this was probably largely due to the exceptional conditions of preservation found in the feature.

Only a few waterlogged seeds were present in the samples, and these were primarily thick-coated seeds indicating that waterlogged conditions had not been maintained throughout the deposit's history. Taxa such as blackberry, fool's parsley and spike-rush indicated that a disturbed, damp habitat existed around the feature. In most cases where large quantities of charred waste have been recovered from the T5 sites, stinging nettles have also been abundant, suggesting repeated deposition of organic, nutrient-rich waste in features such as rubbish pits. In this case, however, nettles were scarce, suggesting a limited episode of dumping of this specific type of burnt waste, or deliberate clearing of nettles on an important thouroughfare.

Ditch 539283, sample 16663, context 539284

This sample came from the initial fill of a NE-SW ditch in Farmstead 1, on the western edge of the excavated area. The deposit contained frequent organic remains, an area of cremated bone and charred material that may have represented hearth debris. Large amounts of charcoal were present comprising mainly of alder and willow/poplar (see Challinor *CD Section 15*). An emmer/spelt grain from this assemblage was radiocarbon dated to 1430-1210 cal BC (Wk-19338).

The waterlogged flot contained frequent fragments of wood, twigs and bark. Alder (*Alnus glutinosa*) seeds were common and several other woody taxa were represented, including willow (*Salix* sp.), blackberry (*Rubus* sect. *Glandulosus*), cf. sloe (*Prunus* sp. fragment), elderberry (*Sambucus nigra*), and the woodland herb three-nerved sandwort (*Moehringia trinervia*). These remains were not abundant, there were some signs of decay, and thorns and leaf fragments were not present. It is likely, therefore, that this material may have washed in to the bottom of the ditch during flooding episodes of the adjacent palaeochannel, or have been blown in from nearby hedges or scrub. If the ditch had only intermittently contained water, soft tissues such as leaf fragments may have rotted away. Therefore, it is possible that, like the other ditches, a hedge had been growing along one side of the ditch to help manage livestock movements.

Most of the other waterlogged plant remains came from common weeds of cultivated and waste ground, particularly from soils with some nutrient enrichment e.g. stinging nettles (*Urtica dioica*). Grazed grassland was also represented (e.g. thistles (*Cirsium/Carduus* sp., greater plantain (*Plantago major*)). A few duckweed (*Lemna* sp.) fruits indicated that the ditch had held water long enough for this free-floating plant to become established, although very few other marsh or wet-ground remains were present. It is possible that the duckweed fruits had also been washed into the ditch during flooding, but the reasonably diverse waterlogged fruit/seed assemblage confirms that the ditch at least held water long enough for anaerobic preservation to take place.

Charred plant remains were frequent and well preserved, having been protected by the damp, organic conditions. They comprised mainly wheat chaff fragments, with frequent emmer/spelt grains and some hulled barley. The predominant cereal represented by the chaff was emmer wheat (*Triticum dicoccum*), but small quantities of spelt chaff were present (in a ratio of 15 : 1, emmer : spelt). A few cereal-sized straw nodes and stem bases (culm nodes and culm bases) were present to indicate that crops had been harvested by uprooting rather than using a sickle. Much more substantial evidence of this was found in ditch 539096 (see M/LBA section below). The few weed seeds present were common weeds of cultivated and disturbed ground, several of which were also present as waterlogged remains. The most significant of these were orache (*Atriplex patula/prostrata*) which was the most frequent taxon and which indicates soil enrichment (perhaps manuring of fields), and a few small-seeded weed vetches (*Vicia/Lathyrus* sp.). This type of waste was very similar to that recovered in much greater concentrations from ditch 539096, around 500 metres south-east of ditch 539283. The dominance of chaff fragments indicated that it was derived primarily from cereal processing waste, although some accidentally burnt whole spikelets or threshed grain may have been included.

Ditch 581045, sample 15052, context 581027

This sample came from a sticky, dark grey/black, silty secondary fill that was present in most of the sections through ditch [581045], Farmstead 4. The deposit was rich in charcoal and burnt clay/daub, and it contained Deverel-Rimbury pot sherds. A well-preserved emmer/spelt wheat grain provided a radiocarbon date of 1380-1050 cal BC (Wk 18576). The ditch ran north-south across Area 42a, probably forming a boundary marker or field ditch to control livestock.

The small flot contained large quantities of charcoal (see report by Challinor, *CD Section 15*), some of which had been adversely affected by high temperature combustion. Although uncharred plant remains from a limited range of taxa were present, it was not clear whether these were modern contaminants or survivors from a once-waterlogged sediment. Common chickweed (*Stellaria media*) was the main component of the uncharred assemblage (>500 seeds), and the other taxa were also common weeds of nutrient-enriched, disturbed places, such as docks and sow-thistles. All of the taxa were also found in secure, waterlogged samples, so it is possible that they were contemporary rather than modern contaminants. As was found in some other ditch samples, nutrient-enrichment was probably the result of livestock management in the area, or perhaps from run-off due to the manuring of arable fields.

The small charred assemblage was notable only in that it included a single charred flax seed (*Linum usitatissimum*). Small numbers of waterlogged flax seeds and capsule fragments were present in two other MBA samples from T5, and from a few of the MBA Perryoaks samples. No doubt the moist soils of this low-lying area would have been well-suited to the cultivation of a crop that could provide both fibre and oil from the seeds. Flax seed also has medicinal uses and can be added to foods for flavour.

Other charred plant remains in this sample included small amounts of poorly preserved emmer/spelt wheat grains and chaff (*Triticum dicoccum/spelta*), and a few seeds from common weeds of cultivated and disturbed soils, such as weedy vetches (*Vicia/Lathyrus* sp.) and cleavers (*Galium aparine*), an indicator of autumn sowing (Reynolds, 1981). No weeds of damp places were charred, so perhaps this particular assemblage had been brought in from drier fields on the river terraces.

The charred plant remains were typical of general burnt waste that would have become trampled, blown or deliberately deposited around the settlement site and associated field systems. It may have originated from midden material being spread on the fields as manure, or from domestic waste being dumped in the ditch.

Ditch 582095, sample 15083, context 582083

This second north-south ditch running across the eastern end of Trench 42a was slightly unusual in that some large fragments of pot (context 582083, towards the base of the ditch) occurred in the deeper sections that appeared to have contained standing water, perhaps suggesting ritual deposition. Its main function was probably as a drainage ditch.

A small waterlogged flot was recovered from the 40 litres of soil processed. The species diversity was low and many of the seeds were fragmented, suggesting that anaerobic preservation conditions were not very good. Very little charcoal was present in the sample, the only recognisable plant macrofossil being an indeterminate cereal or large grass caryopsis. Burnt food offerings, therefore, do not appear to have been deposited in this part of the ditch.

The waterlogged plant remains were more frequent but not very diverse. Stinging nettle seeds (*Urtica dioica*) were abundant, indicating a disturbed, nutrient-enriched habitat. The other dominant taxon was blackberry seeds (*Rubus* sect. *Glandulosus*). *Rubus/Rosa*-type hooked thorns were also common. Together with a few herbs of shaded and woody places such as three-nerved sandwort *(Moehringia trinervia*) and ground-ivy (*Glechoma hederacea*), the evidence suggests that a hedge had probably been growing along the ditch, or that scrub/woods existed very close-by. Elder (*Sambucus nigra*) and probable sloe (*Prunus* sp. fragment) were also present. A few wet-ground weeds such as sedges (*Carex* sp.) and branched bur-reed (*Sparganium erectum*) were recovered, providing evidence that the ditch had held water for at least some of the year, but no free-floating aquatics were present.

Ditch 583160, samples 17001 and 17002, context 529015

These two samples came from an east-west aligned ditch in Farmstead 1 that conforms to the MBA field system. The fill occurred in the middle of the ditch profile, and was probably derived from the silting up of the ditch from the surrounding land surface. An emmer/spelt grain was radiocarbon dated to 1460-1370 cal BC (Wk-18575).

Sample 17001 contained small quantities of poorly preserved charred cereal remains, with the eroded and fragmented condition of the grains suggesting that the material had washed in from the surrounding ground surface, or had been redeposited several times. The only identifiable cereal was emmer (chaff fragments), and the most notable weed group was the small-seeded weedy legumes. These weeds tend to increase in arable fields on poor soil, as they have a competitive advantage due to nitrogen fixing bacteria in their root nodules (Moss, 2004).

Sample 17002 must have come from lower down in the deposit, as some waterlogged remains were preserved. The assemblage was very similar to that from MBA ditch 539283, some 300 metres to the north-west of ditch 529004. Alder, elderberry and blackberry seeds were frequent, and stinging nettles and other weeds of disturbed, nutrient-enriched soils were dominant. Some grassland taxa and wet-ground weeds (duckweed (*Lemna* sp.), spike-rush (*Eleocharis* subg. *Palustres*) were also recorded. The insect assemblage (Emma Tetlow, *CD Section 17*) indicated that a high dung input had occurred in the area, so it is likely that either livestock were grazing close to the ditch, or that manuring of the fields was being practised. Perhaps stock was folded onto harvested fields, although some of the crops (perhaps barley) would have to have been harvested by cutting under the ear rather than uprooting to make this worthwhile.

The woody taxa could have come from material washed in from the alder-enshrouded palaeochannel nearby, or a hedge may have been located nearby. Leaf fragments, thorns and twigs were not present, so either the hedge was not adjacent to the ditch or these items had been lost through organic decay. Charred plant remains were sparse in this sample, with just a few chaff fragments from emmer and barley being identified. Weedy vetches were again present.

Ditch terminus 615043, sample 19174, context 615047

Sample 19174 came from the first fill of ditch terminus 615047 near Trackway 2, comprising slowly accumulated silt in the base of the ditch. The dominant components of this assemblage were fragments of wood and twigs, with abundant stinging nettle (*Urtica dioica*) and blackberry seeds (*Rubus* sect. *Glandulosus*). Both rose/blackberry-type thorns and sloe/hawthorn-type thorns were frequent, and sloe stones, immature hawthorn fruits (*Crataegus monogyna*) and rose (Rosa sp.) seeds were recorded. Because of the abundance of these remains, it would appear that a thorn hedge had been growing along the ditch, or very close to it. Since, in addition to stinging nettle seeds, other indicators of nutrient-rich soils were frequent, e.g. common chickweed (*Stellaria media*), black nightshade (*Solanum nigrum*), greater burdock (*Arctium lappa*) and upright hedge-parsley (*Torilis japonica*), it is likely that the ditch and thorn hedge had been used as a stock-proof barrier. Very few wet/damp ground taxa were recorded (only a few sedge nutlets and rush (*Juncus* sp.) seeds), so the ditch was probably fairly dry at the time of silting, but damp enough for organic material to have become preserved. The surrounding vegetation was probably grassland, as a few buttercup (*Ranunculus repens/acris/bulbosus*), plantain (*Plantago major*) and thistle (*Cirsium/Carduus* sp.) seeds were present. Thistles often become abundant in well-grazed pastures. No charred plant remains indicative of manuring or the proximity of domestic activities were recovered from this sample.

Ditch re-cut 615051, sample 19173, 615046

This sample came from a naturally deposited sediment within a ditch re-cut in Farmstead 3. The ditch runs west-east across the central part of the excavated area,

Area 61. Large pebbles within the fill may indicate high-energy water erosion episodes.

As with ditch 582095, stinging nettle seeds were abundant in this sample, indicating nutrient-enrichment of the ditch sediments, with the nettles probably growing in and along the ditch. Other nitrophilous taxa were not particularly frequent, but the abundance of blackberry seeds indicated that this, too, was probably growing along the ditch. Maple key fragments (*Acer* sp.), sloe stones, *Prunus/Crataegus* – type thorns and frequent *Rosa/Rubus* –type thorns all suggested that a thorny hedge or scrub had been growing alongside the ditch. A well-established hedgerow flora was also represented, including tall plants such as rough chervil (*Chaerophyllum temulentum*), upright hedge-parsley (*Torilis japonica*) and greater burdock (*Arctium lappa*). These taxa could only become established in a hedgerow-type situation, where they were protected from trampling and grazing by livestock. The only indication that the ditch was damp was a single sedge nutlet (*Carex* sp.) and occasional daphnia-type egg cases (cladocerean ephyppia). A trace of burnt cereal processing waste (one emmer glume base and an emmer/spelt spikelet fork) was present, perhaps representing material blowing around the site or being washed in from manuring, trampling etc.

Waterhole 510047, sample 16053, context 562040

This waterhole in Farmstead 8 lies on the eastern edge of the excavated area, in area 77. Sample 16053 was taken from a lower fill (position 3) containing layers of leaves lying within a soft grey clay, with flint and one pot sherd. The principal component of the sample, therefore, was decaying leaves and leaf skeletons. Seeds were fairly infrequent and burnt waste was scarce (only one charred indeterminate grass seed was recorded). A radiocarbon sample of humic material taken from context 562038, which overlies 562040, produced a date of 1940-1740 cal BC (SUERC-11569). A willow stake driven into the base of this feature gave a date of 1610-1410 cal BC (Wk-18459).

The waterlogged seeds indicated that some scrub or hedgerows occurred very close to the waterhole (hence the presence of abundant leaves), comprising field maple (*Acer* cf. *campestre*; seeds*),* willow (*Salix* sp. bud sales), blackberry (*Rubus* sect. *Glandulosus*; seeds and *Rubus/Rosa*- type thorns) and hawthorn and/or sloe

(*Crataegus/Prunus* sp.- type thorns). The woodland herb, three-nerved sandwort (*Moehringia trinervia*) was also represented through the presence of seeds. Small amounts of domestic waste were being deposited, since a couple of waterlogged cereal grain and chaff fragments were recovered (one emmer/spelt spikelet fork and one cf. emmer spikelet fork). The remaining taxa were common weeds of grassy places, waysides, hedgerows and disturbed ground such as thistles (*Cirsium/Carduus* sp.; seeds and seed head fragments), sow-thistles (*Sonchus* spp.) and fat hen (*Chenopodium album*). Stinging nettle seeds, however, were not present, perhaps suggesting the deliberate removal of this taxon or repeated cutting of vegetation around the waterhole (not necessarily grazing, as nettles are often avoided by livestock). No aquatic weeds, such as duckweed, had become established, and marginals and wet-ground plants were not represented. Therefore, it appears that the water surface and margins had been kept clear, or the level of disturbance had been too great for vegetation to have become established. Insect analysis of this deposit (Tetlow, *CD Section 17*) showed that dung beetles were frequent but aquatic taxa were absent.

The overall impression was one of a small clearing in a woody/scrubby area that may have been managed to a certain extent in order to keep human access to the feature fairly clear. Alternatively, the waterhole could have been located alongside an area of scrub, or a hedgerow that originally been part of a woodland, thus retaining its woodland herb flora.

Waterhole 559328, sample 18113, context 559324

This waterhole was more centrally positioned than that above (area 47), being located in Farmstead 3 towards the southern end of MBA enclosure ditch 598081. Context 559324 is a position 2 fill towards the base and sides of the waterhole. An alder fragment produced a radiocarbon date of 1450-1380 cal BC (Wk-18460).

As with the waterhole above, charred waste had not been deposited in the feature, but traces of uncharred cereal remains (an indeterminate cereal grain and a few emmer/spelt chaff fragments) indicated that human activities were taking place nearby. Of course, this type of waste could also have been deposited in animal dung or fodder. The presence of a single cotton thistle (*Onopordum acanthium*) seed is more significant, as this introduced taxon is more typical of Romano-British sites than

Bronze Age deposits. The down from the seed heads can be used for a variety of purposes, oil can be extracted from the seeds and the young shoots can be consumed like artichokes. It is possible that these few remains represent ritually deposited foods rather than dumped waste, since cotton thistle must have been a valued 'exotic' food/fibre plant at the time. However, it is possible that contamination by Romano-British activities in the area has occurred (see below). The very tall (up to 2.5m), downy white-leaved thistle is certainly an impressive plant in comparison with native thistles.

As with waterhole 510047, woody / hedgerow taxa were common in this sample, and leaf fragments, thorns and twigs were frequent. Field maple, willow, sloe (*Prunus spinosa*), blackberry were again recorded, with the addition of hawthorn (*Crataegus monogyna*), elderberry, rose (*Rosa* sp.) and possible buckthorn seeds fragments (cf. *Rhamnus cathartica*). As with the other waterhole, grassland taxa (including thistle seeds and seed heads), hedgerow/wayside weeds and weeds of disturbed places were common, but once again stinging nettles had not become abundant, unlike in some of the pit and ditch samples from this period. Whether this was due to deliberate clearance is difficult to say, but aquatic plants and marginals were also very scarce (one duckweed seed, *Lemna* sp.), suggesting heavy use or the deliberate removal of vegetation.

Waterhole 563060; sample 16524, context 563055; sample 16523, context 563056; sample 16549, context 563058.

This large, oval feature in area 49, Farmstead 2, appears to have functioned as a waterhole. It had one steeply stepped side that was better suited to human access rather than for animals. It contained burnt flint, pot and bone. A charred barley grain from sample 16523, context 563056 was dated to 1500-1320 cal BC (Wk-18573). Barley from context 563055 (upper sample) was dated to 1440-1270 cal BC (Wk-19339).

None of the three samples produced well-preserved waterlogged remains, and there were some signs of seed decay. However, charred plant remains were frequent, particularly in the uppermost sample, 16524 (40 litres). It is likely that the feature had been backfilled with domestic waste after it had fallen out of use.

The lowest sample, 16549, from context 563058 (1 litre), produced a limited range of waterlogged taxa including frequent nitrophilous weeds (stinging nettle, fat hen, docks (*Rumex* sp.)), a few grassland taxa (buttercup, grasses, greater plantain), woody trees/scrub (alder, willow, blackberry, elder) and some aquatics (duckweed (*Lemna* sp.), rushes). Twigs were infrequent and leaf fragments and thorns were not present, so the woody vegetation had probably not been growing very close to the feature. However, the poor state of preservation of the waterlogged remains means that some information may have been lost. The charred remains consisted of a possible bread-type wheat grain, a few hulled barley grains, some chaff fragments (barley, emmer/spelt) and common weeds of cultivation (cleavers, scentless mayweed, vetch/tare, dock). The presence of charred spike-rush and vetch/tare seeds suggest that damp soils that were poor in nutrients were being cultivated.

The middle sample, 16523 (40 litres), produced only poorly preserved charred cereal remains, since it was processed by floatation as a dry sample. A similar range of taxa was present to sample 16524, including cleavers, spike-rush and several vetch seeds. The presence of emmer wheat was confirmed, and a single fragment of hazelnut shell was present.

The uppermost sample (sample 16524) produced large quantities of both charred and waterlogged plant remains, as a large 40 litre sample was processed. Only an eighth of the flot was sorted for waterlogged plant remains, but the remaining seven-eighths was dried and sorted for charred plant remains. The waterlogged plant remains produced very similar results to the lowest sample, but with greater numbers of seeds. Stinging nettles were abundant and other nitrophilous weeds such as fat hen and docks were frequent. Woody taxa included a wider range of scrubby taxa, which could suggest that scrub had grown up around the feature after it was abandoned, since this deposit was said to have represented the period of disuse of the waterhole. Alternately, a wider range may have been obtained because the sample was five times bigger. In addition to alder, blackberry and elder, maple, rose and cf. sloe were present. No leaf fragments or thorns were present, so the remains had probably been deposited as waste. As in 16549, spike-rush, sedges, rushes and duckweed remains demonstrated that the feature held standing water. The absence of a wider variety of rooted aquatic taxa (rather than free-floating and marginal aquatics), could indicate that the level of disturbance from livestock drinking at the waterhole had been too great to permit colonisation of the open water. If people were using the waterhole on a regular basis it is also possible that attempts were made to keep the water clear of vegetation, particularly if bathing was taking place.

The charred plant remains from this sample comprised frequent cereal grains, chaff fragments and weed seeds. The cereals represented were primarily emmer wheat (identified from 21 glume bases and 15 spikelet forks) with frequent hulled barley (grain and rachis fragments), occasional spelt wheat (identified from 4 glume bases) and possible oats (*Avena* sp.). The only oat remains identified to species level from this period, however, were two wild oat pedicels (*Avena fatua*) from waterhole 663167. The quantities of grain to chaff were fairly similar (give or take some alterations to the ratios due to differential preservation), so whole unprocessed spikelets or mixed waste grain and chaff could have been deposited. One of the emmer/spelt grains had sprouted, which may indicate spoilage due to damp storage conditions. The same range of charred weed seeds was present as in the lower deposits (including spike-rush, cleavers, scentless mayweed). Small vetch/tare and clover-type seeds were particularly frequent (>100), perhaps indicating soil impoverishment at this time (Moss, 2004).

Waterhole 641097, sample 25037, context 641104

This waterhole in Farmstead 3 was located in the central area fairly close to M/LBA waterhole 537201. The waterhole cuts the D-shaped enclosure. A sloe stone was radiocarbon dated to 1450-1370 cal BC (Wk-19329).

Once again thorny, woody taxa were common in the sample, including frequent hawthorn, sloe and blackberry seeds. The fact that a third of the sloe stones had been nibbled by rodents lends support to the suggestion that a hedgerow existed alongside this waterhole, as does the fact that thorns, leaf fragments and abundant twigs from shrubby taxa were all present. Alder buckthorn, dogwood (*Cornus sanguinea*) and rose were identified, and a single alder seed marked the furthest east of the palaeochannel that this taxon was recorded so far. Unlike most of the other waterholes, stinging nettle seeds were abundant and other nitrophilous taxa were frequent. This could indicate that livestock had access to this waterhole, rather than being exclusively used by people. Grazed grassland and hedgerow/wayside herbs were common. Although no true aquatic plants were growing in the waterhole, several sedge (*Carex* spp.), rush (*Juncus* sp.) and spike-rush remains were recovered indicating damp margins around the waterhole. Although no other economic plant remains were present, three unidentified seeds from the Liliaceae family that appear to be field garlic (*Allium oleraceum*) could have come from plants used for flavouring. Mabey (1972, p.144) notes that they have been used "in dire circumstances".

Waterhole 693006, sample 27042, context 693004

This waterhole in Farmstead 8, located on the eastern edge of the excavated site in area TEC 05, produced a well-preserved, diverse assemblage of waterlogged plant remains. Sample 27042 came from context 693004, a lower backfill in the waterhole, but not the primary fill. A charred emmer/spelt wheat grain was radiocarbon dated to 1670-1500 cal BC (Wk-19330).

The abundance of seeds from wasteground weeds such as stinging nettles and pale persicaria (*Persicaria lapathifolia*) suggests that the sample may represent a period of abandonment of the waterhole. There was some evidence for the dumping of waste, in that small fragments of oak charcoal were frequent in the sample (see Challinor, this volume). Domestic charred cereal waste, however, was not abundant, as only two poorly preserved charred cereal grains (including an indeterminate wheat grain (*Triticum* sp.)) and one or two weed seeds that may have been deposited amongst cereal processing waste (e.g. poppy (*Papaver* cf. *dubium),* parsley piert (*Aphanes arvensis*)) were recorded. The arable weeds, however, can also grow in waste places, so they may have been growing locally on disturbed areas of soil. It should be remembered that, being a waterlogged sample, these remains came from only 1 litre of soil, so the quantities of charred plant remains are not comparable with the bulk samples from dry deposits. Nevertheless, the better conditions of preservation in waterlogged deposits mean that, if the waterhole had been used for the deposition of burnt domestic waste, more evidence of chaff fragments and charred weed seeds might have been expected.

Further evidence suggesting some degree of abandonment of the waterhole was the frequency of fruits of the free-floating aquatic plant, duckweed (*Lemna* sp.). Most of the Bronze Age waterhole fills from Perryoaks (Carruthers, forthcoming) and from T5 contained very few aquatic plant remains, suggesting that they had been well-used and possibly deliberately kept free of aquatic weeds. Duckweed can rapidly colonise an abandoned pond or ditch, particularly if it is eutrophic. The high nutrient status of waterhole 693006 and its surrounding vegetation was confirmed by the abundance of seeds from stinging nettles and members of the Chenopodiaceae family (includes fat hen, orache and many-seeded goosefoot (*Chenopodium polyspermum*)). Other nitrophilous plants such as chickweed and black nightshade (*Solanum nigrum*) were also common.

A range of seeds from grassland and disturbed ground taxa were present in the waterhole, including several indicative of the damp soils around the feature (e.g. blinks (*Montia fontana* ssp. *chondrosperma*)) and some of trampled ground (e.g. silverweed (*Potentilla anserina*)). The surrounding vegetation was probably primarily grazed grassland, since buttercup and thistle achenes were frequent. There was little evidence for the proximity of woodland; only a few blackberry seeds and sloe/hawthorn-type thorns perhaps suggesting the presence of some scrub nearby. Most of the herbaceous plants were indicative of fairly open habitats. However, plant macrofossils are primarily derived from vegetation growing in and close to the feature, so pollen and insect results would be required to confirm this tentative suggestion.

Waterhole 711024; sample 27205, context 711027 & sample 27207, context 711029

This waterhole was located at the northern edge of the excavated area, area LFA 05, in Farmstead 11. The lower fill, context 711027, sample 27205, was dated to the MBA by the sherds of Deverel Rimbury globular urn within the naturally accumulated grey/black clay. The upper sample 27207, context 711029 was a band of yellow-brown gravel towards the top of the waterhole, above the level of waterlogged preservation. This deposit had formed after the feature had ceased to function as a waterhole. An emmer/spelt wheat grain was radiocarbon dated to 1260-1000 cal BC (Wk-19332).

Waterlogged plant remains were not abundant in the lower deposit (sample 27205), and other organic remains such as twigs were present in small quantities. The most dominant group of taxa was the weeds disturbed, nutrient-enriched soils such as fat hen, stinging nettles and chickweed. A few alder seeds were present, suggesting that alder scrub/woods was growing fairly close to the feature. A trace of charred cereal processing waste (an emmer glume base and a couple of weed seeds) provided scant evidence for human activity occurring in the area.

The upper, possibly later, dry deposit (context 711029, sample 27207) produced only charred plant remains, consisting of a small amount of burnt cereal processing waste and other domestic debris. This may represent ash cleaned from a domestic hearth, or material blowing in from nearby hearths. The fact that the cereal grains were in a poor state of preservation supported this suggestion. The main crop plants represented were emmer wheat (*Triticum dicoccum:* glume bases, spikelet forks, poor grains), with a single rachis fragment providing evidence for the cultivation of barley (*Hordeum* sp.). Of the weeds present, cleavers (*Galium aparine*) was notable in the frequency of the seeds present. Leguminous weeds including 3mm vetch/tare seeds (*Vicia/Lathyrus* sp.) and clover/medick/trefoil –type seeds (*Trifolium/Medicago/Lotus* sp.) were relatively common. This may suggest that soil impoverishment was a problem in some areas through the cultivation of poor, acidic soils. Sheep's sorrel (*Rumex acetosella*), an indicator of acidic soils, was present. Onion couch tubers (*Arrhenatherum elatius* var. *bulbosum*) were also found, and this grass can become an arable weed for a short period where coarse grasslands have been recently ploughed. The presence of a few hazelnut shell fragments in the deposit indicated that other types of domestic waste had also been dumped, and that wild food sources were being exploited.

Waterhole 815041; samples 29058, 29059, 29060, 29061, 29062, all from context 827096

This column of samples was taken in conjunction with a pollen series (see Peglar, Druce & Huckerby, *CD Section 16*). The feature is located along the western edge of area TEC 05 amongst a small group of MBA waterholes (see WH830056 and WH816042) along Trackway 6. Context 827096 was the primary fill, and the sequence of samples ran at 10cm intervals from 29058 at 10-20cm from the top of the deposit to 29062 at 50-60cm below the top. Insects from samples 29060 and 29062 have also been examined (see Tetlow, *CD Section 17*).

Because several of the flots were fairly poorly preserved and similar in nature to each other, only samples 29060 and 29062 were sorted and quantified. The remaining samples were scanned to see whether any notable differences could be seen through the profile. As no significant differences could be seen, it is likely that the sediments had accumulated during a period of use when the local environment was not subject to major change and when no notable alterations in waste disposal activities were occurring.

The most significant ecological groups in these fairly well preserved assemblages were the woodland or hedgerow taxa, and the aquatic or marshy plants. The remains from these groups were from a wider variety of taxa and more frequent than in any of the other waterholes in the TEC 05 area. Woods/hedgerow plants included blackberries, rose, sloes, hazelnut, hawthorn, dogwood, possible alder buckthorn and the herb, three-nerved sandwort. This range of small trees and shrubs included several thorny species that are useful for hedging. Since few thorns or leaf fragments were present it is likely that a hedge was located close to the waterhole but not directly adjacent to it. Most of the fruits and seeds could have been deposited by birds coming to drink, but even so, the fact that a wide variety of 'bird food' taxa was present suggests a hedgerow occurred nearby. It is interesting to compare these results with the pollen results, since low levels of tree/shrub pollen (including most of the taxa noted above) were recorded in the context (15%). This suggests that most of the flowering had been reduced by hedge cutting, although as the macrofossil results showed, some fruits were being produced. Perhaps the hedge was a sufficient distance away for pollen, leaves and thorns not to fall in to the waterhole, but for birds to come and drink (N.B. most of the tree/shrub taxa were insect pollinated).

Both rooted marginals (such as crowfoot, water-pepper, spike-rush) and free-floating true aquatics (e.g. duckweed) were common throughout the sample column, indicating that the feature had retained water to this level for the whole period of formation of context 827096. Tetlow (this volume) notes that aquatic insects were dominant in these two samples, reinforcing the suggestion of a diverse, well-established aquatic flora and fauna. There was no obvious evidence for the deposition of waste or the eutrophication of this waterhole, although a modest number of nitrophilous weeds (e.g. nettles, chickweed, fat hen) were present. Dung beetles were also scarce (Tetlow, *CD Section 17*). It appears that the feature was not as heavily used by livestock and/or humans as some of the other, weed-free waterholes, or that its period of use was very brief and these remains represent the early stages of abandonment. The pollen evidence produced a similar range of aquatic and marginal plants, although free-floating taxa were poorly represented. There was some indication from the pollen that the waterhole was used even less intensively at a later date, and that willows grew up around the feature.

Waterhole 816042; sample 29045, context 816045; sample 29047, context 816048; sample 29049, context 816052.

This feature lies close to the previous waterhole in area TEC 05 along Trackway 6. The samples were taken from a column through the bottom sequence of sediments. Sample 29049 was the lowest sample from the primary fill, but the middle sample produced the most plant macrofossils. Insects were also examined from sample 29047 (see Tetlow, *CD Section 17*). The top sample was poor and so was only scanned. In fact, none of the samples were particularly well preserved or diverse and there were signs of seed decay. Because the diversity was low, it is likely that decay mainly occurred in antiquity rather than in storage.

No charred plant remains were recovered from the feature, or other obvious evidence for dumped waste. However the most frequent taxa were nitrophilous weeds such as nettles, fat hen and common chickweed. The remains of carabid beetles that feed on fat hen and knotweeds were present in sample 29047 (Tetlow, *CD Section 17*). Other habitats represented by the plant remains were open (probably grazed) grassland, such as greater plantain and thistles, marsh or marginal plants such as clustered dock (*Rumex conglomeratus*) and sedges (*Carex* spp.), and a trace of woods/hedgerow remains. These latter taxa included an immature acorn (*Quercus* sp.), a few blackberry seeds and some hedgerow herbs such as prickly sow thistle (*Sonchus asper*). Most of them came from the middle sample, which could indicate the growing up of scrub around the feature as it became abandoned. The upper sample contained duckweed fruits perhaps indicating infrequent use and abandonment. The nitrophilous plants in the bottom two samples probably relate to the use of the waterhole by livestock and the deposition of manure. Tetlow (*CD Section 17*) recovered large numbers of dung beetles from sample 29047. Other significant insect groups were beetles of grassland and disturbed ground, and a few diving beetles characteristic of ponds.

Waterhole 823181; sample 29135, context 823191; sample 29141, context 823192

This Middle to Late Bronze Age feature was also located along Trackway 6 in TEC 05, but further to the south. The two samples were taken from the lowest two sediments. Pollen sequences were also taken from these deposits (see Peglar, Druce & Huckerby, *CD Section 16*).

The assemblages were both fairly limited in species range and biased towards woody remains such as blackberry seeds, and sloe and hawthorn stones. This, and the frequent decaying wood fragments in the flots, suggest that preservation conditions were not ideal in this feature. Pollen preservation was also poor and subject to differential preservation.

No aquatic taxa were recovered, although sedges, rushes and cladoceran ephyppia (water flea egg cases e.g. *Daphnia*) were represented in small numbers, suggesting that areas of damp soil existed. Similar results were recovered from the pollen analysis, with pollen from aquatic taxa being low but damp grassland taxa being more varied. This suggests that the waterhole may not have held water on a permanent basis, but may have been subjected to seasonal episodes of drying out. Since leaves and thorns were not abundant the higher representation of woody taxa may reflect the poor preservation conditions rather than the proximity of woodland/hedges. The pollen results suggested that open oak-dominated woodland existed nearby, with pastures, meadows and some areas of arable cultivation. Management of the landscape appears to have increased at the expense of oak woodland, according to pollen samples taken from the upper part of context 823192, but these deposits were not sampled for plant macrofossils.

Waterhole 830056; sample 29064, context 830061; samples 29065, 29066, context 830060; sample 29067, context 830058

This waterhole was located close to waterholes 815041 and 816042 along Trackway 6. Like the other to waterholes in this group, it showed no obvious signs of domestic waste being deposited. Nitrophilous weeds and grassland taxa were present but not abundant, indicating that the waterhole was probably being used by livestock and was probably located in grazed pasture.

Woody remains were also fairly scarce, and the fragments of wood in the samples may have come from waste deposited in the waterhole, rather than woody taxa growing nearby. Numerically the most abundant group was the wetland plants, in particular crowfoot buttercups (*Ranunculus* subg. *Batrachium*), water-starwort (*Callitriche* sp.) and flote-grass (*Glyceria* sp.). The middle two samples were the most productive, but this could be because vegetation had become well-established by the time these sediments were laid down, and preservation conditions were poorer in the upper sample. These aquatics can become abundant in undisturbed ponds and ditches, covering the surface of the water with vegetation. Their abundance suggests that the waterhole was not being heavily used, and was unlikely to have been used by humans, as most members of the buttercup family are moderately poisonous. Livestock have been known to die of buttercup poisoning, although the more common crowfoot, *Ranunculus aquatilis*, is one of the less poisonous members of the family (Miller, 1953). Insect remains (Tetlow, *CD Section 17*) from sample 29065 were also dominated by 'standing water' taxa, with insects of damp, open ground being common. The presence of insects that feed on tussocky rushes, sedges and willows confirms the existence of a marshy, bankside-type vegetation around this waterhole.

Waterhole 835044, sample 29140, context 835061

This MBA waterhole in the southern group along Trackway 6 at TEC 05 produced some evidence for the deposition of domestic waste, and possibly occasional use of the waterhole for retting (flax processing). The sample came from the primary sediment, and some of the twigs were straight and of the dimension to suggest a wattled lining may have existed.

The traces of domestic waste included a charred chess seed (*Bromus* sect. *Bromus*), a fragment of flax capsule (*Linum* sp.), several stinking mayweed seeds (*Anthemis cotula*), and some fragments of possible corn cockle seed (cf. *Agrostemma githago*). Although stinking mayweed can grow as a weed of damp, disturbed clay soils, by the LIA/ERB period at T5 it was growing as an arable weed, i.e. charred seeds were present amongst charred grain. In this instance, only waterlogged seeds were present, so this may represent a stage at which the weed had been introduced amongst imported grain, but it had only become established as a ruderal weed of heavy damp soils, prior to the wider ploughing up of heavy soils for arable in the Iron Age. Corn cockle is also an introduced arable weed that became a common crop contaminant by the early Medieval period. In the British Isles its earliest published records are Iron Age in date (e.g. Silchester (Jones, 2000; Collfryn, Jones & Milles, 1989), although a few Neolithic and Bronze Age records exist for other parts of Europe. When present as small waterlogged fragments of seed, it often indicates the presence of human sewage, since the large seeds of corn cockle become ground up with the corn in flour. Although the black, spiny fragments are very distinctive, it is unfortunately not possible to confirm the identification from incomplete seeds.

Nitrophilous weeds (mostly stinging nettle) were present but not abundant, so the dumping of domestic waste was not excessive at this time. A few wet/damp ground plants that may have been growing around the waterhole were represented, including water pepper (*Polygonum hydropiper*), clustered dock *(Rumex conglomeratus*) and gypsywort (*Lycopus europaeus*), but no free-floating aquatics were present. The only woody taxon was a few blackberry seeds.

Waterhole 836052, sample 29118, context 836054

This waterhole was located amongst the southern group of MBA and M/LBA waterholes (WH 823181, WH833123, WH835044) in TEC 05 along Trackway 6. The sample came from primary fill, context 836054. Insects from this sample were examined (see Tetlow, *CD Section 17*). Interestingly, these waterholes each contained quite different assemblages, suggesting possible small differences in period of use or type of use. It may be that they were used in sequence for short periods, and that some of the assemblages represent stages in abandonment.

The most abundant taxa in WH 836052 were blackberry seeds and duckweed fruits. Sedge nutlets were also frequent. This may indicate some degree of abandonment, although the sample came from the lowest sediment, context 836054. Perhaps, like the more northerly group, the level of use was low and livestock were the primary users, so the water surface did not need to be kept clear (small, floating duckweed plants soon cover the surface of undisturbed, nutrient-rich water bodies). A couple of other woody taxa were represented (a rose seed and two immature acorns) but small numbers of remains such as these could have been brought in by birds, or with leaf fodder. The decaying wood in the flot may have come from a pit lining, or from dumped material. It appears, therefore, that some scrub may have grown up around the waterhole but woodland/hedges were not immediately adjacent to this feature and domestic occupation was probably some distance away. No remains from economic plants were recovered from this feature.

Pit 527078, sample 17032, context 527081

This position 1 fill of pit 527078 in Farmstead 1 produced frequent twigs and wood fragments, and several large fragments of charcoal. Some signs of decay were seen in the waterlogged plant remains, but this could have been post-excavation and processing. A charred barley grain was radiocarbon dated to 1490-1390 cal BC (Wk-19336).

Blackberry seeds were the dominant remains from this deposit, the seeds and seed fragments being far too abundant to count. Three-nerved sandwort seeds were frequent, occurring in the highest numbers of all the MBA samples. Rough chervil was also present, as were *Rubus/Rosa*-type thorns. These taxa suggest the presence of shaded, hedgerow-type of vegetation very close to the pit. Larger trees, however, were not represented. Weeds of nutrient-rich soils were common but not abundant. Grassland taxa were present, particularly those of damp soils. Some of these may represent the vegetation growing around the pit, such as gypsywort and mint. The presence of water plantain seeds suggests standing water was present in the feature.

The charred plant remains consisted of several hulled barley grains, a possible bread-type wheat grain, some emmer and spelt chaff (both cereal confirmed through the presence of well-preserved glume bases) and several barley rachis fragments. The same range of weed taxa was recorded consisting primarily of several cleavers nutlets and vetch/tare seeds.

Pit 543201, sample 17524, context 543204 & sample 17532, context 543212

This cylindrical pit in Farmstead 5 cut into the gravel may have functioned as a well. Two samples of 40 litres were floated for charred plant remains. An emmer/spelt wheat grain from sample 17524 was radiocarbon dated to 1530-1410 cal BC (Wk-18581).

Sample 17532 came from a thin layer of gravel towards the base of the pit. Several charred emmer/spelt wheat grains, barley grains, a little emmer/spelt chaff (including some possible spelt glume bases) and a few weed seeds were recovered. The weeds included the usual taxa (scentless mayweed, cleavers, vetch) as well as black bindweed (*Fallopia convolvulus*) and ribwort plantain (*Plantago lanceolata*).

Sample 17524 came from a recut in the top of the pit. The flot contained frequent large charcoal and cereal remains. Emmer/spelt wheat was well represented by both grains and chaff fragments. Both emmer and spelt were positively identified from the chaff fragments, but for the first time spelt was present in significant numbers, exceeding emmer by a small margin (32:39 emmer:spelt glume bases (with spikelet forks counted as two glume bases)). Weeds included black bindweed, dock, vetches, cleavers, scentless mayweed and chess. A few hazelnut shell fragments were also recovered. This assemblage appears to be slightly more advanced than the other MBA cereal assemblages, due to the increased spelt content. The early radiocarbon date cited above, however, demonstrated that, rather than being more advanced, it may have been a more spelt-rich maslin of the two hulled wheats. Alternatively, spelt may have been grown as a separate crop but in smaller quantities than emmer, being a more demanding crop, but perhaps more highly valued due to its stronger baking flour. With so few chaff-rich samples to compare and no additional features in this area, it is difficult to know whether or not Farmstead 5 was growing a slightly different balance of crops to the other Farmsteads.

Pit 546202, sample 16577, context 546204

The sample was taken from an organic fill at the base of an oval pit in Farmstead 1, in the south-west corner of area 24. The deposit contained no artefacts, so it does not appear to have functioned as a domestic rubbish pit. It did produce quite a few charred cereal remains, but it would have been much too wet to have functioned as a storage pit. A hulled barley grain was radiocarbon dated to 1420-1260 cal BC (Wk-19337).

The waterlogged remains consisted primarily of twigs and wood fragments. Charcoal was also frequent, including oak, alder/hazel, Prunus and apple-type (see Dana Challinor, *CD Section 15*). Because the large flot from this sample had been dried it is possible that some delicate remains may have been lost, but re-wetting after 50% had been sorted dry produced no additional taxa. The waterlogged assemblage consisted of abundant stinging nettle seeds with a range of other weeds of disturbed places. Blackberry seeds were also frequent, and alder seeds and cones were common. Elderberry and rose were the other woody taxa present. Damp ground taxa were scarce, but gypsywort, sedges and mint (*Mentha* sp.) were probably growing around the margins of the feature. No true aquatics were present. Grassland (*Ranunclus* spp.) was also represented.

The charred plant remains consisted of primarily chaff fragments from (in order of frequency), emmer wheat, hulled barley with just a trace of spelt wheat. The cereal grains comprised mainly hulled barley, with emmer/spelt and one possible bread-type wheat grain. Since chaff is more likely that grain to have been differentially destroyed during charring and redeposition, the original composition of the assemblage was probably much more chaff-rich. The deposit may represent cereal processing waste, perhaps with some spoilt grain or unprocessed spikelets mixed in. The weeds included docks, chickweed, frequent vetch/tare and clover-sized legumes, cleavers, scentless mayweed and several chess (*Bromus* sect. *Bromus*) caryopses. The latter is of note since chess tends to increase with the increased cultivation of spelt wheat, and Helbaek (1953) suggested it was an introduced weed of spelt. The only other occurrence of chess in the MBA samples was in a feature that was rich in charred cereal processing waste and which produced evidence for spelt wheat (sample 17524). Several charred straw nodes and cereal-sized culm bases were recovered, suggesting either that whole, uprooted cereal plants had been burnt, or that mixed burnt waste from both the early stages (straw and weed head removal) and later stages (fine chaff and weed seed removal) of cereal processing were dumped in the feature.

Pit 557027; sample 16519, context 557039 & sample 17076, context 557029

This pit in settlement area 49, Farmstead 2, was probably deliberately backfilled with domestic waste. The two fills examined contained bone, burnt flint, large pot sherds and charred plant remains. Humic acids from context 557039 were radiocarbon dated to 1690-1500 cal BC (SUERC-11570).

Both samples produced well-preserved, diverse waterlogged plant assemblages and there were many similarities between the two deposits. All of the major contributors to the assemblages, in particular the nitrophilous taxa, stinging nettles, chickweed and fat hen, were abundant to frequent in both samples. Wasteground and cultivated soil weeds were important components of the assemblages, including weeds such as poppy (*Papaver* cf. *dubium*), parsley-piert (*Aphanes arvensis*) and small nettle (*Urtica urens*). These annual weeds are typical weeds of cultivation, or of open habitats that are frequently disturbed. They may have been deposited amongst cereal processing waste, since sample 17076 contained a little waterlogged chaff (one emmer/spelt spikelet fork and a waterlogged cereal fragment). Grassland was also much in evidence, particularly open, grazed pastures with frequent buttercups

Although several woody taxa were represented, leaf fragments, twigs and thorns were not particularly numerous and the range of taxa was a little different to that of the proposed hedgerows along the ditches. Thorny trees/shrubs such as blackberry, sloe, rose and hawthorn were less frequent. Remains from the first two taxa were present, but were not abundant. Woodland herbs such as three-nerved sandwort were also not present. Instead, riverside trees such as willow and alder were represented, in addition to the nitrophilous tree indicative of settlements, elder (*Sambucus nigra*). These differences suggest that the woodland remains mainly represent material deposited in the pit as waste, rather than vegetation growing very close to the pit. It is also possible that seeds such as alder, which are designed to float on the surface of water in order to aid dispersal, may have been washed into the feature during a flooding episode. Alder was probably growing along the palaeochannel for most of its history.

Marsh and aquatic plants were well-represented in the pit samples, unlike the waterhole and ditch assemblages. Bankside damp-ground taxa such as gypsywort (*Lycopus europaeus*) and spike-rush (*Eleocharis* subg. *Palustres*) were common in both fills, but true aquatics such as water plantain (*Alisma plantago-aquatica*) and water starwort (*Callitriche* sp.) only occurred in the bottom fill, context 557029, demonstrating the effect of ditch sedimentation on the flora within the ditch.

The charred waste deposited in the pit consisted of one or two grains of wheat and barley, some emmer and spelt chaff fragments, and a few typical weeds of cultivation, such as scentless mayweed (*Tripleurospermum inodorum*) and cleavers. Barley rachis fragments were more frequent than wheat chaff fragments, perhaps indicating that waste fodder had been deposited.

Pit 568092, sample 19029, context 568091

This peaty deposit in pit 568092 contained a pot base that may have been deliberately placed in the pit. The only evidence for the disposal of waste was a couple of fire-cracked flints, an emmer/spelt glume base and a cf. spelt glume base. The waterlogged vegetation types represented included damp grassland taxa (5 taxa) and a few disturbed ground weeds (6 taxa). The most diverse group, however, was the plants of marsh, ponds, ditches etc. (12 taxa). This group contained several species that were not present in any of the other MBA features, including aquatic crowfoot buttercups (*Ranunculus* subg. *Batrachium*), celery-leaved buttercup (*Ranunculus* *sceleratus*), northern yellow-cress (*Rorippa islandica*) and lesser water-parsnip (*Berula erecta*). It would appear, therefore, that the pit had remained open and fairly undisturbed for some time, allowing a diverse aquatic flora to become established.

Pit 615008; sample 16569, context 615012 & sample 16575, context 615015

This circular pit in Farmstead 1 of c. 1.5m diameter contained worked wood that rested on the bottom of the feature and may have functioned as a log ladder. A fragment of alder from the ladder produced a radiocarbon date of 1420-1260 cal BC (Wk-18462).The two samples studied were from the primary fill, context 615015, sample 16575, and a secondary fill half way up the sedimentary sequence. Both fills contained abundant twigs, bark fragments and wood fragments.

The lowest fill (10 litre sample) produced fairly well-preserved waterlogged plant remains consisting of taxa from a range of habitat types. Weeds of nitrophilous waste places were perhaps numerically the most dominant group (stinging nettles, chickweed, fat hen etc.), but woody/hedgerow taxa were relatively common (alder, willow, blackberry, elder, greater burdock, upright hedge-parsley). The presence of leaf fragments and thorns suggests that woods/scrub/hedgerows were growing quite close to the pit. Damp grassland taxa such as ragged robin and greater plantain were present, and a few waterlogged remains of cereal grains, chaff and arable-type weed seeds (poppy, parsley piert) were recorded. A single cultivated flax (*Linum usitatissimum*) seed was recovered from this sample, providing evidence for the cultivation of this fibre and oil-seed crop. The local damp soils would have been well-suited to the cultivation of flax. It is possible that flax retting (processing for fibre) was taking place in water-containing features such as this, although in this case the evidence was rather slight. Being a smelly process that renders the water unfit for drinking, it is usually carried out some distance from houses, preferably in flowing water. A few marsh and aquatic plants were present (marsh pennywort (*Hydrocotyle vulgaris*), water plantain, duckweed), suggesting that the feature was probably not intensively used as a waterhole. Charred plant remains recovered from this pit included evidence for the cultivation of emmer, barley and a little spelt wheat. The cereal grains were in a poor state of preservation, suggesting the redeposition of waste, perhaps from house sweepings. The same range of arable weeds were recovered as in the other featuresfrom this phase (scentless mayweed, cleavers, vetch/tare) with 2-2.5mm vetches again being relatively frequent.

The upper fill, sample 16569, context 615012 (1 litre), produced a similar range of taxa with nitrophilous weeds (primarily stinging nettle) again being frequent. As in the lower sample, elderberry seeds (*Sambucus nigra*) were frequent, providing more evidence for the presence of nutrient-enriched, disturbed soils. Additional woody taxa present in this layer were rose (*Rosa* sp.) and dogwood (*Cornus sanguinea*). Dogwood is a shrub of base-rich soils. This is the only MBA sample that produced dogwood seeds. No aquatic plants were growing in the feature at this level, although sedges were present. A few charred cereal grain fragments and weed seeds were also recorded.

Pit/Waterhole 646068, sample 26055, context 646069

This pit/waterhole in Farmstead 3 contained frequent wood fragments, twigs, leaf fragments and several whole rose hips (*Rosa* sp.). A rose seed was radiocarbon dated to 1690-1510 cal BC at 95% probability (Wk-19331)

Woody taxa were dominant in this deposit, including frequent rose seeds and rose hips, blackberry seeds, hawthorn (*Crataegus monogyna*) seeds, elderberry seeds, a sloe stone (*Prunus spinosa*), thorns of both types and the woodland herb, three-nerved sandwort. Several nitrophilous weeds of disturbed ground were present (primarily stinging nettle) and grassland taxa were common (buttercups, thistles, plantain). Small amounts of domestic debris had been deposited in the feature, as demonstrated by the presence of waterlogged cereal chaff (emmer/spelt glume bases and a spikelet fork), and by the recovery of a flax seed and flax capsule fragment. This is one of six MBA features to have produced small quantities of flax processing waste, demonstrating that flax was probably an important fibre and/or oil crop during this period. No charred cereal remains were deposited in the feature, and the only damp ground taxa represented were sedges and rushes. The absence of aquatic taxa suggests that deliberate clearance of vegetation had been practiced, as found in most of the waterholes excavated in the area.

Pit 821063; samples 29037, 29038, 29039 context 821066

The samples were all taken from the primary fill of this deep pit in area TEC 05. The pit was located some distance to the east of the northern waterhole group in this area. The assemblages were different from the waterhole assemblages in that they all contained much larger concentrations of charred cereal remains, indicating that domestic waste had been deposited in the feature. Further evidence of this was the much higher number of seeds from weeds of nutrient-rich soils, in particular fat hen (*Chenopodium album*), but also chickweed and nettles. These weeds had probably been growing around the feature, in which case the feature must have remained open for at least a year or two. Alternately, weeds could have been collected and deposited in the feature.

The charred cereal assemblages were more concentrated towards the bottom of the feature. They contained mainly cereal grains (mostly hulled barley with a trace of emmer/spelt) with smaller amounts of chaff (including a spelt glume base) and weed seeds. Cleavers (*Galium aparine*), ribwort plantain *(Plantago lanceolata*), a small grass seed (Poaceae) and spike-rush (*Eleocharis* subg. *Palustres*) were the only weeds represented, and these are common weeds of a variety of cultivated soils and waste places. If growing as an arable weed (rather than being deposited amongst other types of burnt waste), the spike-rush nutlet indicates the cultivation of damp soils. Charred spike-rush and sedge seeds were recovered from four other MBA samples from T5 so it is likely that at least some of the arable fields had areas that were wet enough to support this type of vegetation.

A few seeds from woody plants were present, such as blackberry, hazelnut and sloe, but these could have been deposited amongst domestic waste. A few remains from aquatic and bankside plants were present, i.e. crowfoot, rushes and sedges, so the pit probably held water for at least some of the year.

Middle or Late Bronze Age

Sample	context	feature	Feature type	Waterlogged/charred plant remains
M or LBA				
17117	553180	553191	Waterhole	WL & (ch)
17118	553189	“	“	WL & (ch)
27305	685035	685032	Waterhole	WL & (ch)
29100	835029	833123	Waterhole	WL & (ch)

(ch) = 1 to 10 frags

Waterhole 553191; sample 17117, context 553180; sample 17118, context 553189

The two samples examined came from the lower fills of recut 553191 of waterhole 537201, located in the central twin rivers area of the site.

The lowest sample, 17118, came from a sediment derived from the organic breakdown of material falling into the waterhole, context 553189. Organic preservation was fairly good, with frequent leaf fragments, twigs, seeds and some large fragments of charcoal being present. Woody taxa were fairly well represented, particularly thorny ones such as rose (*Rosa* sp.), hawthorn (*Crataegus monogyna*), sloe (*Prunus spinosa*) and blackberry. The presence of thorns and leaves indicated that the shrubs were growing nearby. The woodland herb, three-nerved sandwort, was also frequent. Additional hedge-type small trees/shrubs represented were maple (*Acer* sp.) and alder buckthorn (*Frangula alnus*), the last of which is typical of damp woods, hedgerows and bogs on acidic soils. The upper sample, 17117, contained far fewer remains from the taxa in this group, suggesting some loss of hedgerow or scrub close to the waterhole. Organic preservation may also have been poorer in the upper sample, but this is less likely to have affected the woody taxa.

Weeds of disturbed and cultivated ground, such as nettles, fat hen (*Chenopodium album*) and chickweed (*Stellaria media*) were common but not abundant in both fills. Again there were fewer in the upper sample. Seeds from short, open grassland (e.g. daisy (*Bellis perennis*), greater plantain) and taller hedgerow/wayside herbs (e.g. nipplewort (*Lapsana communis*), rough chervil (*Chaerophyllum temulum*)) were present in low numbers. As with the MBA waterholes, no aquatic plants were growing in the waterhole and the only damp ground remains were a few rush seeds (*Juncus* sp.). This suggests some degree of maintenance, or frequent use by humans but not livestock.

Other evidence of human activity was the presence of a few remains from economic plants. A few charred and waterlogged cereal grains and chaff fragments were present in both deposits, with both emmer and spelt wheat being represented. Cultivated flax seeds and capsule fragments were present in both contexts, but were much more frequent in the upper layer. It is unlikely that the waterhole was being used for flax retting, as this process pollutes the water and would have caused nutrient-enrichment. Perhaps some of these remains were thrown into the waterholes as ritual offerings, as it is notable that most of the waterholes examined to date have produced just a few remains from economic plants but no clear evidence for large scale refuse disposal. A third possible plant of economic use was represented by frequent seeds of mustard or charlock etc. (*Brassica/Sinapis* sp.) in sample 17118. There is some evidence, but no definite proof, that seeds of this group were used either for oil extraction or as a spice in the Late Bronze Age/Early Iron Age, as sites such as Potterne (LBA: Straker, 2000) and Hartshill Copse (EIA: Carruthers, forthcoming) have produced frequent seeds in specific contexts.

Waterhole 685032, sample 27305, context 685035

This deposit, near the base of the waterhole, contained part of a log ladder. This feature is located on the eastern edge of the excavated area.

Once again, twigs were abundant and leaf fragments and thorns were present. Hawthorn fruit were particularly abundant in this feature, including immature fruits, suggesting that bushes were growing very close to the waterhole. Blackberry, sloe and three-nerved sandwort were also present. Weeds of cultivated/disturbed ground were common but not particularly abundant. Grazed grassland and hedgerow/wayside taxa were present and a few damp ground plants were recorded (gypsywort, mint, sedge). However, no aquatics were recovered. As usual, a few cereal remains including two spelt glume bases were present. It is remarkable how similar these waterhole assemblages are, considering that they come from features spread across the site, and possibly from features several hundred years apart in date. This suggests remarkable consistency and continuity in the types of activities taking place at the waterholes.

Waterhole 833123, sample 29100, context 835029

This lower fill of a waterhole in the southern TEC 05 group produced a similar range of taxa to the other features in this area, i.e. occasional signs of domestic waste (a couple of poorly preserved charred cereal remains in this case), some nitrophilous weeds of disturbed and cultivated places, a few damp ground taxa that may have been growing as marginals (water pepper, blinks (*Montia fontana* ssp. *chondrosperma,* mint, sedges) and only traces of woody taxa (hazelnut shell, elderberry). This southerly group was clearly growing in a more open location that was closer to human habitation than the northern group. Alternatively the differences may be temporal, with further clearance of scrub and hedgerows having taken place since the MBA and more domestic waste being distributed around the site by the M/LBA period.

Late Bronze Age or Early Iron Age

Four samples from two pits and two waterholes were analysed (Table 3). The features are widely spread across the excavated area, from LFA 05 to the north (waterhole 726001), to TEC 05 in the east (waterhole 834034) and pit 663167 cutting the D-shaped enclosure in the central area.

Sample	**Context**	**Feature**	**Feature type**	**Waterlogged/charred plant remains**
29130	834055	834034	LBA or EIA waterhole	WL & (ch)
19135	609019	609020	LBA pit	ch
24051	663175	663167	LBA pit	WL & CH
27181	726006	726001	LBA pit/waterhole	WL & (ch)

LBA or EIA Waterhole 834034, sample 29130, context 834055

This sample came from the lowest deposit in a waterhole in Area TEC 05, located amongst a group of MBA waterholes to the south of the area. The large flot consisted mostly of wood fragments with some twigs, although leaf fragments, thorns and buds were scarce. Woody fruits and seeds were present but not abundant, including scrubby taxa such as blackberry, sloe and dogwood.

A small amount of waste had found its way into the deposit, indicated by a charred free-threshing wheat grain (*Triticum aestivum*-type) and possible rachis fragment. Some of the uncharred weed seeds in the assemblage may have been deposited amongst waste or may have been growing nearby in disturbed areas. Stinking chamomile (*Anthemis cotula*) is a weed that today is most frequently found amongst arable crops on damp, clay soils. It begins to become a significant arable weed in Iron Age charred assemblages, and Jones (1981) suggested this was due to iron ploughshares being better able to cope with heavy clay soils. At Heathrow, the earliest records were 16 waterlogged seeds in a MBA waterhole (WH 835044) and 5 waterlogged seeds from this feature. These records may indicate that it was growing locally as a ruderal weed during these periods, prior to the ploughing up of heavier soils. It was not found as charred seeds (i.e. more likely to be representing an arable weed) until the Mid to Late Romano-British period at Heathrow (including Perryoaks), a time when bread wheat and spelt had taken over in importance from emmer wheat. These are the two crops that are particularly well-suited to growing on clay soils, and they increase in importance from the later Bronze Age through the Iron Age and into the Romano-British period.

In this relatively small and limited plant assemblage, the weeds of disturbed and cultivated places were the most dominant component, several of which indicated nutrient-enriched soils (e.g. fat hen, chickweed). A few grassland and wayside plants were represented, but aquatic and wet ground taxa were absent (apart from rushes (*Juncus* sp.)). Aquatic insect remains were also scarce (Tetlow, *CD Section 17*).

This waterhole may have occasionally been used by livestock, with some of the weeds of cultivation having been introduced in dung. However, no stinging nettle seeds were present, so the margins must have been too trampled to allow nettles to seed, or the edges may have been kept clear of vegetation, as perennial nettles can be reduced by regular cutting. Insect remains were limited in this feature, but pasture/dung was the main group represented (Tetlow, *CD Section 17*), suggesting short-term or periodic use of the feature by livestock.

LBA Pit/ Waterhole 726001, sample 27181, context 726006

The waterlogged remains from this teardrop shaped waterhole or pit follow the pattern of most of the MBA to LBA waterholes examined to date. Wood fragments and twigs were abundant and leaf fragments, seeds of woody taxa (blackberry, maple, dogwood, elderberry) and thorns were common. Alder seeds and cone fragments were notably frequent in this sample. It is clear that wood fragments, fruits and seeds from the alder carr growing along the palaeochannel continued to be washed into features during flooding episodes in the Late Bronze Age or Early Iron Age period.

Other plant remains were not frequent in this very woody sample, but the usual range of weeds of cultivated/disturbed soils, grazed grasslands and hedgerows was recovered. No aquatic plants and only a couple of sedge seeds were found. A couple of waterlogged emmer/spelt chaff fragments and a couple of charred weed seeds were the only remains representing domestic waste. In total, the plant assemblage was more characteristic of a waterhole than a pit.

LBA Pit 609020, sample 19135, context 609019

This cremation contained a single fill (context 609019) that produced burnt flint, animal bone and pot sherds. It was excavated in four spits, and sample 19135 came from the lowest of these, spit 4, from the base of the pit. LBA pot had been deliberately placed in the pit after the cremation had been deposited, but there was no evidence of *in situ* burning (Freeview). The pit was located in the central Twin Rivers area of the site.

The charred plant macrofossil assemblage recovered from this feature was small and very poorly preserved, indicating that it is unlikely to have represented a ritually burnt, placed deposit. It is more likely to have been derived from background domestic waste that may have been swept up with the cremated bone when it was deposited in the pit. Roughly equal quantities of cereal grains, chaff fragments and weed seeds were recovered with the only identifiable taxon being emmer/spelt wheat. A few oat (*Avena* sp.) awn fragments were present indicating another possible crop plant or weed contaminant. The weeds represented were mainly common weeds of cultivated and disturbed soils, such as black bindweed (*Fallopia convolvulus*). A charred single nutlet of sedge (*Carex* sp.) and a blinks seed indicated the cultivation of damp soils.

LBA Pit 663167, sample 24051, context 663175

This pit was located in area PSH 02. The sample consisted of a dump of midden material which was located towards the middle of the fills and overlaid a whole pot (27125) deposited as a votive offering. The assemblage contained well-preserved waterlogged and charred plant remains. A large proportion of the flot comprised twigs, wood fragments and decaying wood fibres.

The dumped waste consisted of abundant burnt fine cereal processing waste, such as awn fragments, barley rachis fragments and emmer/spelt glume bases. A few cereal grains (hulled barley and emmer/spelt wheat) were present, but not enough to suggest that whole ears or spikelets of cereals had been burnt as offerings. The ratio of barley grains to rachis segments was roughly one to ten, as opposed to the three to one that would have been present with whole ears. The emmer/spelt grain to glume base ratio was also one to ten where it would have been roughly one to one. Only emmer was confirmed as being present amongst the emmer/spelt chaff. Barley grain and chaff was more frequent than emmer/spelt remains, which was true of only a few of the MBA samples. The small number arable weed seeds present included corn spurrey (*Spergula arvensis*), a weed of acidic, sandy soils. The recovery of an oat rachilla demonstrated that wild oat (*Avena fatua*) had been growing as a weed amongst the cereals.

The waterlogged plant macrofossils comprised a range of weeds of damp grasslands (including ragged robin (*Lychnis flos-cuculi*), blinks (*Montia fontana* ssp. *chondrosperma*) frequent rush seeds (*Juncus* sp.)) and disturbed places, with just a trace of woodland taxa (one rose seed and a thorn). Nettle seeds were scarce but other high-nutrient indicators such as fat hen (*Chenopodium album*) and many-seeded goosefoot (*C. polyspermum*) were well-represented. Damp ground/marsh taxa (e.g. sedges, (*Carex* spp.), spike-rush (*Eleocharis* subg. *Palustres*)) were more common than in the waterholes, but true aquatics were not present. As with several of the waterholes, a trace of waterlogged cereal chaff was present (one cf. spelt glume base).

General discussion – the MBA, LBA and LBA/EIA periods

Crop plants preserved by charring, weed associations and the deposition of burnt waste

The main crops grown during the MBA period were emmer (Triticum dicoccum), spelt (T. spelta) and hulled barley (Hordeum vulgare), with emmer dominating in most of the samples as shown below in Table 4 and in **Figure 4**. Oats were only present in low numbers and probably only grew as a weed, and the presence of free-threshing wheat was unconfirmed, as discussed later.

Both charred and waterlogged plant remains were recovered from twenty-seven of the fifty-five samples (MBA and M or LBA), and from all four LBA samples. However, in many cases charred material was not frequent. It is notable that, although 12 samples from ditches, 18 from pits and 28 from waterholes were examined, only ditch and pit samples produced high concentrations of charred cereal remains, with ditches producing the highest average figure of charred fragments per litre of soil sieved ((fpl) see **Figure 5**). The only waterhole samples to produce more than one or two charred cereal fragments were two upper backfills in waterholes 563060 and 711024 which contained burnt domestic debris that had been dumped after the features had fallen into disuse. The following pit and ditch fills produced samples with concentrations of 10 or more charred fragments per litre (*) or over 80 chaff fragments;

Farm stead	Feature	Grain/chaff/weed seed %	Hulled wheat/barley/oat grain %	Emmer : spelt ratio	No. samples [total no. CH remains]	Charred weed vetch & clover seeds as % total charred	Culm nodes and/or culm bases present
1	MBA Ditch 539096 *	34% / 18% / 48%	Upper 62% / 37% / <1%	33 : 1	3 [2367]	22%	+++
1	" " *	23% / 38% / 39%	Lower 49% / 50% / <1%	50 : 1	3 [3687]	19%	+++
1	MBA Pit 546202*	24% / 51% / 25%	48% / 52% / 0%	46 : 1	1 [215]	17%	++
2	MBA waterhole backfill 563060*	26% / 27% / 47%	29% / 66% / 5%	13 : 1	1 [424]	30%	+
1	MBA Ditch 539283	23% / 56% / 21%	83% / 17% / 0%	6 : 1	1 [305]	3%	+
5	MBA Pit 543201*	41% / 56% / 3%	95% / 5% / 0%	32 : 39	1 [772]	1%	+
4	LBA Pit 663167	15% / 68% / 17%	31% / 69% / 0%	38 : 1	1 [140]	0	-
	AVERAGE	27% / 45% / 28%	57% / 42% / 1%	6 : 1		13%	

+=present; ++=common; +++=frequent

Table 4: The major charred assemblages in the MBA features

These features were all located in the western and central region of the excavated area and all were located in or very close to settlement features. Farmstead 1, Settlement 7, produced the highest concentrations of charred crop processing waste, but this may partly be related to the better conditions of preservation, being lower lying and closer to the palaeochannel. The occurrence of straw stem (culm) nodes and stem bases was recorded as present, common or frequent at Farmsteads 1, 2, and 5 demonstrating that harvesting by uprooting was commonly practised during the MBA period. However, the LBA pit 663167 contained no culm bases or culm nodes. Whether this indicates that methods of harvesting changed through time is impossible to determine from such scant evidence, but it is interesting to note that culm bases and nodes were not found in the other three LBA samples either and they were only occasionally present as one or two items in later periods.

Bearing this observation in mind, weed taxa were compared (as far as was possible with the limited LBA data) to see if factors such as height of weed taxa suggest changes in harvesting methods. The main differences were major reductions in the diversity of weed taxa in the LBA (but this would be expected with fewer, poorer charred assemblages), with certain taxa that were frequent in the MBA samples being absent or scarce in the LBA. The following taxa were notable by their absence in the four LBA samples;

Small-flowered buttercup *(Ranunculus parviflorus)* – thermophilous, procumbent/scrambling

Common chickweed (*Stellaria media)* – nitrophilous, procumbent/scrambling

Docks (*Rumex sp.)* – many species, often grow in nutrient-rich waste places, mostly tall upright

Small-seeded weedy vetches (*Vicia/Lathyrus sp.)* – indicators of nutrient-poor soils, mostly climbing/scrambling

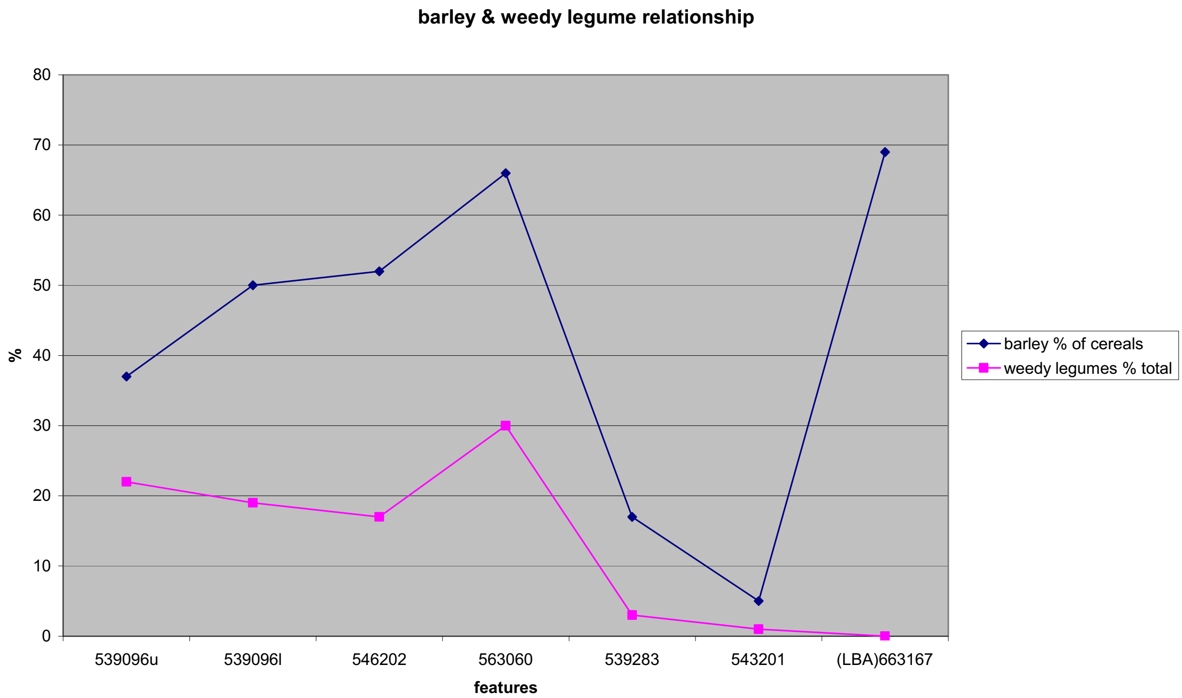
Clovers/medicks/trefoils (*Trifolium/Medicago/Lotus sp.)* – indicators of nutrient-poor soils, mostly low growing, sometimes scrambling

Two other common twining/scrambling weeds were much more frequent in the MBA samples; cleavers (*Galium aparine*) and black bindweed (*Fallopia convolvulus*).

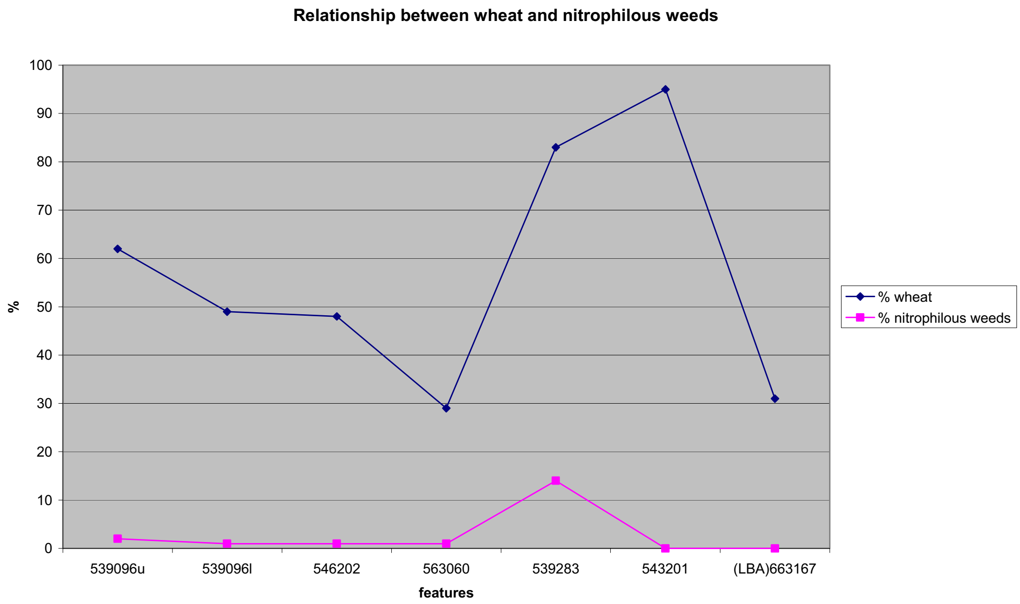
Uprooting rather than cutting with a sickle below the ear would greatly increase the recovery of whole twining, small scrambling and tall weeds, since a gathered handful (taking hold at least halfway down the stem to ensure uprooting) would contain all of these plants entwined together. Cutting below the ear would greatly reduce the recovery of whole seed heads and low-growing weeds, as only plants at and above ear height would be gathered and whole weed plants would not be harvested. All of the LBA weeds were from upright plants, and most grow from 40 to 60cm in height. The evidence (as far as it goes) supports a change from uprooting to cutting below the ear from the Middle to Late Bronze Age.

This small change in harvesting method could have had a major affect on crop husbandry, as seen by the reduction in weed contaminants. In addition, whilst uprooting leaves a clear field to be resown, straw left to stand in the field can be grazed off by livestock in late summer or over winter, with the benefit of spreading manure at the same time. The range of weeds found suggests that some manual manuring was probably carried out during the MBA period (as shown by nitrophilous weeds), but that the coverage was not equal, and some crops may have suffered from nutrient deficiencies (as shown by the frequent leguminous weedy vetches and clovers).

Because the charred assemblages were mixed, it is difficult to determine which weeds accompanied which crops. However, in the MBA features a relationship can be seen between barley and indicators of impoverished soils (weedy leguminous plants), with increases in one being more or less followed by increases in the other. (NB. The graphs are intended to illustrate the relationship only, not changes through time. Although the relationship is not perfect, it should be remembered that the mixing of crops and the inclusion of other type of waste such as hay would affect the data).



The apparent relationship between these taxa, with a fall in one being echoed by a fall in the other, suggests that the weedy legumes were primarily growing as weeds of barley. Frequent leguminous weeds in a crop indicate that soil nutrient levels are low (Moss 2004), so the barley was not being manured and was probably grown on the poorer land. Barley is a very tolerant crop, whilst some wheats, in particular spelt and bread-type wheat, are more demanding of nutrients, so they are likely to have been grown on the best soils and been manured. A plot of wheat's relationship with nitrophilous weeds (indicators of nutrient-rich soils, possibly relating to manuring) was attempted but was less conclusive because of inadequate charred weed seed numbers in some samples:



This barley/weedy legume relationship appears to have been reversed in the LBA, although this is a very tentative observation considering only one sample was examined. The reduced evidence of settlement at this time could relate to arable decline, in particular a failure of wheat, with manuring of barley fields representing and a desperate effort to improve crop productivity. Alternatively, new areas could have been ploughed, or grain brought in from elsewhere. Unfortunately, the data is too scarce to investigate further, so this theory is highly speculative.

One additional weed species is of interest in possibly indicating climate change. Small-flowered buttercup (*Ranunculus parviflorus*) is an arable weed that is rare today and primarily found in southern Britain, particularly coastal areas. At Heathrow it was found as charred and waterlogged remains up to the Middle Romano-British period, and was a common arable weed during the MBA. A number of other Bronze Age sites in southern England have produced this species, including Runnymede (Greig 1991). Its decrease from the Roman period onwards may relate to deteriorating climatic factors, since it is thermophilous and does not compete well with more robust weeds.

Waste deposition - The fact that concentrations of charred cereal processing waste were only found in settlement features is more likely to be because the combination of fires and processing waste occurred in these areas, rather than indicating that crop processing was only taking place close to settlements. Coarse processing waste that was rich in straw and large weed heads would have been valued as kindling and fuel, and this stage in the processing may have taken place either close to the arable fields, or under cover within the settlement area. Straw may also have been used as flooring, bedding and thatch. Fine processing waste (fine chaff including glume bases, spikelet forks, rachis fragments and small weed seeds) would probably have been sieved and hand-picked from parched spikelets within the settlement on a day-to-day basis, and may have been burnt on household fires as fuel or fed to livestock being stabled close-by. Grain or whole spikelets may have accidentally fallen onto the hearth during food preparation. When hearths and floors were swept out, this type of mixed waste would have been deposited in nearby ditches and pits. Some collection in middens may also have occurred, although no evidence if this was found.

Changes in crops through time – Apart from the tentative suggestions above relating to weed taxa, other differences between the periods, such as changes in the crops being grown, are more difficult to detect because, as Table 1 shows (above), there was a lot of variation amongst the MBA charred assemblages, and only one LBA sample produced sufficient charred cereal remains. Differences in the dominance of wheat or barley and in the grain/chaff/weed seed ratios demonstrated that a range of different types of waste were being burnt, probably of both animal fodder/bedding and human food/processing waste origin. No increase in the cultivation of spelt wheat was observed until the LIA (see **Figure 4**), even though this was the general trend across the British Isles from the MBA to the Romano-British Period. This could be another indicator to suggest that the arable economy was under strain at Heathrow by the LBA. Although too few LBA samples were available to draw firm conclusions about changes through time, the following observations can tentatively be made;

- The dominance of emmer wheat, spelt wheat or barley varied more between features than periods and no clear trends could be seen through time. However, in almost every case (apart from pit 543201) emmer was by far the most dominant wheat grown. All three crops were clearly important, and most of the variation probably related to whether burnt animal fodder or human domestic waste was being deposited. Chance accidental burning of crops during drying may also have played a part.

- Possible bread-type wheat grains (cf. *Triticum aestivum*-type) were only found in three samples but these could be aestivoid spelt grains (more rounded variants of spelt). A few poorly preserved tough rachis fragments (*Triticum* sp.) were found in four samples. However, since terminal rachis segments of spelt can appear to be tough, the presence of free-threshing wheat at this time is inconclusive.
- Although oats were found in small numbers as charred grain (3 MBA samples), the only grain identifiable to species level was from wild oat (*Avena fatua*; LBA). It appears, therefore, that oat was only growing as a weed at this time. The earliest confirmed cultivated oat (*Avena sativa*) at Heathrow was recovered from a LIA sample. By the Medieval period oats had become an important crop at Heathrow.
- None of the deposits consisted of pure cereal processing waste (i.e. high chaff and weed seed percentages, low grain percentage). Mixed waste was present in all cases, including hay in a sample from pit 563060 (and possibly smaller quantities in other samples). This suggests that cereal processing was occurring on a day-to-day domestic scale, rather than a large scale in order to produce a surplus for trading. Nevertheless, the relatively large quantities and widespread occurrence across the site of charred cereal remains at Heathrow during the MBA period indicate that arable cultivation was a very important aspect of the economy, particularly in comparison with most sites of the period. It is notable that no large concentrations of charred or waterlogged hazelnut shell were found at Heathrow, even though charcoal and pollen records demonstrate that it was growing in the locality. Since many MBA sites in Britain were still fairly reliant on wild food sources, this suggests that arable cultivation at Heathrow produced sufficiently large yields to comfortably last through the winter, without feeling the need to keep stores of gathered wild foods as a failsafe.
- However, since all of the samples that produced reasonable quantities of charred remains (over 20 fragments) were from pits or ditches, cereal processing was probably not occurring on such a large scale that the burnt waste had become widely distributed around the site, as on many later settlements. Processing waste would have been valued as fodder, and so may

have only become charred when specifically needed for tinder or fuel. In addition, there may have been deliberate efforts to keep such waste out of waterholes, either in order to avoid eutrophication and souring of drinking water, or for cultural reasons. Thus, the dumping of domestic waste appears to have been fairly well organised, with burnt material being deposited in features that were being deliberately backfilled close to the settlement, such as pits, ditches and abandoned waterholes.

- Flax (present as charred or waterlogged seeds and capsule fragments in six features (eleven samples)) was the only other crop plant identified from this period. Charred flax remains were present in two ditches and waterlogged flax remains were found in two pits and two waterholes. Waterlogged flax capsule fragments were also present in three of the MBA waterholes at Perryoaks (Carruthers, 2006). In all cases the quantities of flax remains were small, so it is unlikely that flax retting had taken place in any of the features for any length of time. Flowing water is preferred as retting is a smelly processes. Cultivation is likely to have taken place on the low-lying, moist soils of the floodplain and bundles of flax stems may have been left in the palaeochannel to ret. Flax processing waste can be fed to livestock, and flax seeds have medicinal uses and can be used as a source of oil.

All of the pits that produced large quantities of charred plant remains were also rich in waterlogged seeds from plants that grow in nutrient-rich soils, such as stinging nettles (*Urtica dioica*). This is probably because charred plant material is rich in potash and so causes enrichment of the surrounding soils. In addition, it could also be an indication that large quantities of other organic, domestic waste had been deposited in these features, some of which had rotted away leaving no identifiable traces.

Although some of the waterlogged taxa may have been growing as arable weeds, in particular annuals such as poppy (*Papaver* cf. *dubium*) and parsley piert (*Aphanes arvensis*), this is difficult to prove in mixed deposits containing very little waterlogged cereal chaff. Most of the charred weed seeds, however, were likely to have been burnt amongst cereal processing waste, so their association with crops was more certain. The taxa included in this group were indicative of a range of soil types, including damp soils (e.g. *Eleocharis* subg. *Palustres,* 3 samples from MBA pits 563060, and 821063), and acidic soils ; *Vicia* cf. *tetrasperma* – two MBA pits and ditch 539096; charred *Rumex acetosella* in a MBA ditch and waterhole). All of these indicators were from MBA samples, but this is hardly surprising in view of the much greater number of productive samples from this period.

In comparison with the relatively few other MBA sites that have produced substantial charred cereal assemblages in southern England, the Heathrow samples produced no evidence for the cultivation of pulses such as Celtic bean, unlike MBA sites like Bestwall Quarry, Wareham, Dorset (Carruthers, forthcoming) and Rowden, Dorset (Carruthers, 1990). However, there was more evidence for growing wheat rather than barley, compared with Bestwall Quarry and Trethellan (Straker, 1990) in south-west England. This may be because soils at these two sites were poor and acidic. Brickearth soils in the Heathrow area were likely to have been fertile when they first came into long-term cultivation during the MBA, so perhaps this enabled the preferred cereals for human consumption, emmer and spelt, to be grown in greater quantities. Pulses were not needed to help improve soil fertility and supplement poor grain yields.

Other possible crop plants

The record of a waterlogged achene of cotton thistle (*Onopordum acanthium*) in sample 18113, near the base of waterhole 558302, is of note. However, some RB pot sherds were recovered from a position 9 fill (554329) near the top of the feature, so contamination is a possibility. Godwin (1975) lists it as a Roman introduction, but it has also been recorded from Iron Age sites such as Farmoor (Robinson, 1979). A LIA well 593207, produced abundant seeds in four successive samples (114 in total), and E-MRB pit 617178 produced 53 seeds. Two Romano-British waterholes at Perryoaks also produced a few cotton thistle seeds (F133198 and F174009; Carruthers, 2006). All of these features lie in the central region of the excavated area, in Farmsteads 3 and 4, but apart from pit 617178 cutting well 593207, the others are far enough apart to rule out cross contamination. This impressive and attractive large thistle has a variety of uses, ranging from oil from the seeds, use of the seed-down, eating the more tender parts of the stem, and medicinal uses (Pliny *XXVII*).

A number of common native plants represented in the samples can be used as vegetables, or for medicinal purposes. This is impossible to prove where only a few remains are found, but it should be borne in mind. For example, mallow seed and capsule fragment (*Malva* sp.) were present in two features (pit 557027 and waterhole 693006). Common mallow (*M. sylvestris*) is a native grassland weed of calcareous soils. Its leaves and seeds can be eaten.

Differences between feature types (MBA and LBA)

Although the three different feature types were not equally well represented amongst the samples, some interesting observations can be made concerning possible differences between the features (see **Figures 1 to 3**).

Ditches - Five of the seven ditch samples examined in detail produced abundant stinging nettle seeds and six of the seven ditches appear to have been hedged with thorny shrubs. Stinging nettles are indicative of nutrient-rich (phosphate-rich) soils, so the fields had probably been fairly intensively used for grazing and possibly arable cultivation, hence the need for thorn hedges along the ditches. Charred cereal processing waste had been deposited in two of the ditches and four ditches contained smaller numbers of charred remains that may have washed in off the fields, having been spread amongst manure. On average, the highest concentration of charred plant remains was found in the ditches during the MBA, whilst in all other periods the ditches contained very few charred cereal remains (see **Figure 5**). Although some marshy ground plants were growing along the ditches, no true aquatics were present, suggesting either that the ditches only held water seasonally, or that they had been kept clear of aquatic vegetation. Perhaps grazing animals prevented the vegetation from fruiting.

Pits - Many more samples from pits were examined (ten pits, fifteen samples) and, as noted above, many of the charred cereal remains were recovered from these features. In the eight pits containing waterlogged remains, nitrophilous weeds were often frequent to abundant, as might be expected in a place where rubbish was being deposited. The fact that the widest range of aquatics and plants of marshy ground came from the pits indicates that at least some of them remained open long enough to develop a diverse aquatic flora (six out of eight). This included free-floating plants such as duckweed (five pits), emergents such as water plantain and crowfoot (seven pits), and marginals such as gypsywort, sedges and mint (all eight pits).

***Waterholes* -** It is more difficult to generalise when discussing the waterhole assemblages (thirty-one samples from seventeen M to LBA waterholes) as some of the fills examined relate to the abandonment of the feature, rather than its period of use.

The most consistent feature of the waterholes was the presence of remains from woody taxa, in particular thorny shrubs. Twelve of the seventeen waterholes contained a range of woody taxa, including blackberry, hawthorn, sloe, dogwood, alder, willow, hazel, elderberry and alder buckthorn. Both fruits and thorns were often found, as were frequent leaf fragments and twigs in some cases. Even the five waterholes with few woody remains produced a few fruits/seeds of blackberry, sloe, alder or an acorn fragment. Waterholes in the Perryoaks area also produced frequent woody remains. Sequential samples taken through MBA and M/LBA waterholes at Perryoaks suggested that in some cases scrub growth had increased post-abandonment. Nevertheless, all of the MBA to LBA Perryoaks waterholes/large pits produced substantial evidence for the presence of woods, scrub or hedgerows throughout the period of backfilling, including the primary deposits. Because very little waste appears to have been deposited in these features (see below and **Figure 3**), and because fruits, leaves, thorns and twigs were often present, it is clear that these remains indicate close proximity of hedgerows and/or scrub, rather than just bird-transported berries. Insect and pollen results confirm these findings in many cases. The waterholes appear to have often been located in the corners or along the edge of hedged fields, or perhaps in some cases adjacent to scrub or woodland. The frequent presence of wood/hedgerow herbaceous taxa such as three-nerved sandwort (*Moehringia trinervia*) demonstrate that these hedgerows were well established, as does the diverse range of shrubby taxa identified.

The second most consistent feature was the lack of charred domestic waste in fifteen of the seventeen waterholes. Five of these contained traces of charred waste (maximum of 4 fragments) and six waterholes contained traces of waterlogged cereal chaff (one or two fragments). The two waterholes that produced larger quantities of charred cereals had been backfilled with burnt waste post-abandonment (WH 711024 and WH563060). The absence of this type of waste from the waterholes during use requires either location a good distance away from crop processing and burning activities, and/or deliberate efforts to keep this type of waste away from the waterholes, perhaps to prevent souring the water.

Other types of management appear to have been carried out, since despite being water-filled features (confirmed by often excellent preservation of organic remains), many of the waterholes contained no true aquatic plants and fairly low numbers of marginals or wet-ground plants. The absence of aquatic insects and pollen from aquatic species was also frequently noted (Tetlow; Huckerby & Peglar). In total, nine of the seventeen waterholes produced no truly aquatic taxa and only four waterholes contained frequent floating aquatic plants such as duckweed (*Lemna* sp.), i.e. 24% compared with 63% of the pits. It is possible that the features were only seasonally water-filled, but this would have left a characteristic plant record, and organic preservation would have been much poorer. In addition, this does not fit in with information from the pits which were usually shallower but mostly contained water. Frequent use and grazing of vegetation by livestock may have played a part in reducing pollen and seed numbers, although insect populations would still be able to feed on grazed plants and eutrophication caused by the dung would have encouraged aquatics like duckweed to flourish. It seems likely, therefore, that the waterholes had been kept clear of floating and marginal vegetation, particularly those used by humans.

One more observation of note was that, although these features were presumed to have been used by livestock as waterholes, seven of the seventeen produced no botanical indicators of trampling or nutrient-enrichment of the surrounding soil. Out of the remaining ten waterholes nitrophilous plants such as nettles, chickweed and fat hen were abundant in the following five features: WH 641097, 816042, 693006, 711024, 726001. These features were widely distributed across the excavated area revealing no pattern. Presumably, where these plants were absent or rare either they had been cleared or cut back to prevent flowering, or use of the feature was very low. Since livestock tends to leave patches of nettles rather than graze them, their absence suggests possible deliberate clearance. Certainly, if the features were frequently used by humans, as the waterholes with log ladders presumably were, it would be sensible to keep nettles to a minimum. Six of the seven waterholes that have no/few aquatic plant remains and no/few weeds of nutrient-enriched soils were located in the eastern area, in Farmsteads 8 and 9. The seventh was located in the D-shaped enclosure, Farmstead 3.

The local environment during the Bronze Age

Retrieving information from waterlogged assemblages concerning the local environment can be difficult, since the material could have originated from a range of sources. In addition, adjustments need to be made for differences in seed dispersal distances and vast differences in seed production. A further consideration is the fact that seed production can be totally prevented or reduced by factors such as mowing hay, grazing, coppicing and heavy shading from trees. Preservational limitations can also occur, so that whole families of plants may be greatly under-represented in waterlogged assemblages, in particular the legumes and grasses. Thus, what was probably the dominant vegetation type across much of the excavated area, open grassland, appears in the waterlogged plant macrofossil record as just a few small grass caryopses (which tend to be thin-walled, fragile and difficult to spot) and a few grassland-type herbs, such as buttercups (*Ranunculus repens/bulbosus/acris*), thistles (*Cirsium/Carduus* sp.) and bugle (*Ajuga reptans*). Several of the herbs can grow in a range of habitats (e.g. bugle, self-heal, from open woodland, to hedgerows and disturbed ground), so they cannot be used as definite indicators of grassland. A few are useful in characterising a particular type of grassland, e.g. ragged robin (*Lychnis flos-cuculi*), which grows in damp meadows (present in waterhole 559328 and pit 663167), and e.g. thistles often become abundant in heavily grazed pastures (several achenes and some whole fragments of seed head present in waterholes 510047, 559328, 693006). Where damp and marshy taxa are concerned, it can be difficult to determine how much of the evidence relates to the immediate marshy edges of the feature, and how much could represent a much wider area of wetland.

Similarly, where woody taxa are concerned, some material could have been deposited in features as waste, or could have washed in during flooding episodes. Several of the features, particularly the waterholes, however produced not only large quantities of wood, but also frequent thorns, twigs, bark fragments and leaves, as well as fruits and seeds. In these cases it was fairly clear that woodland, scrub or hedgerows occurred very close to the feature, particularly when woodland herbs such as three-nerved sandwort were also represented. Woody remains were notably frequent in the majority of the waterholes, as noted above, so the positioning of these features next to thorny hedgerows is very likely.

Plotting the occurrence of some of the tree species can be instructive. All of the samples producing alder seeds and cone fragments occurred in features closest to the palaeochannel (pit 557027, WH 563060, pit 615008, pit 546202) apart from waterhole 711024, which was located along the line of the palaeochannel to the north. It is likely, therefore, that alder carr was growing along the peaty floodplain of the valley bottom during the MBA, composed of alder, willow and alder buckthorn. If alder trees were not growing close to these features, the buoyant seeds and cones could have been washed into features closest to the palaeochannel during flooding episodes, having been carried from alder carr upstream. This suggests that many of the pits remained open for some time, as was also indicated by the frequency of aquatic taxa. Willow remains were more widely scattered around the site. A range of species of willow may have been present, including some that can grow on drier soils and can be used in hedging. It is interesting to note that alder carr and old woodland had been cleared from the Runnymede area by the Middle Bronze Age (Robinson 2000, 153).

Plotting the occurrence of elderberry, almost all of the seeds came from features in the western and central area of the site, possibly indicating areas of high activity, i.e. high nitrogen input and also increased waste disposal. This distribution coincides with most of the samples that contained abundant stinging nettle seeds, supporting the suggestion of high levels of domestic waste and/or dung deposition in the central and western area in the vicinity if Farmsteads 1, 2 and 3 (areas 24, 49, 61). It may be significant that the samples from the D-shaped enclosure in Farmstead 3 produced evidence for hedgerows but not abundant nettles. Perhaps there had been deliberate clearance of this area, or lower levels of waste disposal. Of course, this type of plotting of taxa would not be valid if, for example, elderberries were being used for dying or for food, as the waste could have been deposited some distance from the trees. In addition, birds can distribute seeds over great distances. The fact that these seeds do have a limited distribution, therefore, is of interest, even if it is not possible to be sure whether this is due to elder trees growing on nutrient-enriched soils, or human consumption and waste disposal being higher in these three Farmsteads. Both of these suggestions demonstrate that human activity was far greater in these areas, possibly because the Farmsteads were occupied for some time (possibly around two- to three-hundred years).

Maple seeds (probably field maple, *Acer campestre*) primarily occurred on the drier soils to the east (waterhole 510047, pit 563060, waterhole 559328, ditch 615051). A similar distribution was observed for oak remains (acorn cups and immature acorns) in the MBA and LBA/EIA samples (all in area TEC 05). Distribution patterns for other taxa, however, were less clear, for example flax, which was scattered across the site (Areas 42a, PSH02 and TEC05) as both charred and waterlogged remains. This type of distribution suggests that flax was either cultivated over a long period of time, moving across the area with time, or was grown widely by individual farmsteads for their own needs alongside emmer, spelt and barley. Radiocarbon dates on plant remains from four of the features demonstrate that the first suggestion is certainly true, with dates spanning 1690 cal BC at the earliest to 920 cal BC at the latest (95% probability), i.e. Middle to Late Bronze Age.

Comparisons with Runnymede – Although Neolithic and Late Bronze Age in date, the plant assemblages from Runnymede (Greig 1991) a short distance on the River Thames downstream from Heathrow are probably the most closely comparable of sites in the area. All of the plant communities described by Greig were equally well represented at Heathrow. Aquatic, waterside and marsh taxa were as frequent and varied, as were damp grassland taxa. Dry chalk grasslands, however, were not represented at Heathrow, though Runnymede produced only a small number of indicator species for this group. Crop plants and crop weeds were similar in range, but by the LBA at Runnymede spelt wheat had become the dominant crop by about 3 : 1 spelt to emmer (Greig 1991, 254) and barley was only a minor crop. As at Heathrow, flax was relatively frequent, indicating that it had been an important crop along the Thames Valley throughout the Middle to Late Bronze Age. The only pulses to be recovered from Runnymede were two possible charred peas from a Neolithic deposit, so the absence of this useful source of protein appears to have been a common phenomenon in this area (especially when compared to the frequent Bronze Age peas and beans found in e.g. Kent).

As at Heathrow, alder carr continued to grow close to Runnymede, although it had been reduced from its dominant hold over the river valley in the Neolithic period. A few of the woodland trees at Runnymede were not present at Heathrow, and once again this tended to be calcicolous species such as yew and whitebeam. The possibility of hedgerows at Runnymede was raised, although the evidence was less specific and compelling than at Heathrow. Evidence for heathland development was slight, as it was up to the Late Iron Age at Heathrow.

Further upstream in the Middle Thames and Kennet Valleys, LBA sites like Aldermaston Wharf (Bradley *et al*. 1980) and Hartshill Copse, Upper Bucklebury (Carruthers, forthcoming) demonstrate how much variation in crop selection there was during this period. Whilst at Aldermaston Wharf hulled barley dominated at 87% to 13% emmer wheat, with no spelt wheat identified, at Hartshill Copse spelt wheat was dominant by the LBA/EIA and hulled wheat outnumbered barley by 9 : 1. On both sites, however, flax was identified, despite the fact that flax seeds do not preserve well by charring because of their high oil content. This demonstrates the widespread and important role of flax during the Bronze Age.

Conclusions

The analysis of large numbers of samples from a range of feature types and across a wide area has enabled a detailed picture of the environment and economy at Heathrow during the MBA to LBA periods to be built up. This includes information about crop husbandry, the lay out of farmsteads, waste disposal and the use of features such as waterholes.

CHARRED AND WATERLOGGED PLANT REMAINS FROM MIDDLE IRON AGE CONTEXTS

Only four productive samples came from contexts of this period (Table 5). The two pit samples contained only charred plant remains, whilst the two samples from waterhole 521069 produced almost exclusively waterlogged remains. The samples are discussed feature by feature below.

sample	context	feature	Feature type	Waterlogged/charred plant remains
17153	539451	539450	Pit	CH
17519	554144	529306	Pit	ch
18308	521091	521098	Waterhole	WL
18310	“	“	“	WL & (ch)

(ch) = 1-10 frags; ch = 11-40 frags; CH = >40 frags

Methods

The charred flots were all fairly small and unproductive. Modern contaminants such as uncharred seeds (with fresh embryos) and rootlets were common. The charred plant remains were generally poorly preserved, with the cereal grains showing signs of surface erosion, and the glume bases and spikelet forks all being too highly fragmented to be identified to species level. This suggests that the burnt waste was derived from redeposited material that may have lain around the site for some time before being swept up and deposited in the features. Unlike the periods before and after the MIA, no concentrated cereal processing waste was recovered from these samples (see discussion below).

Results

Waterhole 521098, recut of 521069, samples 18308 & 18310, context 521091

This waterhole is one of a group of Bronze Age and Iron Age waterholes that appears to have been used for watering cattle. Context 521091 consisted of grey clay that had probably formed in standing water (Freeview).

This was the only feature examined in detail to produce almost no charred cereal remains (apart from a single emmer/spelt (*Triticum dicoccum/spelta*) glume base in sample 18310). Since the adjacent LIA well 593207 produced reasonable quantities of charred cereal processing waste in all four samples, there must have been some differences in the use and deposition of waste in the features. Uncharred chaff fragments were equally rare (one emmer/spelt glume base in sample 18310), and only one fragment of sloe/plum (*Prunus* sp.) stone was found as evidence of edible plant taxa. The evidence suggests, therefore, that, as in the Bronze Age waterholes, very little domestic waste had been deposited in the feature.

The main habitats represented by the two assemblages were damp grassland (e.g. buttercups (*Ranunculus repens/acris/bulbosus* and *R. parviflorus*), ragged robin (*Lychnis flos-cuculi*), thistles (*Cirsium/Carduus* sp.)), disturbed ground (e.g. nettles, knotgrass, chenopods) and wetland/aquatic plants (e.g. horned pondweed (*Zannichellia palustris*), water pepper (*Polygonum hydropiper*) and spike-rush (*Eleocharis* subg. *Palustres*). Both pasture and meadow plants appear to be present, so animal dung could have been the source of some of the remains, in addition to grassland plants growing around the feature.

The disturbed ground taxa in this feature were not as biased towards indicators of nutrient-enriched soils (e.g. nettles, chenopods, chickweed) as might be expected for a waterhole used by livestock, and no specific indicators of trampled soils were present. Therefore, use of the feature must have been fairly low-level at the time these deposits formed, or livestock access may have been restricted. Since the aquatic plants were all either submerged or marginal taxa, use of the feature was probably frequent enough to have prevented free-floating weeds such as duckweed to have become established, or perhaps some degree of maintenance was practiced. The evidence suggests, therefore, that the waterhole may have been used for livestock, but that use was at a low level or access was restricted for part of the year.

The two samples were very similar in character, the only difference being that 18310, the lower sample, was better preserved than 18308 and so produced a wider range of taxa .

Pit 539450, sample 17153, context 539451

This pit in Area 61 lies within an Iron Age ring gulley in the central region of the excavated area. Its shallow, single fill contained daub, frequent burnt flint, possible slag, small bone and MIA pot sherds, suggesting that it had been deliberately backfilled, perhaps with waste from industrial activities taking place nearby (Freeview). A charred barley grain was radiocarbon dated to 360-350 cal BC (Wk-19334).

The moderate assemblage of charred plant remains consisted of poorly preserved cereal grains, chaff fragments and weed seeds in roughly equal quantities. If well preserved, this could have represented unprocessed spikelets, but considering the poor state of preservation it is more likely to represent background waste material from hearths and floor surfaces that had been swept up with other waste materials deposited in the feature, i.e. pot, bone and slag. As far as could be identified from the poor remains, the cereals present were primarily emmer/spelt wheat (*Triticum dicoccum/spelta*) with a trace of barley (*Hordeum* sp.). Some of the wheat grains were rounded, vacuolated and distorted in a similar fashion to bread-type wheat, but these were probably an aestivoid form of spelt wheat (Jacomet 1987). The weeds indicated nutrient-poor and damp soils, since weed vetches (including *Vicia* cf, *tetrasperma*) were relatively frequent, and blinks (*Montia fontana* ssp. *chodrosperma*) and spike-rush (*Eleocharis* subg. *Palustres*) were represented.

Pit 529306, sample 17519, context 554144

This shallow pit was located in the top of the eastern Stanwell cursus ditch (C1, 529304). It consisted of a layer of burnt flint and charcoal. Forty litres of soil was floated. The resulting flot contained poorly preserved impregnated charcoal, modern uncharred rabbit pellets and fragments of coal, indicating that contamination through rabbit burrowing had occurred. A charred barley grain was radiocarbon dated to 390-200 cal BC (Wk-19335).

Fragmented charred grain (barley, cf. bread-type wheat), small vetch seeds and a seed of stinking mayweed (*Anthemis cotula*) were present. This weed of arable and disturbed areas on damp clay soils is commonly recovered from Iron Age and later sites (Jones 1981), and uncharred seeds were found in a couple of the Bronze Age samples, perhaps indicating that it was growing as a ruderal weed of damp, heavy soils. This is the earliest example of charred stinking mayweed (i.e. probably having been growing as an arable weed) from the Heathrow samples. Charcoal fragments from this sample primarily consisted of alder, with oak, sloe and elm (Challinor, *CD Section 15*).

Discussion

These low concentrations (all less than 2 fragments per litre) of poorly preserved charred cereal remains from the MIA samples are an indication that activities such as cereal cultivation and crop processing were probably only taking place on a small scale during this period, unlike the periods either side of the MIA, the MBA and LIA/ERB. The only crop plants represented were emmer/spelt with a little barley.

The archaeological evidence suggests that settlement in the MIA was "both insular and impoverished" (Framework Project Design Update rep. 95008.01). There was little evidence of granary-type structures and no finds of quernstones. Unfortunately the animal bone was also poorly preserved, providing little reliable information concerning the pastoral economy. Evidence from soil micromorphology (Macphail & Crowther, this volume), however, has produced signs of heavily used droveways, with slurry deposition and trampling suggesting that animal husbandry may have been the dominant type of farming. There were also strong signs of burning in the soil thin sections, and it is tempting to suggest that the high alder charcoal and absence of alder and other woody remains in the plant macrofossil record from the MIA onwards was due to use of any remaining woodland in the vicinity as fuel. The burning of alder would suggest some degree of desperation, since it does not burn well. Clearance of damp alder carr would not be easy and the timber would require a period of drying prior to burning. It should be remembered, however, that few good waterlogged or charred samples have been examined from the LBA to MIA periods, so most of these suggestions are somewhat speculative.

Figures 1 to **3** show a marked fall in tree and shrub species in all types of features, including waterholes. Since it was suggested that woody fruits, seeds, leaf fragments, thorns etc. represented hedging close to the waterholes, a fall in all of these remains indicates the removal of hedges and reorganisation of boundaries.

CHARRED AND WATERLOGGED PLANT REMAINS FROM THE LATE IRON AGE TO EARLY/MIDDLE ROMANO-BRITISH CONTEXTS

Nineteen samples from ten features in the central region of the excavated area (PSH02/58 and PSH02/61) were examined for this report (Table 6). The samples came from pits, waterholes, a well and ditches dating from the M/LIA to E/MRB periods. All of the samples produced charred plant remains, and all except five samples (from three pits, a ditch and an upper waterhole backfill) also contained remains preserved under anaerobic conditions.

sample	context	feature	Feature type	Waterlogged/charred plant remains
27030	678002	678001	LIA pit	CH
18332	593201	593207	LIA well	WL & CH
18334	"	"	"	WL & CH
18336	"	"	"	WL & ch
18368	"	"	"	WL & CH
25051	627043	627042	LIA/ERB waterhole	CH
25052	627046	"		CH & WL
26045	630107	630108	LIA/ERB pit	CH
27027	677002	636073	LIA/ERB ditch	CH
25034	641094	641098	LIA/RB pit	Ch
19188	527377	527374	E/MRB waterhole	WL & (ch)
19191	527379	"	"	WL & (ch)
19192	527376	"	"	WL & (ch)
18384	617176	617178	E-MRB pit	WL & CH
18385	617177	"	"	WL & CH
18387	"	"	"	WL & CH
18389	"	"	"	WL & CH
19176	527369	542387	E/MRB ditch	wl & CH
27039	678043	636100	E/MRB ditch	wl & CH

(ch) = 1 to 10 frags; ch = 11 to 40 frags; CH = >40 frags

Results

State of preservation

The charred and waterlogged flots from this group of samples were fairly well-preserved, but generally not so productive as to require sub-sampling. Only one waterlogged flot, sample 26007, was subsampled (25%) because it contained such a large quantity of organic material.

The waterlogged plant remains in some of the samples showed signs of decay, but this had probably occurred during storage and is not likely to have affected the species composition of the assemblages to a great extent. Other samples produced uncharred seeds from just a few taxa (e.g. samples 18332, 18385 and 19176), and this is probably due to drying out leading to organic decay in some areas of the site. However, the range of seeds in these samples was not restricted to woody seeds only (e.g. blackberry, elder), so drying out had obviously not been too extreme. Perhaps the features had not lain open for long, and little organic waste had been deposited in the first place.

Sample 18368 was much larger than usual (10 litres of soil sieved rather than the usual 1 litre) and it was sorted at Oxford Archaeology rather than by the author. Because the flot had already been sorted, the author could not subsample it without causing sample bias. The sorted remains were too numerous to count, but as three other, very similar but less rich samples had already been examined from this context, the seeds in 18368 were roughly quantified using a star system (+ = occasional; ++ = several; +++ = frequent; ++++ = abundant). The charred remains, however, were counted as these were less frequent.

LIA to LIA/ERB

LIA/ERB Ditch 636073, sample 27027, context 677002

Sample 27027 came from the fill of a ditch that may have functioned an enclosure or part of a droveway (Freeview). The silty, charred flot produced an assemblage characteristic of redeposited cereal processing waste, i.e. rich in poorly preserved emmer/spelt (with only the spelt identification confirmed) glume bases and spikelet forks with occasional wheat grains and weeds of cultivated soils. The G:Ch:W ratio was 1 : 8 : 2. As with all of the LIA and later samples (except ditch sample 19176), a few charred ericaceous fruits were present in the sample, perhaps indicating the type of vegetation bordering the fields, or maybe fuel used to parch the crop during processing. The presence of sheep's sorrel seeds (*Rumex acetosella*) and seeds from damp ground plants such as blinks (*Montia fontana* ssp. *chondrosperma*) and spike-rush (*Eleocharis* subg. *Palustres*) in almost all of the features demonstrates that poor, acidic and damp soils were widespread during this period. Good cereal yields are unlikely to have been obtained from such poor land. An alternative explanation is that these remains might not have been directly associated with the crop, but may have become mixed with the chaff because heather and marsh hay was being used for tinder and/or fuel to parch the cereals. Parching was carried out on semi-processed spikelets in order to facilitate removal of the chaff, i.e. make the chaff more brittle. Once the glume bases and spikelet forks had been rubbed away from the grains the waste chaff may have been thrown into the fire and become charred alongside the fuel. Widespread use of this type of fuel suggests that wood was probably scarce locally by the LIA/ERB.

LIA Pit 678001, sample 27030, context 678002

This single fill of pit 678001 contained charcoal, burnt clay and bone. The fill was not waterlogged. There were frequent charred plant remains in the flot, and blobs of white 'slag' that could have been derived from the burning of silica-rich plant material such as chaff.

The charred assemblage primarily contained well preserved emmer/spelt wheat grains with a few possible bread-type wheat grains (although these were mostly too 'puffed' and distorted to be positively identified and have been left in the *Triticum* sp. aestivoid/spelt type category). Oats were relatively frequent (c. 8% of identifiable grain), although it was not possible to determine whether these were a cultivated crop or weed contaminants (but see discussion of chess below). The presence of cultivated oat was confirmed in one LIA/ERB sample (25051), but most of the chaff fragments recovered from this period (rachilla) were from wild oats (2 samples).

The grain to chaff to weed seed ratio (G:Ch:W) was 11 : 2 : 1, although this was likely to be an underestimate of the frequency of cereal grains as many small indeterminate fragments of grain were not counted. This suggests that most of the burnt waste had consisted of processed grain with some cereal processing waste or residual contaminants. However, taking into account the presence of the white slaggy material, significant quantities of chaff may have been lost on combustion.

This was the only grain-rich assemblage recovered from the LIA/ERB samples, although an E/MRB ditch also contained mostly grain. Most of the other charred assemblages (in particular the waterhole samples) consisted of cereal processing waste, but this pit sample had the character of burnt domestic waste, i.e. accidental charring of processed grain during the preparation of food. The small number of weed seeds still present with the grain were typical weeds of cultivated ground such as scentless mayweed (*Tripleurospermum inodorum*) and black bindweed (*Fallopia convolvulus*), with chess (*Bromus* sect. *Bromus*) being the most common taxon. Chess is often frequent in processed spelt wheat assemblages, since the large seeds are of a similar size to wheat grains and so are not easily separated from the crop. The same would apply to wild oats, although this sort of weed infestation is less easy to detect, because when large quantities of oat grains are found it is usually assumed a crop plant is present.

Other occasional weed taxa of note were a couple of damp ground and acid grassland taxa that may have been growing along field ditches, e.g. spike-rush (*Eleocharis* subg. *Palustres*), stinking chamomile (*Anthemis cotula*), buttercup (*Ranunculus repens/acris/bulbosus*) and sheep's sorrel (*Rumex acetosella*). Some of these taxa are discussed in more detail below.

LIA/ERB Pit 630108, sample 26045, context 630107

The small flot from this single pit fill produced a few cereal remains (barley, oat and emmer/spelt chaff), ericaceous fruits, disturbed ground weed seeds and relatively frequent spike-rush nutlets. Apart from the frequency of this latter taxon, the other remains were similar to (though more sparse than) most of the other charred assemblages from this period. From the evidence of the spike-rush nutlets, the burnt waste deposited in the pit had probably contained marsh hay used for bedding, thatch or fodder.

LIA/RB Pit 641098, sample 25034, context 641094

This sample came from a secondary fill of a pit cutting the Bronze Age D-shaped enclosure. The pit contained large amounts of pottery but a fairly low concentration of charred plant remains. An oat grain, a few emmer/spelt chaff fragments, barley rachis fragments and a few weed seeds (chess and scentless mayweed) all indicate the presence of burnt domestic waste from small-scale grain cleaning prior to cooking.

LIA Well 593207, samples 18332, 18334, 18336, 18368, context 593201

The four samples from this waterhole all came from a sample column through the fill (context 593201) of a shaft cut into the waterhole late in its history. Pollen samples from this column were also examined (Huckerby & Peglar, *CD Section 16*). Two complete pots had been placed in the shaft, and there may originally have been a wattle lining to the well.

The uppermost sample, 18332, produced a higher concentration of charred remains and fewer waterlogged seeds than the others (see bottom of Table 6), indicating that there had been some drying out and decay of organic material in the upper levels. Sample 18334 and the lower samples were sufficiently productive and diverse to indicate that waterlogging had been continuous in the lower levels of the feature. Apart from preservation differences, the four assemblages were so similar in character that they have been described together.

The charred plant remains consisted primarily of cereal processing waste, with poorly preserved emmer/spelt glume bases and spikelet forks being the main components. Although little of this could be identified to species level because of the poor state of preservation, spelt wheat was clearly the major wheat grown by this period (c. 1 : 13, emmer to spelt chaff). A trace of barley and a couple of swollen, rounded wheat grains that could have been bread-type wheat were also recorded. Weed contaminants were very scarce, consisting of small leguminous weeds, scentless mayweed and chess. This type of assemblage is likely to be the waste product of piecemeal processing of semi-cleaned emmer and spelt spikelets during the preparation of food. This would have been an every day activity if, as is usually thought to be the case (Hillman 1981), hulled cereals were stored in spikelet form in order to protect the crop from damp and pest damage.

The remaining charred material consisted of a small quantity of heathland vegetation, including Ericaceae fruits and ling (*Calluna vulgaris*) shoot tips. A couple of uncharred remains from these taxa were also present. Since five other LIA to RB features also produced charred and/or waterlogged ericaceous remains it is clear that heathland was well established in the locality at this time. These were the earliest heathland remains from T5, although at Perryoaks (Carruthers 2006) a LBA well (F180080) contained a few ericaceous remains. The subject is discussed further below.

Considering the probable loss of organic material in the upper levels, the quantities of charred processing waste were fairly similar throughout the sample column. Similarities in the waterlogged assemblages, and the fact that numbers of aquatic plants showed no obvious trends of succession, suggest that context 593201 was deposited in a short space of time using the same sources of waste.

The main components of the waterlogged assemblages were the nitrophilous weeds, in particular nettles (both stinging nettle (*Urtica dioica*) and small nettle (*U. urens*)). Other indicators of nutrient-enriched soils whose seeds were frequent included common chickweed (*Stellaria media*), and henbane (*Hyoscyamus niger*). Chenopods (fat hen, orache etc.) were common but not abundant. Insect remains from the lower sample, 18368, were studied (Emma Tetlow, this report). The presence of frequent dung beetles, some of which were associated with midden-type dung accumulations rather than dung in open pastures, suggested that the well shaft may have deliberately been backfilled with midden material. Tetlow suggests that herbivores were grazing around, and drinking from, the waterhole and that open grassland and disturbed ground occurred locally.

Grassland taxa characteristic of well-grazed pastures were the next most frequent items amongst the plant remains, including thistles (*Cirsium/Carduus* sp.) and greater plantain (*Plantago major*). Damp ground taxa, however, were fairly scarce in comparison with the adjacent waterhole 521069. Tetlow also noted the absence of aquatic insects associated with deeper water, although insects associated with shallower, more ephemeral water bodied were present. The feature, therefore, is unlikely to have existed as an open, water-filled waterhole for long. Perhaps it was ritually backfilled in a short space of time, since there was clearly a sufficient quantity of water at these lower levels to have ensured the preservation of abundant organic remains.

This contrast between the two adjacent features WH593207 and WH 521069 suggests either that use of the features was separated by a sufficient number of years for the local vegetation to have considerably changed, or that WH 593207 had been backfilled using soil from a different area of the site. Deliberate backfilling of 593207 is likely to be the explanation, although Tetlow notes that insect remains associated with human domestic activity were absent (*CD Section 17*).

The most significant plant macrofossils that were present in all four samples (lending support to the explanation above) were the large seeds of cotton thistle (*Onopordum acanthium*). Seeds from this introduced and useful plant were found in three other waterholes from the period, and also in a MBA waterhole, WH559302. At Perryoaks two RB waterholes contained a few seeds (Carruthers 2006). This apparent association with waterholes is worthy of further investigation. It is quite likely that such a plant would have been valued to such an extent that seeds may have been ritually deposited in features such as waterholes, but the plant does colonise disturbed, nutrient-rich soils so the distribution may relate to disturbance by livestock rather than cultural factors. The plant is impressively large (up to 2.5m) and showy, with dense hairs making it appear silvery white. The seed heads contain abundant oil-rich seeds and down, and the plant has medicinal uses, as recognised by classical writers such as Pliny the Elder (AD 23-79; Natural History XXIV, Ch.66) and Dioscorides (c. 40 – 90 BC). Other finds in the British Isles have been from Roman and medieval London (Anne Davis, pers.comm.) and medieval Plymouth (Carruthers, 2003).

LIA/ERB Waterhole 627042, sample 25051, context 627043; sample 25052, context 627046

The two samples from this waterhole produced well-preserved charred assemblages, but only the lower sample contained a few waterlogged plant remains.

Sample 25052 from a lower silty fill, context 627046, contained mainly well preserved charred plant remains, including small (2cm diameter), rounded, compacted lumps of fibrous, chaff-rich material. These appear to be some type of dung, possibly sheep or goat. Other types of burnt waste present in the flots were cereal processing waste, ericaceous vegetation, wasteground weeds, grassland and marsh plants. The processing waste consisted of primarily emmer and spelt wheat chaff, with smaller amounts of grain and weed seeds at a ratio of 2 : 15 : 3 (G:Ch:W). Hulled barley and wild oats were relict crops or minor contaminants. Quantities of emmer chaff were roughly equal to spelt chaff in this sample (correcting for glume bases versus spikelet forks; 1 spikelet fork = 2 glume bases), even though in most other LIA/ERB samples spelt appears to have been the dominant wheat grown. Perhaps this relates to the presence of animal dung, i.e. maybe emmer was more frequently used as fodder than spelt.

The small numbers of waterlogged seeds present were mostly wasteland, heath and damp grassland taxa. Two waterlogged cotton thistle seeds were also recorded. In several cases both waterlogged and charred remains from the same taxon were found, demonstrating that plants such as knotgrass and sedges were both growing as arable weeds (perhaps along damp field margins and ditches) and as weeds of disturbed areas around the waterhole.

Sample 25051 came from a top fill of the waterhole (context 627043) that contained abundant dumps of waste, including burnt flint, burnt clay, burnt bone, pot and slag. As with sample 25052, the charred assemblage contained primarily emmer and spelt remains, but in this case the composition was more typical of domestic waste than processing waste, with a ratio of 1 : 1 : 3 (G:Ch:W). This range of small contaminants could have been sieved from the processed grain prior to cooking. A single grain, still in its floret, identified as cultivated oat (*Avena sativa*) was found in this sample. Since barley was a little more frequent than in most samples, perhaps waste fodder was present amongst the burnt material. The weeds included damp ground taxa and some ericaceous remains, perhaps reflecting types of vegetation bordering the fields, or maybe the presence of material from a range of sources.

Early to middle Romano-British

E/MRB Ditch 542387, sample 19176, context 527369

This sample came from the upper fill of an east-west ditch that produced abundant finds, most of which were RB in date.

The waterlogged assemblage was restricted to a few tough-coated taxa, most of which were common weeds of disturbed or cultivated places (e.g. orache (*Atriplex patula/prostrata*), fumitory (*Fumaria* sp.)). The only taxon of note was possible raspberry (*Rubus* cf. *idaeus*). The 8 seeds could represent sewage spreading into the top of the ditch. If so, raspberry may have been newly introduced into the area as a garden plant, although it is native to the British Isles.

The charred assemblage was different to most of the other samples (apart from pit 678001, G:Ch:W = 11:2:1), as cereal grains were more numerous than chaff fragments, (G:Ch:W = 6 : 2 : 1), in contrast with the chaff-rich cereal processing waste recovered from most of the LIA/ERB waterholes. Whole spikelets appear to have been present in this deposit, since some of the grain was found still in spikelet form, enclosed in the chaff. Chaff fragments are more easily destroyed by burning than grain (Boardman & Jones, 1990), so the ratios may have been affected by differential preservation. Since hulled barley grains were almost as frequent as emmer/spelt grains (unlike the other samples where barley grains were scarce or absent), burnt waste fodder may also have been deposited. The few weed seeds were all common weeds of cultivated land

E/MRB Enclosure Ditch 636100, sample 27039, context 678043

Enclosure ditch fill 678043 was one of several finds-rich deposits in this feature. Frequent pot sherds, bone, worked flint, a loomweight and daub were recovered from the ditch, indicating that settlement or industrial activities were taking place nearby. However, no specific structures that could have been the source of this debris were located. To the north, iron panning indicated periods of waterlogging. To the south, charcoal was more frequent (Freeview).

The charred plant remains from this deposit were moderately frequent (86 fragments) but poorly preserved, and many items showed signs of surface erosion. Chaff fragments from both emmer (uncertain identification; cf. *Triticum dicoccum*) and spelt wheat (*T. spelta*) were the most frequent items, although cereal grains (one bread-type wheat grain, a few emmer/spelt grains and an oat grain) were common. Oat awn fragments were also present. Several weed seeds were recovered, primarily consisting of common weeds of cultivated and disturbed soils such as scentless mayweed (*Tripleurospermum inodorum*) and knotgrass (*Polygonum aviculare*).

The only non-cereal item of note was a mallow (*Malva* sp.) seed. Mallow is commonly found in RB assemblages, probably because it was being used as a vegetable at this time and was valued by the Romans for its medicinal powers. According to classical writers such as Pliny, a spoonful of mallow juice each day keeps diseases at bay, and it is effective against intestinal and respiratory complaints (Culpepper 1826). The poet Martial used it as a cure for hangovers, but Cicero found that eating it as a vegetable gave him indigestion (Readers Digest 1981).

This assemblage probably represents burnt domestic waste that had become redeposited amongst other types of waste, hence the poor state of preservation.

E-MRB Pit 617178, sample 18384, context 617176; samples 18385, 18387 & 18389, context 617177

This series of samples (series 18381) came from two lower fills of a large, purpose built rubbish pit containing daub and pot sherds. Well preserved waterlogged and charred plant remains were recovered from the four samples, with the state of organic preservation becoming less good towards the top of the column (sample 18384). Insect remains were examined by Emma Tetlow (*CD Section 17*) from the top (sample 18384), bottom (sample 18389) and alternate samples in the middle of the sequence.

The four samples were similar in many ways, so most of the discussion concerns the deposits as a whole. However, to some extent a vegetation succession can be seen in the fills by studying the four samples. This could partly be explained by the changes in preservation conditions through the profile, but not entirely, as thin-walled seeds were preserved in the upper layers as well as the lower ones, so drying out was not a major problem. The lower samples contained a range of taxa that rapidly colonise nutrient-rich soils, such as small nettle, chickweed, black nightshade and henbane. By the time the upper two levels were deposited, these plants had been swamped by the perennial nitrophilous weed, stinging nettle, perhaps indicating some degree of abandonment of the area. The usual range of grassland, disturbed ground and damp ground taxa were present throughout the sample column, although the latter group was not well represented, and no free-floating aquatics were recorded.

Evidence for the disposal of burnt waste was obtained from all four samples, with the largest concentration being found in sample 18387. The charred assemblages were very similar in character, having the composition of emmer and spelt processing waste (roughly 1 to 10 emmer to spelt, according to the glume base and spikelet fork count). The G:Ch:W ratio averaged for all four samples was 1 : 68 : 3, demonstrating the chaff-rich character of the burnt waste. Small amounts of barley and wild oat chaff were present as very minor contaminants. Other taxa of note were a charred mallow (*Malva* sp.) seed, several charred and waterlogged ericaceous fruits, leaves and shoot tips and a large number of waterlogged cotton thistle seeds (total = 53 seeds from three out of four samples). This suggests that other types of waste were being deposited, along with the cereal processing waste. Mallow and cotton thistle, as well as some of the other weeds such as henbane, could have been dumped as domestic waste, since all three plants have medicinal uses. However, they also colonise disturbed waste areas, so may have been growing nearby.

It is interesting to see that Tetlow obtained very little evidence for the presence of domestic waste, dung or stable-type waste, and that most of the insects suggested that dry, open grassland was the principal habitat represented. She suggests that the feature may have been abandoned, possibly due to increased waterlogging. This disparity could be partly due to the limited retrieval of insects from the samples, and this in itself could indicate that the feature had not lain open very long. The large rubbish pit appears to have been rapidly backfilled with domestic waste, leading to the growth of nettles and other nitrophilous plant around the feature. Alternately, many of the nitrophilous weed seeds could have been deposited in midden-type waste as part of a rapid backfilling event prior to abandonment (see discussion below).

E/MRB Waterhole 527374: sample 19188, context 527377; sample 19191, context 527379; sample 19192, context 527376

This waterhole was located to the north of the other features, in Area 61. The three samples came from three different contexts, so they differ in a few specific ways, as described below. However, in all cases weed species indicative of nutrient-rich soils were the main components of the assemblages, in particular the nettles, chenopods, docks and farmyard/midden type plants like henbane and woody nightshade. The waterhole, therefore, is likely to have been used for livestock, or for depositing organic, midden-type waste. Identifiable charred and waterlogged cereal remains were present (both emmer and spelt wheat chaff) but not frequent in all three deposits. However, the secondary fill 527376 (sample 19192) contained frequent small fragments of waterlogged straw and chaff, so animal dung or stable waste may have been deposited in this layer.

The primary fill, sample 19191, was the most productive of the three, although unfortunately it produced no dateable finds. The frequent fragments of wood in this sample were probably derived from some sort of lining, since leaf fragments, thorns and woodland taxa were scarce (unlike waterholes from earlier periods - a few elder and blackberry seeds only). Notable taxa in this deposit were stinking chamomile (*Anthemis cotula*), hemlock (*Conium maculatum*) and mallow (*Malva* sp.). This sample produced a wider range of plants of marshy ground than any of the other samples, such as yellow iris (*Iris pseudacorus*), frequent sedge nutlets (*Carex* spp.) and bristle club-rush (*Isolepis setacea*). Hemlock would have been well-suited to these nutrient-rich, damp conditions. It should be noted that this highly poisonous but medicinally useful plant is rarely found prior to the Iron Age and become common in the Romano-British period. However, at Runnymede it was common in LBA deposits

(Greig 1991). This waterhole is the earliest feature to have produced hemlock at T5, and at Perryoaks it was recorded from the RB period onwards (although very few samples were examined from Iron Age deposits). The few mallow seed and capsule fragments are a further possible indication of Roman influence, since even if it is a native species, this taxon becomes much more frequently associated with domestic waste deposits around the Roman period. Classical writers mention mallow as being an effective cure for a range of intestinal and respiratory complaints, and Pliny recommends the taking of a spoonful of juice from any of the mallows each day to guard against diseases in general (Culpepper 1826). The poet Martial used it as a cure for hangovers, but Cicero found that eating it as a vegetable gave him indigestion (Readers Digest 1981). A few mallow seeds were recovered from MBA T5 and Perry Oaks samples, suggesting that their properties were appreciated prior to the Roman invasion. The presence of mallow feeding insects in LIA/ERB features (Tetlow, *CD Section 17*; F617178) confirms that mallows were growing in sufficiently large numbers to maintain viable populations of insect pests. Perhaps they were grown as garden plants, as their showy pink flowers make mallows popular today.

Sample 19188 was from a clayey, secondary fill slightly higher up the soil profile. Straw fragments and decayed woody fibres were once again present, perhaps indicating dung. As with the other two samples, the main habitat represented was wasteground, with some damp grassland indicated. The only species of note was cotton thistle, two seeds from which were present in the sample. As this was a secondary rather than primary fill, it is uncertain whether the seeds were deposited for a ritual purpose, amongst domestic waste or the plants were growing nearby.

Discussion

Charred plant remains were more frequent in the LIA to MRB samples on average than in the MBA samples, as shown below;

Fpl (charred fragments per litre of soil sieved)	**Pits (no. of samples)**	**Ditches (no. of samples)**	**Waterholes (no. of samples)**	**average**	**Total No. of samples**
MBA	8.6 (13)	60.3 (13)	0.4 (24)	23.1	50
LBA	1.1 (2)	-	2.0 (1)	1.6	3
MIA	1.1 (2)	-	0.5 (2)	0.8	4
LIA/ERB	3.9 (3)	3.3 (1)	49.3 (6)	31.0	10

E/MRB	190.3 (4)	2.3 (2)	2.9 (3)	86.1	9
M-LRB	52.5 (2)	2.2 (2)	4.0 (1)	22.7	5

Even if this figure was biased by the selection of 'ashy-looking' samples, it demonstrates that there were a greater number of rich, charred samples to select than in previous periods. Well-preserved waterlogged features, however, were scarcer than in the MBA. The distribution of charred cereal processing waste and burnt grain was also different, in that charred cereal remains found their way into all types of features, pits, ditches, waterholes and wells (see **Figures 1** to **3**). This was particularly true of the LIA features, whilst the E/MRB waterholes contained just a few burnt chaff fragments. This sort of wider distribution of burnt material could be explained in the following ways;

- either crop processing was being carried out on a larger scale, so more burnt waste was blowing and being trampled around the site. This could include larger scale de-husking of hulled wheats for market, as seen at Stansted in the LRB (Carruthers 2008)

- or the burning of waste was taking place in a different location, closer to the features in question

- or there were fewer controls operating on waste disposal, so dumping was taking place in all types of features. Increased abandonment of waterholes could also be a factor, leading to deliberate backfilling with burnt waste.

As with the MIA samples, woodland taxa were scarce in these samples. Only one of the LIA/RB samples contained a few leaf fragments, and where woody material was present, this was usually in the primary fill, in situations where the waterholes may have possessed timber or wattle linings. Seeds from woody taxa only came from elderberry (*Sambucus nigra*) and blackberry/raspberry (*Rubus* sect. *Glandulosus* and *R*. cf. *idaeus*), two ruderal invasive species typical of wastegrounds. In previous periods these particular taxa had often been so abundant that the numbers had to be estimated. It is obvious that the landscape was very much more open from the Middle Iron Age onwards, due to the clearance of remaining areas of woodland and scrub, and possibly also some grubbing out of hedgerows. Since no alder remains were present in the features, alder carr that had survived up to the LBA along the palaeochannel must also have been cleared by the LIA.

Widespread woodland clearances, particularly the clearance of alder carr on the floodplain, would have affected the soil hydrology, causing the leaching of nutrients from these already poor soils (Macphail, *CD Section 19*) and leading to the establishment of heaths and bogs. Flooding episodes are likely to have become more frequent and severe. Charred and waterlogged Ericaceous plant remains were recovered from eight of the ten LIA/ERB features and five of the nine E/MRB samples. Heather (*Calluna vulgaris*) and cross leaved heath (*Erica tetralix*) are both plants of wet, peaty bogs, moors and heaths. Since both charred and waterlogged ericaceous fruits, leaves and shoot tips were present in the features, it appears that heather was being gathered to be used as fuel, and perhaps for fodder and building materials. It may also have been growing close enough to the western-most features to have fallen into them during their period of use. Since the samples that contained the most charred ericaceous remains also produced the largest quantities of charred cereal processing waste, it would appear that, either heathland vegetation was being used for fuel in the parching of cereals during processing, or that arable crops were growing close enough to heathland for ericaceous remains to become mixed with the crop. An alternative explanation could be that part processed spikelets were being stored in a structure that was thatched using heather. The first of these explanations seems most likely, but other explanations could apply to different degrees. However, it is notable that the occurrence of charred and waterlogged ericaceous remains in features matches that found in earlier periods for alder remains, i.e. the six western-most features contain heathers but four features furthest away from the palaeochannel do not. This could be coincidence, or it could suggest that where the alder was lost or removed along the palaeochannel, boggy heathland developed on the impoverished wet soils. Only one LIA sample was examined for charcoal (Challinor). The assemblage contained both primary (oak) and secondary (maple, ash) woodland taxa but no evidence for the use of heathland vegetation for fuel and little evidence for burning thorny shrubs that were growing abundantly as hedges during the Bronze Age. Perhaps most of the clearance occurred at the very start of this period and wood was now being collected from further afield in woodlands on higher ground surrounding the settlement.

Climatic changes may also have played a part in some of the changes seen in the vegetation, since increased wetness on some LIA sites in southern England such as Mingies Ditch (Robinson 1993) lead to periods of abandonment. At T5 the range and frequency of plants of damp and marshy soils increased in the E/MRB samples (sedges, spike-rush, lesser spearwort, water-pepper, mint, rushes, bristle club-rush, yellow iris) in comparison with earlier periods, although in no cases were free-floating, invasive aquatics recorded (such as duckweed), to indicate abandoned, water-filled features. This change to wetter conditions appears to have occurred between the LIA and MRB periods at Heathrow. In the LIA the only features that probably held standing water, at least periodically, were the waterholes (see **Figures 1** to **3**). By the E/MRB the pits and ditches also produced waterlogged plant remains, and evidence for marshy ground close to the waterholes had increased. This trend continued into the M-LRB, with possible evidence that the use of drainage ditches helped to improve pastures in the later RB period.

Permanent waterlogging may not have reached some settlement features until the MRB, but increased flooding epidsodes may have affected LIA farmers at Heathrow. Although there is no clear evidence for new dry-ground arable weed taxa which might suggest movement to higher ground, arable weeds such as field madder (*Sherardia arvensis*) and scentless mayweed (*Tripleurospermum inodorum*) were recorded, and these species prefer drier soils. In contrast, several marsh and wet-ground taxa that had been present in waterlogged assemblages in earlier periods were found as charred seeds for the first time in the LIA to MRB assemblages, such as lesser spearwort (*Ranunculus flammula*), blinks (*Montia fontana* ssp. *chondrosperma*) and meadowsweet (*Filipendula ulmaria*). Whilst this could indicate that damp meadow hay had been burnt and mixed with crop processing waste, an alternative explanation is that this type of damp ground flora was encroaching on the arable fields as the climate deteriorated and/or flooding increased.

One notable new introduced arable weed was corn cockle (*Agrostemma githago*), a poisonous contaminant that first appears in LIA charred assemblages such as Danebury (Campbell 2000). By the medieval period this plant had become a serious cause for concern.

The frequency and range of nitrophilous plants in the LIA to MRB periods, such as henbane (*Hyoscyamus niger*) and black nightshade (*Solanum nigrum*), and in the E/MRB period hemlock (*Conium maculatum*), suggest that organic waste was accumulating in areas around the site, perhaps in middens. Henbane, black nightshade and hemlock are poisonous to livestock, but are usually avoided by animals due to unpleasant odours of the plants (Miller & West 1953). They are, therefore, unlikely to have been present in dung but would have readily grown on dung heaps. They are potentially useful as medicinal plants, if used with care. Grieve (1992) notes that in the Middle Ages henbane seeds were chewed as a cure for toothache and hemlock was used against rabies, amongst several other uses. It is impossible to know whether any plants were deliberately grown for this type of use, but if found growing on a midden undoubtedly they would have been used for poultices and ointments. Classical authors such as Pliny the Elder (AD23-79) wrote about the medical uses of all three species, which included clearing skin disorders and fastening loose teeth. Greek writers such as Theophrastus (372-286 BCE) and Dioscorides (c.40-90 BCE) described medicinal properties for these plants even earlier.

The LBA midden-like deposit at Potterne, Wiltshire (Carruthers 2000) produced mineralised assemblages containing frequent seeds of many of the taxa in the LIA to MRB samples, such as henbane, blinks and small nettle, and there were similarities between the Potterne and T5 samples. Some of the LIA insect assemblages at Heathrow indicated accumulations of dung rather than dung in open fields (Tetlow, *CD Section 17*, Well 593207). If soil impoverishment was widespread, manuring may have become increasingly important to ensure reasonable yields of cereals were obtained. When spread on the fields, seeds shed by the vegetation growing on and around the midden may have found a suitably disturbed habitat to become established for a while, and so become harvested and charred as arable weeds. Where waterlogged remains of these taxa were recovered, midden material may have been used to backfill some of the features, or even stored in disused waterholes (e.g. Well 593207, WH527374). Pit 617178, a feature rich in other types of waste, also appears to have contained midden-type remains. An alternative explanation for the waterholes is that the prolonged and intensive use of waterholes for livestock lead to dung accumulations in and around the features. If true, the scale of this increase (see

Figures 1 to **3**) would suggest that a far greater level of stock-rearing was occurring than in the MBA period.

Further evidence for manuring during the LIA/E/MRB but not in earlier periods was the sudden decrease in small-seeded weedy legumes after the MBA period. Whereas the MBA samples contained an average of 13% (maximum 30%) of the charred assemblage consisting of small weedy legume seeds (vetch, medick, clover etc.), the LIA/ERB and E/MRB samples contained an average of 2.5% weedy vetches. High numbers of leguminous weeds are characteristic of crops grown on impoverished soils (Moss 2004), since plants in this family have the ability to fix their own nitrogen with the assistance of bacteria in nodules on their roots. This gives them a competitive advantage on poor soils, and they can become abundant as arable weeds, scrambling up through the crop. The introduction of manuring would have decreased leguminous weeds and encouraged nitrophilous taxa such as small nettle instead.

Of the arable crops being grown during the LIA/ERB period, spelt wheat was the most frequently represented in the charred assemblages. However, in contrast to chalkland sites in Wessex such as Danebury (Campbell 2000) where emmer had almost disappeared, emmer was still an important crop in the LIA at Heathrow. The ratios of emmer to spelt wheat chaff through the phases were (adjusting for 1 spikelet fork = 2 glume bases):

LIA/ERB = 5 : 7 emmer : spelt

E/MRB = 1 : 8 emmer : spelt

Spelt finally became the dominant wheat grown at Heathrow by the E/MRB period (see **Figure 4**). The following average cereal percentages demonstrate that other changes were occurring;

Cereals as % of identifiable grain;

Average MBA & LBA - 57% wheat / 42% barley / 1% oat

Average LIA - 85% wheat / 8% barley / 7% oat

Average E/MRB - 65% wheat / 33% barley / 2% oat

Average M/LRB - 63% wheat / 36% barley / 1% oat

Barley appears to have decreased in importance during the LIA, perhaps being substituted by oats to some extent as the preferred fodder crop. There is a little evidence to suggest that oats became a crop plant during the Iron Age (a single cultivated oat (*Avena sativa*) grain with floret base was identified from sample 25051 and fourteen cultivated/wild oat grains were present in pit 678001). There are a number of possible explanations for crop changes, for example differing food/fodder preferences or the availability of seedcorn. In some measure the increase in hulled wheats at the expense of barley is a change that was occurring widely across southern England from the Late Bronze Age onwards. Some Bronze Age sites, such as Rowden (Carruthers 1990) grew predominantly barley for many centuries, and hulled wheats only took over as the dominant grain for human consumption in the Iron Age. Other explanations may relate to changes in growing conditions, for example changes in weather and/or soils through time. Better understanding of increasing yields by manuring could have enabled more demanding crops such as spelt to have been more widely grown. The introduction of oats, a high-energy fodder crop, may have reduced the need for large areas of barley to be grown.

The presence of bread-type wheat was unconfirmed by the recovery of any rachis fragments, although 'swollen' aestivoid wheat grains were found in a few samples and one well-preserved possible bread-type wheat grain was identified. This scant evidence could simply be the result of natural variation in grain shape within a genetically diverse spelt crop. It is noteworthy that bread wheat does not appear to have been grown in the Heathrow area during this period, as some other Iron Age and E/M Roman sites have produced reasonable numbers of free-threshing wheat grains (e.g. Bierton, Bucks; Jones 1984). Free-threshing wheat was not grown at Danebury during the Iron Age. Perhaps the poor, damp soils precluded its cultivation at T5.

The constant but fairly low occurrence of barley through the periods suggests that it was probably mainly used for fodder. This type of use would produce fewer grains (as these mostly become charred during processing for human use and the preparation of food), but more chaff from fodder scattered around the site and from burnt stable waste. Three times as much barley chaff as grains was found in the E/MRB period samples. By the E/MRB period barley resumed its importance, according to the charred grain percentages above, and it maintained the same position throughout the Romano-British period at Heathrow. Oats were only occasionally recovered as charred grain, though they may have been used as an early bite crop or used as fodder and not come into contact with fire. It is interesting to see how little change there appears to have been through the RB period, perhaps suggesting controls were in operation over which crops were being grown.

Other possible plants of economic importance were cotton thistle (*Onopordum acanthium*) and mallow (*Malva* sp.). Cultivated flax, however, a crop grown in the MBA to LBA/EIA, was not found in T5 or Perryoaks Romano-British samples. Cotton thistle is a tall (up to 2.5 metres), downy plant that was thought to have been introduced by the Romans, although Stace (1997) suggests that it may be native in East Anglia. A number of seeds were recovered from Iron Age deposits at Farmoor (Robinson 1979), Godwin (1976) mentions Reid's record from Roman Silchester, and nine Romano-British sites in London have produced records (Anne Davis, pers. comm.; e.g. Gray 2001 & 2002). The substantial records from LIA (WH 593207) and later features at Heathrow confirm that introduction occurred during the Late Iron Age (the single MBA seed was probably a contaminant). Cotton thistle has a variety of uses; boiling the stem to eat as a vegetable, using the oil and downy fibres from the seed heads, and medicinal uses ranging from curing convulsions to rickets (see above). At Perry Oaks the earliest records were Middle Romano-British, but few Iron Age samples were available for study. Mallow can also be eaten as a vegetable and the seeds make a tasty snack. Its value as a medicinal plant has been noted above.

CHARRED AND WATERLOGGED PLANT REMAINS FROM MIDDLE TO LATE ROMANO-BRITISH CONTEXTS

Six samples were examined for this report. All of the samples were from the central area of the Terminal 5 site, Areas 58 and 61.

sample	**context**	**feature**	**Feature type**	**Preservation (waterlogged/charred)**
19155	553169	553166	MRB pit	CH
26050	658167	658175	MRB pit	wl & ch
19187	527347	527388	M-LRB waterhole	WL & (ch)
27028	673028	673029	LRB ditch	CH
25003	666013	666001	RB waterhole	CH
26007	644007	644006	RB waterhole	WL & (ch)

(ch) = 1 to 10 frags; ch = 11 to 40 frags; CH = >40 frags

Methods

Two samples were subsampled: 26007 (25% sorted) because it consisted of a large waterlogged flot full of straw, and 25003 (50% sorted) because it was composed of concentrated crop processing waste with components too abundant to count fully. All calculations in these reports (e.g. fpl) have taken this into account.

Results

Most of the plant remains were preserved by charring and only waterholes 527388 and 644006 produced diverse and well preserved waterlogged assemblages. One other MRB sample, 26050, produced some uncharred seeds in flots that had been processed for charred plant remains (i.e. floated and dried out). Although these were initially thought to be modern contaminants, the range of taxa and state of preservation suggested that they could have survived in the semi-waterlogged, lower fills of this feature. These remains, therefore are listed in Table 7 as waterlogged seeds.

The six samples are firstly discussed sample by sample, and then compared as a whole to the results from earlier periods at Heathrow. Some aspects of this period has been covered in the LIA/E/MRB report above.

Mid Romano-British

Pit 553166, sample 19155, context 553169

This sample came from a deliberate backfill in a pit that was probably used for the disposal of household waste (Freeview). The moderate sized charred plant assemblage (141 remains) had the character of domestic waste, comprising mainly the chaff from small-scale de-husking emmer/spelt wheat, with a few wheat grains and small weed seeds. Spelt (*Triticum spelta*) was positively identified from four glume bases. A possible bread-type wheat grain, some oat awn fragments and a barley rachis fragment were the only remains from other crops being grown. Amongst the typical weeds of cultivated and disturbed soils, a couple of indicators of acidic soils were found, including an ericaceous fruit (heather, heath) and 3 sheep's sorrel seeds (*Rumex acetosella*). This and an ericaeous fruit and *Calluna vulgaris* shoot tip from RB waterhole 644006 were the only indicators of heathland from the period. In comparison, 63% of the LIA to MRB samples contained heathland remains, and some produced large numbers of charred and waterlogged ericaceous fruits, shoot tips or leaves. It appears, then that heathy vegetation may have been reduced close to the occupied features by the M/LRB period, perhaps due to heavy use as fuel during the LIA and E/MRB periods.

As with several of the samples from this period, a few remains from damp/wet ground taxa (spike-rush, *Eleocharis* subg. *Palustres*) were recovered. These may have been present amongst the heathland material, or have grown along damp field margins or ditches amongst the arable crops.

Pit 658175, sample 26050, context 658167

This rectangular shaped pit produced frequent burnt clay and charcoal. The light grey, silty fill may have contained hearth material (Freeview). The charred plant assemblage was small (15 items), consisting of a few emmer/spelt grains and glume bases, a possible bread-type wheat grain and a few seeds of stinking chamomile. These remains are consistent with the interpretation of redeposited hearth material, as they have the character of domestic waste from small scale de-husking and cleaning of grain prior to cooking.

Several uncharred plant remains were also present. It is difficult to tell whether these were contaminants or remains preserved by waterlogging, but the nature of the assemblage suggests that they were likely to be Romano-British in date. Most of the remains were typical of disturbed habitats where human activity has caused nutrient-enrichment of the soil (e.g. stinging nettle (*Urtica dioica*) and chickweed (*Stellaria media*)). Elderberry (*Sambucus nigra*) and blackberry (*Rubus* sect. *Glandulosus*) seeds have tough, woody seed coats and they can survive in semi-waterlogged conditions for many centuries. Hemlock seeds (*Conium maculatum*), however, are less robust and are usually only found in fully waterlogged deposits. They are very characteristic of RB samples, the earliest records for the Heathrow sites being an ERB waterhole at Perryoaks and a E/MRB waterhole at T5 (WH 527374). Hemlock is also found in later periods, often having been growing in damp soils on wasteground or by ditches where soil-enrichment has occurred.

The most noteworthy of the uncharred remains was a single grape pip (*Vitis vinifera*). Grape is commonly found in RB waste deposits on urban sites, particularly where sewage has been deposited. However, the Perryoaks and Terminal 5 samples have all been notably free of imported fruits and spices, being much more rural in character. The grape pip, therefore, is the first possible (if not a contaminant) evidence for the consumption of luxury foods from either Perryoaks or Terminal 5. Admittedly, no deposits with recognisable concentrations of faecal waste have yet been investigated at Heathrow, so it is possible that this type of information has been missed if sewage was being composted and used to manure the fields. Since such a large number of waterlogged and charred deposits have been sampled during excavations at Heathrow as a whole, foods consumed on a regular basis are likely to have become incorporated into domestic waste being burnt on hearths and being deposited in abandoned waterholes etc. As native fruits have commonly been preserved in this way, it appears that the simple, rural character of the diet is likely to be a fairly accurate description for this site.

Mid-late Romano-British

Waterhole 527388, sample 19187, context 527347

This sample came from the secondary fill in a re-cut of the waterhole. The deposit is thought to have formed over a period of time in standing water (Freeview).

This sample produced one of only two well-preserved waterlogged assemblages from the period, providing some information about the local environment. The few charred plant remains present (3 spelt glume bases; 1 emmer/spelt glume base) suggested that spelt was probably still be the main crop being grown.

The waterlogged plant assemblage was very similar to the LIA/ERB and E/MRB waterholes described in the previous report, i.e. disturbed ground (particularly on nutrient-rich soils) and grassland were the dominant vegetation types represented. The only difference of note was that the remains of ericaceous plants were not present in this sample. The only heath or acid grassland taxa represented was a bracken pinnule fragment (*Pteridium aquilinum*). No woodland or hedgerow taxa were present (in contrast to the M and LBA waterholes), so the local environment must have been very open and pastoral. As with the earlier cut of this feature, E/MRB Waterhole 527374 (see samples 19188, 19191 and 19192), decayed wood fragments in the sample are likely to have come from rotting structural timbers present in the feature or dumped waste, rather than overhanging shrubs. The main differences between the two phases of use were that the environment may have become even more open in the later period, as blackberry and elderberry remains, found in small numbers in the earlier samples, were not present in the LRB sample. In addition, in two of the E/MRB samples from secondary fills (samples 19188 and 19192), waterlogged straw and chaff fragments and the seeds from nitrophilous plants characteristic of middens or farmyards (henbane (*Hyoscyamus niger*) and nightshades (*Solanum* spp.)) were frequent, but these were not found in the later re-cut. It appears, therefore, that by the time the secondary fills were accumulating in the E/MRB period, the waterhole had fallen into disuse and was being used for the disposal of midden-type waste, or it was becoming contaminated by the dung of livestock coming to drink. Following the later RB re-cut, management of the area may have become more intensive, with organic waste and colonising weedy shrubs being cleared in order to improve the access to, and cleanliness of, the water. Some muddy, dung-enriched areas still existed, however, as several dung beetle fragments and taxa of foul, rotting material were identified by Tetlow (*CD Section 17*). The pollen evidence (assessment only) reinforced the general impression of a very open landscape with very few trees or shrubs and with arable cultivation occurring nearby (Huckerby, OU archive report).

Plant taxa of note in both phases of the waterhole included mallow seeds (*Malva* sp.), a plant that grows in disturbed ground and was important to the Romans, as noted above. Deliberate cultivation of this plant on a small scale, perhaps in gardens, cannot be ruled out as it occurs very commonly on Roman sites. Insects that feed on mallow were recorded, suggesting the plant may have been growing close by (Tetlow, *CD Section 17*). Helmock was also frequent in both phases of use, and this could relate to medicinal use externally as an antispasmodic (see LIA/ERB report). This is another plant whose record increases sharply in the RB period.

Free-floating aquatics were not recorded, although plants of marshy places that were probably growing as marginals, such as sedges and rushes, were quite frequent. Aquatic insect remains were also rare, suggesting, perhaps, that the waterhole had been deliberately kept clear of vegetation or was too frequently used to allow free-floating plants to become established. The presence of waterfowl would also keep the surface free of vegetation and would create a very muddy, nutrient-rich habitat. However, the water would then only be fit for livestock to drink, and not humans.

Late Romano-British

Ditch 673029, sample 27028, context 673028

This sample came from the secondary fill of an enclosure ditch that produced a number of finds, including bone, a fragment of mortaria and burnt flint. Perhaps this high frequency of finds was due to the position of the deposit, in the south-west corner of the enclosure (Freeview).

The flot produced a moderate assemblage (67 fragments) of typical burnt domestic waste arising from the de-husking of emmer/spelt spikelets prior to cooking. Emmer/spelt chaff, a few grains and a few weed seeds were the principal components. Spelt (*Triticum spelta*) was positively identified from a single glume base. An oat grain, oat awn fragments and a barley rachis fragment provided evidence of other crops or possibly weeds (oats) that were present. The range of weeds was similar to the other samples from this period, including stinking chamomile, scentless mayweed (*Tripleurospermum inodorum*) and wet/damp ground taxa such as spike-rush. The presence of charred spike-rush seeds could be due to crops growing close to drainage ditches or patches of poorly drained land.

Romano-British

Pit 666001, sample 25003, context 666013

This undated pit has been assigned to the RB period on stratigraphic grounds. It is said to have been used as a cess pit, although no evidence for this was found amongst the plant remains in the flot. Unfortunately the residue could not be found.

A rich deposit of charred cereal remains was present in the flot. Because none of the other samples from this phase were very productive, this sample was examined in detail to try to find out more about RB crop husbandry practices. 50% of the flot (mixed and divided using a riffle box) was sorted in detail and quantified.

If derived from a single source rather than being mixed waste, the assemblage appears to have consisted of a burnt deposit of emmer and spelt, mixed with a slightly smaller quantity of barley (*Hordeum* sp.). Small numbers of oat (*Avena* sp.) and possible rye grains (cf. *Secale cereale*) could be weed contaminants or minor crops (wheat:barley:oat:rye = 81:50:1:2). These crops may have been charred when in the ear or in spikelet form, but the presence of weed seed heads suggests the former is more likely. The grain to chaff to weed seed ratio was 11 : 2 : 16. Although the proportion of chaff seems low (a ratio of one grain to one glume base is the theoretical ratio in most emmer/spelt crops, plus rachis fragments, straw nodes etc.), differential preservation following charring could easily explain this type of loss of the more delicate chaff fragments, according to experimental work carried out by Boardman and Jones (1990). The quantity of weed seeds was very high, but this was primarily due to the recovery of abundant seeds (569) of stinking chamomile and fragments of the seed head (receptacle). Since very few straw nodes but frequent fragments of stinking chamomile seed heads were present, the likely explanation is that the deposit represents unprocessed ears of emmer, spelt and barley that had been harvested by cutting below the ear. Thus, most of the straw and seed heads from shorter weeds would have been left standing in the field, but seed heads above the point of cutting would have been gathered with the spikelets. The spikelets appear to have been burnt before any further processing was done, since threshing them would have caused most of the stinking chamomile seed heads to have broken up and their small seeds to have been shed.

Stinking chamomile is said to be able to grow up to 60cm tall (Keble Martin 1969), although weeds growing through a densely-sown crop can become very tall, scrambling up through the crop in order to obtain sufficient light. Percival (1921) states that European forms of emmer grow to a height of 100-125cm, and spelt reaches 100-120cm. Heights of 80-90cm are mentioned by Beaven (1947) for old varieties of barley, although there is a large amount of variation between varieties. In a field experiment set up to examine the yield potential of ancient wheats grown in different parts of the British Isles, heights ranged from 60-155cm, mean=104cm, for emmer and 80-180cm, mean=124cm, for spelt (van der Veen & Palmer 1997, 166). Allowing for an ear length of 10-15cm (Percival 1921), both crops must have been growing at the lower end of their height range at T5 in order that stinking chamomile seed heads were harvested with the crops.

An alternative suggestion is that, because ancient crops were genetically much more diverse than arable crops grown today, ears would have been growing at a variety of heights within each field of wheat. Therefore, it would be necessary to cut the crop fairly low on the straw in order to retrieve as many of the ears as possible. This requirement would need to be weighed against the advantages of cutting high on the straw, which can help to reduce low-growing weeds over time and, over time, produce a more uniform crop by selection. Height of cutting would also depend on the value and uses to which the straw was being put, i.e. was the straw being used for thatching, and so needed to be as long as possible, or was the field simply being turned over to livestock to graze the straw *in situ* after the harvest?

The presence of such a large quantity of barley (38% of the identifiable grain) with the wheat is of interest, since none of the other samples contained barley and it is, at best, only usually present at a low level on most other sites of the period. Barley rachis fragments were relatively frequent (allowing for differential preservation), again indicating that whole ears were probably present. These could have been growing with the wheat as a mixed crop or ‘beremancorn’. Alternatively, ears from two or three (if emmer and spelt had also been grown separately) crops could have been burnt. Possible reasons for burning range from accidental fires, the deliberate burning of contaminated ears, to the deliberate burning for ritual purposes. If the feature had been used as a cess pit, accidentally burnt material may have been thrown into the pit to help dampen odours.

In addition to stinking chamomile, other weeds that were frequent in the assemblage were all members of the phytosociological class Chenopodietea, i.e. 'waste ground and related arable and garden weeds' (Ellenberg 1988). Most were weeds of nutrient-enriched soils, such as fat hen (*Chenopodium album*), docks (*Rumex* sp.) and persicaria (*Persicaria* sp.). Weeds of nutrient-poor soils, such as leguminous weeds, were scarce. This suggests that manuring was probably taking place. All of the taxa are tall-growing weeds, so their fruits and seeds could easily have been gathered with a crop cut below the ear. This also applies to chess (*Bromus* sect. *Bromus*) and tall grasses (indeterminate Poaceae) whose seeds were frequent in the sample.

Waterhole 644006, sample 26007, context 644007

This sample, from the primary fill of the waterhole, was subsampled (25% sorted) because it was so rich in organic material. Straw/hay and wood fragments were abundant in the flot, although waterlogged cereal chaff was quite scarce. Stinging nettle seeds were also abundant, making the assemblage similar to that recovered from E/MRB waterhole 527374. The finds from the base of this feature included a large quernstone, so perhaps straw and/or hay had also been deposited for ritual purposes.

There was some evidence for the presence of hay from both dry and damp ground, since fairy flax (*Linum catharticum*; dry, calcareous soils) and yellow rattle (*Rhinanthus* sp.; moist meadows and pastures) seeds were present. Other damp meadow and pasture taxa that were common were self heal (*Prunella vulgaris*), lesser stitchwort (*Stellaria graminea*) and spike-rush. Hemlock may also have been growing in disturbed areas, along with dead-nettle (*Lamium* sp.). However, the seeds from this medicinal plant could have been deposited in mixed waste, since a few emmer/spelt chaff fragments, a mallow seed and capsule fragment and a couple of ericaceous remains were also present.

Sedge nutlets were frequent, but it is uncertain whether these plants were growing around the wet margins of the waterhole or deposited amongst waste marsh hay.

Other possible semi-aquatic marginals are mint (*Mentha* sp.) and lesser spearwort (*Ranunculus flammula*).

Charred plant remains were scarce in this feature, the only identifiable remains being a wheat grain (*Triticum* sp.), an emmer spikelet fork and a couple of emmer/spelt chaff fragments.

Discussion

The structural evidence from this period shows that a certain amount of reorganisation of the landscape took place during the later Romano-British period, including the construction of 'ladder enclosures' and a droveway. The function of the ladder enclosures has not been confirmed by excavation, but the evidence suggests that a combination of livestock management and arable cultivation took place. On the whole the evidence for human activity during the RB period was sparse, particularly in comparison with sites such as Stansted (Cooke *et al.* 2008). This is reflected in the relative scarcity of charred plant remains recovered from most of the samples, when compared to many sites of this period. The assemblages were composed of primarily domestic, day-to-day spikelet processing waste and were more characteristic of a small farmstead, or a small settlement with an economy heavily based on livestock rearing than arable cultivation.

There were, however, a few rich samples excavated in the Perryoaks area, including a series of M/LRB samples from barn B1 (Challinor 2008). Some of the barn assemblages were rich in chaff, whilst others were rich in grain, suggesting that both the cleaned product and waste from crop processing activities in the barn, or perhaps stored crops, were represented. Spelt wheat was by far the dominant crop, with smaller amounts of emmer and barley representing minor crops, or possibly a relict crop in the case of emmer (=5% of identifiable glume bases). The few oat and rye grains may represent weeds, because they amounted to less than 1% of the cereal grains each. In addition, RB pit 666001 produced abundant charred cereal remains as described above. This grain-rich deposit produced more evidence of barley, but just as few emmer, oat and possible rye grains. It is clear that by this time, spelt had become the principal crop for human consumption. Information concerning crop husbandry was recovered from this unusual, large cereal deposit. As discussed above, the deposit appears to contain charred spikelets cut below the ear but not yet processed. Abundant stinking chamomile seed heads present amongst the cereal remains demonstrated that damp, clay soils were now being brought into cultivation. As can be seen in the table below, stinking chamomile increased at the same time that spelt became the major crop, signifying the move to heavier soils that are better suited to the cultivation of hexaploid wheats such as spelt. Of course, the abundant weed seeds in the M/LRB period is mostly due to the well-preserved seed heads of this plant in pit 666001. However, charred stinking chamomile seeds occur in a number of other RB samples, and this trend has also been seen at sites such as Stansted where large-scale spelt cultivation was taking place on the Essex clays (Carruthers 2008).

Period	% spelt glume bases	Number of charred *Anthemis cotula* achenes	Seeds per sample	No. of samples
MBA	8	0	0	50
LBA	5	0	0	3
MIA	57	1	0.25	4
LIA/ERB/MRB	92	33	1.75	19
M/LRB	99	632	126.4	5
E/M Saxon	trace	2	0.3	6
Medieval	trace	24	2.4	10

Table 8: Spelt relationship with stinking chamomile

Although spelt cultivation virtually ceased in the Saxon period, its replacement, bread wheat, is also better suited to heavy clay soils. The Saxon samples were generally poorly preserved and produced few charred cereal remains, but there was some indication that barley became the dominant cereal at this time, perhaps explaining the sudden reduction in stinking mayweed as barley would have been grown on lighter, better-drained soils wherever possible. By the Medieval period, bread wheat had become the main cereal grown for human consumption (63% of identifiable grain), and the numbers of stinking mayweed seeds began to increase again, indicating the return to cultivating heavier soils.

According to the charred and waterlogged evidence from these few M/LRB samples, the range of crop plants during the RB period was fairly limited, since no large legumes (peas, beans) or flax remains were recovered. Mallow may have been grown as a garden vegetable, and grapes or raisins may have been an occasional luxury food that was brought onto the site. Native fruits and nuts such as blackberry (*Rubus* sect. *Glandulosus*) , possible raspberry (*R.* cf. *idaeus*), elderberry (*Sambucus nigra*) and hazelnut (*Corylus avellana*) were probably gathered from woodland margins and hedgerows. It should be noted that the apparent regrowth of some woody taxa during the Romano-British period according to **Figures 1** to **3** is solely due to blackberry, raspberry and elderberry seeds, all of which are edible and useful for dying. They indicate the presence of some scrubby areas, or possibly the importation of these fruits from further afield, but they do not represent the re-establishment of diverse, woody areas or hedgerows. The landscape, therefore, appears to remain very open. The occurrence of several raspberry seeds in two separate E/MRB ditches (D636100 and D542387) is of interest, as perhaps this indicates a connection between these boundaries, and possibly even deliberate planting as thorn hedges. There has, as yet, been no evidence for the importation of other fruits, spices or other flavourings such as opium poppy seeds, as have been found on some other RB sites. Admittedly, no cess pits have yet been found, so direct evidence of this type has not been available. However, if luxury goods were being consumed, it must have been on a very small scale for no evidence to be found in the large number of charred and waterlogged samples taken from the T5 and Perryoaks excavations.

A few general observations can be made about the M/LRB samples as a whole, taking into account the fact that the range of weeds in most of the samples might be biased by processing. Damp/wet ground taxa such as rushes and sedges were present in half of the charred assemblages, indicating that there had been damp areas in the arable fields, perhaps where they were bordered by ditches. Leguminous weeds such as vetches, tares, clover and medick were present in small numbers but never frequent. These taxa are indicators of nutrient-poor soils. The most commonly occurring and frequent weed seeds were from indicators of nutrient-rich soil (see discussion of sample 25003). This suggests that manuring was taking place. The increased occurrence of stinking chamomile in the samples in comparison with earlier periods (as mentioned above) indicates that damp, clay soils were increasingly being cultivated, probably because spelt and bread-type wheats were becoming dominant and these grow well on heavier soils.

Along with the absence of true woodland taxa, grassland and marsh or damp grassland taxa appear to have increased by the LRB, perhaps indicating a tendancy towards pastoral rather than arable agriculture. Levels of grassland and marsh taxa do not quite reach those obtained in the MIA waterholes or LBA pits, two periods of markedly low arable activity. However, they are greater than in the MBA period, a time when large areas of land were being farmed. It is also interesting to see that no well-preserved waterlogged ditches were excavated after the MBA until the E/MRB period, when the absence of woodland on the floodplain and possible increases in rainfall with climatic deterioration made the digging of more drainage ditches necessary. By the LBA the ditches were again dry at least part of the year, since waterlogged plant remains were not preserved, though as mentioned above, damp-ground plants were represented in the charred assemblages. Perhaps the absence of waterlogged deposits was also due to better management of the ditches, involving more regular cleaning out ensuring that they functioned efficiently. Efficient drainage would have helped to improve the land enough for areas of pasture to be extended.

Evidence for heathland was rare, unlike in the LIA/ERB period. This could also indicate improvements to the land, or changes in the selection of materials for fuel. The latter explanation is perhaps more likely, since heather and bracken pollen were recovered from LRB deposits, although these could have travelled for some distance. Heathland remains in post-Roman features also demonstrated that, once degraded to heathland, areas of heath persisted in the area for many centuries.

CHARRED AND WATERLOGGED PLANT REMAINS FROM EARLY/MIDDLE SAXON DEPOSITS

Six samples were examined from deposits of this period (Table 9). The samples all came from Early/Middle Saxon features located in area 14 to the north of the main excavated area, comprising a pit group (pits 525295, 525340, 525331), a sunken featured building (SFB 538326) and a waterhole (WH 555805).

sample	context	feature	Feature type	Preservation (waterlogged/charred)
15142	525322	525340	pit	(ch)
15144	"	"	"	(ch)
15145	525296	525295	pit	ch
15146	538329	538326	Sunken featured building	ch
18278	555826	555805	waterhole	WL & (ch)
19222	"	"	"	WL & (ch)

(ch) = 1 to 10 frags; ch = 11 to 40 frags; CH = >40 frags

Methods and Results

The pit and SFB samples were from dry deposits, so bulk samples (40 litres) were processed using standard floatation methods for charred plant remains. Despite the large sample size, small flots were recovered (15ml to 30ml) and these produced limited amounts of charcoal and sparse, poorly preserved charred plant macrofossil assemblages. Of the charred cereals represented, the barley grains were often too poorly preserved to be identified to species level. Both straight and twisted grains were observed, so hulled, six-row barley (*Hordeum vulgare*) was likely to have been the main cereal present. Bread-type wheat (*Triticum aestivum*-type) and oats (*Avena* sp.) were also present, although it was not possible to confirm whether the oats were cultivated or wild. No rye or leguminous crops were recovered.

The two waterlogged samples from waterhole 555805 were reasonably well preserved, particularly the lower of the two, sample 19222. Some seed decay was seen in the upper sample (sample 18278), but this is unlikely to have affected the species composition to any noticeable extent.

The results of the analysis are presented in Table 9.

Discussion

The samples are firstly discussed, feature by feature, and then the information for the Early/Middle Saxon period is discussed as a whole, and compared to previous periods and contemporary sites.

Pit 525340, sample 15142, context 525322 – The centrally placed pit in this group produced some fairly high status finds, suggesting a possible ritual function (Freeview). The charred plant assemblage, however, was very sparse, comprising mainly grain, of which a couple of barley grains were the only identifiable cereals. The seeds from three common weeds of cultivation/disturbed soils could have been present as contaminants (including rye grass (*Lolium perenne/rigidum*), fat hen (*Chenopodium album*) and eyebright/euphrasia (*Odontites verna/Euphrasia* sp.)). This assemblage could have been derived from a small quantity of burnt domestic waste, or it may represent a handful of processed barley burnt as an offering. Although barley is not normally thought of as a high status cereal, being mainly used for fodder, there is some suggestion that it may have become important for human consumption in some regions during the Middle Saxon period (see general discussion below).

Pit 525331, sample 15144, context 525332 – This pit lies adjacent to, and to the south of, pit 525340. The fill is said to probably have consisted of gradual silting interspersed with domestic waste (Freeview).

The small charred cereal assemblage consisted of four barley grains with a couple of bread-type wheat grains and a possible oat grain. A single dock seed (*Rumex* sp.) was the only non-cereal contaminant present. The origin of this assemblage was probably burnt domestic waste, for example, cereals that were accidentally dropped into the fire during cooking, or perhaps floor sweepings.

Pit 525295, sample 15145, context 525296 – This pit, lying to the north of pit 525340, contained frequent pot, daub and bone indicating the deposition of domestic waste (Freeview).

The small charred plant assemblage again produced mainly barley grains, with single bread-type wheat and oat grains. Several small weed seeds were present as contaminants, including stinking chamomile (*Anthemis cotula*), a weed of heavy, damp, clay soils. Henbane (*Hyoscyamus niger*) and stinging nettle (*Urtica dioica*) are indicative of nutrient-rich soils, perhaps indicating manuring of the fields. However, this assumes that all of the seeds had the same origin, and it is, of course, possible that a variety of burnt material had been deposited in the pit as mixed waste. The waterhole samples provided evidence to suggest that nutrient-enriched, disturbed habitats might have been frequent on the site during this period (see below).

SFB 538326, sample 15146, context 538329 – This context was an organic deposit containing frequent finds, possibly representing a post-use rubbish deposit thrown into the base of the Sunken Featured Building (Freeview). This type of deposit is frequently found in SFB's, and the organic nature of the waste was confirmed by the presence two mineralised 'nodules' of the type characteristic of faecal and midden deposits (Carruthers 1989). Unfortunately no residue was available for examination to check whether further remains had become mineralised. Scattered mineralised plant remains mixed with charred waste have been recovered from SFB's in calcareous regions of southern and north-eastern England by the author (Carruthers (1991), Abbots Worthy, Hampshire; Carruthers & Hunter (forthcoming), West Heslerton, Yorkshire). Whether this represents the accumulation of organic waste in the bottom of the buildings while in use, or the post-use deposition of rubbish in the features is uncertain.

Charred cereal grains were, again, fairly few in number and were virtually the only charred remains present. Barley (four grains) and bread-type wheat (three grains) were represented. A single sedge nutlet (*Carex* sp.) was the only non-cereal present. Although little information was recovered from this sample so there is little scope for interpretation, it is interesting to note that at West Heslerton (Carruthers and Hunter, forthcoming) frequent sedge seeds and rhizomes from the SFB's provided evidence for the possible use of turves for walling. An alternative explanation is that the sedge was growing as a cereal contaminant, indicating the cultivation of damp ground.

Waterhole 555805; sample 18279, context 555826; sample 19222, context 555830 – Sample 19222 was positioned at the base of the waterhole and sample 18279 came from the deposit above. The waterhole contained evidence for woodworking occurring nearby and a possible ladder. The sediments formed in standing water due to silting and erosion of the sides, but waste materials were also being deposited (Freeview).

The main plant group represented in the assemblages from both fills was seeds from plants of nutrient-enriched, disturbed places (see **Figure 3**). These included nettles, (*Urtica dioica and U. urens*), fat hen, chickweed (*Stellaria media*), knotgrass (*Polygonum aviculare*), docks (*Rumex* sp.) and henbane (*Hyoscyamus niger*). The increase in henbane and stinging nettles in the upper sample may be due to the establishment of this type of vegetation close to the waterhole after abandonment. Henbane, a poisonous but also medicinally useful plant, is characteristic of middens and farmyards. Dung enrichment by grazing livestock would have created an ideal habitat for this range of taxa.

There is some evidence to suggest that the waterhole may have been used for flax retting (rotting down the stems to release the fibres), or at least for the deposition of flax processing waste. Running water is preferable for retting as it is a very smelly business that would have made the waterhole un-usable for people or livestock. The small sections of flax capsule observed in the lower sample were more characteristic of the waste from 'rippling', i.e. pulling the dried stems through a comb-like structure to remove the brittle, dry leaves, capsules and seeds, prior to bundling the stems for retting. No seeds were recovered from the sample, but these would have been valued for their medicinal properties, for oil and for sowing the next year's crop. They are also more vulnerable to decay, due to their high oil content.

Other evidence of deposited waste was the presence of a few fragments of cereal chaff, both charred and uncharred (bread-type wheat, barley and emmer/spelt), and hemp seed fragments. The charred emmer/spelt spikelet fork was in a very poor state of preservation, so this may have been redeposited. However, there is some evidence to suggest that spelt wheat continued to be grown in small quantities into the Saxon period in some areas (e.g. Stansted, Carruthers 2008). Cannabis or hemp (*Cannabis sativa*) remains have been recovered from a few Saxon sites (e.g. Glasson Moss, Jones et al; Carruthers (1997), pre-Abbey deposits at Reading waterfront), but in most cases this is pollen in retting pools rather than seeds. The seed fragments could have been deposited amongst hemp processing waste, or they may represent the chewed remains of seeds consumed for medicinal purposes. The two cotton thistle (*Onopordum acanthium*) seeds could represent plants grown for food, fibre or medicinal use. Cotton thistle was grown as a crop in earlier periods at Heathrow, and was abundant in some of the LIA/ERB waterholes, so it may have persisted as a useful weed in the area. Its close association with waterholes through the ages could indicate that, like flax, some sort of processing using water was taking place next to, or in the waterholes. Of course, this relationship could simply be due to better waterlogged conditions in the waterholes ensuring the preservation of these remains.

Other rubbish either thrown into the waterhole with the woodworking waste, or growing near enough to the feature to have blown in, consisted of a few remains from woody taxa. These included a few leaf fragments, thorns, moss and twigs. Hawthorn (*Crataegus monogyna*) and blackberry (*Rubus* sect. *Glandulosus*) were the only fruit/seed remains preset, and these were sparse (3 items in total). When compared to the variety of woody taxa recovered from the Bronze Age waterholes, it is clear that the environment was very much more open in the Saxon period. However, there is a small increase in woody taxa when compared with the Romano-British period, which only produced edible remains from shrubby plants such as blackberry.

The presence of a range of plants characteristic of grassland, such as buttercups (*Ranunculus repens/acris/bulbsus*), meadowsweet (*Filipendula ulmaria*), upright hedge parsley (*Torilis japonica*), selfheal (*Prunella vulgaris*) and thistles (*Cirsium/Carduus* sp.) suggests that the surrounding area was probably dominated by meadows and pastures, with frequent areas of nutrient-enriched, disturbed ground (see above). Damp ground taxa such as blinks (*Montia fontana* ssp. *chondrosperma*) rushes (*Juncus* sp.), sedges (*Carex* sp.) and spike-rush (*Eleocharis* subg. *Palustres*) may have been growing around the waterhole, if the edges were not too disturbed by heavy use, or in areas of damp grassland nearby. Use of the waterhole must have been too intensive for aquatic vegetation to have become established, although a few

Daphnia-type egg cases (Cladoceran ephyppia) were present in the lower sample. Alternative explanations are that the waterhole was deliberately kept clear of vegetation.

Environment and economy in the early/middle Saxon period

The fact that charred cereal remains were sparse in the Saxon samples (see **Figure 5**), despite the large sample size, suggests that arable cultivation was probably not the dominant component of the economy during this period. It is not possible to know whether the four small charred assemblages listed in Table 9 were representative of the period, but it is notable that for the first time at Heathrow, barley grains were more frequent in all four samples than the other cereals, bread-type wheat and oats. In his review of Saxon sites in southern Britain, Monk (1977, unpublished) noted that barley was the main cereal being grown in Britain and on the continent. Barley was also by far the dominant cereal at Middle Saxon West Heslerton in South Yorkshire (Carruthers & Hunter, forthcoming). By the Medieval period bread-type wheat had taken over as the preferred cereal for human consumption in most areas, although Dyer (2000) quotes documentary evidence from Sedgeford, Norfolk, that shows that bread for the harvest workers was mainly made from barley flour up to the fourteenth century.

The sparse ecological evidence gathered from the charred weed contaminants suggested that the arable fields had been manured, since nitrophilous weeds were dominant, and that at least some of the fields were on heavy, damp clay. It is possible that some of the cereals were being purchased elsewhere and brought onto site, in view of the fact that charred cereal remains were so scarce. However, charred cereal processing waste is scarce on most Saxon and Medieval sites, due to differences in the taphonomy of crops being grown at this time. It is likely that most households would have grown some cereals for their own use and to feed livestock. If the main aspect of the economy was livestock, manure would have been in plentiful supply. Stock was often turned onto arable fields after the grain was harvested to graze the straw and manure the fields. The scarcity of charred cereal waste may be due to a small, low-status farmstead producing less waste to burn. Preservation also was poor in this area of the site, and a third explanation could be that the occupation may have been short-lived.

The waterlogged assemblages indicated that nutrient-rich, disturbed areas were common around the waterhole, and that open grassland was likely to be the predominant vegetation type on the site as a whole. As well as providing lush pasture, the damp soils of the floodplain would have been suitable for the cultivation of fibre crops such as flax, cotton thistle and hemp, with flax retting probably taking place in the flowing waters of the river Colne nearby.

CHARRED AND WATERLOGGED PLANT REMAINS FROM MEDIEVAL TO POST-MEDIEVAL CONTEXTS

Seventeen samples from PSH 02 sites 17, 49, 58 and 77 have been examined for this report, as listed below (Table 10). Nine of the samples (from the ditch, pits and upper fills of the Later Medieval waterhole) were primarily dry contexts that produced only charred plant remains, with a trace of waterlogging in pit 658047. The other eight were from the Medieval waterhole 529139, the primary fill of Later Medieval waterhole 569022 and the Post-Medieval retting pit 546437. These produced reasonably well-preserved waterlogged assemblages with smaller amounts of charred material.

sample	**context**	**feature**	**feature type**	**preservation (waterlogged / charred)**
15507	559109	559118	Med. ditch	CH
15044	562020	562018	Med. pit	CH
17065	537109	537105	Med. pit	CH
17066	537110	“	“	CH
26035	658048	658047	Med. pit	wl & CH
17046	568018	529139	Med. waterhole	WL
17054	568019	“	“	WL
17056	568022	“	“	scanned only (WL)
17059	529149	“	“	WL
17068	569029	569022	Later Med. (C13th-C14th) waterhole	CH
17069	569030	“	“	ch
17070	569031	“	“	ch
17072	569035	“	“	ch
17073	“	“	“	WL & CH
18455	546439	546437	Post-Med. Retting pit	WL
18458	“	“	“	WL & (ch)
18459	546438	“	“	scanned only (WL)

(ch) = 1 to 10 frags; ch = 11 to 40 frags; CH = >40 frags

Methods and Results

Some of the charred flots were very rich in cereal remains, in particular sample 15507 from ditch 559118, so this sample was gently mixed and divided using a riffle box. One eighth of the flot was fully sorted and quantified, whilst the remaining 7/8 was rapidly scanned for larger, rarer items (see discussion below).

Four samples from medieval waterhole WH 529139, were recommended for full analysis due to the interesting woodland assemblages observed at the assessment stage. It was hoped that some changes in the local environment might be detected by studying a sequence of samples through the feature in detail, but when full analysis was carried out all four samples produced almost identical ranges of taxa, with the only differences being the frequency of fruits and seeds amongst the abundant leaf and twig fragments. This is discussed further below. As the large flots were very time consuming to sort, sorting of one of the samples was abandoned (sample 17056) at the point that it was found to be very similar to the other three. Records for this sample, therefore, are given in rough estimations of frequency (+ = occasional; ++ = several; +++ = frequent) rather than numbers of seeds.

The same 'scanning' methodology was used for the lowest fill of the proposed retting pit, sample 18459. This sample was added to the list at a late stage, in order to see whether additional evidence for the use of the pit could be obtained. It was hoped that more remains from economic taxa such as hop, hemp or flax would be found to help in the interpretation. The results are discussed below.

State of preservation and notes on identification

Charred cereals in the samples were fairly poorly preserved but reasonably frequent. The cereal grains were often vacuolated ('puffed up') and there was some surface erosion. Vacuolation is common in bread-type wheat grains, because burning grain with a high gluten content makes large air pockets form inside the grain. This often leads to fragmentation due to increased fragility. Distortion during charring and fragmentation during redeposition meant that large numbers of grains could not be identified or accurately counted in some samples.

Wheat – Very few chaff fragments were recovered from the samples as a whole and where they were present in reasonable numbers (e.g. sample 15507) the poor state of preservation meant that identification to species level was rarely possible. Most of the free-threshing wheat rachis fragments were broken into small fragments close to the nodes, so discrimination between hexaploid bread-type wheats and tetraploid rivet-type wheats was rarely possible (Moffett, 1990). In fact, only two rachis fragments characteristic of bread-type hexaploid wheat, and no tetrapoid rivet-type wheat rachises were found. The fairly wide range in shapes of wheat grains suggested that the crops were, genetically, quite diverse. Grain shape is not reliable enough to differentiate between tetraploid and hexaploid wheats (Jacomet, 1990), but the longer, more hump-backed grains characteristic of tetraploid wheats were not obvious amongst the assemblages. The question as to whether rivet-type wheat was grown in addition to bread-type wheat, therefore, remains unanswered.

Barley – Erosion of the grains meant that it was not often possible to tell whether the grains had been hulled or naked. It is likely that hulled barley would have been grown, since naked barley is rarely found beyond the Bronze Age in southern England. The scarcity of the smaller, twisted lateral grains of six-row barley could be due to the fact that most of the burnt material originated in domestic waste, so most of the smaller 'tail grains' had been sieved off amongst processing waste. Alternatively some two-row barley may have been grown, but this could not be confirmed through the recovery of rachis fragments. It was noted that some of the barley grains were larger than usual, but grain size is not reliable enough to confirm the presence of 2-row barley.

Oats – No floret bases were preserved to indicate whether cultivated or wild oats were present. However, the frequent occurrence (present in 80% of the charred flots) and large size of the grains suggested that oats were a fairly important crop during this period. This could relate to the increased use of horses for traction in the Medieval period, and also to the poor, acidic nature of the soil suiting this crop well.

Cultivated vetch – Only a few of the large vetch-type seeds were well-enough preserved to still retain their hila, so only eight seeds were positively identified as being cultivated vetch (*Vicia sativa* ssp. *sativa*). Leguminous seeds that fell within the size range of cultivated vetch seeds (c.3 to 4mm, but also large legume fragments of c. 5mm) were quite frequent in most of the charred flots, so it is likely that vetch was grown as a crop plant, perhaps in rotation with cereals in an attempt to improve soil fertility. It should be noted, however, that small-seeded weed vetch seeds were even more abundant (see **Figure 6**), so various species of vetches, tares and clovers were also growing as crop weeds. The implications of this are discussed below.

Peas and beans – Two Celtic beans (*Vicia faba* var, *minor*) were identified in sample 15044 but none of the large, round, pea-like seeds were positively identified because no hila were present. It is possible that these c.4mm round pulses were cultivated vetch seeds rather than peas, since measurements made on charred cultivated vetch seeds at Wharram Percy barn (identified by the presence of hila) ranged from 2.5 to over 5mm (Carruthers, forthcoming). Peas and beans would have been useful crops on the local, impoverished soils and even if they were not grown as field crops, they may have been grown as garden plants. These types of foods are grossly under-represented in charred plant assemblages, as demonstrated by the recovery of abundant mineralised legume fragments from Saxon cess pits at Hamwic (Carruthers 2005).

cf. Cultivated Flax – only one sample produced possible evidence for the cultivation of flax (cf. *Linum usitatissimum*) in the Medieval period. The seed fragment was charred and poorly preserved so only a tentative identification was made. Flax retting waste was recovered from an Early/Middle Saxon waterhole in Area 49 (WH 555805) and from Bronze Age samples, so it is clear that the low-lying, damp soils in the T5 area were suitable for growing this useful crop. In addition to producing fibre from the stems, flax seeds can be used medicinally and as an oil seed crop.

Medieval

Ditch 559118, sample 15507, context 559109

Ditch 559118 was located in Area 51, to the south–west of the main group of Medieval features. Charcoal in the base of the ditch may have been derived from a structure that had been burnt down. The charred cereal assemblage recovered from sample 15507 was the richest examined for this report (254.6 fpl). This may have been because the preservation conditions were good, perhaps indicating that the material had been deposited immediately after being burnt, or that it had been burnt *in situ*. It is possible that the structure was a barn that had been used to store cereals.

Bread-type wheat was the dominant cereal, at a ratio of 19:1:1:3 Wheat : Barley : Oat : Rye. Chaff fragments were more frequent than in other samples (Grain : Chaff : Weed seeds = 8 : 1 : 6), perhaps due to the better preservation conditions, since chaff is less likely to survive charring and re-deposition than grain and weed seeds (Boardman & Jones, 1990). The fairly high proportion of weed seeds, and the fact that in several cases seed head fragments were present, suggested that either whole sheaves had been burnt, or that waste from the early stages of processing had been deposited. Both stinking chamomile seed head fragments, and corn cockle seeds (*Agrostemma githago*) fused together in the position they would have been in their capsules, were present. The only other example of preservation of this nature known to the author was from a post-medieval barn at Wharram Percy, Yorkshire, that had been burnt down in 1553 (Carruthers, forthcoming). Sheaves of wheat were charred *in situ* at Wharram, and similar proportions of grains to rachis fragments (G/R), and grains to straw nodes (G/N), were found in some of the samples. Fragments of seed heads were present in about a quarter of the samples.

	Grains/ Rachis frags	**Grains/ Straw Nodes**
Heathrow Terminal 5 - ditch 559118	8.2	19.4
Wharram Barn - e.g. sample 7: reasonably well preserved, next to barn's southern wall,	7.3	17.1
Wharram Barn - e.g. sample 19 : well-preserved, towards centre of barn,	3.9	81.4
Wharram Barn - e.g. sample 16 : poorly preserved sample next to east wall	15.7	290.5

At Wharram the grain was so abundant that many of the fragile charred straw nodes had probably been crushed under the weight of material. The G/N ratios, therefore, were mostly higher than at T5. The ratios of grain to rachis fragments, however, (G/R) were fairly similar, ranging from 3.9 in the best preserved samples in the centre of the barn to 15.7 on the outer, more damaged margins. The T5 ratio falls well within this range and both ratios were quite similar to a Wharram sample that was located next to the south wall of the barn, sample 7. It is possible, therefore, that a similar situation occurred in this ditch, with the remains of a stored crop in sheaves being preserved *in situ*. If so, this sample can provide useful information about the quality of the crops grown during this period, as its weed assemblage has not been biased by crop processing.

Assuming that the assemblage is from a primary context and is not mixed waste, the grain to chaff to weed seed ratio (=8:1:6) shows that the crop was fairly badly infested with weeds or, as noted above, had not been processed. Stinking chamomile, vetches/tares, corn cockle, corn marigold (*Chrysanthemum segetum*) and chess (*Bromus* sect. *Bromus*) were the main contaminants, all of which are common weeds of arable fields. Corn marigold is typical of moderately acid, sandy soils and stinking chamomile prefers damp clay soils. Small leguminous weed seeds were particularly frequent (see **Figure 6**), although some of the larger seeds, 3-4mm, could have been from the crop plant, cultivated vetch (*V. sativa* ssp. *sativa*) as noted above. Counting only the <2mm and 2-3mm vetch seeds, an average of 32 seeds per 10 litre soil sample was present in the charred flots. This can be compared with the charred assemblages from earlier periods at T5 (see **Figure 6**).

An abundance of leguminous weeds in a crop is often indicative of impoverished soils (Moss 2004). Leguminous plants are at a competitive advantage as they have the ability to manufacture their own nutrients with the help of nitrogen-fixing bacteria located in nodules in their roots. High levels of leguminous weeds during the MBA probably relates to the intensity of arable cultivation at this time causing impoverishment of at least soil of the soils. This was a period when charred cereal processing waste was abundant in some of the samples. It is interesting to note, however, that even though charred cereal processing waste was also frequent in some of the LIA to LRB samples, leguminous weed seeds were dramatically reduced in number. This may indicate improvements in soil fertility through manuring, and possibly also changes in crop husbandry, including a change to cutting the crop high on the straw. The implication is, therefore, that by the medieval period manuring may not have been adequate to cope with the increased demands on the soil made by the cultivation of bread wheat. Crop rotation involving cultivated vetch, peas and/or beans may have been practised, but this does not appear to have been sufficient to maintain soil fertility, since leguminous weeds once again increased.

Pit 562018, sample 15044, context 562020

This sample, from a lower level in a pit in Area 77, is the only Medieval sample examined from the eastern region of the excavated area. Most of the rich medieval samples came from Area 49 to the south-west. Context 562020 was an organic deposit that contained pot, charcoal and wood fragments. However, the only uncharred seeds present were two, woody, blackberry (*Rubus* sect. *Glandulosus*) seeds, so the deposit must have dried out at some point in its history.

The charred seed assemblage was large but fairly poorly preserved, with vacuolated and fragmented bread-type wheat grains (*Triticum aestivum*-type) dominating the cereals. The wheat to barley to oats to rye ratio was 48 : 4 : 9 : 1 (compared with the overall averaged ratio for the Medieval period of roughly 6 : 1 : 1 : 1). Chaff fragments were fairly scarce, as is usually found on sites of this period, but weed seeds were frequent and varied in their species range (grain : chaff : weed seeds ratio = 33 : 1 : 6). The assemblage appears, therefore, to consist of burnt waste grain mixed with cereal processing waste, with much of the chaff having been lost on charring. An alternative suggestion is that, as with ditch 559118, some whole sheaves may have been burnt, or the waste from an early stage in processing, since several fragments of stinking chamomile (*Anthemis cotula*) seed head were present, in addition to frequent loose seeds from this weed. Large, heavy objects such as seed heads are unlikely to be present amongst winnowing waste or fine sieving waste, but may be removed by a coarse sieve in the early stages of processing (Hillman 1981). Corn cockle (*Agrostemma githago*) was one of the other typical medieval arable weeds present. Leguminous weed seeds (vetches. tares and clover/medick) and chess (*Bromus* sect. *Bromus*) seeds were quite frequent.

It is clear that other types of waste were mixed in with the cereal remains, as hazelnut shell fragments (*Corylus avellana*), a sloe/cherry (*Prunus* sp.) stone fragment, some large legume fragments including Celtic bean (*Vicia faba* var. *minor*) and a few ericaceous fruits were recovered. Some of these items may have come from domestic hearths, with heather having been used as fuel and the food items having been thrown into the fire as waste.

Pit 537105, sample 17065, context 537109 and sample 17066, context 537110

Pit 537105 is located in Area 49, close to Waterhole 569022. The two samples came from adjacent secondary fills towards the top of the pit. The charred cereal assemblages were sufficiently different to suggest that the waste had been deposited at different times or from slightly different sources. The lower fill was a little more productive (12 charred fragments per litre of soil processed (fpl)) than the upper one (7.2 fpl), and the cereal ratios were different (wheat:barley:oat:rye ratio (W:B:O:R) 17065 = 2:2:2:1; 17066 = 14:15:1:1). Both samples produced small numbers of chaff fragments, but the range of weed taxa varied to some extent, with over 60% of weed taxa in sample 17065 not in 17066. Some of the weed differences may be due to the larger quantities of oats and rye in sample 17065, since weeds of acidic soils (*Rumex acetosella, Raphanus raphanistrum, Chrysanthemum segetum*) were present in this sample but not in sample 17066. Oats and rye are better suited to poor, sandy acidic soils, and cereals with greater value for human consumption such as bread wheat would have been grown on the better, heavier soils.

A possible charred flax seed was recovered from sample 17065, (cf. *Linum usitatissimum*). The seed was incomplete and poorly preserved, but it had some of the morphological features of flax, and dense, rounded cells on its seed surface. Flax was recovered from earlier periods as both seeds and capsule fragments, so it is clear that the low-lying, damp soils were well suited to the cultivation of this crop. Flax seeds can be used medicinally, for flavouring and as a source of oil, in addition the stems being a valuable source of fibres.

The charred plant remains in these two samples are likely to have been derived from mixed domestic waste, including grain burnt accidentally during cooking preparations and processing waste used for kindling and/or fodder.

Pit 658047, Sample 26035, Context 658048

This pit was located in Area 58, in the central Twin Rivers area of the site, north of the main Medieval settlement. Charred plant remains were frequent in this sample (18.6 fpl) with the cereals being at a similar ratio to the average (5 : 1 : 1 : 2). As with the other charred samples, weeds such as stinking chamomile were frequent. Small-seeded weed legumes (seed <2mm) were particularly abundant. The main difference between this sample and the other charred flots was that fruits of ericaceous taxa such as heather and cross-leaved heath were frequent, as were twisted stems characteristic of heather plants. This sample probably contained sweepings from a hearth or oven that had been fuelled using heathland vegetation. Heathers are particularly useful for industrial purposes, as they burn rapidly with a hot flame.

Waterhole 529139, sample 17046, context 568018, sample 17054, context 568019, sample 17056, context 568022, sample 17059, context 529149

This fully-waterlogged, pear-shaped waterhole was located in Area 49. Its position at the northern end of a medieval enclosure suggested that it had been used to control access to the enclosure, as well as to provide water for livestock (Freeview). The south-west side of the waterhole was sloped to provide access to livestock, and there were traces of steps at this end. The four samples examined for this report were located in a section down through the central part of the waterhole, with 17046 being the uppermost sample. Sediments deposited above these layers included material that had been dumped after the waterhole fell out of use, including industrial waste. The contexts described in this report, however, appear to represent natural accumulations of material, rather than deliberate dumping.

All four samples produced almost identical waterlogged plant assemblages, the main differences being the concentrations of fruits and seeds rather than the range of taxa. The most notable character of the assemblages was the abundance of leaf fragments, twigs, buds and wood fragments. Unlike the Bronze Age waterholes, however, thorns and fruits from thorny taxa were not frequent. Instead, acorns (*Quercus* sp.) were the predominant plant macrofossils from woody taxa, including immature acorns, and fragments of cupules and cotyledons. It is unlikely that these remains represent leaf fodder brought into the enclosure for livestock, as oak leaves and acorns are poisonous to cattle and horses, although they are better tolerated in small quantities by sheep and pigs (Miller & West 1953). In addition, the woodland herb, three-nerved sandwort (*Moehringia trinervia*) was present in the lower three samples, so it is likely that oak woodland existed close to the feature for the entire time that it took for these deposits to accumulate. It is possible that these remains represent dumped woody material, but less likely because of the abundance of leaf fragments and buds. No charred domestic waste was present in the feature.

Amongst the fairly small range of other taxa represented, aquatic and semi-aquatic plants were the next most prominent group. These included free-floating aquatics like duckweed (*Lemna* sp.), floating marginals such as flote-grass (*Glyceria* sp.) and emergent marginals such as celery-leaved buttercup (*Ranunculus sceleratus*). Water-flea eggcases (Cladoceran ephyppia e.g. *Daphnia* sp.) were also frequent, indicating that standing water remained in the feature throughout the period of accumulation. Duckweed is a coloniser eutrophic waters. As anyone with a garden pond close to trees knows, autumnal leaf and acorn falls would have produced enough organic material to have made the water eutrophic and unpleasant to drink.

The vegetation surrounding the waterhole does not appear to have been especially disturbed or nutrient-enriched when compared to waterholes in earlier periods (see **Figure 3**), as weeds such as stinging nettle and fat hen were not frequent. However, many-seeded goosefoot (*Chenopodium polyspermum*) ranged from ‘frequent’ to ‘present’ in the four samples, and this is an indicator of nutrient-enriched soils (Hill *et al*. 1999).

Putting all of the evidence together, the samples from this waterhole are quite unlike most of the earlier waterholes at Heathrow, although it is most like the MBA waterholes (see **Figure 3**). During the Bronze Age, thorny hedgerow and woody taxa were common in the waterholes, but aquatics and nitrophilous plants were usually fairly scarce during the period of use. In the Iron Age, Roman and Saxon periods, woody taxa became scarce and grassland plants were dominant. Heathland remains, possible dung and charred cereal processing waste were sometimes dumped in the features, and nitrophilous plants were often abundant. Aquatic plants, however, were still rare. Medieval waterhole 529139 appears to have been close enough to mature oak woodland for leaves, buds, twigs and acorns to have fallen into the feature throughout the period represented by the four samples. In view of the small amount of evidence for animal disturbance and the growth of aquatic vegetation, it is likely that this waterhole had a very low-level of use. The higher fruit and seed concentrations at the bottom and top of the sequence can be explained by differing preservation conditions and perhaps the canopy becoming more closed, making flowering less likely in most plants. Although the highest concentration of remains was at the top of the sequence, signs of decay suggested that some drying out had occurred, leading to the loss of leafy material which would have increased the concentration of more resilient fruits and seeds. In addition, some of the aquatic plants had clearly become more established by this time. The drying out, therefore, probably occurred after the feature had been backfilled rather than while it remained open.

Later medieval: c 13th –c14th

Waterhole 569022, sample 17068, context 569029, sample 17069, context 569030, sample 17070, context 569031, sample 17072, context 569035, sample 17073, context 569035

This waterhole was located in Area 49. Although classified as a waterhole, all of the samples except the lowest, sample 17073, produced only charred plant remains. The sediments in this area must have dried out at some point after the feature was in use, resulting in the loss of organic material. In contrast, as noted earlier, waterhole 529139 further to the north of area 49 produced well-preserved waterlogged assemblages.

Charred plant remains were present in fairly low concentrations in all five samples. The lowest sample, sample 17073, produced the highest concentration of charred plant remains (2.6 fpl), perhaps gaining some protection from the waterlogged organic remains. The general character of the assemblages was very similar down through the profile, with cereal grains being the dominant components. Chaff fragments were only present in the lowest sample, again probably due to the extra protection against erosion and the effects of freezing and thawing. Weed seeds were fairly scarce and limited in species range. Small-seeded weedy legumes (vetches and tares) and stinking chamomile seeds were the main taxa represented, and these were present in almost all of the samples. The dominance of these two taxa indicated that nutrient-poor, heavy, damp soils were being cultivated. Apart from the cereals, cultivated vetch (sample 17068), possible pea (sample 17069) and a sloe, cherry or plum (*Prunus* sp.) stone fragment were the only other remains of economic importance. Once again, mixed burnt domestic waste appears to have been represented.

Compared to the overall average ratio of wheat to barley to oats to rye, the samples from this feature produced slightly lower quantities of bread-type wheat but relatively frequent rye grains (5:2:1:4 compared with the overall average of 6:1:1:1). Rye rachis fragments (chaff) were also more common in the lowest sample than other chaff fragments. This may indicate that the origin of the burnt waste was more likely to be fodder than household waste, or that fodder was mixed with other types of rubbish. Cultivated vetch and peas probably represent fodder, as peas were often used to feed pigs in medieval times (Dyer 2000). Since only one feature from this period was examined it is not possible to determine whether the increase in rye related to the origin of the waste, or a change towards the cultivation of more rye (perhaps due to falling soil nutrient status and increased acidity) over time. The Post Medieval retting pit contained only a trace of cereal remains, so no further information was available from later periods.

The small waterlogged assemblage was fairly limited in the range of taxa represented, and most of these were tough-coated seeds. This suggests that there may have been some loss of more delicate remains due to drying out, although this was only for a short period, as remains like hemlock (*Conium maculatum*) and henbane (*Hyoscyamus niger*) survived. From the surviving assemblage, the overwhelming impression was one of an open vegetation (all of the taxa have Ellenburg (Hill et al,

1999) light values of 7 or 8) on soils with high nutrient levels (Ellenburg nitrogen values of 7 to 9, but mainly 8). Apart from hemlock which prefers damp soils, no aquatic or marsh taxa were present, even though seeds such as sedge have tough seed coats. Some of the remains were from poisonous plants with medicinal uses (hemlock, henbane), whilst others were from edible taxa (elderberry, mallow, and possibly fat hen and orache). However, use of these plants is difficult to prove since all of the taxa would also be well-suited to growing in a disturbed, nutrient-rich, damp habitat like as a midden or farmyard.

Post-medieval

Possible Retting Pit 546437; samples 18455 and 18458, context 546439; sample 18459, context 546438

This pit was situated over a kilometre north of Area 49, in Area 17. It was rectangular, had been dug into the palaeochannel, and had possible evidence for collapsed wattled walls. The initial samples examined for his report came from secondary fill 546439, with sample 18455 being located at 27-30cm and sample 18458 at 40-45cm from the top. The pit appeared to have been subjected to seasonal flooding episodes, as well as gradual silting, since clay lenses were visible within the fills, so presumably the palaeochannel was still active from time to time and was used to flush the pit through (Freeview).

Sample 18459 was added to the samples for analysis at a later date. The flot from this sample was found to be very similar to the upper two samples, so it was rapidly scanned solely in order to find economically important taxa that might help determine the function of the feature.

The waterlogged plant remains were reasonably well preserved, with the lower samples producing wider ranges of taxa and slightly more fruits and seeds. As with waterhole 529139, leaf fragments, buds and twigs were frequent, although acorns were not present. Instead, willow buds (*Salix* sp.), ash keys (*Fraxinus excelsior*) and alder seeds (*Alnus glutinosa*) were present in small quantities in all three samples. These taxa grow together in floodplain alder woods and fens, with alder and willow on wetter soils close to rivers, and ash growing a secondary woodland on drier land where the vegetation is sufficiently open.

There was little evidence to indicate that domestic waste had been deposited in the feature, or to demonstrate what the function of the pit had been. Two, poorly preserved charred cereal remains (a possible rye grain and a barley rachis fragment) were present in the middle of the three samples, but these may have been washed in from manured land close by. The three cherry stones (*Prunus avium*) present in the middle sample had all been gnawed by rodents, so they probably represent an animal deposit rather than human waste. Nitrophilous plants such as nettles and docks were common but not abundant, as might be expected if the pit had been used for retting causing nutrient-enrichment of the surrounding soil. No flax remains were recovered from the three fills.

The only unusual taxa represented were hop (*Humulus lupulus*) and possible hemp (cf. *Cannabis sativa* seed fragments). Hop was present in small numbers in all three samples but a few hemp seed fragment were present in the middle sample. Hops grow naturally in hedgerows, scrub and fen-carr, so it is difficult to know whether the presence of seeds has any bearing on the use of the feature. Hop bracts can be used for dying, producing a yellow-green colour. However, no flower bracts were found to indicate use of hop fruits for brewing or dyeing. Hops also have medicinal uses.

The hemp seeds were unfortunately only present as fragments, so there was some uncertainty over their identification. However, a few hemp pollen grains were recorded (Peglar, Druce & Huckerby, *CD Section 16*) confirming the presence of this useful plant. Hemp was grown as a fibre crop and for medicinal purposes, and it may also have grown more widely as a casual (escaped cultivated plant) in the medieval period than today, at a time when it was widely grown as a garden plant as well as a crop. If the identification is correct, hemp retting is a possibility, although the author would have expected greater evidence for nutrient-enrichment of the soil around a feature with this function, since retting produces large amounts of decaying organic waste. In order to obtain the finest fibre, the plants are considered ready for retting shortly after pollination, when the first seeds are developing in the female plants (www.innvista.com). The scarcity of seeds, therefore, may not be surprising. The plants are stripped of leaves, put into small bundles and left in water for 7 to 10 days to allow the plant tissues surrounding the stem fibres (bast fibres) to rot away. Peglar, Druce & Huckerby commented on the low occurrence of hemp pollen grains. This could be explained in a variety of ways; perhaps periodic flushing out by the palaeochannel occurred, removing most of the evidence. Alternatively, flowering heads may have been removed prior to retting, for medicinal use and to retain seeds for the next years crop. It is unlikely that only female plants would be selected for retting, since male plants produce superior quality fibre (Horkay & Bocsa 1996). Therefore, one of the other explanations must apply.

The remaining taxa in these samples were primarily plants of wet places, grassland and damp meadows. Aquatics such as duckweed (*Lemna* sp.), flote grass (*Glyceria* sp.) and crowfoot (*Ranunculus* subg. *Batrachium*) appear to have been growing in the feature from the earliest level sampled, and their presence confirms that the feature held standing water. However, remains from these taxa could also have been washed in from the palaeochnnel. Frequent sedge nutlets (*Carex* spp.) and other marginals such as gypsywort (*Lycopus europaeus*) would have been growing around the edges. Damp grassland, possibly growing as hay meadow, occurred nearby. Meadow plants such as meadowsweet (*Filipendula ulmaria*), buttercups (*Ranunculus repens/bulbosus/acris*) and wild anglica (*Angelica sylvestris*) were present. The pollen evidence confirmed the diversity of the aquatic and marshy vegetation (Peglar *et al., CD Section 16*).

Although the function of this feature is unconfirmed, the small amount of evidence for hemp and its location in the palaeochannel suggest that retting was taking place. Many of the plant remains may have accumulated after the feature fell out of use but it was notable that nutrient-enrichment around the feature was not excessive (see **Figure 3**). Regular flushing through by flooding episodes must have prevented foul, rotting organic waste from accumulating. A similar wood-lined rectangular box sampled by the author at Felstead, Essex, (Carruthers, forthcoming/unpublished?) dated to the 5th century AD produced the same sort of inconclusive results. The Felstead box, however, had a layer of pebbles at its base and a wooden pipe and culvert leading from it, suggesting some sort of filtration purpose.

Discussion

In comparison with earlier periods, the Medieval and Post-Medieval samples produced moderate concentrations of charred plant remains with a similar distribution across features as in the MBA samples, i.e. occasional large deposits of charred waste in the ditches, more frequent moderate deposits in the pits and very little in the waterholes (see **Figure 5**). The poor preservation of most of the cereal grains is typical of the period, mainly being due to the chemical composition of the grain being charred but also probably due to the redeposition of composted waste. Some of the better preserved samples produced chaff and seed head fragments, demonstrating that cultivation was occurring locally (as opposed to processed cereals being bought at market). The accompanying weed seeds were indicative of nutrient-poor soils (frequent leguminous weeds) and heavy, damp clay soils (seeds and seed heads of stinking chamomile). It is likely that the predominant cereal, bread-type wheat, would have been grown on the heavier soils, and that nutrient depletion was mainly due to the cultivation of this nutrient-demanding crop. Barley, oats, rye, cultivated vetch, Celtic beans and possibly peas were also being grown, as is common on many medieval sites. It is less certain whether flax, hemp or hops were being cultivated or perhaps gathered from the hedgerows in the case of hops. However, where a useful plant such as hop was growing locally it is inevitable that someone would have made use of it, at a time when much more was known about plant uses than today, and wild plant resources were more highly valued. This would also have been true for hedgerow herbs, fruits and nuts such as mallow (one waterlogged sample), blackberries (6 waterlogged samples), sloes, cherries (one waterlogged sample for each) and hazelnuts (2 charred samples, one waterlogged). A raspberry seed found in pit 658047 could represent the garden cultivation of some fruits and vegetable.

Information concerning the local environment came from both charred and waterlogged samples. Three samples produced small quantities of charred ericaceous fruits, the origins being a ditch and two pits in Areas 51, 58 and 77. All of these areas were on the southern edge of the excavated area. Unlike in the LIA/ERB samples, however, waterlogged ericaceous remains were not found in the waterhole or ‘retting pit’ samples. Heathland, therefore, may not have been located adjacent to the settlement features, but was probably close enough to make gathering vegetation for fuel worthwhile.

The two waterlogged features both produced abundant evidence for the presence of trees (see **Figure 3**), and these must have grown close to the features as buds, twigs and leaf fragments were frequent as well as fruits and seeds. The waterhole contained mainly oak remains, whilst the ‘retting pit’ produced remains from willow, alder and ash. Although some of this tree growth may have occurred after the features were abandoned and there was an increase in the occurrence of acorn fragments towards the top of the feature, acorn fragments were also found towards the bottom of the feature so woodland must have existed close to the waterhole while it was in use. This is similar to the situation during the Bronze Age, although at that time thorny taxa were predominant, suggesting hedgerows rather than woodland. In contrast, during the IA and RB periods the waterholes were located in very open, grassland environments.

It is interesting to see that indicators of heavily disturbed, nutrient-enriched soils such as nettles and fat hen were not particularly abundant in the waterlogged features, perhaps suggesting that the level of occupation was fairly low during this period, or fairly short-lived. Aquatic and bankside plants grew in and around the waterhole and retting pit, whilst during earlier periods, use of the waterholes was sufficient to prevent aquatic plants from becoming frequent. Alternatively, perhaps they were deliberately kept clear of weeds.

Since no imported fruits and spices were recovered from the samples, apart from possible hemp, the status of the settlement appears to have been fairly rural in character. However, no cess pits or deposits that definitely contained faecal waste were examined, so information concerning diet was biased towards foods that frequently became charred, such as cereals.

References

Beaven, E.S. (1947) *Barley. Fifty Years of Observation and Experiment*. Duckworth.

Boardman, Sheila & Jones, Glynis (1990) Experiments on the Effects of Charring on Cereal Plant Components. *Jour. Arch. Sci*. **17**, 1-11.

Bradley, R., Lobb, S., Richards. J. & Robinson, M. (1980) Two Late Bronze Age settlements. *Proc. Prehist. Soc.* **46**, 245-294.

Campbell, Gill (2000) The charred plant remains. In Barry Cunliffe & Cynthia Poole, Danebury Environs Programme: The Prehistory of a Wessex Landscape. Volume 2 – Part 3, Suddern Farm, Middle Wallop, Hants, 1991 and 1996. pp.193-198.

Carruthers, Wendy (1989) for 1988 Mystery object no. 2 – animal, mineral or vegetable? *Circaea* **6 (1),** p.20.

Carruthers, W.J. (1990) The carbonised plant remains. *In* P.J.Woodward, *The South Dorset Ridgeway Survey and Excavations 1977-83: The Pre-Iron-Age Landscapes.* Dorset Nat.Hist.&Arch.Soc.Mono.8, p.106-11.

Carruthers, W.J. (1991) The plant remains. *In* P.J.Fasham & R.J.B.Whinney Archaeology and the M3. Hants.Field Club Mono. 7, p.67-75.

Carruthers, W.J. (2001) Charred plant remains from the Neolithic horizon, Chalcolithic horizon & Bronze Age horizon. *In* Mark Patton, Le Pinacle, Jersey: a reassessment of the Neolithic, Chalcolithic and Bronze Age horizons. *Archaeological Journal*, 158, 1-61.

Carruthers, Wendy J. (2003) Appendix 7: Analysis of the plant remains in samples of waterfront sediments from Dung Quay, Plymouth. *In* Peter Stead, Excavation of the Medieval and later waterfront at Dung Quay, Plymouth. *Proc. Devon Arch Soc*. **61**, 116-122.

Carruthers, Wendy J. (2005) Mineralised Plant Remains. *In* Vaughan Birbeck, with Roland Smith, Phil Andrews & Nick Stoodley, *The Origins of Mid-Saxon Southampton: Excavations at the Friends Provident St Mary's Stadium 1998-2000.* Wessex Archaeology, pp. 157-173.

Carruthers, Wendy (2008) CD-Rom Chapter 29: Environmental Overview. Chapter 34: Charred, mineralised and waterlogged plant remains. *In* Nicholas Cooke, Fraser Brown & Christopher Phillpotts, *From hunter gatherers to huntsmen. A history of the Stansted landscape*. Framework Archaeology Monograph No. **2.**

Carruthers, Wendy J. (forthcoming) Charred Plant Remains from Hartshill Copse, Upper Bucklebury, Berkshire for Cotswold Archaeology, draft submitted January 2004.

Carruthers, Wendy & Hunter, Katherine (forthcoming) The Plant Remains. In Dominic Powlesland, West Heslerton, Yorkshire.

Challinor, Dana (2008) Report 10, CD Rom. In In Lisa Brown, John Lewis & Alex Smith (eds) *Landscape Evolution in the Middle Thames Valley. Heathrow Terminal 5 Excavations Volume 1*, *Perry Oaks.* Framework Archaeology Mono. 1.

Cooke, Nicholas, Fraser Brown & Christopher Phillpotts, *From hunter gatherers to huntsmen. A history of the Stansted landscape*. Framework Archaeology Monograph No. **2**

Culpepper, Nicholas (1826) *Culpepper's Complete Herbal*. Facsimile edition 1979, Gareth Powell Ltd.

Dyer, Christopher (2000) *Everyday Life in Medieval England.* Hambledon and London, London & New York.

Ellenberg, Heinz, (1988) *Vegetation Ecology of Central Europe*. Cambridge University Press.

Fairweather, Alan D. & Ralston, Ian B.M. (1993) The Neolithic timber hall at Balbridie, Grampian region, Scotland.: the building, the date, the plant macrofossils. *Antiquity***, 67**, (255) 313-323.

Godwin, Sir Harry (1975) *History of the British Flora*. Cambridge University Press.

Gray, Lisa (2001) Excavations at Governors House, City of London. Brigham & Woodger. MoLAS mono 9, 77-78, 110-115.

Gray, Lisa (2002) J. Drummond-Murray. Settlement in Roman Southwark. MoLAS 12, 242-259.

Greig, James (1991) The botanical remains. *In* Stuart Needham, *Excavation and salvage at Runnymede Bridge, 1978*. British Museum Press & E.H. 234-261.

Grieve, Mrs M. (1931) *A Modern Herbal*. Revised edition 1992. Tiger Books International, London.

Helbaek, H (1953) Early crops in Southern England. Proc Prehist. Soc. 18, 194-233.

Hill, M.O., Mountford, J.O., Roy, D.B. & Bunce, R.G.H. (1999) *Ellenberg's indicator values for British plants.* ECOFACT Volume 2: Technical Annex. HMSO.

Hillman, Gordon (1981) Reconstructing Crop Husbandry Practices from Charred Remains of Crops. *In* R. Mercer (ed) *Farming Practice in British Prehistory*. Edinburgh Univ. Press

Jones, Martin (1981) The Development of Crop Husbandry. In M.Jones & G. Dimbleby (eds) *The Environment of Man: the Iron Age to the Anglo-Saxon Period*. B.A.R. 87, 95-121.

Jones, Martin (1984) Regional Patterns in Crop production. *In*. B. Cunliffe & D. Miles (ed), Univ. Ox Mono. 2. 120-125.

Jones M. 2000. The plant remains. 505-12. *In*: Fulford M and Timby J. 2000. *Late Iron Age and Roman Silchester. Excavations on the site of the Forum-Basilica 1977, 1980-86*., pp.77 & 80-6. Britannia Monogr. Ser **15**.

Jones G. and Milles A. 1989. Iron Age, Romano-British and medieval plant remains. Fiche pp. 74-84. *In*: Britnell W. The Collfryn hillslope enclosure, Llansantffraid Deuddwr, Powys: Excavations 1980-1982. *Proc. Prehist. Soc***. 55.** 89-134

Lust, John (1974) *The Herb Book*. Bantam Books, New York.

Miller, William C., & West, Geoffrey P. (1953) *Black's Veterinary Dictionary*. Adam & Charles Black, London.

Monk, M (unpublished) The Plant Economy and Agriculture of the Anglo-Saxons in Southern Britain with particular reference to the 'mart' settlements at Southampton and Winchester. Southampton University, M.Phil. 1977.

Moss, Stephen (2004) The Broadbalk long-term experiment at Rothamsted: what has it told us about weeds? *Weed Science*, **52**: 864-873.

Percival, J. (1921) *The wheat plant: A Monograph*. Duckworth & co.

Pliny the Elder. Natural History. Book XXIV, Chapter 66.

Pliny the Elder. *The Natural History. XXVII*. Ch. 87. Trans. John Bostock, London 1855

Readers Digest (1981) *Field Guide to the Wild Flowers of Britain*.

Reynolds, P.J. (1981) Deadstock and Livestock. *In* R. Mercer, *Farming Practice in British Prehistory*. Edin. Univ. Press, 97-122.

Robinson, Mark (1979) Biological Evidence. *In,* George Lambrick & Mark Robinson, *Iron Age & Roman riverside settlements at Farmoor, Oxfordshire*. Ox Arch Unit Rep. **2,** 77-123.

Robinson, M.A. (1993) The Scientific Evidence. *In* T. G. Allen & M.A. Robinson, *The Prehistoric Landscape and Iron Age Enclosed Settlement at Mingies Ditch, Hardwick with Yelford, Oxon.* Oxford Arch. Unit, pp. 101-117.

Robinson Mark (2000) *The Passage of the Thames*. Ed. Stuart Needham. British Museum Press. Pp. 146-168.

Stace, Clive (1997*) New Flora of the British Isles*. Second Edition. C.U.P.

Straker, V. (1990) Carbonised plant macrofossils. *In* Alan Saville, *Hazleton North, Gloucestershire 179-82: The excavation of a Neolithic long cairn of the Cotswold-Severn group*. E.H. Arch. Rep. **13,** 215-218.

Figure 1: Pits (no. of features)

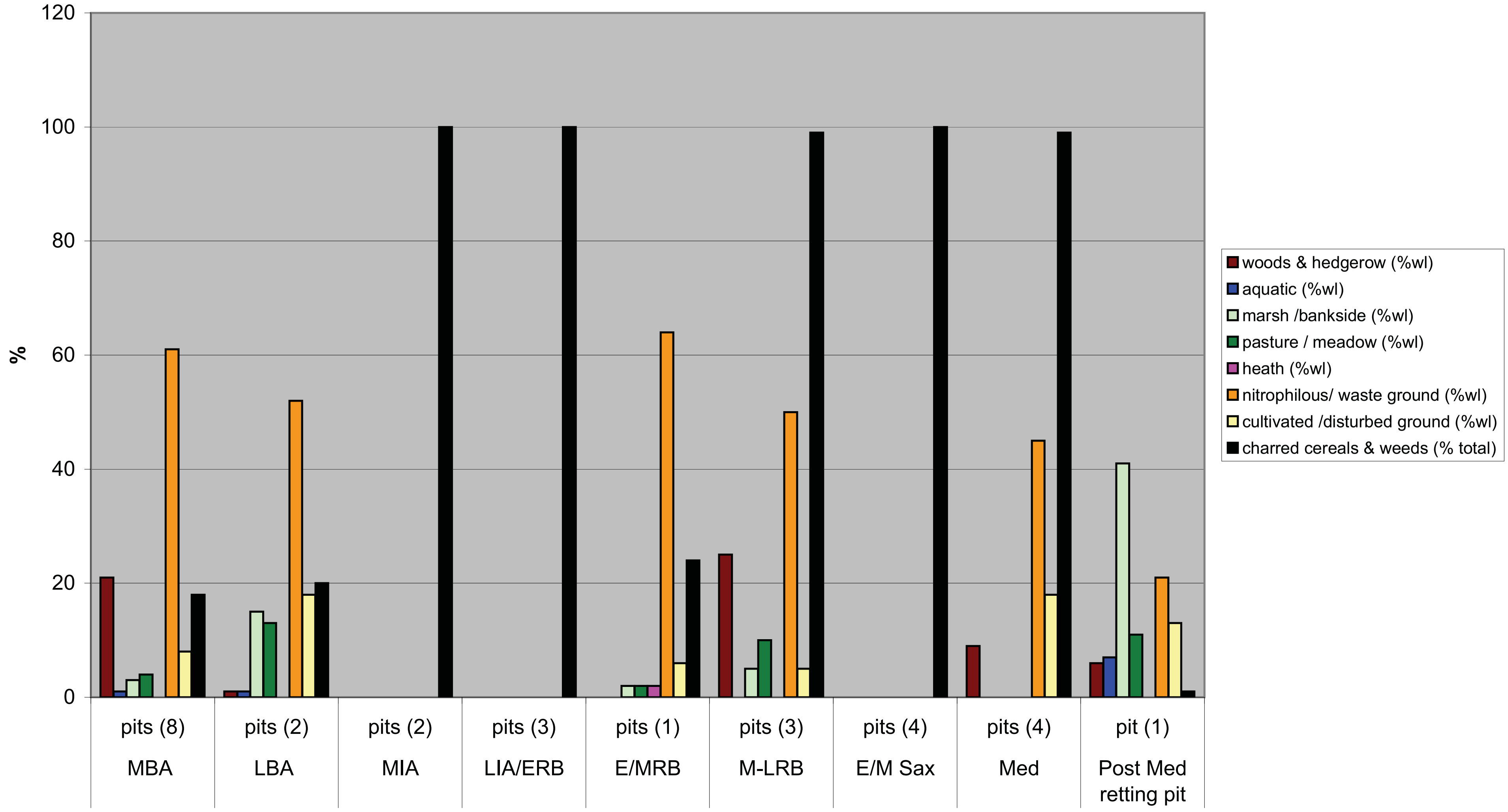


Figure 2 : ditches (no. of features)

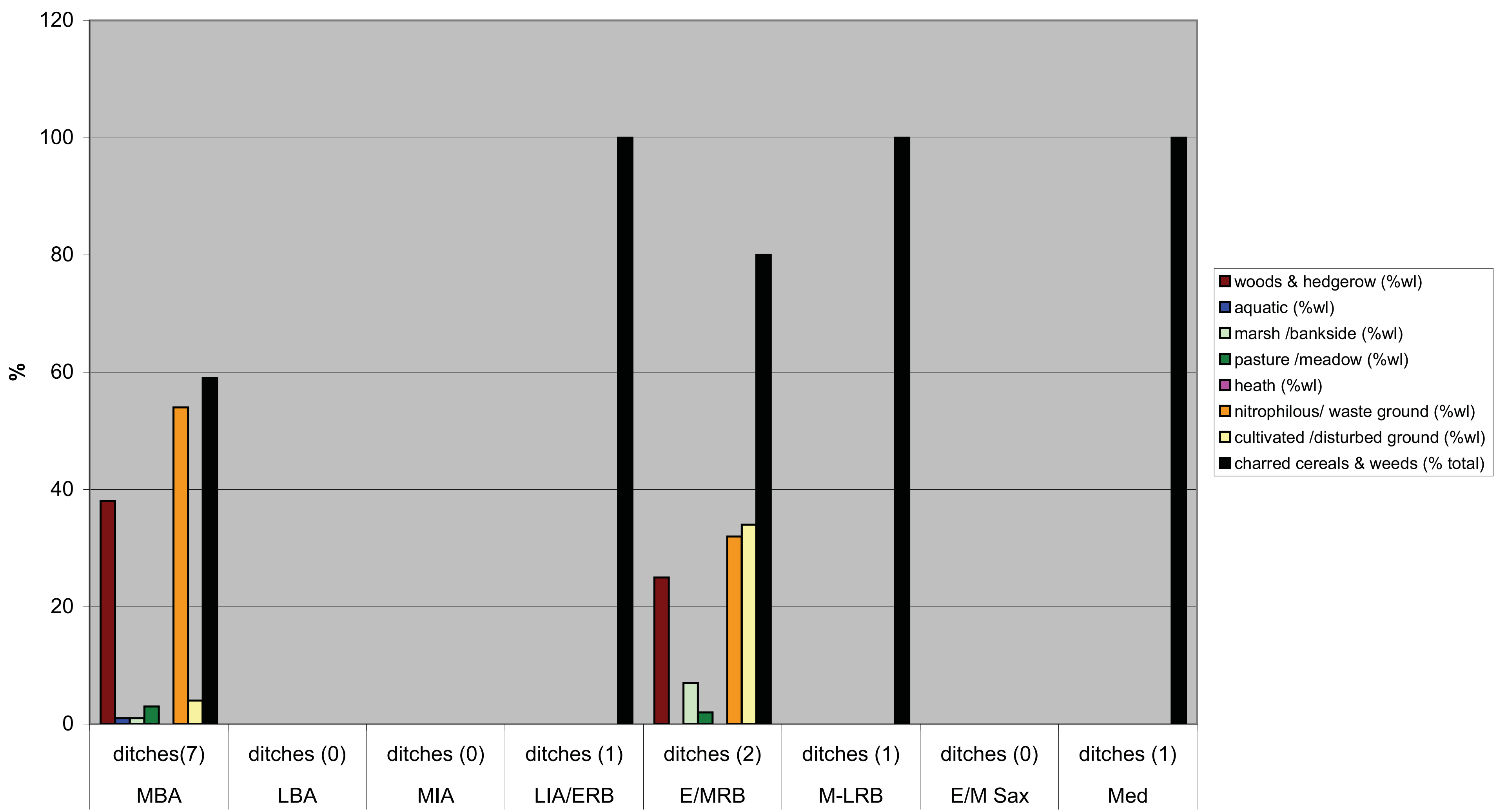


Figure 3 : waterholes (no. of features)

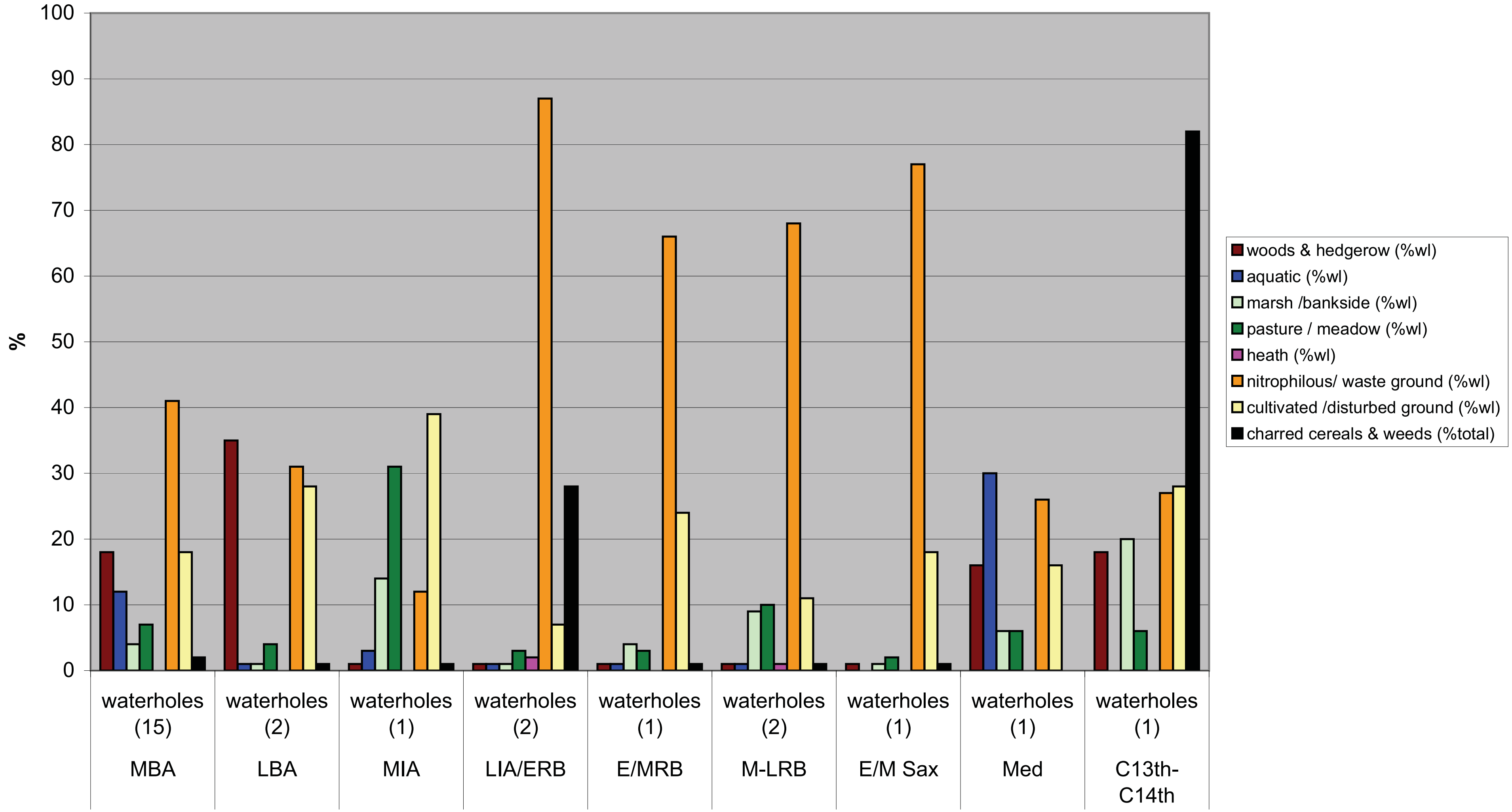


Figure 4: transition from emmer to spelt wheat

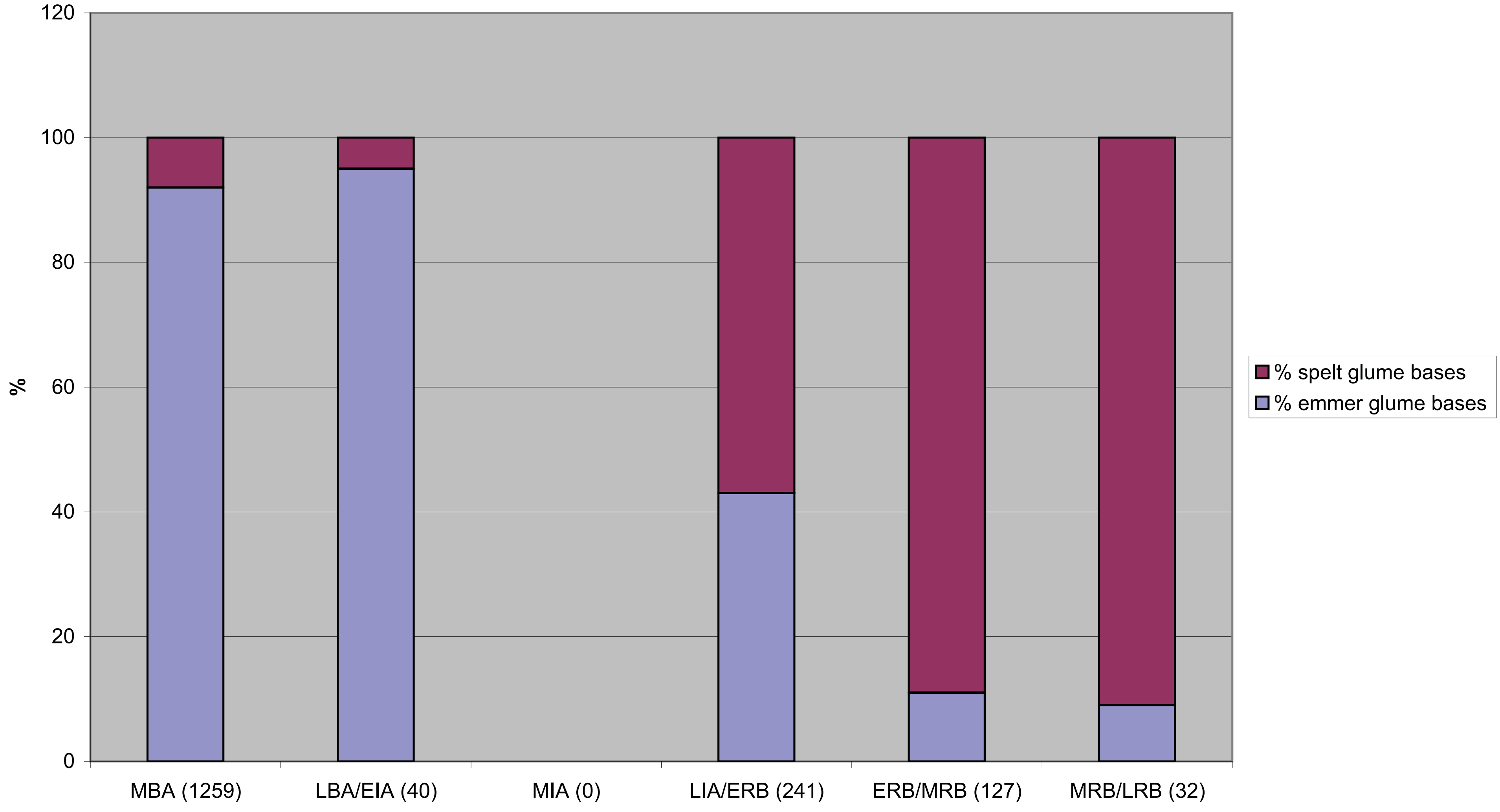


Figure 5 : charred fragments per litre (no. of samples)

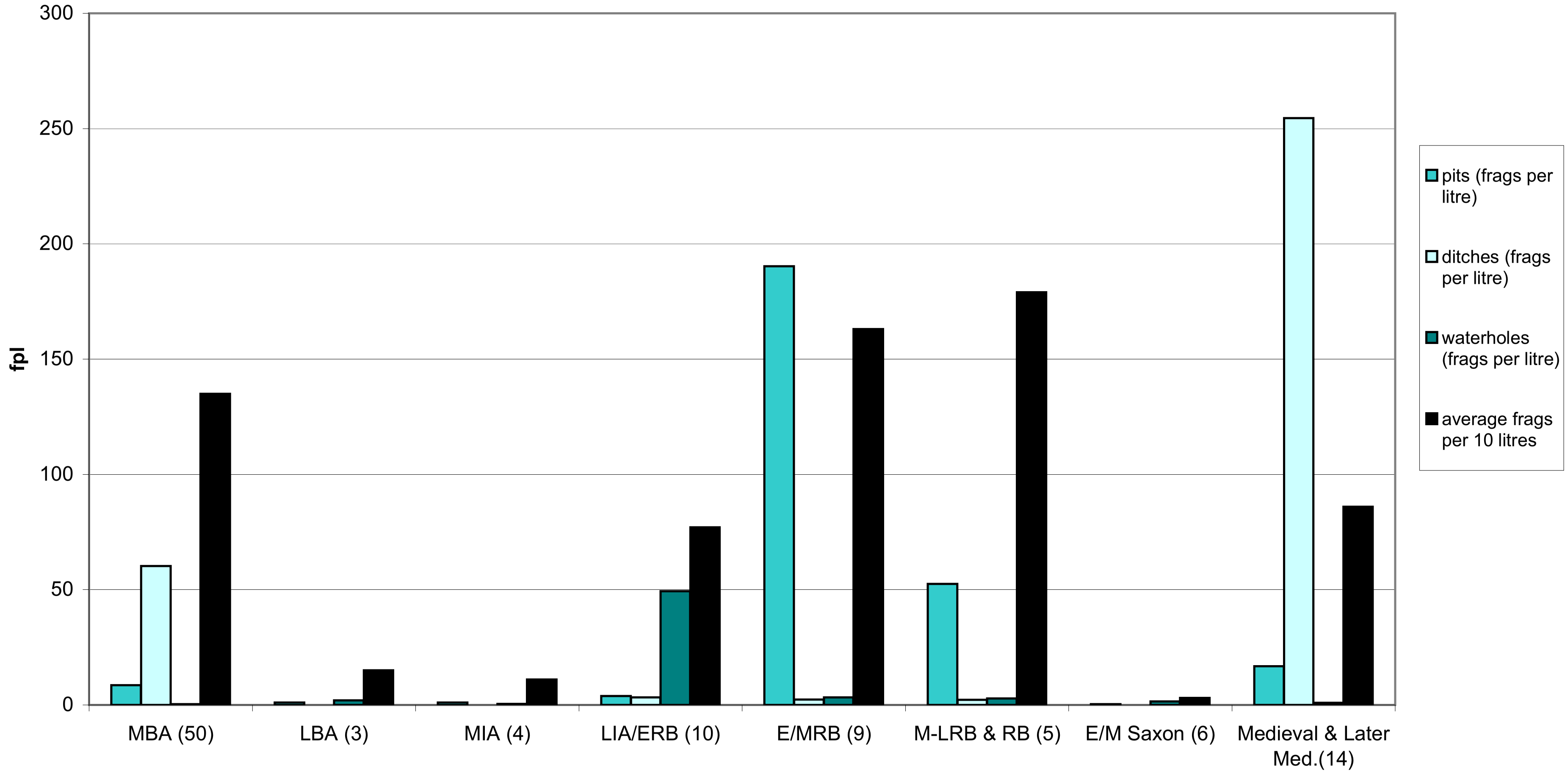


Figure 6: small legume seeds per 10 litre soil sample (pits and ditches only)

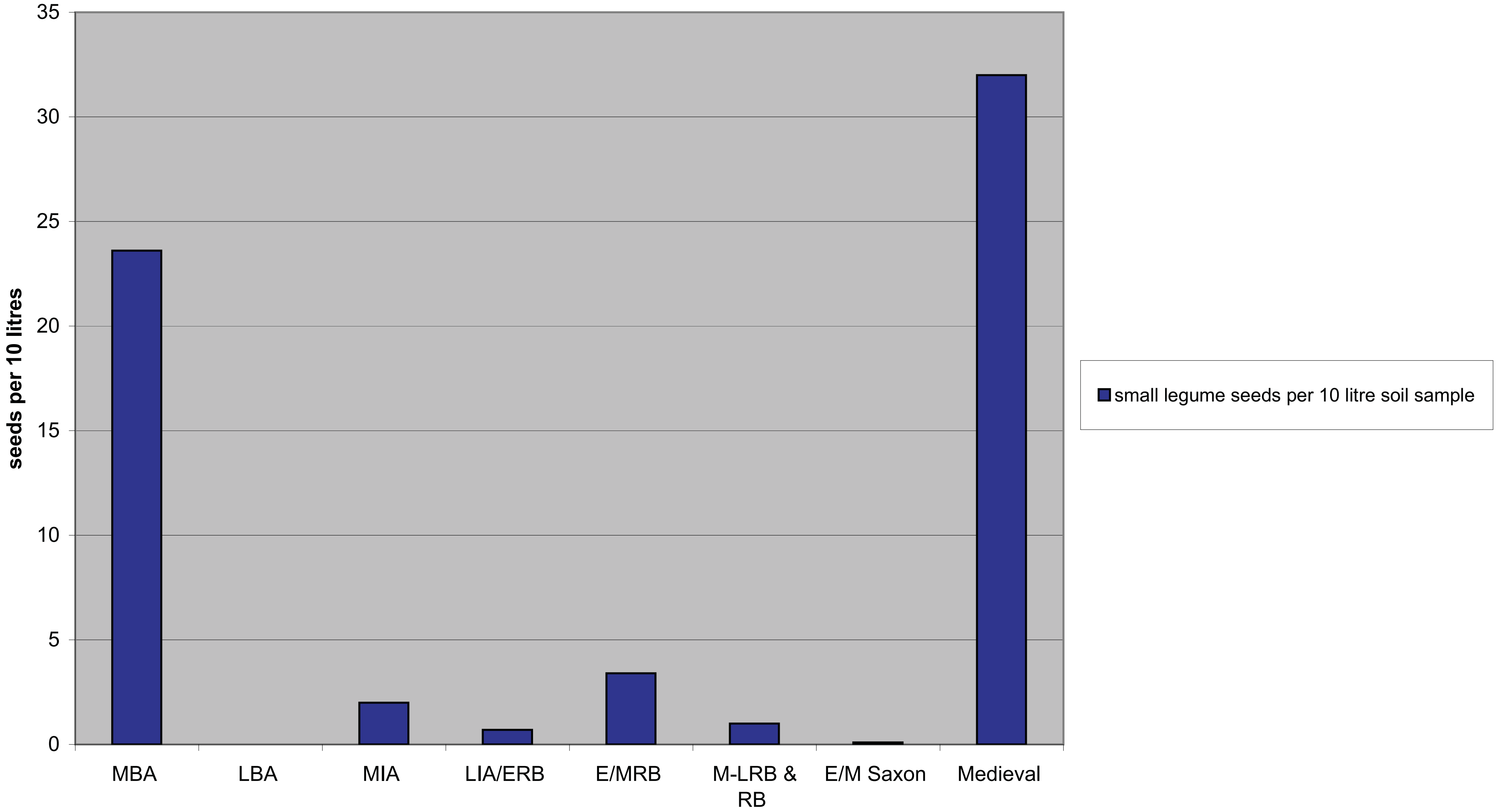


Figure 7: Concentration of waterlogged remains in the pits (no. of samples)

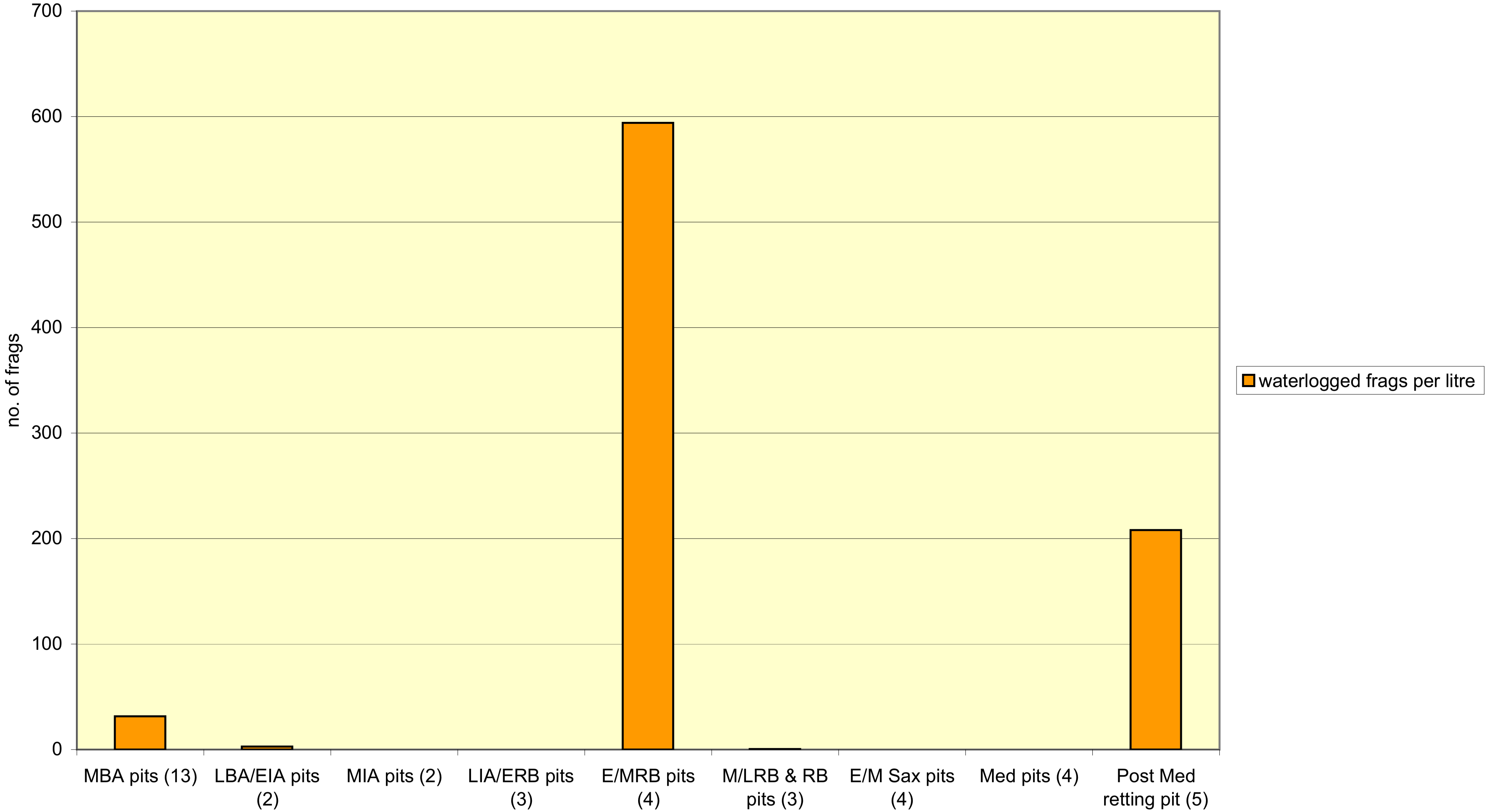


Figure 8: Concentration of waterlogged remains in the ditches (no. of samples)

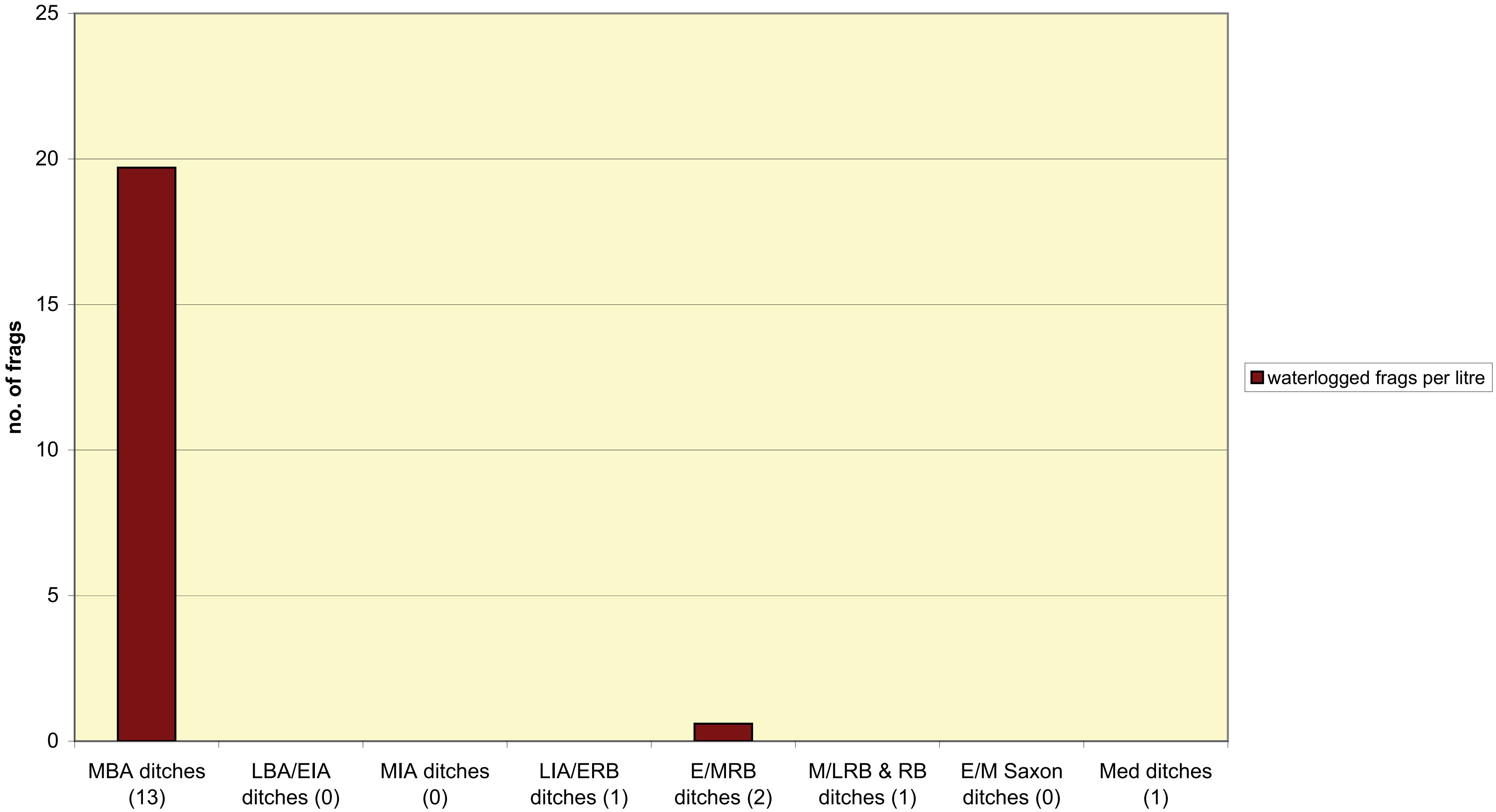


Figure 9: Concentration of waterlogged remains in the waterholes (no. of samples)

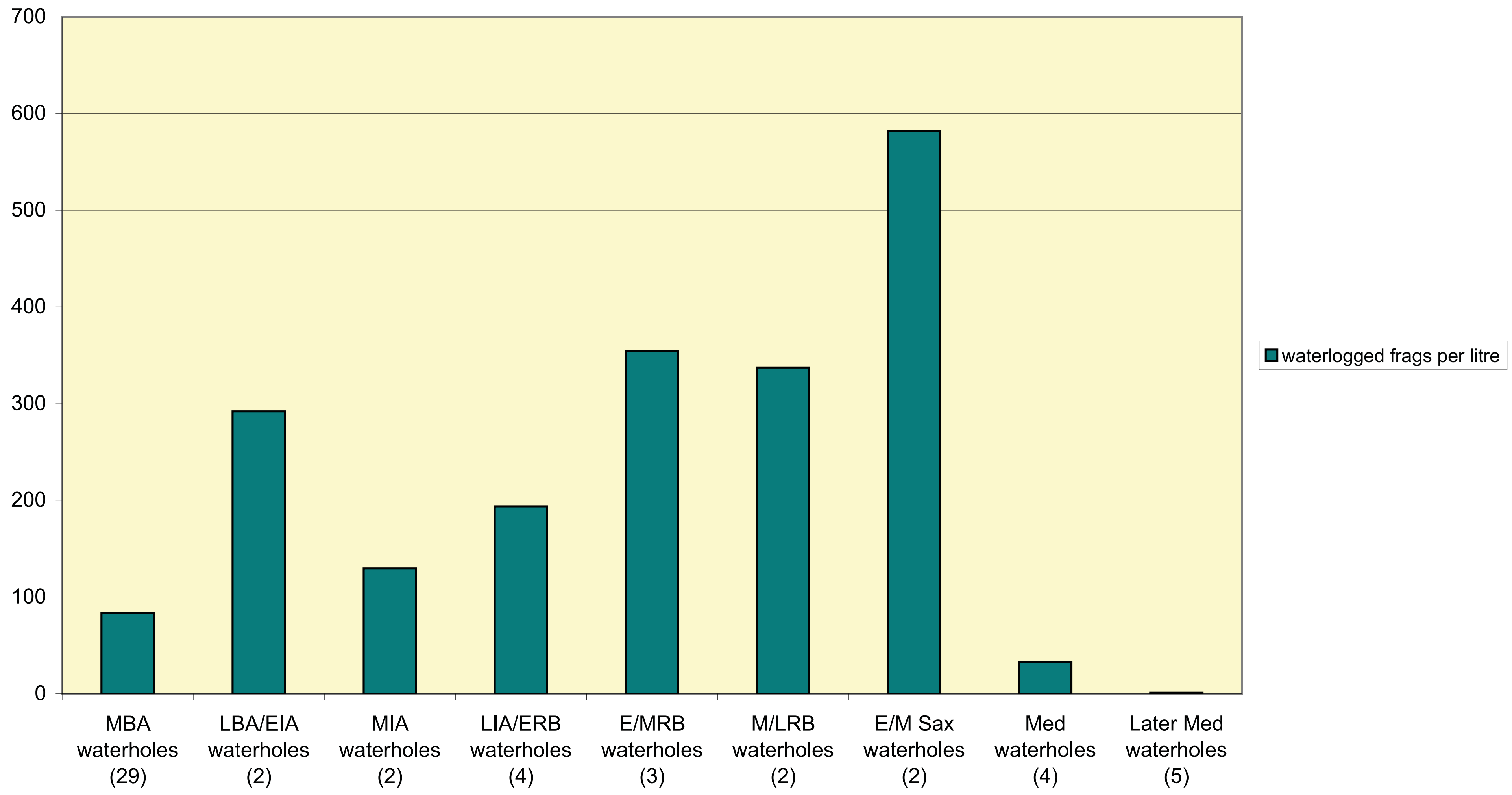


Table 1 : Neolithic to EBA plant macrofossil samples from Heathrow Terminal 5 (T5)

Site	BCU02	BCU02	PSH02/72a	PSH02	TEC05	PSH02
Sample	20006	20000	16056	17090	29113	15506
Context	807015	802008	558059	527224	833073	541015
Feature & type	tufa L	peat L	threethrow 558057	G527233	Pit 833067	D529313
Phase	?Meso/Neo	?prehist.	E.Neo	E.Neo (contam.)	L.Neo	LN/EBA
CEREAL GRAINS						
Triticum aestivum -type (bread-type free threshing wheat grain)				[2]†		[7]
T. dicoccum/spelta (emmer/spelt wheat grain)			[4]			
Triticum sp. (indeterminate wheat grain)				[4]		
Triticum/Secale cereale (wheat/rye grain)				[1]		[1]
Hordeum sp. (barley grain)				[1]†		
Avena/Bromus sp. (oat/chess grain)						[2]
Indeterminte cereals			[11]	[19]		[5]
CEREAL CHAFF						
Triticum dicoccum (emmer spikelet fork)				cf. [1]		
Hordeum/Secale cereale (barley/rye rachis frag.)						cf. [1]
OTHER PLANT MACROFOSSILS						
Nuphar lutea (L.)Sm. (yellow water-lily seed) M	3					
Ranunculus acris/bulbosus/repens (buttercup achene) DG	3	5				
R. subg. *Batrachium* (crowfoot achenes) BP	47	28				
R. sceleratus L. (celery-leaved buttercup achene) MP	1	12				
Fumaria sp. (fumitory achene) CD		1				
Urtica dioica L. (stinging nettle achene) CDn	3	4			20	
U. urens L. (small nettle achene) CDn					1	
Alnus glutinosa L. (alder seed) WSF		2				
Alnus glutinosa L. (alder catkin) WSF		1				
Corylus avellana L. (hazelnut shll frag.) HSW			[114]		290	
Chenopodium album L. (fat-hen seed) CDn	4	1			2	
Stellaria media (L.) Villars (common chickweed seed) CD		1				
Polygonum hydropiper (L.)Spach (water-pepper achene) Pwh		3				
Rumex conglomeratus Murray (clustered dock achene) woBP		2				
Rumex sp. (dock achene) CDG		30	[1]			
Rubus sect. *Glandulosus* (blackberry seed) DHSW*		1				
Potentilla sp. (cinquefoil achene) DGMY					5	
Prunus sp. (cf. sloe stone frag.) HSW					1	
Pisum/Vicia/Lathyrus sp.(large legume frag c. 5mm)				[1]		
Vicia/Lathyrus sp. (3.5-4mm vetch/tare seed)						[3]
Vicia/Lathyrus sp. (c. 2-3mm small vetch seed)				[2]		[1]
Chaerophyllum temulum L. (rough chervil mericarp) GHWo	6					
Berula erecta (Huds.) Coville (lesser water-parsnip mericarp) FMc		5				
Apium nodoflorum (L.)Lag. (fool's watercress mericarp) MPw		60				
S. dulcamara L. (bittersweet seed) DHWY		3				
Solanum sp. (nightshade seed)		2				
Menyanthes trifoliata L. (bogbean seed) M	1					
Mentha sp. (mint nutlet) GwBM	2	7				
Sambucus nigra L. (elder seed) DHSW	2					
Carduus/Cirsium sp. (thistle achene) GDY	1					
Anthemis cotula L. (stinking mayweed achene) ADhd						[1]
Alisma plantago-aquatica L. (water plantain achene) P		22				
Potamogeton sp. (pondweed fruit) M	6	5				
Zannichellia palustris L. (horned pondweed achene) Mc		1				
Lemna sp. (duckweed fruit) P		5				
Juncus sp. (rush seed) MPd		+				
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd	1	5				
Schoenoplectus lacustris (L.)Palla (common club-rush nutlet) M	5					
cf. *Blysmus compressus* (L.)Panz.ex Link (flat sedge nutlet) Mo	1					
Carex sp. (trigonous sedge nutlet) MPd	5	38				
Glyceria sp. (sweet-grass caryopsis) P		8				
Sparganium erectum L. (branched bur-reed fruit) PM		29				
Characeae (stonewort algae)	+++	++				
waterlogged wood fragments & twigs		+++				
Total remains:	91	281	[130]	[31]	319	[21]
Sample volume (litres soil)	1	1		40	10	40
% of flot sorted	100	50	100	100	100	100

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; +=C14 dated

Table 2 : MBA samples from Heathrow, T5

Site	PSH02	PSH02	PSH02	PSH02	PSH02	PSH02	PSH02/24	PSH02/24	PSH02/42a	PSH02	PSH02/24	PSH02	PSH02/61
Sample	17005	17013	17031	17014	17015	17033	17001	17002	15052	15083	16663	19174	19173
Context	527076			527085			529015	529015	581027	582083	539284	615047	615046
Feature & type	D539096						D529004		D581045	D582081	D539283	D615043	D615051
Period	MBA						MBA	MBA	MBA	MBA	MBA	MBA	MBA
CEREALS													
Grain													
Triticum aestivum -type (bread-type free threshing wheat grain)													
Triticum dicoccum/spelta (emmer/spelt grain)	[80]	[61]	[94]	[43]	[22]	[199]			[2]†		[28]		
Triticum dicoccum/spelta (sprouted emmer/spelt grain)													
Triticum sp. (wheat grain)	[1]			[1]	[2]	[5]					[1]		
Triticum/Secale cereale (wheat/rye grain)													
Hordeum sp. (hulled barley grain)	[19]	[15]	[32]	[16]	[38]	[92]					[4]		
Hordeum sp. (barley grain)	[30]	[18]	[28]	[12]	[8]	[65]					[2]		
Avena sp. (wild/cutivated oat grain)			[2]			[4]							
Avena/Bromus sp. (oat/chess grain)	[2]			[7]	[1]	[2]	cf.[1]						
Indeterminate cereal or large grass caryopsis	[68]	[61]	[297]	[47]	[22]	[259]	[11]	[4]	[3]	[1]	[37]	cf.1	
Chaff													
cf. tough wheat rachis	[1]				[8]	[4]							
Triticum dicoccum (emmer glume base)	[20]	[7]	[3]	[39]	[74]	[56]	[2]	[2]			[32]		[1]
T. dicoccum (emmer spikelet fork)	[46]	[2]	[2]	[86]	[111]	[89]	[1]				[38]		
Triticum dicoccum (emmer rachis frag.)	[4]			[1]	[6]	[5]							
T. spelta (spelt glume base)	[2]			[5]	[4]	[1]					[9]		
T. spelta (spelt spikelet fork)	[1]			[1]		[1]					[5]		cf.1
T. spelta (spelt rachis frag.)											[1]		
T. dicoccum/spelta (emmer/spelt glume base)			[9]	[11]	[26]	[11]	[3]		[2]		[22]		1
T. dicoccum/spelta (emmer/spelt spikelet fork)	[19]	[21]	[39]	[29]	[50]	[163]	[7]	[4]	[3]		[43]		[1]
T. dicoccum/spelta (emmer/spelt rachis frag.)		[1]		[4]	[2]						[6]		
Hordeum sp. (barley rachis frag.)	[36]	[17]	[1]	[56]	[53]	[125]		[2]			[7]		
Avena fatua L. (wild oat pedicel)													
Avena sp. (oat pedicel, ?incomplete)													
basal collared rachis frag.													
cereal-sized culm node	[27]	[3]	[1]	[37]	[20]	[27]					[3]		
cereal-sized culm base	[144]	[20]	[10]	[104]	[52]	[124]					[4]		
Other													
Ranunculus acris/bulbosus/repens (buttercup achene) DG			[1]	[1]	2[2]	[1]	[1]	7			[1]	1	1
R. parvilflorus L. (small-flowered buttercup achene) o	1[4]	[2]	[9]	[3]	[2]	[7]						1	
R. subg. *Batrachium* (crowfoot achenes) BP													
R. sceleratus L. (celery-leaved buttercup achene) MP													
Papaver cf. *dubium* L. (long-headed poppy seed) AD				[1]									
Papaver cf. rhoeas	[1]	[1]											
Papaver sp. (poppy seed) CD										1			
Fumaria sp. (fumitory achene) CD	[4]			1[2]	2	[6]		3		3		1	
Urtica dioica L. (stinging nettle achene) CDn	[3]	[3]						118		>500	100	>500	>500
Urtica urens L. (small nettle achene) CDn									5				
Quercus sp. (acorn cup frags) WSH					[2]								
Quercus sp. (immature acorn) WSH													

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	17005	17013	17031	17014	17015	17033	17001	17002	15052	15083	16663	19174	19173
Context		527076			527085		529015	529015	581027	582083	539284	615047	615046
Alnus glutinosa L. (alder seed) WSF								36			28	1	
Alnus glutinosa L. (alder catkin) WSF													
Corylus avellana L. (hazelnut shell frag.) HSW													
Chenopodium album L. (fat-hen seed) CDn			4	[1]				13		8		5	2
C. polyspermum L. (many-seeded goosefoot seed) CD	[3]							19	1		10		
Atriplex patula/prostrata (orache seed) CDn	[3]		[4]	[12]		[3]		30		2	18[42]	6	2
Chenopodiaceae embryo			[14]				[1]				[1]		
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w						[1]		2				1	
Arenaria serpyllifolia L. (thyme-leaved sandwort seed) cso													
Moehringia trinervia (L.)Clairv. (three-nerved sandwort seed) Why										5	1		
Stellaria media (L.) Villars (common chickweed seed) CD	[18]	[13]	[9]	[6]	[23]	[9]		2[1]	>500			31	
S. graminea L. (lesser stitchwort seed) Gd													
Cerastium sp. (mouse-ear seed) CDGo													
Spergula arvensis L. (corn spurrey seed) Aas					[1]								
Lychnis flos-cuculi L. (ragged Robin seed) MGw													
Persicaria maculosa Gray (redshank achene) Cdo	[1]					[1]					[1]		
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo					[1]							1	
Persicaria maculosa/lapathifolia (redshank/persicaria achene) Cdwo													
Polygonum aviculare (knotgrass achene) CD	[1]		[1]	[5]	[2]	[5]						2	
P. hydropiper (L.)Spach (water-pepper achene) Pwh													
Fallopia convolvulus (L.)A.Love (black bindweed achene) CD	[14]	[12]	[50]	[4]	[4]	[22]					1[3]		
Rumex acetosella L. (sheep's sorrel acene) EoGCas						[1]							
Rumex conglomeratus Murray (clustered dock achene) woBP												2	
R. crispus L. (curled dock achene) CD									cf. 1				
Rumex sp. (dock achene) CDG	[5]	[7]	[2]	[10]	[14]	[37]		1	6	1	[2]	5	1
Hypericum s p.(St John's wort seed) G													
Malva sp. (mallow capsule frag.) DG						[1]							
Salix sp. (willow bud scale)											1		
Salix sp. (willow catkin bract)		[1]											
Viola sp. (violet seed) GHWEMF	[1]			[1]		[1]							
Cardamine sp. (bitter-cress seed) CGw													
Rorippa islandica (Oeder ex Gunnerus)Borbas (northern yellow-cress seed) P													
Thlaspi arvense L. (field penny-cress seed) AD													
Brassica/Sinapis sp. (mustard, charlock etc. seed) CDG													
Primulaceae NFI	[1]							1					
Rubus sect. *Glandulosus* (bramble seed) DHSW*			3		8			86		92+	17	533	>500

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	17005	17013	17031	17014	17015	17033	17001	17002	15052	15083	16663	19174	19173
Context		527076			527085		529015	529015	581027	582083	539284	615047	615046
Potentilla anserina L. (silverweed achene) DGYo								1					
Potentilla sp. (cinquefoil achene) DGMY								6					
Agrimonia eupatoria L. (agrimony achene) GH													
Aphanes arvensis L. (parsley-piert achene) Co								1			1		
Rosa sp. (rose seed) HSW												2	
Rosa sp. (whole rose hip) HSW													
Rosa /Rubus sp. (rose/bramble type thorn) HSW										12		66	17
Prunus spinosa (sloe stone) HSW						[1]						16	4
Prunus sp. (sloe etc. seed frag.) HSW										1	10		
Prunus/Crataegus sp. (sloe /hawthorn type thorn) HSW												3	2
Malus sylvestris L. (apple pip) *HSW						[1]							
Malus sylvestris L. (apple endocarp frag.) *HSW						[2]							
Crataegus monogyna Jacq. (hawthorn fruit stone) HSW												1	
Crataegus monogyna Jacq. (immature hawthorn fruit) HSW												22	
Vicia cf. *tetrasperma* (cf. smooth tare seed + hilum) G		[1]	[10]		[8]	[9]							
cf. *Lathyrus aphaca* (2.5-3mm, round hilum)		[3]		[5]	[9]	[12]							
Vicia/Lathyrus sp. (vetch/tare <2mm seed) CGD	[22]	[40]	[178]	[43]	[21]	[105]	[2]	[3]			[1]		
Vicia/Lathyrus sp. (vetch/tare 2-3mm seed) CDG	[57]	[80]	[101]	[72]	[47]	[260]	[20]	[6]	[2]		[9]		
Vicia/Lathyrus sp. (3.5-4mm vetch/tare)		[1]		[1]	[1]								
Pisum/Vicia/Lathyrus sp.(large legume frag c. 5mm)													
Legume pod frag.	[7]			[4]		[1]							
Legume tendril frag.				[1]									
Medicago lupulina capsule					[5]	[5]							
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD	[3]	[10]	[10]	[5]	[56]	[27]	[1]						
Ulex europaeus L. (gorse seed) GEsp					[1]								
Cornus sanguinea L. (dogwood stone) WSc													
Frangula alnus Mill . (alder buckthorn seed coat) SMFoWcw													
Linum usitatissimum L. (flax seed) *	[7]	[1]	[1]			[3]			[1]				
Linum usitatissimum L. (flax capsule frag.) *	[11]	[5]	[4]		[2]	[4]							
L. catharticum L. (fairy flax seed) Gdcs		[2]											
Acer sp. (maple seed) HSW													2
Hydrocotyle vulgaris L. (marsh pennywort fruit) FMP													
Chaerophyllum temulum L. (rough chervil mericarp) GHWo								1			6	26	17
Anthriscus sylvestris (L.)Hoffm. (cow parsley meicarp) GHW								2					

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	17005	17013	17031	17014	17015	17033	17001	17002	15052	15083	16663	19174	19173
Context		527076			527085		529015	529015	581027	582083	539284	615047	615046
Berula erecta (Huds.) Coville (lesser water-parsnip mericarp) FMc													
Aethusa cynapium L. (fool's parsley mericarp) CD	24	[7]	1[92]	17	12	1[6]		23		8	3	2	3
Bupleurum rotundifolium L. (thoro-wax mericarp) Ac									cf.[3]				
Apium nodoflorum (L.)Lag. (fool's watercress mericarp) MPw													
cf.*Pimpinella major* (L.)Huds. (cf. greater Burnet-saxifrage mericarp) GHW	[2]		[22]	[7]	[3]	[47]							
Pastinaca sativa L. (wild parsnip mericarp) GDYc													
Torilis japonica (Houtt.)DC (upright hedge-parsley mericarp) GHWo												22	11
Daucus carota L. (wild carrot mericarp) Gc													
Apiaceae NFI													
Solanum nigrum L.(black nightshade seed) CD			2									1	6
S. dulcamara L. (bittersweet seed) DHWY													
Solanum sp. (nightshade seed)													
Menyanthes trifoliata L. (bogbean seed) M													
Lithospermum arvense L. (field gromwell nutlet) ADGo						[1]							
Stachys sp. (woundwort nutlet) GHEWM										14			
Lamium sp. (dead-nettle nutlet) CDY		[1]						2			1		
Galeopsis tetrahit L. (common hemp-nettle nutlet) ADWod												2	6
Glechoma hederacea L. (ground-ivy nutlet) WHDh								7		15			2
Ajuga reptans L. (bugle nutlet) WGw													
Prunella vulgaris L. (selfheal nutlet) GDWo	[1]												
Lycopus europaeus L. (gypsywort nutlet) GwFMP				[1]									
Mentha sp. (mint nutlet) GwBM								1					
Callitriche sp. (water-starwort fruit) P													
Plantago laceolata L.(ribwort plantain seed) Go	[1]	[1]			[7]	[1]							
P. major L. (greater plantain seed) Cgo					[1]						2	1	
Veronica hederifolia L. (ivy-leaved speedwell seed) CDWH	[1]	[1]	[1]			[3]							
Veronica sp. (speedwell seed) CDG	[1]												
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG			[1]						[4]				
Galium aparine L. (cleavers nutlet) CDSH	[25]	[13]	[67]	[36]	[21]	[159]		[2]	[2]		1		
Galium small c1mm													
Galium sp. (frag.)							[2]						
Sherardia arvensis		[1]			[1]								
Sambucus nigra L. (elder seed) DHSW	3		5					46		19	23		
Valerianella dentata (L.)Pollich. (narrow-fruited corn-salad fruit) AD	[1]					[1]							
Arctium lappa L. (greater burdock achene) DWoY												8	7

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	17005	17013	17031	17014	17015	17033	17001	17002	15052	15083	16663	19174	19173
Context		527076			527085		529015	529015	581027	582083	539284	615047	615046
Carduus/Cirsium sp. (thistle achene) GDY									1	6	22[1]	5	1
Carduus/Cirsium sp. (thistle seed head frag.) GDY													
Onopordum acanthium L. (cotton thistle achene) *													
Lapsana communis L. (nipplewort achene) DHWo	1		[1]		[1]			8		3	2	1	1
Leontodon autumnalis L. (autumn hawkbit achene) G												1	
Sonchus oleraceus L. (smooth sow-thistle achene) CDY									2			5	2
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY									2		1	3	7
Taraxacum sp. (dandelion achene) CDGH			2	10									1
Bellis perennis L.(daisy achene) Go													
Anthemis cotula L. (stinking mayweed achene) ADhd													
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) CD	[5]	[5]	[12]	[14]	[123]	[18]					[1]		
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed seed head frag.) CD				[1]	[10]	[4]							
Alisma plantago-aquatica L. (water plantain achene) P													
Potamogeton sp. (pondweed fruit) M													
Zannichellia palustris L. (horned pondweed achene) Mc													
cf. Arum sp. (collapsed thin seed coat, cf. Lords & Ladies HSW													
Lemna sp. (duckweed fruit) P								1			5		
Juncus sp. (rush seed) MPd		++						++			+	++	
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd	1	[1]	13[1]	[1]	1[4]	[4]		5					
Liliaceae cf. *Allium oleraceum* L. (field garlic seed) Gd													
Schoenoplectus lacustris (L.)Palla (common club-rush nutlet) M													
cf. *Blysmus compressus (L.)Panz.ex Link (flat sedge nutlet) Mo*													
Carex cf. spicata	[4]		[1]		[4]	[6]							
Carex sp. (trigonous sedge nutlet) MPd	[1]	[1]	[2]		5[4]	6[1]		2		1		1	
Carex sp. (lenticular sedge nutlet) MPd				[2]				1				5	1
Glyceria sp. (sweet-grass caryopsis) P													
Arrhenatherum elatius var. *bulbosum* (Willd.)St-Amans (onion couch tuber) GDH			[1]										
Bromus sect. Genea		[1]		[1]		[1]							
Bromus sect. *Bromus* (chess caryopsis)	[49]	[17]	[3]	[4]	[4]	[11]					[1]		
Lolium- type long-seeded grass caryopsis					[1]								
Poaceae (small seeded grass caryopsis) CDG	[17]	[8]	[11]	[7]	[15]	[8]	[2]	4		[1]	1[1]	1	3
Sparganium erectum L. (branched bur-reed fruit) PM	[1]				[1]					1			
Characeae (stonewort algae)													
Cladoceran ephyppia (water-flea eggcases e.g.*Daphnia*)								++				++	+
leaf fragments												+	
waterlogged wood fragments & twigs								+			++	+++	
Total remains:	**30[775]**	**[464]**	**28[1128]**	**20[757]**	**40[900]**	**7[2030]**	**[54]**	**429[24]**	**>518[22]**	**>692[2]**	**254[305]**	**>1285**	**>1102[2]**
Sample volume (litres soil)	**29**	**1**	**30**	**30**	**10**	**30**	**40**	**25**	**40**	**40**	**40**	**1**	**1**
% of flot sorted	**25%**	**100%**	**100%**	**100%**	**100%**	**25%**	**100%**	**25%**	**100%**	**100%**	**25%**	**100%**	**100%**
charred fragments per litre of soil processed (fpl)													

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Site	PSH02/49	PSH02/49	PSH02/24	PSH02/24	PSH02	PSH02	PSH02/61	PSH02/24	PSH02	PSH02/58	TEC05	TEC05	TEC05
Sample	16519	17076	16569	16575	17032	17524	17532	16577	19029	26055	29037	29038	29039
Context	557039	557029	615012	615015	527081	543204	543212	546204	568091	646069	821066	821066	821066
Feature & type	P557027		P615008		P527078	P543201		P546202	P568092	P646068	P821063		
Period	MBA		MBA		MBA	MBA		MBA	MBA	MBA	MBA		
CEREALS													
Grain													
Triticum aestivum -type (bread-type free threshing wheat grain)					cf.[1]			[1]					
Triticum dicoccum/spelta (emmer/spelt grain)				[1]		[79]†	[18]†	[13]					[2]
Triticum dicoccum/spelta (sprouted emmer/spelt grain)													
Triticum sp. (wheat grain)	[1]		cf.[1]			[3]		[6]					
Triticum/Secale cereale (wheat/rye grain)													
Hordeum sp. (hulled barley grain)				[1]	[4]†	[1]		[19]*					[46]
Hordeum sp. (barley grain)		[1]		[1]	[4]	[3]	[10]	[3]			[1]	[23]	[7]
Avena sp. (wild/cutivated oat grain)													
Avena/Bromus sp. (oat/chess grain)			[1]				[3]						
Indeterminate cereal or large grass caryopsis		2[3]		2[8]	[5]	[227]	[32]	[9]			[5]	[16]	[37]
Chaff													
cf. tough wheat rachis								[1]					
Triticum dicoccum (emmer glume base)	[1]			[3]	[1]	[14]		[19]					[4]
T. dicoccum (emmer spikelet fork)				[5]	2]	[9]		[21]					
Triticum dicoccum (emmer rachis frag.)													
T. spelta (spelt glume base)	cf.[1]			[1]	[2]	[39]	cf.[3]	cf.[1]				[1]	
T. spelta (spelt spikelet fork)									cf.[1]				
T. spelta (spelt rachis frag.)	[1]							[1]					
T. dicoccum/spelta (emmer/spelt glume base)		[1]			[3]	[237]	[5]	[16]	[1]	3		[5]	[4]
T. dicoccum/spelta (emmer/spelt spikelet fork)		1[1]		1[4]	[5]	[132]	[2]	[21]		1		[1]	[1]
T. dicoccum/spelta (emmer/spelt rachis frag.)													
Hordeum sp. (barley rachis frag.)	[2]	[6]		[6]	[7]			[16]				[2]	[2]
Avena fatua L. (wild oat pedicel)													
Avena sp. (oat pedicel, ?incomplete)				1									
basal collared rachis frag.													
cereal-sized culm node				1		[2]		[10]					
cereal-sized culm base					[1]	[3]		[3]					
Other													
Ranunculus acris/bulbosus/repens (buttercup achene) DG	16	16	1	5	3			20	15	22	1	1	3
R. parvilflorus L. (small-flowered buttercup achene) o	19	3	1	4		[2]		1				15	5
R. subg. *Batrachium* (crowfoot achenes) BP									4		19	4	
R. sceleratus L. (celery-leaved buttercup achene) MP									10				
Papaver cf. *dubium* L. (long-headed poppy seed) AD		6		1								1	
Papaver cf. rhoeas													
Papaver sp. (poppy seed) CD					1								2
Fumaria sp. (fumitory achene) CD				1	1							5	1
Urtica dioica L. (stinging nettle achene) CDn	>500	>500	123	131	10			>500	4	119	3	8	9
Urtica urens L. (small nettle achene) CDn	13	10							2			16	15
Quercus sp. (acorn cup frags) WSH													
Quercus sp. (immature acorn) WSH													

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	16519	17076	16569	16575	17032	17524	17532	16577	19029	26055	29037	29038	29039
Context	557039	557029	615012	615015	527081	543204	543212	546204	568091	646069	821066	821066	821066
Alnus glutinosa L. (alder seed) WSF	6	19	8	13				31					
Alnus glutinosa L. (alder catkin) WSF			1					2					
Corylus avellana L. (hazelnut shell frag.) HSW						[2]					1	1	
Chenopodium album L. (fat-hen seed) CDn	189	43	13	48	32			28	17	9	5	>500	>500
C. polyspermum L. (many-seeded goosefoot seed) CD	40	22	5	6	69			8		3			
Atriplex patula/prostrata (orache seed) CDn	37	28	10	24	26			14	3			4	3
Chenopodiaceae embryo													
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w	1			1	6			1					
Arenaria serpyllifolia L. (thyme-leaved sandwort seed) cso		6		4									
Moehringia trinervia (L.)Clairv. (three-nerved sandwort seed) Why					32					2			
Stellaria media (L.) Villars (common chickweed seed) CD	47	72	2	46	13			[2]	6	8	1	19	4
S. graminea L. (lesser stitchwort seed) Gd													1
Cerastium sp. (mouse-ear seed) CDGo		2		2							1		
Spergula arvensis L. (corn spurrey seed) Aas										1			
Lychnis flos-cuculi L. (ragged Robin seed) MGw													
Persicaria maculosa Gray (redshank achene) Cdo	1			1				2					
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo	8	4			3			1					
Persicaria maculosa/lapathifolia (redshank/persicaria achene) Cdwo													
Polygonum aviculare (knotgrass achene) CD	5	14		5	6			12	3	2	1		1
P. hydropiper (L.)Spach (water-pepper achene) Pwh									1				
Fallopia convolvulus (L.)A.Love (black bindweed achene) CD	4	1	1	2		[3]	[1]			1		1	1[1]
Rumex acetosella L. (sheep's sorrel acene) EoGCas	10	6							1				1
Rumex conglomeratus Murray (clustered dock achene) woBP		1		1									
R. crispus L. (curled dock achene) CD													
Rumex sp. (dock achene) CDG	9[1]	18[1]	2	11[1]	5	[1]		9[2]	4	2		2	3
Hypericum sp.(St John's wort seed) G													
Malva sp. (mallow capsule frag.) DG	1												
Salix sp. (willow bud scale)		6	6	16									
Salix sp. (willow catkin bract)				3									
Viola sp. (violet seed) GHWEMF	1	1		1						1			
Cardamine sp. (bitter-cress seed) CGw													
Rorippa islandica (Oeder ex Gunnerus)Borbas (northern yellow-cress seed) P									2				
Thlaspi arvense L. (field penny-cress seed) AD													
Brassica/Sinapis sp. (mustard, charlock etc. seed) CDG													
Primulaceae NFI													
Rubus sect. *Glandulosus* (bramble seed) DHSW*	26	4	10	24	>500			86		41		5	8

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	16519	17076	16569	16575	17032	17524	17532	16577	19029	26055	29037	29038	29039
Context	557039	557029	615012	615015	527081	543204	543212	546204	568091	646069	821066	821066	821066
Potentilla anserina L. (silverweed achene) DGYo	7	2											
Potentilla sp. (cinquefoil achene) DGMY	7			5	6						1	8	3
Agrimonia eupatoria L. (agrimony achene) GH													
Aphanes arvensis L. (parsley-piert achene) Co	6	2		2	1							9	3
Rosa sp. (rose seed) HSW			1					5		79†			
Rosa sp. (whole rose hip) HSW										2			
Rosa /Rubus sp. (rose/bramble type thorn) HSW	2	2	3	2	4			7		38			1
Prunus spinosa (sloe stone) HSW	1							2		1		1	1
Prunus sp. (sloe etc. seed frag.) HSW													
Prunus/Crataegus sp. (sloe /hawthorn type thorn) HSW	6	2	6		8			9		3		1	1
Malus sylvestris L. (apple pip) *HSW													
Malus sylvestris L. (apple endocarp frag.) *HSW													
Crataegus monogyna Jacq. (hawthorn fruit stone) HSW					cf.1					6			
Crataegus monogyna Jacq. (immature hawthorn fruit) HSW													
Vicia cf. *tetrasperma* (cf. smooth tare seed + hilum) G					[1]	[2]		[1]					
cf. *Lathyrus aphaca* (2.5-3mm, round hilum)				[2]									
Vicia/Lathyrus sp. (vetch/tare <2mm seed) CGD		[2]	[2]		[8]	[6]	[1]	[8]					
Vicia/Lathyrus sp. (vetch/tare 2-3mm seed) CDG	[1]			[8]				[21]					
Vicia/Lathyrus sp. (3.5-4mm vetch/tare)								[1]					
Pisum/Vicia/Lathyrus sp.(large legume frag c. 5mm)													
Legume pod frag.													
Legume tendril frag.													
Medicago lupulina capsule		1						[5]					
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD		[1]			[1]	[1]							
Ulex europaeus L. (gorse seed) GEsp													
Cornus sanguinea L. (dogwood stone) WSc			3										
Frangula alnus Mill. (alder buckthorn seed coat) SMFoWcw													
Linum usitatissimum L. (flax seed) *				1						1			
Linum usitatissimum L. (flax capsule frag.) *										1			
L. catharticum L. (fairy flax seed) Gdcs	1												
Acer sp. (maple seed) HSW													
Hydrocotyle vulgaris L. (marsh pennywort fruit) FMP				1									
Chaerophyllum temulum L. (rough chervil mericarp) GHWo	8	9†			11								
Anthriscus sylvestris (L.)Hoffm. (cow parsley meicarp) GHW													

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	16519	17076	16569	16575	17032	17524	17532	16577	19029	26055	29037	29038	29039
Context	557039	557029	615012	615015	527081	543204	543212	546204	568091	646069	821066	821066	821066
Berula erecta (Huds.) Coville (lesser water-parsnip mericarp) FMc					cf.1				1				
Aethusa cynapium L. (fool's parsley mericarp) CD	9	3	6	5				20	1				
Bupleurum rotundifolium L. (thoro-wax mericarp) Ac													
Apium nodoflorum (L.)Lag. (fool's watercress mericarp) MPw													
cf.*Pimpinella major* (L.)Huds. (cf. greater Burnet-saxifrage mericarp) GHW													
Pastinaca sativa L. (wild parsnip mericarp) GDYc									1				
Torilis japonica (Houtt.)DC (upright hedge-parsley mericarp) GHWo				1									
Daucus carota L. (wild carrot mericarp) Gc				1									
Apiaceae NFI	[1]		1										
Solanum nigrum L.(black nightshade seed) CD		1		5						1			
S. dulcamara L. (bittersweet seed) DHWY			1										
Solanum sp. (nightshade seed)													
Menyanthes trifoliata L. (bogbean seed) M													
Lithospermum arvense L. (field gromwell nutlet) ADGo													
Stachys sp. (woundwort nutlet) GHEWM					2						cf.1		
Lamium sp. (dead-nettle nutlet) CDY	5		2	10				10				78	42
Galeopsis tetrahit L. (common hemp-nettle nutlet) ADWod	3	1	5	1				2	1	2			
Glechoma hederacea L. (ground-ivy nutlet) WHDh								1					1
Ajuga reptans L. (bugle nutlet) WGw								1				1	1
Prunella vulgaris L. (selfheal nutlet) GDWo	11	5		3					1	5			2
Lycopus europaeus L. (gypsywort nutlet) GwFMP	2	7			9			1					
Mentha sp. (mint nutlet) GwBM		3			2			1	11		1	1	
Callitriche sp. (water-starwort fruit) P		1							1		1		
Plantago laceolata L.(ribwort plantain seed) Go		[1]					[1]						[2]
P. major L. (greater plantain seed) Cgo		2		2					2	5		2	1
Veronica hederifolia L. (ivy-leaved speedwell seed) CDWH													
Veronica sp. (speedwell seed) CDG													
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG													
Galium aparine L. (cleavers nutlet) CDSH	[1]	[2]		[3]	[4]		[1]	[6]				[1]	
Galium small c1mm					[1]	[1]	[2]						
Galium sp. (frag.)						[1]							
Sherardia arvensis													
Sambucus nigra L. (elder seed) DHSW	98	1	91	57				19		3			
Valerianella dentata (L.)Pollich. (narrow-fruited corn-salad fruit) AD	2												
Arctium lappa L. (greater burdock achene) DWoY				2									

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	16519	17076	16569	16575	17032	17524	17532	16577	19029	26055	29037	29038	29039
Context	**557039**	**557029**	**615012**	**615015**	**527081**	**543204**	**543212**	**546204**	**568091**	**646069**	**821066**	**821066**	**821066**
Carduus/Cirsium sp. (thistle achene) GDY		1	7		1					2		1	1
Carduus/Cirsium sp. (thistle seed head frag.) GDY	2												
Onopordum acanthium L. (cotton thistle achene) *													
Lapsana communis L. (nipplewort achene) DHWo		1	3		2								
Leontodon autumnalis L. (autumn hawkbit achene) G		6			1								
Sonchus oleraceus L. (smooth sow-thistle achene) CDY	4	7	2										
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY	5	7	1	3	1					1			
Taraxacum sp. (dandelion achene) CDGH													
Bellis perennis L.(daisy achene) Go													
Anthemis cotula L. (stinking mayweed achene) ADhd													
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) CD	[1]	[1]	[1]	[2]			[2]	[1]					
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed seed head frag.) CD						[1]							
Alisma plantago-aquatica L. (water plantain achene) P		10		1	4				7				
Potamogeton sp. (pondweed fruit) M													
Zannichellia palustris L. (horned pondweed achene) Mc									3				
cf. Arum sp. (collapsed thin seed coat, cf. Lords & Ladies HSW	1	1	1		1			1					
Lemna sp. (duckweed fruit) P				1									
Juncus sp. (rush seed) MPd	+++	++		++	++				+	++		++	++++
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd	24	7		1	5							[1]	3
Liliaceae cf. *Allium oleraceum* L. (field garlic seed) Gd													
Schoenoplectus lacustris (L.)Palla (common club-rush nutlet) M													
cf. *Blysmus compressus (L.)Panz.ex Link (flat sedge nutlet) Mo*													
Carex cf. spicata													
Carex sp. (trigonous sedge nutlet) MPd	3	5	2	5	3			1	3	2			1
Carex sp. (lenticular sedge nutlet) MPd	9	15		2	10			[1]	1	4		22	8
Glyceria sp. (sweet-grass caryopsis) P													
Arrhenatherum elatius var. *bulbosum* (Willd.)St-Amans (onion couch tuber) GDH													
Bromus sect. Genea								[6]					
Bromus sect. *Bromus* (chess caryopsis)						[2]							
Lolium- type long-seeded grass caryopsis													
Poaceae (small seeded grass caryopsis) CDG	2	1		6[1]	1	[1]	[1]	2[1]				1	[2]
Sparganium erectum L. (branched bur-reed fruit) PM													
Characeae (stonewort algae)													
Cladoceran ephyppia (water-flea eggcases e.g.*Daphnia*)			++		+								
leaf fragments	+	+		+++						++			
waterlogged wood fragments & twigs	++	+	+++	+++	+++			+++		++++			
Total remains:	**>1151[11]**	**>888[20]**	**318[5]**	**472[47]**	**>781[50]**	**[772]**	**[82]**	**>798[215]**	**103[2]**	**371**	**36 [6]**	**>708 [50]**	**>629 [108]**
Sample volume (litres soil)	**1**	**30**	**1**	**10**	**40**	**40**	**40**	**20**	**20**	**10**	**10**	**5**	**?8**
% of flot sorted	**100%**	**100%**	**25%**	**25%**	**100%**	**100%**	**100%**	**50%wl;100%ch**	**12.50%**	**100%**	**100%**	**100%**	**100%**
charred fragments per litre of soil processed (fpl)													

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Site	PSH02/77	PSH02/47	PSH02	PSH02	PSH02	PSH02/58	TEC05	TEC05	TEC05	TEC05	TEC05	TEC05	TEC05	TEC05	TEC05
Sample	**16053**	**18113**	**16524**	**16523**	**16549**	**25037**	**27042**	**29058**	**29059**	**29061**	**29060**	**29062**	**29045**	**29047**	**29049**
Context	**562040**	**559324**	**563055**	**563056**	**563058**	**641104**	**693004**	**827096**					**816045**	**816048**	**816052**
Feature & type	**WH510047**	**WH559302**	**WH563060**			**WH641097**	**WH693006**	**WH815041**					**WH816042**		
Period	**MBA**	**MBA**	**MBA**			**MBA**	**MBA**	**MBA**					**MBA**		
CEREALS															
Grain															
Triticum aestivum -type (bread-type free threshing wheat grain)					cf.[1]										
Triticum dicoccum/spelta (emmer/spelt grain)			[18]	[2]			[1]†								
Triticum dicoccum/spelta (sprouted emmer/spelt grain)			[1]												
Triticum sp. (wheat grain)			[1]												
Triticum/Secale cereale (wheat/rye grain)															
Hordeum sp. (hulled barley grain)			[24]*		[4]*										
Hordeum sp. (barley grain)			[19]	[2]*											
Avena sp. (wild/cutivated oat grain)			[4]												
Avena/Bromus sp. (oat/chess grain)			[10]		[1]										
Indeterminate cereal or large grass caryopsis	3	1	[39]	[12]	[6]		[1]								
Chaff															
cf. tough wheat rachis															
Triticum dicoccum (emmer glume base)			[21]	[1]											
T. dicoccum (emmer spikelet fork)	cf.1		[15]												
Triticum dicoccum (emmer rachis frag.)			[1]												
T. spelta (spelt glume base)			[4]												
T. spelta (spelt spikelet fork)															
T. spelta (spelt rachis frag.)			[1]												
T. dicoccum/spelta (emmer/spelt glume base)		1	[8]	[9]											
T. dicoccum/spelta (emmer/spelt spikelet fork)	1	1	[29]	[1]	[1]										
T. dicoccum/spelta (emmer/spelt rachis frag.)															
Hordeum sp. (barley rachis frag.)			[36]	[4]	[2]										
Avena fatua L. (wild oat pedicel)															
Avena sp. (oat pedicel, ?incomplete)															
basal collared rachis frag.															
cereal-sized culm node			[2]												
cereal-sized culm base			[4]												
Other															
Ranunculus acris/bulbosus/repens (buttercup achene) DG		1	2		1	12	61	+	++		21	23		6	1
R. parvilflorus L. (small-flowered buttercup achene) o						2	129				1	3		1	
R. subg. *Batrachium* (crowfoot achenes) BP								++	++	++	68	41	+	4	4
R. sceleratus L. (celery-leaved buttercup achene) MP			1									1			
Papaver cf. *dubium* L. (long-headed poppy seed) AD			2				5								
Papaver cf. rhoeas															
Papaver sp. (poppy seed) CD						1									
Fumaria sp. (fumitory achene) CD			1			1	5					1			
Urtica dioica L. (stinging nettle achene) CDn		11	>500		61	>500	>500	+		+	20	8	+	2	1
Urtica urens L. (small nettle achene) CDn			3			1								14	3
Quercus sp. (acorn cup frags) WSH												cf.5			
Quercus sp. (immature acorn) WSH														1	

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	16053	18113	16524	16523	16549	25037	27042	29058	29059	29061	29060	29062	29045	29047	29049
Context	**562040**	**559324**	**563055**	**563056**	**563058**	**641104**	**693004**	**827096**					**816045**	**816048**	**816052**
Alnus glutinosa L. (alder seed) WSF			14		8	1									
Alnus glutinosa L. (alder catkin) WSF															
Corylus avellana L. (hazelnut shell frag.) HSW				[1]								1			
Chenopodium album L. (fat-hen seed) CDn	10	13	82		12	45	>500		+		7	8	+	3	13
C. polyspermum L. (many-seeded goosefoot seed) CD			17		5	1	45					2			
Atriplex patula/prostrata (orache seed) CDn		3	31		10	47	95	+			2	4			
Chenopodiaceae embryo															
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w			2				62								
Arenaria serpyllifolia L. (thyme-leaved sandwort seed) cso															
Moehringia trinervia (L.)Clairv. (three-nerved sandwort seed) Why	2							+			3				
Stellaria media (L.) Villars (common chickweed seed) CD	12	7	1[4]			36	>500		+		5	3			18
S. graminea L. (lesser stitchwort seed) Gd						1	5	+			7	3			
Cerastium sp. (mouse-ear seed) CDGo	1					1									
Spergula arvensis L. (corn spurrey seed) Aas															
Lychnis flos-cuculi L. (ragged Robin seed) MGw		1							+			2			
Persicaria maculosa Gray (redshank achene) Cdo			3		1										
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo			1				>500								
Persicaria maculosa/lapathifolia (redshank/persicaria achene) Cdwo			[1]												
Polygonum aviculare (knotgrass achene) CD	1	10	4			18	150	+	+	+	8	1		1	
P. hydropiper (L.)Spach (water-pepper achene) Pwh									+		11	16			
Fallopia convolvulus (L.)A.Love (black bindweed achene) CD		1	[1]			1	13								
Rumex acetosella L. (sheep's sorrel acene) EoGCas															
Rumex conglomeratus Murray (clustered dock achene) woBP	2						45							82	12
R. crispus L. (curled dock achene) CD							2								
Rumex sp. (dock achene) CDG	1		103[8]		30[3]		117	+	+		6	9	+	14	4
Hypericum s p.(St John's wort seed) G						3	2								
Malva sp. (mallow capsule frag.) DG							1				cf.1				
Salix sp. (willow bud scale)	7	15			11										
Salix sp. (willow catkin bract)															
Viola sp. (violet seed) GHWEMF			1[2]	[1]				+			4	3		1	
Cardamine sp. (bitter-cress seed) CGw	3														
Rorippa islandica (Oeder ex Gunnerus)Borbas (northern yellow-cress seed) P															
Thlaspi arvense L. (field penny-cress seed) AD															
Brassica/Sinapis sp. (mustard, charlock etc. seed) CDG	2														
Primulaceae NFI															
Rubus sect. *Glandulosus* (bramble seed) DHSW*	6	26	36		10	58	42	+	+	+	8	14	+		4

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	16053	18113	16524	16523	16549	25037	27042	29058	29059	29061	29060	29062	29045	29047	29049
Context	562040	559324	563055	563056	563058	641104	693004			827096			816045	816048	816052
Potentilla anserina L. (silverweed achene) DGYo							3				2	1			
Potentilla sp. (cinquefoil achene) DGMY						1	15				5	1		3	3
Agrimonia eupatoria L. (agrimony achene) GH							1								
Aphanes arvensis L. (parsley-piert achene) Co						1	45	+			6	5			
Rosa sp. (rose seed) HSW		5	1			4					4	2			
Rosa sp. (whole rose hip) HSW															
Rosa /Rubus sp. (rose/bramble type thorn) HSW	5	18				31					1	1		1	
Prunus spinosa (sloe stone) HSW		1	1fg.			47					1+cf.2f				
Prunus sp. (sloe etc. seed frag.) HSW						41									
Prunus/Crataegus sp. (sloe /hawthorn type thorn) HSW	15	2				1	7								
Malus sylvestris L. (apple pip) *HSW															
Malus sylvestris L. (apple endocarp frag.) *HSW															
Crataegus monogyna Jacq. (hawthorn fruit stone) HSW		7				11					cf.1				
Crataegus monogyna Jacq. (immature hawthorn fruit) HSW															
Vicia cf. *tetrasperma* (cf. smooth tare seed + hilum) G			[7]												
cf. *Lathyrus aphaca* (2.5-3mm, round hilum)															
Vicia/Lathyrus sp. (vetch/tare <2mm seed) CGD			[52]	[5]	[3]										
Vicia/Lathyrus sp. (vetch/tare 2-3mm seed) CDG			[53]	[3]	[2]										
Vicia/Lathyrus sp. (3.5-4mm vetch/tare)			[9]												
Pisum/Vicia/Lathyrus sp.(large legume frag c. 5mm)															
Legume pod frag.															
Legume tendril frag.															
Medicago lupulina capsule		2	[7]	[2]	[1]										
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD															
Ulex europaeus L. (gorse seed) GEsp															
Cornus sanguinea L. (dogwood stone) WSc						1					3	cf.1f			
Frangula alnus Mill . (alder buckthorn seed coat) SMFoWcw		cf.2				4					cf.1f				
Linum usitatissimum L. (flax seed) *															
Linum usitatissimum L. (flax capsule frag.) *															
L. catharticum L. (fairy flax seed) Gdcs											7	3			
Acer sp. (maple seed) HSW	9	19	1												
Hydrocotyle vulgaris L. (marsh pennywort fruit) FMP															
Chaerophyllum temulum L. (rough chervil mericarp) GHWo						21					cf.2				
Anthriscus sylvestris (L.)Hoffm. (cow parsley meicarp) GHW		1													

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	16053	18113	16524	16523	16549	25037	27042	29058	29059	29061	29060	29062	29045	29047	29049
Context	562040	559324	563055	563056	563058	641104	693004	827096					816045	816048	816052
Berula erecta (Huds.) Coville (lesser water-parsnip mericarp) FMc															
Aethusa cynapium L. (fool's parsley mericarp) CD		1	33		4	6									
Bupleurum rotundifolium L. (thoro-wax mericarp) Ac			cf.[1]												
Apium nodoflorum (L.)Lag. (fool's watercress mericarp) MPw															
cf.*Pimpinella major* (L.)Huds. (cf. greater Burnet-saxifrage mericarp) GHW															
Pastinaca sativa L. (wild parsnip mericarp) GDYc						1	16								
Torilis japonica (Houtt.)DC (upright hedge-parsley mericarp) GHWo			1			1									
Daucus carota L. (wild carrot mericarp) Gc															
Apiaceae NFI															
Solanum nigrum L.(black nightshade seed) CD	1					4	6					1		2	
S. dulcamara L. (bittersweet seed) DHWY															
Solanum sp. (nightshade seed)											1f				
Menyanthes trifoliata L. (bogbean seed) M															
Lithospermum arvense L. (field gromwell nutlet) ADGo															
Stachys sp. (woundwort nutlet) GHEWM							1								
Lamium sp. (dead-nettle nutlet) CDY	1	1	11		2	4	4								1
Galeopsis tetrahit L. (common hemp-nettle nutlet) ADWod						1	3								
Glechoma hederacea L. (ground-ivy nutlet) WHDh			3			18									
Ajuga reptans L. (bugle nutlet) WGw							2								
Prunella vulgaris L. (selfheal nutlet) GDWo	2				2		3	+			10	5		1	
Lycopus europaeus L. (gypsywort nutlet) GwFMP											1	3			
Mentha sp. (mint nutlet) GwBM											1				
Callitriche sp. (water-starwort fruit) P															
Plantago laceolata L.(ribwort plantain seed) Go			[4]		[2]										
P. major L. (greater plantain seed) Cgo			2		7		1			+	4	1	+	3	1
Veronica hederifolia L. (ivy-leaved speedwell seed) CDWH															
Veronica sp. (speedwell seed) CDG															
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG															
Galium aparine L. (cleavers nutlet) CDSH			[13]	[1]	[1]										
Galium small c1mm			[5]	[3]											
Galium sp. (frag.)															
Sherardia arvensis															
Sambucus nigra L. (elder seed) DHSW		2	8		7	1									
Valerianella dentata (L.)Pollich. (narrow-fruited corn-salad fruit) AD															
Arctium lappa L. (greater burdock achene) DWoY						1	cf.1								

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	16053	18113	16524	16523	16549	25037	27042	29058	29059	29061	29060	29062	29045	29047	29049
Context	**562040**	**559324**	**563055**	**563056**	**563058**	**641104**	**693004**			**827096**			**816045**	**816048**	**816052**
Carduus/Cirsium sp. (thistle achene) GDY	3	5				26	14				1			32	6
Carduus/Cirsium sp. (thistle seed head frag.) GDY	7	1												2	
Onopordum acanthium L. (cotton thistle achene) *		1													
Lapsana communis L. (nipplewort achene) DHWo	2	4				10	2								
Leontodon autumnalis L. (autumn hawkbit achene) G															
Sonchus oleraceus L. (smooth sow-thistle achene) CDY	9	1					3								
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY	3	4				2	2						+	26	
Taraxacum sp. (dandelion achene) CDGH															
Bellis perennis L.(daisy achene) Go															
Anthemis cotula L. (stinking mayweed achene) ADhd															
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) CD			[6]												
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed seed head frag.) CD			[1]		[4]										
Alisma plantago-aquatica L. (water plantain achene) P															
Potamogeton sp. (pondweed fruit) M															
Zannichellia palustris L. (horned pondweed achene) Mc															
cf. Arum sp. (collapsed thin seed coat, cf. Lords & Ladies HSW															
Lemna sp. (duckweed fruit) P		1	3		11		52	++			111	46	++		
Juncus sp. (rush seed) MPd	++		++		+++	++		++	+	++		++	++	++	+
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd			6[1]	[1]	2[1]	1					7	3		1	
Liliaceae cf. *Allium oleraceum* L. (field garlic seed) Gd						3									
Schoenoplectus lacustris (L.)Palla (common club-rush nutlet) M															
cf. *Blysmus compressus (L.)Panz.ex Link (flat sedge nutlet) Mo*															
Carex cf. spicata															
Carex sp. (trigonous sedge nutlet) MPd			6[1]		1	1			+		2			1	
Carex sp. (lenticular sedge nutlet) MPd			1[2]			6	14		+	+	7	10		1	2
Glyceria sp. (sweet-grass caryopsis) P									+		3	9			1
Arrhenatherum elatius var. *bulbosum* (Willd.)St-Amans (onion couch tuber) GDH															
Bromus sect. Genea															
Bromus sect. *Bromus* (chess caryopsis)															
Lolium- type long-seeded grass caryopsis															
Poaceae (small seeded grass caryopsis) CDG	[1]4		10[9]	[1]	9					+	9			2	
Sparganium erectum L. (branched bur-reed fruit) PM															
Characeae (stonewort algae)															
Cladoceran ephyppia (water-flea eggcases e.g.*Daphnia*)		++	++		+	++	+++								
leaf fragments	+++	++++				+									
waterlogged wood fragments & twigs		+++			+	+++	++								
Total remains:	**113[1]**	**169**	**>891[424]**	**[49]**	**195[34]**	**>977**	**>2974[2]**				**355**	**234**		**204**	**74**
Sample volume (litres soil)	**1**	**1**	**40**	**40**	**1**	**20**	**20**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
% of flot sorted	**100%**	**50%**	**12.5%wl;100 %ch**	**100%**	**100%**	**100%**	**100%**	**scanned**	**scanned**	**scanned**	**100%**	**100%**	**scanned**	**25%**	**100%**
charred fragments per litre of soil processed (fpl)															

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Site	TEC05	TEC05	TEC05	TEC05	TEC05	LFA05	LFA05	TEC05	TEC05	TEC05	PSH02	PSH02	TEC05	TEC05
Sample	29064	29065	29066	29067	29118	27205	27207	29135	29141	29140	17117	17118	27305	29100
Context	830061	830060	820060	830058	836054	711027	711029	823191	823192	835061	553180	553189	685035	835029
Feature & type	WH830056				WH836052	WH711024		WH823181		WH835044	WH553191		WH685032	WH833123
Period	MBA				MBA	MBA		MBA		MBA	M or LBA		M or LBA	M or LBA
CEREALS														
Grain														
Triticum aestivum -type (bread-type free threshing wheat grain)														
Triticum dicoccum/spelta (emmer/spelt grain)							[3]				[1]			
Triticum dicoccum/spelta (sprouted emmer/spelt grain)														
Triticum sp. (wheat grain)							[2]							
Triticum/Secale cereale (wheat/rye grain)														
Hordeum sp. (hulled barley grain)														
Hordeum sp. (barley grain)														
Avena sp. (wild/cutivated oat grain)														
Avena/Bromus sp. (oat/chess grain)														
Indeterminate cereal or large grass caryopsis							[3]				7[2]	16[1]	5f	[1]
Chaff														
cf. tough wheat rachis														
Triticum dicoccum (emmer glume base)						[1]	[3]				cf.1			
T. dicoccum (emmer spikelet fork)											[1]			
Triticum dicoccum (emmer rachis frag.)														
T. spelta (spelt glume base)												1	2	
T. spelta (spelt spikelet fork)														
T. spelta (spelt rachis frag.)														
T. dicoccum/spelta (emmer/spelt glume base)							[7]				2	1		[1]
T. dicoccum/spelta (emmer/spelt spikelet fork)							[9]					1	2	
T. dicoccum/spelta (emmer/spelt rachis frag.)														
Hordeum sp. (barley rachis frag.)							[1]							
Avena fatua L. (wild oat pedicel)														
Avena sp. (oat pedicel, ?incomplete)														
basal collared rachis frag.														
cereal-sized culm node														
cereal-sized culm base														
Other														
Ranunculus acris/bulbosus/repens (buttercup achene) DG	3	12	3		14						10	18	53†	76
R. parvilflorus L. (small-flowered buttercup achene) o					1									
R. subg. *Batrachium* (crowfoot achenes) BP	56	266	100	6										
R. sceleratus L. (celery-leaved buttercup achene) MP														
Papaver cf. *dubium* L. (long-headed poppy seed) AD						1					3	1		
Papaver cf. rhoeas														
Papaver sp. (poppy seed) CD						1								
Fumaria sp. (fumitory achene) CD					2	2						4	1	
Urtica dioica L. (stinging nettle achene) CDn	7	28	34	7	1	153		2		40	16	22	30	1
Urtica urens L. (small nettle achene) CDn												1		
Quercus sp. (acorn cup frags) WSH								2						
Quercus sp. (immature acorn) WSH		1			2									

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	29064	29065	29066	29067	29118	27205	27207	29135	29141	29140	17117	17118	27305	29100
Context	830061	830060	820060	830058	836054	711027	711029	823191	823192	835061	553180	553189	685035	835029
Alnus glutinosa L. (alder seed) WSF						15								
Alnus glutinosa L. (alder catkin) WSF														
Corylus avellana L. (hazelnut shell frag.) HSW							[3]			1				2
Chenopodium album L. (fat-hen seed) CDn					5	69	[1]	1		3	11	57	73	10
C. polyspermum L. (many-seeded goosefoot seed) CD	1	2			14							12	13	2
Atriplex patula/prostrata (orache seed) CDn						37	[1]			2	12	15		
Chenopodiaceae embryo														
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w											6	8	13	9
Arenaria serpyllifolia L. (thyme-leaved sandwort seed) cso											1	20		
Moehringia trinervia (L.)Clairv. (three-nerved sandwort seed) Why		1											3	
Stellaria media (L.) Villars (common chickweed seed) CD	1	10	4		3	19	cf.[4]				6	33	19	
S. graminea L. (lesser stitchwort seed) Gd						3							4	6
Cerastium sp. (mouse-ear seed) CDGo		3												
Spergula arvensis L. (corn spurrey seed) Aas													2	
Lychnis flos-cuculi L. (ragged Robin seed) MGw														
Persicaria maculosa Gray (redshank achene) Cdo														
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo						3						1	1	
Persicaria maculosa/lapathifolia (redshank/persicaria achene) Cdwo														
Polygonum aviculare (knotgrass achene) CD										3	2	18†	9	2
P. hydropiper (L.)Spach (water-pepper achene) Pwh	2	4								15				3
Fallopia convolvulus (L.)A.Love (black bindweed achene) CD											2	6	1	
Rumex acetosella L. (sheep's sorrel acene) EoGCas					2		[1]							
Rumex conglomeratus Murray (clustered dock achene) woBP										6				
R. crispus L. (curled dock achene) CD												cf.3		
Rumex sp. (dock achene) CDG					8	7[1]	[2]			17	7	3	6	
Hypericum sp.(St John's wort seed) G														
Malva sp. (mallow capsule frag.) DG										cf.2f				
Salix sp. (willow bud scale)														
Salix sp. (willow catkin bract)														
Viola sp. (violet seed) GHWEMF						2		2			2	4		3
Cardamine sp. (bitter-cress seed) CGw														
Rorippa islandica (Oeder ex Gunnerus)Borbas (northern yellow-cress seed) P												1		
Thlaspi arvense L. (field penny-cress seed) AD											1			
Brassica/Sinapis sp. (mustard, charlock etc. seed) CDG												28		
Primulaceae NFI						1								
Rubus sect. *Glandulosus* (bramble seed) DHSW*		3	1f	1f	112			147	>500	3	8	70	22	

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	29064	29065	29066	29067	29118	27205	27207	29135	29141	29140	17117	17118	27305	29100
Context	830061	830060	820060	830058	836054	711027	711029	823191	823192	835061	553180	553189	685035	835029
Potentilla anserina L. (silverweed achene) DGYo													2	
Potentilla sp. (cinquefoil achene) DGMY					5								1	
Agrimonia eupatoria L. (agrimony achene) GH														
Aphanes arvensis L. (parsley-piert achene) Co					1	3					16	63	6	
Rosa sp. (rose seed) HSW					1							2		
Rosa sp. (whole rose hip) HSW														
Rosa /Rubus sp. (rose/bramble type thorn) HSW			1					2		2	1	37		
Prunus spinosa (sloe stone) HSW		1						cf.4f	3		2	3	1	
Prunus sp. (sloe etc. seed frag.) HSW													2	
Prunus/Crataegus sp. (sloe /hawthorn type thorn) HSW					1							2	7	1
Malus sylvestris L. (apple pip) *HSW														
Malus sylvestris L. (apple endocarp frag.) *HSW														
Crataegus monogyna Jacq. (hawthorn fruit stone) HSW		1						7	13			10	126	
Crataegus monogyna Jacq. (immature hawthorn fruit) HSW													4	
Vicia cf. *tetrasperma* (cf. smooth tare seed + hilum) G														
cf. *Lathyrus aphaca* (2.5-3mm, round hilum)					cf.[1]									
Vicia/Lathyrus sp. (vetch/tare <2mm seed) CGD							[2]							
Vicia/Lathyrus sp. (vetch/tare 2-3mm seed) CDG							[2]							
Vicia/Lathyrus sp. (3.5-4mm vetch/tare)														
Pisum/Vicia/Lathyrus sp.(large legume frag c. 5mm)														
Legume pod frag.														
Legume tendril frag.														
Medicago lupulina capsule														
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD							[3]							
Ulex europaeus L. (gorse seed) GEsp														
Cornus sanguinea L. (dogwood stone) WSc														
Frangula alnus Mill . (alder buckthorn seed coat) SMFoWcw												1		
Linum usitatissimum L. (flax seed) *											15	1		
Linum usitatissimum L. (flax capsule frag.) *										1	12	3		
L. catharticum L. (fairy flax seed) Gdcs														
Acer sp. (maple seed) HSW												1		
Hydrocotyle vulgaris L. (marsh pennywort fruit) FMP														
Chaerophyllum temulum L. (rough chervil mericarp) GHWo												2		
Anthriscus sylvestris (L.)Hoffm. (cow parsley meicarp) GHW														

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	29064	29065	29066	29067	29118	27205	27207	29135	29141	29140	17117	17118	27305	29100
Context	830061	830060	820060	830058	836054	711027	711029	823191	823192	835061	553180	553189	685035	835029
Berula erecta (Huds.) Coville (lesser water-parsnip mericarp) FMc														
Aethusa cynapium L. (fool's parsley mericarp) CD			1			9					6	3		
Bupleurum rotundifolium L. (thoro-wax mericarp) Ac														
Apium nodoflorum (L.)Lag. (fool's watercress mericarp) MPw														
cf.*Pimpinella major* (L.)Huds. (cf. greater Burnet-saxifrage mericarp) GHW														
Pastinaca sativa L. (wild parsnip mericarp) GDYc					cf.1								cf.1	
Torilis japonica (Houtt.)DC (upright hedge-parsley mericarp) GHWo										5			2	
Daucus carota L. (wild carrot mericarp) Gc													2	
Apiaceae NFI														
Solanum nigrum L.(black nightshade seed) CD												5	4	
S. dulcamara L. (bittersweet seed) DHWY														
Solanum sp. (nightshade seed)	1f										1			
Menyanthes trifoliata L. (bogbean seed) M														
Lithospermum arvense L. (field gromwell nutlet) ADGo														
Stachys sp. (woundwort nutlet) GHEWM		1						1			2	1		
Lamium sp. (dead-nettle nutlet) CDY			2		5	1					1	9		
Galeopsis tetrahit L. (common hemp-nettle nutlet) ADWod										2	3	3	cf.1f	
Glechoma hederacea L. (ground-ivy nutlet) WHDh						3		1	1		1	2	1	
Ajuga reptans L. (bugle nutlet) WGw													1	
Prunella vulgaris L. (selfheal nutlet) GDWo											4	5	6	2
Lycopus europaeus L. (gypsywort nutlet) GwFMP										21			1	
Mentha sp. (mint nutlet) GwBM	2	4	2										4	11
Callitriche sp. (water-starwort fruit) P	10	55	16											
Plantago laceolata L.(ribwort plantain seed) Go														
P. major L. (greater plantain seed) Cgo											14	1	2	
Veronica hederifolia L. (ivy-leaved speedwell seed) CDWH														
Veronica sp. (speedwell seed) CDG														
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG														
Galium aparine L. (cleavers nutlet) CDSH							[8]							
Galium small c1mm														
Galium sp. (frag.)														
Sherardia arvensis														
Sambucus nigra L. (elder seed) DHSW	1f		1	2	1			1				1		1
Valerianella dentata (L.)Pollich. (narrow-fruited corn-salad fruit) AD														
Arctium lappa L. (greater burdock achene) DWoY														

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 2 : MBA samples from Heathrow, T5

Sample	29064	29065	29066	29067	29118	27205	27207	29135	29141	29140	17117	17118	27305	29100
Context	**830061**	**830060**	**820060**	**830058**	**836054**	**711027**	**711029**	**823191**	**823192**	**835061**	**553180**	**553189**	**685035**	**835029**
Carduus/Cirsium sp. (thistle achene) GDY		1			1	1				2			3	
Carduus/Cirsium sp. (thistle seed head frag.) GDY														
Onopordum acanthium L. (cotton thistle achene) *														
Lapsana communis L. (nipplewort achene) DHWo		1								4		2	1	
Leontodon autumnalis L. (autumn hawkbit achene) G												1		
Sonchus oleraceus L. (smooth sow-thistle achene) CDY										1	3			
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY										2	2	6	6	
Taraxacum sp. (dandelion achene) CDGH														
Bellis perennis L.(daisy achene) Go											1			
Anthemis cotula L. (stinking mayweed achene) ADhd										16				
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) CD						[1]								
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed seed head frag.) CD														
Alisma plantago-aquatica L. (water plantain achene) P														
Potamogeton sp. (pondweed fruit) M														
Zannichellia palustris L. (horned pondweed achene) Mc														
cf. Arum sp. (collapsed thin seed coat, cf. Lords & Ladies HSW														
Lemna sp. (duckweed fruit) P					62									1
Juncus sp. (rush seed) MPd		++	++		+++				+	+	++	+	+	++
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd														
Liliaceae cf. *Allium oleraceum* L. (field garlic seed) Gd														
Schoenoplectus lacustris (L.)Palla (common club-rush nutlet) M														
cf. *Blysmus compressus (L.)Panz.ex Link (flat sedge nutlet) Mo*														
Carex cf. spicata														
Carex sp. (trigonous sedge nutlet) MPd		2			1			1		5			2	3
Carex sp. (lenticular sedge nutlet) MPd			1		29								2	60
Glyceria sp. (sweet-grass caryopsis) P	1f	15	5	1										
Arrhenatherum elatius var. *bulbosum* (Willd.)St-Amans (onion couch tuber) GDH							[2]							
Bromus sect. Genea														
Bromus sect. *Bromus* (chess caryopsis)										[1]			[1]	
Lolium- type long-seeded grass caryopsis														
Poaceae (small seeded grass caryopsis) CDG	2	6	3			1				4	4	1	3	4
Sparganium erectum L. (branched bur-reed fruit) PM														
Characeae (stonewort algae)														
Cladoceran ephyppia (water-flea eggcases e.g.*Daphnia*)												++	+++	
leaf fragments											++	+++	+	
waterlogged wood fragments & twigs						+						+++	+++	
Total remains:	**84**	**417**	**173**	**16**	**271**	**330[3]**	**[57]**	**171**	**>517**	**159 [1]**	**186[4]**	**512[1]**	**450[1]**	**197 [2]**
Sample volume (litres soil)	**1**	**1**	**1**	**1**	**1**	**?**	**40**	**1**	**1**	**1**	**11**	**1**	**20**	**1**
% of flot sorted	**100%**	**100%**	**100%**	**100%**	**25%**	**100%**	**100%**	**100%**	**50%**	**25%**	**100%**	**100%**	**25%**	**100%**
charred fragments per litre of soil processed (fpl)														

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 3 : LBA/EIA samples from Heathrow, T5

Site	PSH02	PSH02	LFA05	TEC05
Sample	**19135**	**24051**	**27181**	**29130**
Context	**609019**	**663175**	**726006**	**834055**
Feature & type	**P609020**	**P663167**	**WH/P726001**	**WH 834034**
	LBA	**LBA**	**LBA**	**LBA or EIA**
CEREALS				
Grain				
Triticum aestivum -type (bread-type free threshing wheat grain)				[1]
Triticum dicoccum/spelta (emmer/spelt grain)	[2]	[5]		
Hordeum sp. (hulled barley grain)		[11]		
Avena/Bromus sp. (oat/chess grain)		[3]		
Indeterminate cereal or large grass caryopsis	[5]	[4]		
Chaff				
cf. tough wheat rachis				[1]
Triticum dicoccum (emmer glume base)		[14]		
T. dicoccum (emmer spikelet fork)		[12]		
Triticum dicoccum (emmer rachis frag.)		[4]		
T. spelta (spelt spikelet fork)		cf.1		
T. dicoccum/spelta (emmer/spelt glume base)	[3]	[6]	1	
T. dicoccum/spelta (emmer/spelt spikelet fork)	[1]	[3]	1	
Hordeum sp. (barley rachis frag.)		[50]		
cereal-sized culm node			[1]	
Avena sp. (oat awn frag.)	[+]			
Avena fatua L. (wild oat pedicel)		[2]		
basal collared rachis frag.		[2]		
Other				
Ranunculus acris/bulbosus/repens (buttercup achene) DG		16	4	
R. parvilflorus L. (small-flowered buttercup achene) o			1	
Papaver cf. *dubium* L. (long-headed poppy seed) AD			2	
Fumaria sp. (fumitory achene) CD			1	
Urtica dioica L. (stinging nettle achene) CDn		1	120	
Alnus glutinosa L. (alder seed) WSF			90	
Alnus glutinosa L. (alder catkin) WSF			9	
Chenopodium album L. (fat-hen seed) CDn	[1]	37	2	6
C. polyspermum L. (many-seeded goosefoot seed) CD		124		1
Atriplex patula/prostrata (orache seed) CDn		1	18	
Chenopodiaceae embryo	[1]			
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w	[1]	34		
Stellaria media (L.) Villars (common chickweed seed) CD		1	13	8
S. graminea L. (lesser stitchwort seed) Gd		5		
Cerastium sp. (mouse-ear seed) CDGo				2
Spergula arvensis L. (corn spurrey seed) Aas		[1]		
Lychnis flos-cuculi		1		
Persicaria maculosa Gray (redshank achene) Cdo		6	2	1
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo		14		
Polygonum aviculare (knotgrass achene) CD	[1]	2	5	17
P. hydropiper (L.)Spach (water-pepper achene) Pwh		4	1	
Fallopia convolvulus (L.)A.Love (black bindweed achene) CD	[1]			
Rumex acetosella L. (sheep's sorrel acene) EoGCas			1	
R. crispus L. (curled dock achene) CD				5
Rumex sp. (dock achene) CDG		2	4	8
Viola sp. (violet seed) GHWEMF		7		
Thlaspi arvense L. (field penny-cress seed) AD	[1]			
Rubus sect. *Glandulosus* (bramble seed) DHSW*			8	18
Potentilla sp. (cinquefoil achene) DGMY		7		
Rosa sp. (rose seed) HSW		1		
Rosa /Rubus sp. (rose/bramble type thorn) HSW			38	
Prunus spinosa (sloe stone) HSW				2
Prunus/Crataegus sp. (sloe /hawthorn type thorn) HSW		1	2	
Vicia/Lathyrus sp. (3-4mm vetch/tare)			[1]	
Medicago lupulina capsule + seed			1	
Cornus sanguinea L. (dogwood stone) WSc			1	1
Acer sp. (maple seed) HSW			1	
Chaerophyllum temulum L. (rough chervil mericarp) GHWo			1	
Aethusa cynapium L. (fool's parsley mericarp) CD		4	1	
Pastinaca sativa L. (wild parsnip mericarp) GDYc			1	
Torilis japonica (Houtt.)DC (upright hedge-parsley mericarp) GHWo			1	1
Daucus carota L. (wild carrot mericarp) Gc				cf.1
Solanum nigrum L.(black nightshade seed) CD		2		
Lamium sp. (dead-nettle nutlet) CDY		2		
Galeopsis tetrahit L. (common hemp-nettle nutlet) ADWod			2	
Glechoma hederacea L. (ground-ivy nutlet) WHDh			1	
P. major L. (greater plantain seed) Cgo			1	2
Galium sp. (frag.)			[1]	
Sambucus nigra L. (elder seed) DHSW			1	
Carduus/Cirsium sp. (thistle achene) GDY			4	
Lapsana communis L. (nipplewort achene) DHWo				2
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY		26[6]	19	
Anthemis cotula L. (stinking mayweed achene) Adhd				5
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) CD		[1]		
cf. Arum sp. (collapsed thin seed coat, cf. Lords & Ladies) HSW			1	
Lemna sp. (duckweed fruit) P				
Juncus sp. (rush seed) MPd		++++	++	++
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd		2		
Carex sp. (trigonous sedge nutlet) MPd	[1]	3	2	
Carex cf. spicata		7		
Bromus sect. *Bromus* (chess caryopsis)		[11]		
Lolium- type long-seeded grass caryopsis		[1]		
Poaceae (small seeded grass caryopsis) CDG	[1]	6[4]	4	4
Cladoceran ephyppia (water-flea eggcases e.g.*Daphnia*)		+++		
leaf fragments			+	
waterlogged wood fragments & twigs		++++	+++	+++
Total remains:	[19]	317[140]	[3] 365	[2] 73
Sample volume (litres soil)	70	80	?	1
% of flot sorted	100%	50%	100%	50%

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 4

in text

Table 5 : MIA samples from Heathrow, T5

Site	PSH02/61	PSH02	PSH02/61	PSH02/61
Sample	17153	17519	18308	18310
Context	539451	554144	521091	521091
Feature & type	P539450	P529306	WH521069	
PHASE	MIA	MIA	M/LIA	
CEREALS				
Grain				
Triticum aestivum -		cf.[1]		
Triticum dicoccum/spelta (emmer/spelt grain)	cf.[9]			
Triticum sp. (wheat grain)		[1]		
Hordeum sp. (barley grain)	[1]*	[2]*		
Avena/Bromus sp. (oat/chess grain)		[1]		
Indeterminate cereal or large grass caryopsis	[14]	[4]		
Chaff				
T. dicoccum/spelta (emmer/spelt glume base)	[24]			[1] 1
T. dicoccum/spelta (emmer/spelt spikelet fork)	[4]			
Other				
Ranunculus acris/bulbosus/repens (buttercup achene) DG			25	8
R. parvilflorus L. (small-flowered buttercup achene) o				3
R. subg. *Batrachium* (crowfoot achenes) BPw			1	2
Papaver cf. *rhoeas* L. (cf. common poppy seed) ADY				1
Urtica dioica			11	7
U. urens L.			3	2
Chenopodium album L. (fat-hen seed) CDn				1
Atriplex patula/prostrata (orache seed) CDn			1	
Montia	[1]		7	12

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 5 : MIA samples from Heathrow, T5

Sample	17153	17519	18308	18310
Context	539451	554144	521091	521091
Stellaria media (L.) Villars (common chickweed seed) CD			1	5
S. graminea L. (lesser stitchwort seed) Gd				
Lychnis flos-cuculi L. (ragged-robin seed) MGw			2	
Cerastium sp. (mouse-ear seed) CDGo				2
Polygonum aviculare (knotgrass achene) CD			8	63
P. hydropiper (L.)Spach (water-pepper achene) Pwh				1
Rumex acetosella L. (sheep's sorrel acene) EoGCas			1	4
Rumex sp. (dock achene) CDG	[2]			
Viola sp. (violet seed) GHWEMF			1	
Capsella bursa-pastoris L. (L.)Medik. (shepherd's purse seed) Cdo				6
Brassica/Sinapis sp. (mustard, charlock etc. seed) CDG				1
Potentilla sp. (cinquefoil achene) DGMY				1
Aphanes arvensis L. (parsley-piert achene) Co			12	5
Rosa /Rubus sp. (rose/bramble type thorn) HSW				
Prunus sp. (sloe etc. seed frag.) HSW				1
Vicia cf. *tetrasperma* (cf. smooth tare seed + hilum) G	[3]			

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 5 : MIA samples from Heathrow, T5

Sample	17153	17519	18308	18310
Context	539451	554144	521091	521091
Vicia/Lathyrus sp. (vetch/tare <2mm seed) CGD	[8]			
Vicia/Lathyrus sp. (vetch/tare 2-3mm seed) CDG		[5]		
Vicia/Lathyrus sp. (3-4mm vetch/tare)		[1]		
Solanum nigrum L.(black nightshade seed) CDn				1
Lamium sp. (dead-nettle nutlet) CDY				2
Prunella vulgaris L. (selfheal nutlet) GDWo			2	1
Plantago major L. (greater plantain seed) Cgo				2
Carduus/Cirsium sp. (thistle achene) GDY			1	12
Leontodon autumnalis L. (autumn hawkbit achene) G				2
Anthemis cotula L. (stinking mayweed achene) Adhd		[1]		
Tripleurospe	[1]			
Zannichellia				1
Juncus sp. (rush seed) GwMP			+++	++
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd	[1]		8	1
Isolepis setacea (L.)R.Br (bristle club-rush nutlet) PFME				3
Carex sp. (trigonous sedge nutlet) MPd				2
Bromus sect. *Bromus* (chess caryopsis)	[1]			
Lolium- type long-seeded grass caryopsis		[1]		

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 5 : MIA samples from Heathrow, T5

Sample	17153	17519	18308	18310
Context	**539451**	**554144**	**521091**	**521091**
Poaceae (small seeded grass caryopsis) CDG			6	16
Cladoceran ephyppia (water-flea eggcases e.g. *Daphnia*)			+++	+++
leaf fragments				+
waterlogged wood fragments & twigs				+
Total remains:	**[69]**	**[18]**	**90**	**[1] 169**
Sample volume (litres soil)	**40**	**40**	**1**	**1**
% of flot sorted	**100%**	**100%**	**100%**	**100%**

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches/rivers; S=scrub; W=woods;Y=waysides; a=acidic soils; c=calcareous soils; d=dry soils; o=open soils; w=wet/damp soils; *=C14 dated

Table 6 : LIA to MRB samples from Heathrow, T5

Site	PSH02/58	PSH02/61	PSH02/61	PSH02/61	PSH02/61	PSH02/	PSH02/	PSH02/58	PSH02	PSH02/58
Sample	**27030**	**18332**	**18334**	**18336**	**18368**	**25051**	**25052**	**26045**	**27027**	**25034**
Context	**678002**	**593201**	**593201**	**593201**	**593201**	**627043**	**627046**	**630107**	**677002**	**641094**
Feature & type	**P678001**	**Well 593207**				**WH627042**		**P630108**	**D636073**	**P641098**
Phase	**LIA**	**LIA**				**LIA/ERB**		**LIA/ERB**	**LIA/ERB**	**LIA/RB**
Grain										
Triticum aestivum -type (bread-type free threshing wheat grain)	[1]									
Triticum spelta (spelt spikelets with grain)										
Triticum dicoccum/spelta (emmer/spelt grain)	[150]	[1]				[11]	[37]			
Triticum dicoccum/spelta (sprouted emmer/spelt grain)										
Triticum sp. (aestivoid/spelt wheat grain)	[7]		[1]	[1]		[1]	[2]		[4]	
Triticum sp. (indeterminate wheat grain)										
Hordeum sp. (hulled barley grain)	[10]		[1]			[7]		[1]		
Avena sativa L. (cultivatd oat grain + floret base)						[1]				
Avena sp. (wild/cutivated oat grain)	[14]							[2]		[1]
Avena/Bromus sp. (oat/chess grain)	[4]					[9]	[2]			
Indeterminate cereal or large grass caryopsis	[97]					[12]	[11]	[6]	[8]	
Chaff										
Triticum dicoccum (emmer glume base)	[4]	[1]			[1]	[1]	[8]			
T. dicoccum (emmer spikelet fork)	[2]		[1]			[2]	[39]			
Triticum dicoccum (emmer rachis frag.)							[15]			
T. spelta (spelt glume base)	[8]	[7]	[14]	[7]	[19]	[7]	[52]		[6]	
T. spelta (spelt spikelet fork)	[2]				[2]		[5]			
T. spelta (spelt rachis frag.)			[2]				[2]			
T. dicoccum/spelta (emmer/spelt glume base)	[18]	[125]	[53]	[12]	[16]	[14]	[97]	[3]	[66]	[5]
T. dicoccum/spelta (emmer/spelt spikelet fork)	[5]	[20]	[7]	[2]	[2] 1		[52]	[1]	[14]	[5]
T. dicoccum/spelta (emmer/spelt rachis frag.)	[2]	[1]	[1]				[25]			
basal collared wheat rachis frag							[6]			
Hordeum sp. (barley rachis frag.)	[1]		[1]			[2]	[4]			[2]
Avena fatua (wild oat rachilla)							[9]			
Avena sp. (indeterminate oat rachilla)										
Avena sp. (oat awn frag)	++					+			++	+
cereal-sized culm node							[9]			
cereal-sized culm base							[1]			
Other										
Ranunculus acris/bulbosus/repens (buttercup achene) DG	[1]					[1]				
R. parvilflorus L. (small-flowered buttercup achene) o					+		1			
Ranunculus flammula L. (lesser spearwort achene) wPM						[1]	[1]			
R. subg. *Batrachium* (crowfoot achenes) BPw			1	1	+					
Thalictrum flavum L. (common meadow-rue achene) FwG										
Papaver cf. *rhoeas* L. (cf. common poppy seed) ADY		1	1	2			2			
Fumaria sp. (fumitory achene) CD										
Urtica dioica L. (stinging nettle achene) CDn		48	179	28	>500		[1] 1			
Urtica urens L. (small nettle achene) CDn		14	306	>500	>500		16			
Chenopodium album L. (fat-hen seed) CDn	[2]	1	28	2	+	[3]	[1]		[2]	
C. polyspermum L. (many-seeded goosefoot seed) CD	[3]						[4]			
Atriplex patula/prostrata (orache seed) CDn			13	3	++					
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w			3	4	+	[5]	1	[1]	[1]	
Stellaria media (L.) Villars (common chickweed seed) CD		2	41	34	+++		7			
S. graminea L. (lesser stitchwort seed) Gd				1						
Lychnis flos-cuculi L. (ragged-robin seed) MGw							1			
Cerastium sp. (mouse-ear seed) CDGo				3	+					
Agrostemma githago L. (corncockle seed frag.) AD							[1]			
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo										
P. maculosa/lapathifolia (redshank/pale persicaria achene) Cdo	[1]								[1]	
Polygonum aviculare (knotgrass achene) CD			16	6	+++	[7]	[1] 11			
Fallopia convolvulus (L.)A.Love (black bindweed achene) CD	[1]		1			[1]				
Rumex acetosella L. (sheep's sorrel acene) EoGCas	[2]	1	2			[3]			[3]	
R. crispus L. (curled dock achene) CD										
R. conglomeratus Murray (clustered dock achene)wP										
Rumex sp. (dock achene) CDG		1	2				[2] 2		[1]	
Malva sp. (mallow capsule frag.) DG										
Malva sp. (mallow seed) DG					+					
Viola sp. (violet seed) GHWEMF				1						
Rorippa nasturtium-aquaticum (L.)Hayek (water-cress seed) PM										
Capsella bursa-pastoris L. (L.)Medik. (shepherd's purse seed) Cdo			4	16	++					
Ericaceae fruit (heather, heath etc. fruit) E		[1]	1		[1]	[1]	[15] 41	[3]	[5]	
Calluna vulgaris (L.)Hull (heather shoot tip) E			1	[1]		[1]	[49]			
Calluna vulgaris (L.) Hull (heather leaf) E							[26]			
Erica tetralix L. (cross-leaved heath leaf) E							[12]			
Rubus sect. *Glandulosus* (bramble seed) DHSW*			1							
Rubus cf. *ideaus* L. (cf. raspberry seed) *EW										
Potentilla anserina L. (silverweed achene) DGYo										
Potentilla sp. (cinquefoil achene) DGMY										
Aphanes arvensis L. (parsley-piert achene) Co			1	6	+					
Prunus/Crataegus sp. (sloe /hawthorn type thorn) HSW										
Filipendula ulmaria (L.)Maxim. (meadowsweet seed) GYw			1				[1]			
Vicia cf. *tetrasperma* (cf. smooth tare seed + hilum) G										
Vicia/Lathyrus sp. (vetch/tare <2mm seed) CGD		[1]	[1]			[2]		[3]	[7]	
Vicia/Lathyrus sp. (vetch/tare 2-3mm seed) CDG								[1]		
Vicia/Lathyrus sp. (3-4mm vetch/tare)	[1]									
Medicago lupulina L. *(* black medick seed in capsule) GD							[1]			
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD					[1]	[9]	[16]		[1]	
Linum catharticum L. (fairy flax seed) GcdE										
Conium maculatum L. (hemlock mericarp) wGDY										
Torilis japonica (Houtt.)DC (upright hedge-parsley mericarp) GHWo					+					
Solanum nigrum L.(black nightshade seed) CDn			3		+					
Hyoscyamus niger L. (henbane seed) Dn		5	61	5	+++			[1]		
Lamium sp. (dead-nettle nutlet) CDY			5		+					
Galeopsis tetrahit L. (common hemp-nettle nutlet) ADWod										
Prunella vulgaris L. (selfheal nutlet) GDWo							1			
Mentha sp. (mint nutlet) GwBM										
Plantago major L. (greater plantain seed) Cgo		2	88	1	+++					
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG						[3]			[1]	
Galium sp. (frag.) CDY										
Sherardia arvensis L. (field madder nutlet) ADG	[1]									
Sambucus nigra L. (elder seed) DHSW						[2]				
Cirsium/Carduus s p. (thistle embryo)										
Carduus/Cirsium sp. (thistle achene) GDY		16	16	13	+++		2			
Lapsana communis L. (nipplewort achene) DHWo										
Leontodon autumnalis L. (autumn hawkbit achene) G										
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY			2		++		1			
Anthemis cotula L. (stinking chamomile achene) Adhw	[1]									
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) CD	[5]	[1]			+	[22]	[9]	[5]	[5]	[1]
Asteraceae embryo,*Tripleurospermum* -type						[6]				
Onopordum acanthium L. (cotton thistle achene) *		9	8	1	96		2			
Centaurea nigra -type (common knapweed achene) GDY										
Juncus sp. (rush seed) MPd			++	++						
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd	[1]		1				1	[15]	[2]	
Isolepis setacea (L.)R.Br (bristle club-rush nutlet) PFME										
Carex sp. (trigonous sedge nutlet) MPd				2			[3] 1			
Carex sp. (lenticular sedge nutlet) MPd				1	+		[1] 1	[1]		
Bromus sect. *Bromus* (chess caryopsis)	[7]		[6]		[1]	[16]	[33]		[4]	[2]
Poaceae (small seeded grass caryopsis) CDG		2			+++[1]	[3]				
Sparganium erectum L. (branched bur-reed) MP										
Iris pseudacorus L. (yellow iris seed) wGFP										
Cladoceran ephyppia (water-flea eggcases e.g.*Daphnia*)			++		+++					
waterlogged straw fragments and chaff										
waterlogged wood fragments & twigs			+							
Total remains:	**[351]**	**[158] 102**	**[88] 786**	**[23] 630**	**[44] >1000**	**[153]**	**[553] 92**	**[43]**	**[131]**	**[16]**
Sample volume (litres soil)	**40**	**1**	**1**	**1**	**10**	**40**	**30**	**20**	**40**	**20**
% of flot sorted	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
charred fragments per litre of soil sieved	**8.8**	**158**	**88**	**23**	**4.4**	**3.8**	**18.4**	**2.2**	**3.3**	**0.8**

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches etc.; S=scrub; W=woods;Y=waysides; SOILS: a=acidic; c=calcareous; d=dry; h = heavy ; o=open; w=wet/damp; *=economic use

Table 6 : LIA to MRB samples from Heathrow, T5

Site	PSH02/61	PSH02/61	PSH02/61	PSH02/61	PSH02/61	PSH02/61	PSH02/61	PSH02/61	PSH02
Sample	**19188**	**19191**	**19192**	**18384**	**18385**	**18387**	**18389**	**19176**	**27039**
Context	**527377**	**527379**	**527376**	**617176**	**617177**	**617177**	**617177**	**527369**	**678043**
Feature & type	**WH527374**			**P617178**				**D542387**	**D636100**
Phase	**E/MRB**			**E-MRB**				**E/MRB**	**E or MRB**
Grain									
Triticum aestivum -type (bread-type free threshing wheat grain)									[1]
Triticum spelta (spelt spikelets with grain)								[3]	[5]
Triticum dicoccum/spelta (emmer/spelt grain)						[1]		[21]	
Triticum dicoccum/spelta (sprouted emmer/spelt grain)					[1]			[1]	
Triticum sp. (aestivoid/spelt wheat grain)									
Triticum sp. (indeterminate wheat grain)							[1]		
Hordeum sp. (hulled barley grain)								[17]	
Avena sativa L. (cultivatd oat grain + floret base)									
Avena sp. (wild/cutivated oat grain)									[1]
Avena/Bromus sp. (oat/chess grain)									
Indeterminate cereal or large grass caryopsis	[2]		1	[1]		[5]	[2] 18	[17]	[13]
Chaff									
Triticum dicoccum (emmer glume base)	[1]		[2]	[5]	[1]	[1]			[cf.1]
T. dicoccum (emmer spikelet fork)					[1]			[1]	
Triticum dicoccum (emmer rachis frag.)									
T. spelta (spelt glume base)	2	[1]	[10]	[11]	[53] 4	[34] 1			[2]
T. spelta (spelt spikelet fork)						[1]	[1]		
T. spelta (spelt rachis frag.)					[2]		[2]		
T. dicoccum/spelta (emmer/spelt glume base)	[1] 3	[2] 4	[2] 5	[105]	[88]	[162] 3	[72]	[21]	[32]
T. dicoccum/spelta (emmer/spelt spikelet fork)	4	1	11	[7]	[17]	[32]	[16]	[1]	[7]
T. dicoccum/spelta (emmer/spelt rachis frag.)					[3]				
basal collared wheat rachis frag									
Hordeum sp. (barley rachis frag.)		[2]		[5]	[9]	[21]	[15]		
Avena fatua (wild oat rachilla)							[1]		
Avena sp. (indeterminate oat rachilla)						[1]	[3]		
Avena sp. (oat awn frag)				++		+	+		[++]
cereal-sized culm node						[1]			
cereal-sized culm base					[1]				
Other									
Ranunculus acris/bulbosus/repens (buttercup achene) DG		5							
R. parvilflorus L. (small-flowered buttercup achene) o						1			
Ranunculus flammula L. (lesser spearwort achene) wPM		9							
R. subg. *Batrachium* (crowfoot achenes) BPw									
Thalictrum flavum L. (common meadow-rue achene) FwG						1			
Papaver cf. *rhoeas* L. (cf. common poppy seed) ADY	1		2	51	18	6	3		
Fumaria sp. (fumitory achene) CD		1				1		5	
Urtica dioica L. (stinging nettle achene) CDn	413	192	77	>500	>500	258	171		4
Urtica urens L. (small nettle achene) CDn	2	89	3	14	23	130	100		
Chenopodium album L. (fat-hen seed) CDn	15	49	2	3	24	47	33	3	
C. polyspermum L. (many-seeded goosefoot seed) CD	113	15	82						
Atriplex patula/prostrata (orache seed) CDn	37	77	13		9	8	12	5	
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w	18	3	3			9	1		[1]
Stellaria media (L.) Villars (common chickweed seed) CD	51	353	9			12	24		2
S. graminea L. (lesser stitchwort seed) Gd	1	6				1			
Lychnis flos-cuculi L. (ragged-robin seed) MGw		1					3		
Cerastium sp. (mouse-ear seed) CDGo									
Agrostemma githago L. (corncockle seed frag.) AD									
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo	2	1					1		
P. maculosa/lapathifolia (redshank/pale persicaria achene) Cdo									
Polygonum aviculare (knotgrass achene) CD	77	76	21		2	14	7	1	[2]
Fallopia convolvulus (L.)A.Love (black bindweed achene) CD					1	1	1		
Rumex acetosella L. (sheep's sorrel acene) EoGCas		1		2		1	2	[1]	
R. crispus L. (curled dock achene) CD		73							
R. conglomeratus Murray (clustered dock achene)wP		2							
Rumex sp. (dock achene) CDG	10	205	1	[1]	2	6	9	[1] 4	[1]
Malva sp. (mallow capsule frag.) DG		1	1						[1]
Malva sp. (mallow seed) DG		2			[1]				
Viola sp. (violet seed) GHWEMF		1			4	2	1		
Rorippa nasturtium-aquaticum (L.)Hayek (water-cress seed) PM	1								
Capsella bursa-pastoris L. (L.)Medik. (shepherd's purse seed) Cdo	1	51							
Ericaceae fruit (heather, heath etc. fruit) E				[1]	[2] 1	[3] 8	[1] 3		
Calluna vulgaris (L.)Hull (heather shoot tip) E						[6] 1	[3] 1		
Calluna vulgaris (L.) Hull (heather leaf) E									
Erica tetralix L. (cross-leaved heath leaf) E						[2]	11		
Rubus sect. *Glandulosus* (bramble seed) DHSW*	2	1	1						
Rubus cf. *ideaus* L. (cf. raspberry seed) *EW								8	3
Potentilla anserina L. (silverweed achene) DGYo						1			
Potentilla sp. (cinquefoil achene) DGMY	1	9				2	2		
Aphanes arvensis L. (parsley-piert achene) Co	9	1	4	[1]		2	1		
Prunus/Crataegus sp. (sloe /hawthorn type thorn) HSW						1			
Filipendula ulmaria (L.)Maxim. (meadowsweet seed) GYw		1					1		
Vicia cf. *tetrasperma* (cf. smooth tare seed + hilum) G				[1]	[2]	[3]	[1]		
Vicia/Lathyrus sp. (vetch/tare <2mm seed) CGD	[1]			[5]			[3]		
Vicia/Lathyrus sp. (vetch/tare 2-3mm seed) CDG									
Vicia/Lathyrus sp. (3-4mm vetch/tare)									
Medicago lupulina L. *(* black medick seed in capsule) GD									
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD									[5]
Linum catharticum L. (fairy flax seed) GcdE		2							
Conium maculatum L. (hemlock mericarp) wGDY		19							3
Torilis japonica (Houtt.)DC (upright hedge-parsley mericarp) GHWo	1	1	2		[2]	3	1		
Solanum nigrum L.(black nightshade seed) CDn	13	1	15	1		55	34		
Hyoscyamus niger L. (henbane seed) Dn	11	3	12	4	4	2	38		
Lamium sp. (dead-nettle nutlet) CDY	1	15	1				2	1	2
Galeopsis tetrahit L. (common hemp-nettle nutlet) ADWod		2							
Prunella vulgaris L. (selfheal nutlet) GDWo		4				2	2		
Mentha sp. (mint nutlet) GwBM		2							
Plantago major L. (greater plantain seed) Cgo	2		3			2	8	1	
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG	3							[2]	
Galium sp. (frag.) CDY						[1]		[1]	
Sherardia arvensis L. (field madder nutlet) ADG									
Sambucus nigra L. (elder seed) DHSW		2							
Cirsium/Carduus s p. (thistle embryo)									[3]
Carduus/Cirsium sp. (thistle achene) GDY	7	1	1		5	14	28		1
Lapsana communis L. (nipplewort achene) DHWo		1							
Leontodon autumnalis L. (autumn hawkbit achene) G		1							
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY						3	6	1	
Anthemis cotula L. (stinking chamomile achene) Adhw		34							
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) CD	5	1		[2]	[1] 1	[11] 3	[3] 5	[1]	[4]
Asteraceae embryo,*Tripleurospermum* -type									
Onopordum acanthium L. (cotton thistle achene) *	2				3	16	34		
Centaurea nigra -type (common knapweed achene) GDY						[1]			
Juncus sp. (rush seed) MPd	++		+	+++	+++	+++	+++		
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd		8				1			[1]
Isolepis setacea (L.)R.Br (bristle club-rush nutlet) PFME		3				1			
Carex sp. (trigonous sedge nutlet) MPd		41		7	2	3	1		
Carex sp. (lenticular sedge nutlet) MPd		9				2	1	[1]	[1]
Bromus sect. *Bromus* (chess caryopsis)					[4]	[3]	[1]		
Poaceae (small seeded grass caryopsis) CDG		17	2	[1]			[1] 2	[3]	[2]
Sparganium erectum L. (branched bur-reed) MP		1							
Iris pseudacorus L. (yellow iris seed) wGFP		1							
Cladoceran ephyppia (water-flea eggcases e.g.*Daphnia*)									
waterlogged straw fragments and chaff	+++		+++						
waterlogged wood fragments & twigs	+	+++		+		+	+++	+	
Total remains:	**[6] 806**	**[5] 1401**	**[3] 272**	**[142] >582**	**[149] >599**	**[309] 627**	**[161] 568**	**[91] 29**	**[86]15**
Sample volume (litres soil)	**1**	**5**	**1**	**1**	**1**	**1**	**1**	**40**	**40**
% of flot sorted	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
charred fragments per litre of soil sieved	**6**	**1**	**3**	**142**	**149**	**309**	**161**	**2.3**	**2.2**

KEY: A=arable; C=cultivated; D=disturbed; E=heath; G=grassland; H=hedges; M=marsh/bog; P=ponds/ditches etc.; S=scrub; W=woods;Y=waysides; SOILS: a=acidic; c=calcareous; d=dry; h = heavy ; o=open; w=wet/damp; *=economic use

Table 7 : MRB to LRB samples from Heathrow, PSH02, T5

Sample	19155	26050	19187	27028	25003	26007
Context	**553169**	**658167**	**527347**	**673028**	**666013**	**644007**
Feature & type	**P553166**	**P658175**	**WH527388**	**D673029**	**P666001**	**WH644006**
Phase	**MRB**	**MRB**	**M-LRB**	**LRB**	**RB**	**RB**
Grain						
Triticum aestivum -type or aestivoid spelt (plump, rounded wheat grain)	[1]	[1]				[1]
Triticum dicoccum/spelta (emmer/spelt grain)	[4]	[4]		[1]	[242]	
Triticum sp. (indeterminate wheat grain)	[1]			[3]		
Hordeum sp. (hulled barley grain)					[26]	
Hordeum sp. (indeterminate barley grain)					[124]	
Avena sp. (wild/cutivated oat grain)				[1]	[3]	
Secale cereale L. (rye grain)					[cf.5]	
Indeterminate cereal or large grass caryopsis	[1]	[3]		[4]	[175]	
Chaff						
Triticum dicoccum (emmer glume base)					[2]	
T. spelta (spelt glume base)	[4]		[3]	[1]	[13]	
T. spelta (spelt spikelet fork)					[3]	
T. spelta (spelt rachis frag)					[8]	
T. dicoccum/spelta (emmer/spelt rachis frag.)					[4]	
T. dicoccum/spelta (emmer/spelt glume base)	[76]	[2]	[1]	[36]	[21]	[1]1
T. dicoccum/spelta (emmer/spelt spikelet fork)	[29]			[8]	[16]	[1]5
Hordeum sp. (barley rachis frag.)	[1]			[1]	[37]	
Avena sp. (oat awn frag)	[++]			[++]		
cereal-sized culm node					[2]	1
Other						
Ranunculus acris/bulbosus/repens (buttercup achene) DG	[1]		8	[1]	[1]	5
Ranunculus flammula L. (lesser spearwort achene) wPM						3
Corylus avellana L. *(* hazelnut shell frag.) HSW					[1]	
Fumaria sp. (fumitory achene) CD			1			
Urtica dioica L. (stinging nettle achene) CDn		8	120			>500
Urtica urens L. (small nettle achene) CDn			22			4
Chenopodium album L. (fat-hen seed) CDn			22		[72]	20
C. polyspermum L. (many-seeded goosefoot seed) CD			2			5
Atriplex patula/prostrata (orache seed) CDn		1	4			7
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w						1
Stellaria media (L.) Villars (common chickweed seed) CD		1	94			16
S. graminea L. (lesser stitchwort seed) Gd						3
Cerastium sp. (mouse-ear seed) CDGo						1
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo			1			
P. maculosa/lapathifolia (redshank/pale persicaria achene) Cdo					[68]	
Polygonum aviculare (knotgrass achene) CD			3		[1]	1
Fallopia convolvulus (L.)A.Love (black bindweed achene) CD					[1]	
Rumex acetosella L. (sheep's sorrel acene) EoGCas	[3]				[1]	2
Rumex sp. (dock achene) CDG	[2]	1	57	[1]	[34]	1
Malva sp. (mallow capsule frag.) DG						1
Malva sp. (mallow seed) DG			1			1
Capsella bursa-pastoris L. (L.)Medik. (shepherd's purse seed) Cdo			2			
Thlaspi arvense L. (field penny-cress seed) AD			1			
Calluna vulgaris (L.)Hull (heather shoot tip) E						1
Ericaceae fruit (heather, heath etc. fruit) E	[1]					1
Rubus sect. *Glandulosus* (bramble seed) DHSW*		3				
Potentilla sp. (cinquefoil achene) DGMY	[1]	2	1			5
Aphanes arvensis L. (parsley-piert achene) Co			2			
Vicia/Lathyrus sp. (vetch/tare <2mm seed) CGD	[1]			[4]	[3]	
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD	[2]					
Vitis vinifera L. (grape pip) *		1				1
Linum catharticum L. (fairy flax seed) GcdE			1			4
Conium maculatum L. (hemlock mericarp) wGDY		1	32			6
Hyoscyamus niger L. (henbane seed) Dn						1
Lamium sp. (dead-nettle nutlet) CDY			9			17
Prunella vulgaris L. (selfheal nutlet) GDWo	[1]				[1]	5
Mentha sp. (mint nutlet) GwBM						2
Plantago lanceolata L. (ribwort plantain seed) G	[1]					
P. major L. (greater plantain seed) Cgo			1			
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG					[1]	3
Rhinanthus sp. (yellow rattle achene) G			2			1
Galium sp. (bedstraw nutlet) GHD					[1]	
Sambucus nigra L. (elder seed) DHSW		2				16
Carduus/Cirsium sp. (thistle achene) GDY						5

Table 7 : MRB to LRB samples from Heathrow, PSH02, T5

Sample	**19155**	**26050**	**19187**	**27028**	**25003**	**26007**
Context	**553169**	**658167**	**527347**	**673028**	**666013**	**644007**
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY						2
Sonchus oleraceus (smooth sow-thistle achene) CDY			3			
Anthemis cotula L. (stinking chamomile achene) Adhw		[3]	5	[1]	[569]	
Anthemis cotula L. (stinking chamomile receptacle frags) Adhw					[11]	
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) CD	[5]			[2]	[34]	
Asteraceae receptacle frags					[7]	
Asteraceae embryo, *Tripleurospermum* -type		[2]				
Juncus sp. (rush seed) MPd			+++			
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd	[2]		1	[1]		6
Carex sp. (trigonous sedge nutlet) MPd			15			40
Carex sp. (lenticular sedge nutlet) MPd						5
Bromus sect. *Bromus* (chess caryopsis) CD	[3f]			[1]	[13]	
Poaceae (small seeded grass caryopsis) CDG	[1]		>72	[1]	[51]	
Cladoceran ephyppia (water-flea eggcases e.g. *Daphnia*)			+			
Pteridium aquilinum (L.)Kuhn (bracken pinnule frag) WEda			1			
waterlogged straw fragments and chaff						+++
waterlogged wood fragments & twigs			+			++
Total remains:	**[141]**	**[15] 20**	**[4] 483**	**[67]**	**[1551]**	**[4] >698**
Sample volume (litres soil)	**?**	**10**	**1**	**30**	**30**	**10**
% of flot sorted	**100%**	**100%**	**100%**	**100%**	**50%**	**25%**
charred fragments per litre of soil processed (fpl)	**?**	**1.5**	**4**	**2.2**	**103.4**	**0.4**

Table 8

in text

Table 9 : Early/Middle Saxon samples from Heathrow,Terminal 5

Sample	15142	15144	15145	15146	18278	19222
Context	**525322**	**525332**	**525296**	**538329**	**555826**	**555830**
Feature & type	**P525340**	**P525331**	**P525295**	**SFB538326**	**WH555805**	
Phase	**E/M Sax**	**E/M Sax**	**E/M Sax**	**E/M Sax**	**E/M Sax**	
Grain						
Triticum aestivum -type (bread-type free threshing wheat grain)		[2]	[1]	[3]		
Hordeum sp. (indeterminate barley grain)	[2]	[4]	[6]	[4]		
Avena sp. (wild/cutivated oat grain)		cf.[1]	[1]			
Indeterminate cereal or large grass caryopsis	[5]	[2]	[2]	[4]		
Chaff						
Triticum aestivum -type (bread-type free threshing wheat rachis frag.)						2
T. dicoccum/spelta (emmer/spelt spikelet fork)					[1]	
Hordeum sp. (barley rachis frag.)					[1]	
Other						
Ranunculus acris/bulbosus/repens (buttercup achene) DG					2	1
Corylus avellana L. *(* hazelnut shell frag.) HSW					1	1
Papaver sp. (poppy capsule lid) CD						2
Cannabis sativa L. (hemp achene) *					5f	cf.1f
Urtica dioica L. (stinging nettle achene) CDn			[1]		370	169
Urtica urens L. (small nettle achene) CDn					1	13
Chenopodium album L. (fat-hen seed) CDn	[1]				59	69
Atriplex patula/prostrata (orache seed) CDn					4	2
Montia fontana ssp. *chondrosperma* (Fenzl.)Walters (blinks seed) w					3	1
Stellaria media (L.) Villars (common chickweed seed) CD					28	79
S. graminea L. (lesser stitchwort seed) Gd						2
Cerastium sp. (mouse-ear seed) CD			[1]		1	1
Persicaria lapathifolia (L.)Gray (pale persicaria achene) Cdwo						1
P. maculosa (redshank achene) Cdo						1
Polygonum aviculare (knotgrass achene) CD					3	73
Rumex sp. (dock achene) CDG		[1]			26	23
Malva sp. (mallow capsule frag.) DG						1
Capsella bursa-pastoris L. (L.)Medik. (shepherd's purse seed) Cdo						34
Anagallis arvensis L. (scarlet pimpernel) Ado						1
Filipendula ulmaria (L.)Maxim. (meadowsweet) Gw						1
Rubus sect. *Glandulosus* (bramble seed) DHSW*					4	
Crataegus monogyna Jacq. (hawthorn fruit stone) HSW					2	
sloe/hawthorn-type thorn						1
Vicia/Lathyrus sp. (vetch/tare 3-4mm seed) CGD			[1]			
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD			cf.[1]			
Epilobium sp. (willowherb seed) CDGw						1
Linum usitatissimum L. (cultivated flax capsule frag.) *						12
Torilis japonica (Houtt.)DC (upright hedge-parsley mericarp) GHWo						4
Hyoscyamus niger L. (henbane seed) Dn			[1]		78	29
Solanum dulcamara L. (bittersweet seed) DHWY					1	
Lamium sp. (dead-nettle nutlet) CDY					14	8
Prunella vulgaris L. (selfheal nutlet) GDWo						1
Mentha sp. (mint nutlet) GwBM						1
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG	[1]		[2]			
Carduus/Cirsium sp. (thistle achene) GDY					1	1
Onopordum acanthum L. (cotton thistle achene) *					1	1f
Sonchus asper (L.)Hill (prickly sow-thistle achene) CDY					1	4
Anthemis cotula L. (stinking chamomile achene) Adhw			[1]			[1] 13
Juncus sp. (rush seed) MPd					++	+
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd						1
Carex sp. (trigonous sedge nutlet) MPd				[1]		1
Poaceae (various grass caryopses) CDG						4
Lolium perenne/rigidum (rye-grass caryopsis) GD	[1]					
Cladoceran ephyppia (water-flea eggcases e.g. *Daphnia*)						+
waterlogged wood fragments & twigs					++	+++
Total remains:	**[10]**	**[10]**	**[18]**	**[12]**	**[2] 605**	**[1] 559**
Sample volume (litres soil)	**40**	**40**	**40**	**40**	**1**	**1**
% flot sorted	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
charred fragments per litre of soil processed (fpl)	**0.25**	**0.25**	**0.45**	**0.3**	**2**	**1**

Table 1 : Medieval and Post-Medieval samples from Heathrow,Terminal 5

Bed	51	77	49	49	58	49	49	49	49	49	49	49	49	49	17	17	17
Sample	**15507**	**15044**	**17065**	**17066**	**26035**	**17046**	**17054**	**17056**	**17059**	**17068**	**17069**	**17070**	**17072**	**17073**	**18455**	**18458**	**18459**
Context	**559109**	**562020**	**537109**	**537110**	**658048**	**568018**	**568019**	**568022**	**529149**	**569029**	**569030**	**569031**	**569035**	**569035**	**546439**	**546439**	**546438**
Feature & type	**D559118**	**P562018**	**P537105**		**P658047**	**WH529139**				**WH569022**					**RP546437**		
Phase	**Med**	**Med**	**Med**		**Med**	**Med.**				**Later Med (C13th-C14th)**					**Post-Med.**		
Grain																	
Triticum aestivum -type (bread-type free threshing wheat grain)	[271]	[144]	[47]	[27]	[97]					[5]	[6]	[10]	[9]	[3]			
Hordeum vulgare (hulled barley grain)	[2]													[2]			
Hordeum sp. (indeterminate barley grain)	[13]	[11]	[41]	[30]	[25]					[4]	[4]	[4]		[3]			
Avena sp. (wild/cutivated oat grain)	[14]	[26]	[32]	[2]	[21]							[2]	[2]	[3]			
Avena/Bromus sp. (oat/chess grain)	[60]	[7]	[21]		[29]												
Secale cereale L. (rye grain)	[39]	cf.[3]	[21]	[2]	[31]					[9]	[2]	[4]	[2]	[6]		cf.[1]	
Indeterminate cereal or large grass caryopsis	[312]	[351]	[200]	[73]	[262]					[22]	[9]	[16]	[12]	[57]			
Chaff																	
Triticum aestivum -type (bread-type free threshing wheat rachis frag.)	[2]																
Triticum aestivum/turgidum (free-threshing wheat rachis frag.)	[31]	[11]			[8]												
T. spelta/dicoccum (spelt/emmer spikelet fork)														[1]			
Hordeum sp. (barley rachis frag.)	[4]	[1]	[1]	[1]	[1]									[1]		[1]	
Secale cereale L. (rye rachis frag.)	[25]	[2]	[2]	[1]	[3]									[6]			
Cereal-sized culm node	[14]	[2]			[2]									[1]			
cereal-sized culm base	[3]		[1]														
Avena sp. (oat awn frag.)	+									+							
Other																	
Ceratophyllum demersum L. (rigid hornwort achene) P																1	
Ranunculus acris/bulbosus/repens (buttercup achene) DG	[1]	[1]			[2]	19	1	+	5						3	21	+++
R. sceleratus L. (celery-leaved buttercup achene) MP						218	17	+	2						1		
R. subg. *Batrachium* (crowfoot achenes) BP																3	+
Corylus avellana L. *(*hazelnut shell frag.) HSW		[12]			[1]												+
cf. Cannabis sativa L. (cf. hemp achene frag) *															2		
*Humulus lupulus L. (hop achene) HFS**															5	1	1
Urtica dioica L. (stinging nettle achene) CDn							3								48	28	++
Urtica urens L. (small nettle achene) CDn															1		
Quercus sp. (immature acorn) HSW						12	6	++	1								
Quercus sp. (acorn cupule) HSW						50f	26f	++	7								
Quercus sp. (acorn cotyledon frag.) HSW						7f	2f										
Alnus glutinosa L. (alder seed) WSF															2	1	+
Ficus carica L. (fig seed) *					3												
Chenopodium album L. (fat-hen seed) CDn	[2]	[4]	[6]											28		3	+
C. polyspermum L. (many-seeded goosefoot seed) CD						104	91	+	57							4	
Atriplex patula/prostrata (orache seed) CDn	[1]													24			
Moehringia trinervia (L.)Clairv. (three-nerved sandwort seed) WH							3	+	3								
Stellaria media (L.) Villars (common chickweed seed) CD		[1]			5				1							4	+
S. graminea L. (lesser stitchwort seed) Gd							1										
Cerastium sp. (mouse-ear seed) CD						1	2										+
Scleranthus annuus L. (annual knawel achene) dos					[1]												
Agrostemma githago L. (corn cockle seed) A	[14]h	[1]			[1]									[2]			
Agrostemma githago L. (corn cockle capsule bract) A	[6]																
Silene sp. (catchfly seed) GHD	[1]																
Persicaria maculosa (redshank achene) Cdo						10	4	+	17								
P. maculosa/lapathifolia (redshank/pale persicaria achene) Cdo		[1]			[3]									1			
P. hydropiper (L.)Spach (water-pepper achene) Pwh	[1]				[1]											11	+
Polygonum aviculare (knotgrass achene) CD						1			1								
Rumex acetosella L. (sheep's sorrel achene) EoGCas			[1]			4		+								1	+
Rumex sp. (dock achene) CDG	[19]	[4]	[11]		[4]	64	28	++	8	[1]				1	16	34	++
Malva sp. (mallow capsule frag.) DG														13			
Viola sp. (violet seed) GEWSH					[1]	3	1										
Thlaspi arvense L. (field penny-cress seed) AD				[1]													
Raphanus raphanistrum ssp. *raphanistrum* (wild radish mericarp) CD			[1]														
Raphanus raphanistrum ssp. *raphanistrum* (wild radish seed) CD						12	1										
Capsella bursa-pastoris L. (L.)Medik. (shepherd's purse seed) Cdo					2		1										
Rorippa nasturtium-aquaticum (L.)Hayek (water-cress seed) MP																8	+
Erica sp./*Calluna vulgaris* (heather, ling capsule) EM	[9]	[2]			[55]												
Anagallis arvensis L. (scarlet pimpernel) Ado						1											
Filipendula ulmaria (L.)Maxim. (meadowsweet) Gw																2	++
Rubus sect. *Glandulosus* (bramble seed) DHSW*						25	11	++							1	2	+
Rubus idaeus L. (raspberry seed) WE*					1												
Prunus aium L. (cherry stone) *WSH																3	
P. spinosa L. (sloe stone) HSW*																	+
Prunus sp. (sloe/plum/cherry stone frag.) HSW		[1]												[1]			
Rosa sp. (rose seed) HSW						2											
rose/blackberry-type thorn HSW						4	1		1						7	1	++
Crataegus monogyna Jacq. (hawthorn fruit stone) HSW															1		
Potentilla sp. (cinquefoil achene) DGMY					[1]												
Vicia/Lathyrus sp. (<2mm small vetch seed)	[168]	[7]	[21]	[12]	[147]					[2]	[2]		[5]	[1]			
Vicia/Lathyrus sp. (c. 2-3mm small vetch seed)	[13]	[9]	[5]		[4]						[1]			[1]			
Vicia/Lathyrus sp. (vetch/tare 3-4mm seed) CGD	[41]	[5]	[7]	[4]	[5]						[2]		[5]	[1]			
Vicia sativa ssp. *sativa* (cultivated vetch seed) *	[5]	[1]		[1]						[1]							
Vicia cf *tetrasperma* (L.)Schreb. (smooth tare seed) G	[2]				[9]												
Vicia faba var. *minor* (Celtic bean) *		[2]															
Pisum/Vicia/Lathyrus sp.(large legume frag c. 5mm)		[7]	[1]	[1]	[6]					[2]							
Pisum sativum L. (pea) *		cf.[1]	cf.[1]		cf.[1]						cf.[1]						
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed) GCD	[2]	[4]		[1]	[2]												
Epilobium sp. (willowherb seed) CDGw																6	
cf. Linum usitatissimum L. (cf. cultivated flax seed frag.) *			[1]														
L. catharticum L. (fairy flax seed) dcsG							1										
Anthriscus sylvestris (L.)Hoffm. (cow parsley mericarp) GHW															4	2	+
Berula erecta (Huds.) Coville (lesser water-parsnip mericarp) FMc																1	
Conium maculatum (hemlock mericarp) wDPY														44			
Angelica sylvestris L. (wild angelica mericarp) wFMP																1	+
Hyoscyamus niger L. (henbane seed) Dn										[1]				2			
Solanum dulcamara L. (bittersweet seed) DHWY															2	1	
Lamium sp. (dead-nettle nutlet) CDY														57			
Galeopsis tetrahit L. (common hemp-nettle nutlet) ADWod																	+
Glechoma hederacea L. (ground-ivy nutlet) WHD															1		
Prunella vulgaris L. (selfheal nutlet) GDWo					[2]	4	1										
Stachys sp. (woundwort nutlet) GHEWM						1										1	
Lycopus europaeus L. (gypsywort nutlet) FGwP																2	++
Ballota nigra L. (black horehound nutlet) HDY						2										1	
Callitriche sp. (water-starwort nutlet) P						1											
Plantago laceolata L.(ribwort plantain seed) Go			[1]														
Plantago major L. (greater plantain seed) Cgo						1	4								1		
Odontites verna/Euphrasia sp. (red bartsia/eyebright seed) ADG	[1]																
Galium aparine L. (cleavers nutlet) CDSH	[1]																

Table 1 : Medieval and Post-Medieval samples from Heathrow,Terminal 5

Sample	**15507**	**15044**	**17065**	**17066**	**26035**	**17046**	**17054**	**17056**	**17059**	**17068**	**17069**	**17070**	**17072**	**17073**	**18455**	**18458**	**18459**
Context	**559109**	**562020**	**537109**	**537110**	**658048**	**568018**	**568019**	**568022**	**529149**	**569029**	**569030**	**569031**	**569035**	**569035**	**546439**	**546439**	**546438**
Galium sp. (nutlet frag.)		[1]															
Sambucus nigra L. (elder seed) DHSW														39	1		
Carduus/Cirsium sp. (thistle achene) GDY						1	2									1	
Centaurea sp. (cornflower, knapweed achene frag.) CDG			[1]														
Lapsana communis L. (nipplewort achene) CD	[1]															1	
Sonchus oleraceus L. (smooth sow-thistle achene) CDY																1	
Anthemis cotula L. (stinking chamomile achene) Adhw	[128]	[20]	[35]	[11]	[20]					[1]	[5]	[1]	[1]	[10]			
Anthemis cotula L. (stinking chamomile seed head frag.) Adhw	[11]	[8]	[4]											[1]			
Chrysanthemum segetum L. (corn marigold achene) AD	[5]		[3]		[2]												
Tripleurospermum inodorum (L.)Sch.Bip. (scentless mayweed achene) AD	[3]	[3]	[3]	[1]	[2]									[2]			
Anthemis/Tripleurospermum- type embryo		[1]															
Lemna sp. (duckweed fruit) P						57	1								3	2	
Juncus sp. (rush seed) MPd						+	+++		+								
Eleocharis subg. *Palustres* (spike-rush nutlet) MPd			[1]		[2]												
Carex sp. (trigonous sedge nutlet) MPd		[1]				12	4								69	53	++
Carex sp. (lenticular sedge nutlet) MPd						7	2		1						18	19	+
Glyceria sp. (sweet-grass caryopsis) P						37									4	3	++
Bromus sect. *Bromus* (chess caryopsis) AD	[47]	[11]	[11]	[2]	[1]								[1]	[2]			
Poaceae (various grass caryopses) CDG	[1]	[3]			[1]	1	9								2	2	+
Cladoceran ephyppia (water-flea eggcases e.g*Daphnia*)						+++	++	++	+++						+	++	+
tree/shrub buds and leaf fragments						+++	+++	+++	+++						+	++	+++
waterlogged wood fragments & twigs						+++	+++	+++	++						+	++	+++
Characeae (stonewort algae)																	+
Total remains:	[1273]	[669]	[480]	[144]	[745]11	661	223	++	104	[48]	[32]	[37]	[37]	[104]207	191	[2]225	+++
Sample volume (litres soil)	40	21	40	20	40	40	26	20	1	40	40	40	40	40	1	1	1
% flot sorted	12.50%	100%	100%	100%	100%	10%	100%	scanned	100%	100%	100%	100%	100%	100%	100%	100%	scanned
fragments per litre of soil processed (fpl)	[254.6]	[31.9]	[12]	[7.2]	[18.6]0.3	165.3	8.6	++	104	[1.2]	[0.8]	[0.9]	[0.9]	[2.6]5.2	191	[2]225	+++

Landscape Evolution in the Middle Thames Valley
Heathrow Terminal 5 Excavations Volume 2

This is one of the
24 specialist reports
provided with
the above publication.

Framework Archaeology
Monograph 3

ISBN 978-0-9554519-2-8

Framework
Archaeology

BAA Heathrow