

Relief Road Central: Felpham Site 6

Geoarchaeological boreholes through, and adjacent to, the Lidsey Rife, Felpham, West Sussex.

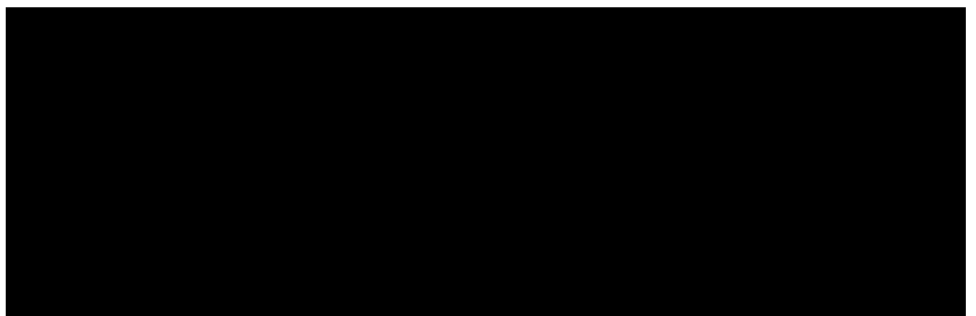
NGR (Central) SU 495250 101750

Site Code: 06929L



Written Scheme of Investigation

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Geoarchaeological WSI prepared for:-

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1.0 Introduction

- 1.1 This document represents a 'Written Scheme of Investigation' (WSI) for a geoarchaeological investigation and assessment associated with the construction of a relief road between the A259 and A29, at Felpham, West Sussex. The geoarchaeological works ('the Site') will be located in the area of the Lydney Rife centred on NGR SU 9480 0180 (Fig.1).
- 1.2 This 'WSI' was prepared on behalf of LP Archaeology Limited by M.B. Roberts (MBR), Principal Research Fellow at the Institute of Archaeology, UCL.
- 1.3 This document has been prepared in response to a planning condition attached to the planning consent granted for the site (FP/92/04) by the local planning authority – Arun District Council.
- 1.4 This document (WSI) sets out a series of measures to mitigate the impact of development on Late Pleistocene and Early Holocene sediments and their associated palaeoenvironmental remains, which were identified during the preparation of an Environment Statement. A series of Mitigation Areas was consequently defined, and the ES established that no construction works would commence until a Written Scheme of Investigation (WSI) had been approved by Arun District Council, based on recommendations made by West Sussex County Council (WSCC) as their archaeological advisers.
- 1.5 A condition attached to the grant of planning consent stipulated that '*The mitigation measures set out in the Environmental Statement submitted in support of the application, as amended, shall, unless provided for in other conditions attached to this notice of permission, be carried out and completed in accordance with the Environmental Statement*'.
- 1.6 This WSI sets out a proposed scheme for the undertaking of monitoring and recording boreholes prior to the construction of an elevated section of the road over the Lydney Rife.
- 1.7 The WSI was prepared on the basis of discussions between MBR, Barratts David Wilson Southampton and West Sussex County Council.

Geoarchaeological Background

2.1 Location

The site is located on the coastal plain of West Sussex, 2.8km north of the current coastline of the English Channel and 6.4km south of the dipslope of the South Downs (Fig. 2). The town of Bognor Regis is situated immediately south-west of the site; Chichester, the county town, lies some 8km to the north-west. Relief across the site is very gentle falling from 4m to 3m over c. 0.6km, from north to south.

2.2 Drainage

The geological sheet (BGS 1996), indicates the presence of a NE-SW trending alluvial channel, now containing the underfit Lidsey Rife that is confluent with the Aldingbourne Rife at South Bersted. These channels were, during and at the end of the Pleistocene, major downland and coastal plain drainage carriers of ice and snow melt. The unnamed confluent rife enters the English Channel at Bognor Regis. Physical sedimentary evidence for their subsequent infill with Holocene alluvium was encountered during the geoarchaeological mitigation works at North Bersted (Roberts 2008). Feeder streams and drainage ditches feed into the rifes throughout the site area and are largely oriented WNW-ESE.

2.3 Geology

The solid geology underlying the entire site area is the Campanian Upper Chalk, with most of the development overlying the Spetisbury Chalk Member, whilst the edge of the Tarrant Chalk Member subcrops to the north. The NW-SE trending edge of the Palaeogene Reading Beds Formation lies c. 1.6km to the south west and south of the site and also outcrops to the north, at the edge of the Chichester Syncline, near the village of Lidsey (Fig. 2).

The Chalk members comprise the major geological strata of the Littlehampton Anticline (Shephard-Thorn *et al.* 1982; Aldiss 2002), a periclinal structure that was uplifted during a period of tectonism, probably during the Middle to Late Eocene, coeval with the formation of the Sandown Pericline on the Isle of Wight (Gale *et al.* 1999). The anticlinal axis is located c.1km north of the site. Subsequent subaerial and marine erosion, sometime during the Late Middle to Late Pleistocene, resulted in the planation of the structure, apart from an extant rump at the chalk inlier of Highdown Hill (Roberts and Pope 2001, 2009).

The superficial deposits to be examined overlie the Chalk throughout the site. The sediments as summarised and described by Roberts (2007), comprise brickearths (Collcutt 2007), calcareous solifluction deposits with some evidence for marine littoral sedimentation in the form of rounded to subrounded flint clasts, and alluvial deposits associated with the Lidsey Rife. The rockhead contact is diffuse and variable in height across the site (GEA 2007) (Figs 3, 4).

Recent work by Roberts (2007) at the nearby site of Felpham East SU 9600 0090 (Figs. 5, 6) revealed a common sedimentary profile of up to 1m of Devensian Brickearth (Loess) overlying c. 3m of freshwater calcareous fine

grained deposits, with associated flint nodules derived from both the Chalk bedrock and from marine littoral deposits, overlying the weathered Chalk bedrock. The platform height at Felpham varied between -0.10 and 0.8m OD. At North Bersted (SU 9335 0150) (2007b) (Figs. 7, 8) the Chalk bedrock surface has been differentially lowered, in comparison to the neighbouring Palaeogene rockhead, and is cut through by the palaeochannel of the Aldingbourne Rife. The sediments that overly the Chalk, the Calcareous Basin Deposits (CBD), comprise a mixture of reworked marine sand; silt laid down by small ephemeral waterbodies; and locally cryoturbated Chalk and solifluction deposits. At the eastern margin of the site, extensive Holocene alluvial/marine sediments infill the periglacially overdeepened valley of the Aldingbourne Rife (Fig. 9). The rockhead heights below the superficial deposits were between -2 and -4m OD under the CBDs but down to -13m OD under the rife.

The detailed work at North Bersted (Roberts 2008) revealed evidence for highly eroded and re-incorporated marine sediments, in the form of beach pebbles, comminuted shells of *Mytilus edulis*, and rare specimens of the marine brackish foraminifer *Elphidium williamsoni*. The raised beach at Norton Farm (Bates *et al.* 1998, 2000) represents the most northerly point of the MIS 7 transgression. To the south of this location beaches have been found and described at Merston (SU 894 028) and Aldwick (SZ 912 992) (Roberts 1999, 2000), it is thought, by the author (MBR), that these two beaches represent still stands during the retreat of the Marine Isotope Stage (MIS) 7 sea and are thus regressional littoral zones. It has yet to be demonstrated whether the Pagham Raised Beach (Bates 2001), further to the south and west on the Manhood Peninsula, is another of these regressional beaches or the MIS 5e beach. Correlation of marine deposits at Bersted and Felpham with the Merston Raised Beach *sensu stricto*, as suggested by Pine and Bates (Pine 2005) is considered unlikely as these deposits are found some 1.2km further to the north and thus any marine deposits are more likely to be part of the general regression sequence.

The bedrock heights at Felpham of 0.77m OD and 0.42m OD at GTPs 3 and 4 and sub 0m OD at other locations are considerably lower than those at Merston 3.00-4.80m OD, 7km to the WNW, and Aldwick, 2.60-2.80m OD, 5.5km to the WSW. It is proposed here, that the reason for the height discrepancy and thus the conditions necessary for the formation of the Calcareous Basin Deposits (CBD) is the nature of the bedrock type. The marine planation surface left by the last marine transgression and regression has been differentially eroded by fluvial and subaerial processes, with the soft calcareous beds of the Chalk Members lowered to a much greater depth than the largely clay dominant Reading Beds and London Clay Formations. The CBD sediments at Felpham and Bersted are likely to have been laid down by a variety of agencies that include; solution weathering; very localised solifluction; and fluvial activity. The combination of these aforementioned factors would have produced an area of lowered relief within which freshwater pools and lakes developed. The marine lag that lay on the chalk surface has been totally reworked by these same processes. The organic remains identified at Felpham and Bersted, indicate cool - cold climatic conditions, and

a mixed palaeoenvironment of freshwater pools and grassland. The presence of earthworms and slugs indicates dry land conditions and suggests that the ground was not subject to prolonged freezing. The age of the CBD sediments is unknown: neither geological nor biostratigraphical data provides any indication of the date of deposition other than a post MIS 7 cold stage. The Calcareous Basin Deposits could therefore date to the final Saalian of MIS 6; any part of the Devensian Stage; or be a combination of both, with reworking and re-sedimentation in the calcareous basin taking place whenever it was exposed.

The sedimentary profile from the palaeochannel of the Aldingbourne Rife revealed alluvial sediments in both test pits and boreholes (Table 1, Fig. 9). The profile in summary, from the borehole data (Fig.), is of an upward fining profile with coarse flint fluvial gravel overlying the chalk, which passes into silty sands and then into silty clays and clays. Samples were taken from the basal 2.50m of BH507 and between 2.00 and 3.00m in GTP15 (Roberts 2008). At the test pit, plant debris and brackish water foraminifera were found in all the samples, and the taxonomic composition of the fauna indicated an environment of mid-high saltmarsh. The samples from BH 507 indicated a rather different palaeoenvironment (Table), predominantly of mudflats and creeks of what could have become over time, a quite open and widespread estuary. The overall ecology is described as “brackish intertidal mudflats and creeks, with some fringing saltmarsh”, but the sample interval of 0.50m was probably too great to show fully the differing nuances, and hence changing environments, which might be indicated by the foraminifera and ostracods. For instance, the occurrence of *Ammoscalaria runiana*, albeit briefly at 8.50m, could be significant as this intertidal species is...“common only in fine to medium sand with <20% mud and low total organic carbon (0.2-0.7%)” (Murray 2006). It was found to be very widespread in the Holocene sediments of nearby, Chichester Harbour (Whittaker, 2007). Moreover, the uppermost sample ([Sviii] 7.00m) showed some indication of a more marine influence, which may indicate sea-level rise and the area becoming more open- estuarine.

2.4 Potential of the sediments

There is therefore potential for palaeoarchaeological remains to be preserved to depth, within and on the margins of the Lidsey Rife. It is highly probable that, underlying the brickearth, terrestrial, lacustrine, alluvial and marine sediments of geoarchaeological significance will be encountered. These sediments are likely to contain associated palaeoenvironmental material and may possibly preserve important Holocene and Quaternary artefacts. Within the palaeochannel, a complex sequence of post-Pleistocene sediments have the potential, through their associated palaeoenvironmental indicators, to provide critical data on Holocene sea level rise and climate change.

2.5 Scope of the works

The proposed Geotechnical works to be carried out at the site by the Institute of Archaeology's Boxgrove Project, will include the following:-

1. Two boreholes on the margins of the alluvial channel containing the Lidsey Rife.
2. Two boreholes through the central part of the channel containing the organic deposits identified during the geotechnical boreholes. One of these boreholes to consist of continuous U100 sampling through the channel sediments.
3. One borehole outside the margins of the channel through the Calcareous Basin Deposits.

3.0 Aims and methodology.

- 3.1 The general objective of the proposed geoarchaeological work is to record and sample the sediment stack adjacent to and within the palaeochannel of the Lidsey Rife. In order to develop a detailed sedimentological/stratigraphic model for the site; provide environmental samples for assessment of potential; and to investigate the possibility of archaeological material surviving in the Late Pleistocene and Early Holocene sediments.
- 3.2 For 5 days two geoarchaeologists will be on site to enable dual monitoring of the boreholes and the samples taken from them. The Boxgrove Project Team will work closely with the geotechnical operators to ensure that the boreholes sunk during these works are cut and recorded in an order that allows for close and detailed inspection (Table 2). At all borehole locations monitoring will continue until/unless it becomes clear beyond reasonable doubt that no archaeological remains/significant geoarchaeological deposits are present (e.g. once excavation reaches the solid Cretaceous rockhead).

All units and unit boundaries will be fully described following the methodology of Tucker (1996), Jones *et al.* (1999), and Roberts and Pope (2001). Fine-grained deposits will be sampled and assessed for vertebrate and invertebrate microfauna and palynological analysis. If waterlogged sediments are encountered sampling will be undertaken for plant macros and coleopteran analyses (Green *et al.* 2006).

All identified boreholes will be monitored and sampled in their entirety until bedrock is proven. Geological profiles from the boreholes will be measured and recorded in note form, and then drawn up in the Logplot programme in conjunction with photographic data, individual logs will then be linked to produce fence diagrams in the Rockworks programme. Samples will be given a unique running number and marked on the section drawings. Sediment chromas and hues will be recorded using a Munsell Soil Colour Chart. Site plans showing the location of sections will be provided by LP Archaeology.

- 3.3 The County Archaeologist at WSCC will be kept informed of progress so that he may monitor the archaeological work or inform the Local Planning Authority (Arun District Council) of developments as necessary.
- 3.4 Where possible, any archaeological features encountered during starter pit excavation will be noted and recorded. Significant features will lead to a relocation of the borehole. An appropriate mitigation for the archaeology will then be discussed and agreed between the County Archaeologist and LP Archaeology.
- 3.5 Where Holocene or Pleistocene contexts suitable for environmental sampling are encountered, bulk soil samples (40 litres) will be taken for environmental analysis.

4. Location and sampling of the boreholes

The positioning of the boreholes has been agreed with the County Archaeologist John Mills, their distribution covers the palaeochannel and the area immediately adjacent it. Borehole logs and test pits quoted are those undertaken by Geotechnical and Environmental Associates in 2007. Further data refer to the investigative location and a composite section for boreholes compiled by MJA Consulting in 2008. The boreholes will be placed on or near the centre line of the road wherever possible.

Geoarchaeological BH1

This hole will be placed between existing geotechnical boreholes 2/2a, 3 (SU 494690-101983) and BH2.5 at route chainage 673m, just to the west of the railway line. The depth to the Chalk is c.3.40m, with an expected bedrock surface height of -1.12m OD. The main geological units expected are channel edge alluvial deposits and weathered Chalk. Bulk samples of 40 litres will be taken from the clay, if molluscs are revealed. The weathered Chalk will be sampled for invertebrate microfauna (40l). The borehole is located through the western, right bank, edge of the palaeochannel of the Lidsey Rife.

Geoarchaeological BH2

This hole will be placed between existing geotechnical boreholes 5 and 6/6a (SU 494754-101964) and BH2.9 at route chainage 760m, to the east of the railway line and west of the right bank of the Lidsey Rife. The depth to the Chalk is c.12m, with an expected bedrock height of -10.97m OD. The main geological units to be sampled are alluvial organic clays from the channel, with a flint gravel lag at the base, overlying weathered Chalk. Bulk samples of 40 litres will be taken from the clay, if molluscs are revealed. The weathered Chalk will be sampled for invertebrate microfauna (40l). The borehole is located just off the centre of the palaeochannel of the Lidsey Rife.

Geoarchaeological BH3

This hole will be placed c.40m east of geotechnical borehole 7 (SU 494914-101991), adjacent to BH3.8 at route chainage 900m, between the left bank of the Lidsey Rife and the drainage carrier. The depth to the Chalk is c.12m, with an expected bedrock height of -11.26m OD. The main geological units that the hole will pass through are alluvial clays and weathered Chalk. Bulk

samples of 40 litres will be taken from the clay, if molluscs are revealed. The weathered Chalk will be sampled for invertebrate microfauna (40l). The borehole is located in the centre of the palaeochannel of the Lidsey Rife.

Geoarchaeological BH4

This hole will be placed c.30m east and 30m north of geotechnical borehole 8 (SU 495088-101889) and to the east of BH4.2 at route chainage 976m, east of the left bank of the drainage carrier. The depth to the Chalk is c.3.7m, with an expected bedrock height of -2.53m OD. The main geological units that the hole will pass through are alluvial clays and weathered Chalk. Bulk samples of 40 litres will be taken from the clay, if molluscs are revealed. The weathered Chalk will be sampled for invertebrate microfauna (40l). The borehole is located just on the eastern, left bank, edge of the palaeochannel of the Lidsey Rife.

Geoarchaeological BH5

This hole will be placed next to the location of geotechnical test pit 9 (SU 495138-101842) at route chainage 1254m, east of the left bank of the palaeochannel. The depth to the Chalk is unknown as bedrock was not proven in the test pit, although it is estimated to be c.4m below ground level. The main geological units that the hole will pass through are brickearth, calcareous sandy silt and weathered Chalk. Bulk samples of 40 litres will be taken from the clay, if molluscs are revealed. The weathered Chalk will be sampled for invertebrate microfauna (40l). The borehole is located outside of the palaeochannel above the Calcareous Basin Deposits.

The boreholes will be sunk using a standard cable percussion rig. The topsoil will be removed in a standard 0.25m² starter pit, and down cutting will proceed using a combination of clay cutter and cylinder bits, from which bulk samples will be taken. In Geoarchaeological BH3 from c.1m-12m depth continuous U100 samples will be taken. All holes will be backfilled, with their arisings upon completion. If required, the holes may be sealed with bentonite.

5. Treatment of Human Remains

- 5.1 If human remains are found, work will cease and all necessary statutory provisions followed. LP Archaeology and WSCC staff shall be informed immediately.

6. Treatment of Artefacts and Ecofacts other than Human Remains

- 6.1 Pottery, worked flint, metal and other finds of archaeological significance will be retained and treated according to standard LP Archaeology/IoA procedures. The identification of retained finds will be undertaken by, staff of or specialists contracted by, the IoA, as necessary. All recovered beach pebbles will be examined for the presence of exotic rocks; these are lithologies that are alien to the area, including both igneous and metamorphic cobbles. These rocks were introduced to the area by sea ice and form an important element in

elucidating climate change during the Milankovitch defined interglacial-glacial climate cycle. Identification and analysis of these finds will be added to the Boxgrove Project's exotic rock database.

- 6.2 Bulk samples of organic material, charcoal and plant macros, will be processed using tank flotation unless considered detrimental to the samples or recovery rate. Waterlogged samples will be wet sieved through nested sieves and stored in wet, cool conditions or dried if considered an appropriate form of conservation for the remains. Dry bulk samples will target recovery of vertebrate and invertebrate faunas, and small artefacts. Other bulk grab samples will be taken for pollen analysis. As a general rule waterlogged wood specimens will be recorded in detail in their original location, if removed they will be cleaned, photographed and a thin section sample will be taken for identification. Specimens will either be stored in wet cool conditions or dried if considered appropriate for the material. In all instances deposits with clear intrusive material shall be avoided.

7. Reporting and Archive

- 7.1 If the results merit, a post-excavation assessment report will be prepared, and a programme of post-excavation analysis and reporting, along the lines recommended in MoRPHE and SHAPE (English Heritage 2006, 2008), will be agreed with the client and the relevant authorities.
- 7.2 If it is agreed that the results do not merit the full procedure described in 7.1 above, a report will be prepared describing the site and the work undertaken, and giving sufficient geoarchaeological and historical information to adequately understand the results of the investigation. The report will describe the geoarchaeological significance of the site in terms of its sedimentary character, potential for environmental analysis and archaeological relevance. Plans and section drawings showing the location of the site, geological logs and details of any features will be included. Interpretative drawings, geological models, environmental profiles and discussion will also be included as necessary.
- 7.3 A draft copy of the report will be sent to the County Archaeologist, West Sussex County Council in the first instance for his comments and approval. Once the report has been accepted and WSCC have recommended to the Local Planning Authority that the relevant planning condition should be discharged, further copies will be sent to WSCC and the client as appropriate.
- 7.4 A further digital copy of the report (including plans, illustrations and photographs) will be supplied to the West Sussex Historic Environment Record on CD-ROM in a PDF format.
- 7.5 The written and drawn archive will be deposited in an appropriate museum. Artefacts and ecofacts recovered during excavation form an important part of an archaeological site archive. Permission will be sought from the landowner to donate any finds from this project to an appropriate museum for deposition with the rest of the archive. The archive will be prepared according the

principles of *Management of Research Projects in the Historic Environment* (English Heritage 2006) and the requirements of the recipient museum.

8. Health and Safety

- 8.1 Health and Safety obligations take priority over archaeological requirements. It is essential that all works be carried out in accordance with safe working practices and under a defined Health and Safety Policy. A risk assessment for the project will be prepared prior to the commencement of work and all relevant health and safety regulations will be adhered to. All staff will have the appropriate PPE and be apprised of any site-specific safety requirements before starting work.

9. Insurance

- 9.1 Institute of Archaeology staff carrying out fieldwork are insured against claims for: employer's liability to the value of £50,000,000 each and every loss; primary public/products liability to the value of £50,000,000 any one occurrence and in the aggregate for products liability, with an extension for no-fault compensation up to £10,000,000 in the aggregate; professional indemnity to the value of £10,000,000 in any one occurrence.

10. Time Table and Project Management

- 10.1 The geotechnical work is envisaged as taking 1 week from the 9/07/12 to 13/07/12, although provision has been made for this period to be extended in the case of delay from inclement weather. The site works will be carried out by a team from the Boxgrove Project comprising; Mark Roberts (Director); and Liane Peyre (Senior Research Fellow). Seven working days have been allocated for preparation of the report following the receipt of assessment reports from specialists.
- 10.2 The project will be managed by Matt Williams of LP Archaeology.

11. Budget

Day rates for site and post-excavation assessment works

MBR 5 days at £350 pd	£1750
LP 5 days at £200	£1000
Travel at £0.40 per mile	
MBR £14.40 pd x 5	£72
LP £22.80 pd x 5	£114
Wet sieving bulk samples 3 days at £200 pd	£600
Pick dried samples to assessment level	
2 days at £200 pd	£400
Preparing U100 samples 3 days at £300 pd	£900

Transferring and delivering samples 1 day at £200 pd	£200
Sample preparation travel costs	£163

Specialist analyses to assessment

Invertebrate microfauna and molluscs

(J.E. Whittaker)

4 days sample preparation at £350 pd	£1400
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Analysis of 10 samples at £80 per sample	£800
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Palynological samples 3 days at £350	£1050
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(P.L. Gibbard)

Sort for exotic rocks and prepare geological descriptions 1 day at £350	£350
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(MBR)

Vertebrate faunas 1 day at £300	£300
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(S.A. Parfitt)

Prepare assessment report

4 days at £350	£1050
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3 days at £200	£600
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Preparation of WSI, including site visit, 2 days at £350 pd	£700
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Total	£11,449
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12. Bibliography

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