Lowdham 1 – Cocker Beck Flood Alleviation Scheme

Geoarchaeological and Archaeological monitoring of Ground Investigation Works

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wessexarchaeology

Portway House
Old Sarum Park
Salisbury
Wiltshire
SP4 6EB

www.wessexarch.co.uk

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Document Information

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Client name	Jackson Civil Engineering Ltd
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Site location	Lambley Lane Lowdham Newark and Sherwood NG14 7DF
County	Nottinghamshire
National grid reference	SK 65159 46177 (465159, 346177)
Planning authority	Newark and Sherwood District Council
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Museum name	Newark Museum
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Summary

Wessex Archaeology was commissioned by Jackson Civil Engineering Ltd ('the client') on behalf of the Environment Agency to undertake a programme of geoarchaeological and archaeological monitoring of additional Ground Investigation (GI) works and deposit modelling in advance of development proposals for a flood alleviation scheme at Lowdham, Nottinghamshire.

The superficial geology recorded within the Site comprised alluvium, located within the floodplain of the Cocker Beck, flanked to the north and south by Head deposits. Head is also recorded flanking the canalised stream, which joins the Cocker Beck in the south-west corner of the Site.

Recent Ground Investigations (GI) (Arcadis 2020, WA 2020) carried out in the south of the Site recorded superficial alluvial and colluvial sediments over solid bedrock mudstones and sandstones. Generally, the superficial deposits are capped by topsoil; however, made ground was recorded in 15 deposit records and ranged in thickness from 0.25m in TP206 to 2.3m in TP207.

The deposit models place the sediments at the Site in their wider topographic context. The sands and gravels were depoSited within a braided river system of the Cocker Beck in a periglacial environment during the late Devensian 15,000 to 10,000 years before present. While active, the river system would have been characterised by longitudinal gravel bars and intervening shallow water channels.

Deposit modelling showed the upper surface of the sands as sloping down from the west to the east and ranged in thickness from 0.3m thick in TP05 at 33.49m OD to 2.6m in BH05 at 32.83m OD. The sands and gravels were overlain by minerogenic deposits of fine-grained alluvium comprising silts, sands and clays. These alluvial deposits were recorded across the Site, present in thicknesses from 0.1m in TP202 at 31.7m OD to 2.0m in BH102 at 31.4m OD.

The age of the sands is currently unknown, but they are likely to be terminal Pleistocene and/or Holocene in date. At Farndon Fields, 14km north-east from the Site, comparable sandy sediments originally considered to be Holocene alluvium were shown to reflect much more complex, polygenetic deposition, including two phases of alluvial sedimentation, one which may date to late Pleistocene to early Holocene (c. 8–13 Ka) and one to later Holocene (c. 3–1 Ka) (Wessex and Cotswold Archaeology 2017).

Depending on the construction design, the implementation of the flood alleviation scheme across the Site may impact upon deposits of Palaeolithic/prehistoric archaeological potential on the surface of the gravels. The surface of the gravel is considered to be medium geoarchaeological potential, but the coarse-grained (gravel-rich) deposits of the gravel body are considered to be low geoarchaeological potential.

Acknowledgements

Wessex Archaeology thanks Jackson Civil Engineering Ltd for commissioning the work. The fieldwork was managed by Ben Cullen. The deposit modelling was undertaken by Richard Payne The report was compiled by Richard Payne. Figures were produced by Kitty Foster The project was managed on behalf of Wessex Archaeology by Dr Alex Brown

Lowdham 1 – Cocker Beck Flood Alleviation Scheme

Geoarchaeological and Archaeological Monitoring of Ground Investigation Works

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Jackson Civil Engineering Ltd ('the client') on behalf of the Environment Agency to undertake a programme of geoarchaeological and archaeological monitoring of additional Ground Investigation (GI) works in advance of development proposal associated with a flood alleviation scheme at Lowdham, Nottinghamshire.. The princpial aim of the monitoring was to incorporate information from the monitoring within an updateddeposit model.

1.2 Site location and geology

1.2.1 The Site covers 24 hectares and is located approximately 1km to the south-west of Lowdham and 3km east of Lambley, Nottinghamshire (**Figure 1**). Lowdham is located approximately 10km north-east of Nottingham city centre. The Site is located north of the Cocker Beck, and principally comprises arable fields bordered with hedge rows. The southern boundary is marked by the Cocker Beck/Lambley Road, which at this point is tree lined and with significant vegetation bordering it.

1.2.2 The Site is bounded by the Cocker Beck and Lambley Road to south and south-east, Bockleys View Road to the east and arable land to the north and west. Farm buildings belonging to Hunters Hill Farm are located west of the Site; access to the Farm runs east to west across the Site.

1.2.3 Historic mapping (ARUP 2021) demonstrates that the Site has largely been occupied by arable fields from the 19th century to present. Key changes recorded in the Site on this mapping are:

- A shift from smaller field enclosures to the two large enclosed fields;
- The construction of two small cottages, 'Hunters Hill Cottages', in the south-west of the Site in the 19th century, which have subsequently been demolished;
- The construction of Bockleys View Road which borders the eastern edge of the Site, leading northwards to an interwar housing estate surrounding HM Lowdham Grange; and
- The construction of extant buildings along the southern boundary of the Site in the strip of land between Cocker Beck and Lambley Road.

1.2.4 The Site is located within the floodplain of the Cocker Beck. The Cocker Beck is a north bank tributary of the River Trent, with the confluence between the two rivers located 2.5km south-west of the Site. A canalised water course joins the Cocker Beck from the north south-east corner of the Site. Current ground levels within the Site drop steeply from 50m OD (Ordnance Datum) in the north-west of the Site, down to 35.60m to 31.30m in the narrow floodplain of the Cocker Beck, located in the south of the Site.

1.2.5 The underlying solid geology is mapped by the British Geological survey (BGS) as comprising Triassic mudstones and siltstones of the Gunthorpe Member laid down 237–247 million years ago (MA). These have been eroded and removed within the Cocker Beck and its tributary valley, exposing the underlying Triassic mudstones and siltstones of the Radcliffe Member (242–247 MA).

1.2.6 The superficial geology mapped by the BGS within the Site comprises alluvium, located within the floodplain of the Cocker Beck, flanked to the north and south by deposits of Head (**Figure 3**). Head is also recorded flanking the canalised stream, which joins the Cocker Beck in the south-west corner of the Site. Elsewhere in the Site no superficial deposits are recorded.

1.2.7 Recent Ground Investigations (GI) (Arcadis 2020, WA 2020) carried out in the south of the Site recorded superficial alluvial and colluvial sediments, the former of which coarsens with depth, over solid bedrock mudstones and sandstones. Generally, the superficial deposits are capped by topsoil; however, made ground was recorded in three interventions in the south-east (BH01 and BH02) and south of the Site (TP04 and BH08), which ranged up to 2m in thickness.

1.3 Scope of document

1.3.1 This report provides a detailed description of the results of the monitoring of the GI works, interpreted within a wider geoarchaeological context, and assesses whether the aims of the archaeological and geoarchaeological monitoring have been met. The results reported on here will provide additional information on the sediments underlying the Site, informing on the geoarchaeological resource and the requirement for, and methods of, any further geoarchaeological or archaeological works.

1.3.2 To help frame geoarchaeological investigations of this nature, Wessex Archaeology has developed a five-stage approach, encompassing different levels of investigation appropriate to the results obtained, accompanied by formal reporting of the results at the level achieved. The stages are summarised below (**Table 1**). This report represents Stage 2 of this process.

Table 1 Staged approach to geoarchaeological investigations

Stage 1: WSI / Geoarchaeological Desk-based Assessment	Review of sub-surface data (e.g. mapping, existing GI, BGS logs), and summary of local or regional context. Establish likely presence/ absence/ distribution of archaeologically relevant deposits. May include modelling of existing data, and for larger schemes a fuller landscape characterisation. Present recommendations for fieldwork including type, number, distribution and depth of sampling methods.
Stage 2: Fieldwork, interpretation and reporting (e.g. Borehole survey)	Fieldwork to investigate deposits and obtain samples, followed by reporting. Reporting will present results (usually including deposit modelling), interpretations and recommendations for further work. Should suitable deposits be present, detailed recommendations for palaeoenvironmental assessment and dating will be made (Stage 3).
Stage 3: Palaeoenvironmental assessment	Assessment of subsamples agreed in Stage 2 (for e.g. pollen, diatoms, plant macrofossils, molluscs, ostracods and foraminifera), together with radiocarbon dating. Reporting will summarise results in the archaeological and palaeoenvironmental context of the local or wider area. Should deposits have the potential for analysis, recommendations will be for Stage 4 work.

Stage 4: Analysis	Full analysis of samples specified in Stage 3, together with a detailed synthesis of the results, in their local, regional or wider archaeological and palaeoenvironmental context as appropriate. Publication would usually follow from a Stage 4 report.
Publication	The scope and location of a publication report will be agreed in consultation with the client and LPA advisor. The publication report may comprise a note in a local journal or a larger publication article or monograph, dependant on the significance of the archaeological work.

2 GEOARCHAEOLOGICAL, ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 Introduction

2.1.1 This section summarises information relevant to assessing the geoarchaeological and archaeological potential of the Site. A review of the geoarchaeological potential of the Site is provided, which draws on the results of the prior geoarchaeological monitoring of GI works (WA 2020) and has been outlined in detail in the WSI for archaeological evaluation (WA 2021).

2.1.2 The archaeological and historical background was assessed in a Cultural Heritage Desk Based Assessment (CHDBA; ARUP 2021), which considered the recorded historic environment resource within 1km radius of the proposed development. A summary of the information within the CHDBA is provided, with additional sources of information referenced, as appropriate.

2.1.3 Where age estimates are available these are expressed in millions of years (Ma), thousands of years (Ka) and within the Holocene epoch as either years Before Present (BP), Before Christ (BC) and Anno Domini (AD).

2.2 Geoarchaeological Background

2.2.1 Previous investigations within the Site (WA 2020, WA 2021) have identfied superficial deposits which may date to the Pleistocene and/or Holocene. Together these epochs form the most recent parts of the Quaternary, a period covering the last 2.6 Ma, and defined by repeated fluctuations between cold (glacial) and warm (interglacial) climate stages (**Table 2**).

2.2.2 Data provided by GI investigations (Arcadis 2020) and the results of geoarchaeological monitoring (WA 2020) suggests that the following Quaternary deposits are present in the Site:

- Head (Pleistocene)
- Coarse alluvial deposits (?Pleistocene)
- Sands (?Pleistocene and/or Holocene)
- Alluvial clays (?Holocene)

2.2.3 The archaeological and geoarchaeological potential of each of these deposits is considered below.

Table 2 British Quaternary chronostratigraphy

Geological Period	Chronostratigraphy		Age (Ka)	Marine Isotope Stage (MIS)
Holocene	Holocene interglacial		11.7 – present	1
Late Pleistocene	Devensian Glaciation	Loch Lomond Stadial	11.7 – 12.9	2 – 5d
		Windermere Interstadial	12.9 – 15	
		Dimlington Stadial	15 – 26	
		Upton Warren Interstadial	40 – 43	
		Early Devensian	60 – 110	
	Ipswichian interglacial		115 – 130	5e
Middle Pleistocene	Wolstonian Complex	Unnamed cold stage	130-374	6
		Avery interglacial		7
		Unnamed cold stage		8
		Purfleet interglacial		9
		Unnamed cold stage		10
	Hoxnian interglacial		374 – 424	11
	Anglian glaciation		424 – 478	12
	Cromerian Complex		478 - 780	13 – 19

Head

2.2.4 Head deposits are mapped to the NW and SE of the Site along the flanks of the Cocker Beck, recorded as firm to stiff clayey sands and sandy clays, with variable gravel content, above bedrock. They have been deposited by solifluction processes, representing the downslope movement of sediments due to saturation by water and/or freeze thaw processes during periods of periglacial climate.

2.2.5 Head deposits generally have low archaeological and geoarchaeological potential but may contain redeposited artefacts and palaeoenvironmental evidence. Head deposits can sometimes bury or contain units with greater archaeological and geoarchaeological potential, most notably stable past land-surfaces.

Coarse alluvial deposits

2.2.6 Sands and gravels and sandy clayey gravels are recorded in GI interventions located in the south of the Site, adjacent to the Cocker Beck, representing deposits laid down under relatively high energy fluvial processes.

2.2.7 The age of these fluvial sediments is unknown, but they have been suggested to broadly correlate with the Holme Pierrepoint Sands and Gravels of the River Trent (WA 2020). The Holme Pierrepont Sands and Gravels (HPSG) form the youngest Pleistocene unit of the of the Middle Trent Valley terrace stratigraphy (Bridgland et al. 2013). The high energy sands and gravel units of the HPSG likely reflect deposition during cold climatic conditions, probably during the Loch Lomond Stadial (see **Table 2**).

2.2.8 Investigations at Holme Pierrepoint identified organic silts and peats infilling channels at the base of sands and gravels and cut into bedrock., Radiocarbon dates on material from these channel sediments suggest that date to the Windermere Interstadial (15–12.9 Ka), supporting a latest Devensian date (12.9 –11.7Ka) for the HPSG (Howard et al. 2011).

2.2.9 The high energy, likely cold climate, coarse alluvial deposits in the Site, have limited archaeological and geoarchaeological potential, although they could contain reworked material. If correlation with the HSPG is correct, these would have been deposited during peak cold conditions of the Loch Lomond Stadial, a period in which humans may have been absent from Britain (Jacobi and Higham 2011).

2.2.10 Should any basal channels be present containing organic sediments, akin to those at Holme Pierrepoint, these may have significant archaeological and geoarchaeological potential (there is clear evidence for human activity in the area during the Windermere Interstadial). However, the GI data from the Site (Arcadis 2020, WA 2020) does not suggest that such sediments are present.

Sands

2.2.11 The GI data from the Site (Arcadis 2020) records fine to coarse sands, with variable clay content, overlying the Head and coarse alluvial deposits. Much of these sands are undoubtedly alluvial; however, they could include colluvial and, possibly aeolian, units in some instances.

2.2.12 The age of these sands is currently unknown, but they are likely to be terminal Pleistocene and/or Holocene in date. At Farndon Fields, 14km north-east from the Site, comparable sandy sediments originally considered to be Holocene alluvium were shown to reflect much more complex, polygenetic deposition, including two phases of alluvial sedimentation, one which may date to late Pleistocene to early Holocene (c. 8–13 Ka) and one to later Holocene (c. 3–1 Ka) (Wessex and Cotswold Archaeology 2017). These alluvial units are separated by coversands which reflect aeolian sediments; these coversands were dated by OSL to the Loch Lomond Stadial and Early Holocene, 10,500–9400 BC (Harding et al 2014).

2.2.13 At Farndon Fields artefacts of multiples dates have been recovered from field walking and excavations distributed over a wide area (15 ha). These include Upper Palaeolithic (LUP) and Mesolithic material (Cooke and Mudd 2014**;** Ice Age Insights 2019). Fieldwalking. Excavations identified two LUP in situ lithic scatters. The typo-technological characteristics of the lithic artefacts in the two scatters are indicative two phases of activity within the Windermere Interstadial (15–12.9 Ka; Harding et al 2014).

2.2.14 The context of these scatters is complex; they were recovered from fine grained alluvial silts and clays, overlying basal gravels of the HPSG of the River Trent. Geoarchaeological investigations of these alluvial deposits suggested that they are Pleistocene, and therefore broadly contemporary with the scatters, but partially disturbed by subsequent human activity and bioturbation.

Alluvial clays

2.2.15 Alluvial clays overlie the coarse alluvial deposits in GI interventions in the Site (Arcadis 2020, WA 2020); sands recorded in similar stratigraphic position are also likely to belong to the same alluvial sequences (see above). Theses finer alluvial sediments are likely to be mostly Holocene. The sediments have the potential to be cut by archaeological features and bury earlier archaeological features and layers

2.2.16 The finer alluvial sediments are generally minerogenic, reflecting active alluvial overbank deposition, and therefore have generally low palaeoenvironmental potential. However, if peats were to occur, such deposits would have high palaeoenvironmental potential; no peats were identified in GI monitoring (WA 2020).

2.3 Archaeological and historic background

2.3.1 The following archaeological and historical background to the Site is based on information provided by the prior CHDBA which considered the recorded historic environment resource within 1km radius of the proposed development (ARUP 2021) The location of historic environment assets recorded in the CCHDBA are illustrated in **Appendix 1**. Additional information is provided where relevant and reference as appropriate.

Palaeolithic (970,000–10,700 Ka) and Mesolithic (8500–4000 BC)

2.3.2 No Palaeolithic or Mesolithic archaeology has been identified in the study area.

2.3.3 Palaeolithic and Mesolithic archaeology is documented in the Trent Valley, north-east of the Site, most notably at Farndon Fields (14km north-west of the Site) (Harding et al. 2014, Wessex and Cotswold Archaeology 2017). This includes LUP Creswellian and Federmeser lithic scatters, which reflect two phases of activity within the Windermere Interstadial (15–12.9 Ka).

Neolithic (4000–2400 BC)

2.3.4 A scatter of Neolithic flint implements was identified through fieldwalking prior to 1958 along a 4km stretch of the Cocker Beck in the general area of the Site (Historic Environment Record (HER) MNT5395). The HER find location is given as being at the edge of the western half of the Site; however, the precise findspot location within the 4km length of the Cocker Beck is unknown. A Neolithic polished axe was recovered from a field outside the former HM Borstal Lowdham Grange, approximately 600m north of the Site (MNT10930).

Bronze Age (2400–700BC) and Iron Age (700 BC–AD 43)

2.3.5 No evidence of Bronze Age activity has been identified in the study area.

2.3.6 Crop marks visible in aerial photographs indicate the location of a possible Iron Age enclosure on the hillside to the south of Cocker Beck overlooking the Site (MNT7397)

Romano-British (AD 43–410)

2.3.7 Only limited evidence of Romano-British activity has been noted in the study area, in the form of residual Roman potsherds were recovered from an excavation of the medieval castle mound in Lowdham, 900m to the east of the Site (MNT8104). The section of the Fosse Way, the Roman Road linking Leicester and Lincoln (roughly followed today by the course of the modern A46), lies over 6km to the south of the Site.

Early Medieval (AD 410–1066)

2.3.8 No archaeological evidence of the Early Medieval period has been noted from the study area. In the Early Medieval Period, the Site lay within the Kingdom of Mercia. However, Nottingham and the surrounding area captured by Danish Vikings in AD 867 and later became part of the Five Burghs (fortified towns) of The Danelaw. The name Lowdham is most likely of Danish origin, suggesting the village was settled at this time, although the earliest archaeological and documentary evidence of settlement at Lowdham dates from the Medieval period.

Medieval (AD 1066–1500)

2.3.9 Medieval activity is document 700m east of the Site within the settlement of Lowdham. This includes the Grade I listed St Mary's parish church, which was initially constructing from the 13th to the 15th centuries, with later restorations and repairs in the 1800s (List entry number: 1285738).

2.3.10 Excavations in the 1930s and 1940s within its grounds the current, post-Medieval, Grade II* Old Hall (List entry number: 1045495), located 950m east of the Site, revealed a well-defined castle mound surrounded by a depression which was identified as the infilled moat (MNT13527, MNT9228). Fragments of roofing tile and medieval green glaze potsherds were found in the mound (MNT1747) A stone wall foundation was found around the edge of the top of the mound, indicating the presence of a stone keep (MNT9230). Two 14th century keys were found nearby (MNT9232).

2.3.11 Beyond the settlement at Lowdham, the majority of the study area appears to have been mainly in agricultural and forestry use during the Medieval period. Traces of Medieval agriculture in the form of lynchets, holloways and earthwork banks and woodbanks are found in and around Lowdham (MNT10256, MNT10257, MNT10258, MNT10259).

2.3.12 Documentary sources suggested that the location of the deserted medieval village of Woolsthorpe (recorded as Vulvestorp c.1200AD) is potentially within the Site itself; however, a walkover survey in the 1970s revealed no evidence of a deserted medieval village on the Site (MNT13549, MNT1831).

2.3.13 Late 19th century Historic Ordnance Survey indicates that there were, formerly, a series of long, narrow fields running down the slope from north to south across the Site. Given their narrow form, these may have been Medieval strip-fields fossilised within a post-Medieval enclosure, suggesting the Site may have been in agricultural use during the Medieval period.

Post-Medieval (AD 1500–1800) and 19th Century (AD 1800–1900)

2.3.14 Evidence of the post-Medieval development of the settlements of Lowdham and Lambley is documented in the study area. In Lowdham this includes the construction of Old Hall (see above). Lowdham Mill, a framework knitters workshop and new cottages and buildings (MNT1869). At Lambley, a men's stocking factory was built on the main street by the late 19th century (MNT14570).

2.3.15 Sanderson's 1836 Map of the County of Nottingham shows the Site as agricultural fields. The 1875 Ordnance Survey (OS) map shows the Site as consisting of long narrow fields running north to south across the Site, with the buildings of Hunters Hill Farm directly adjacent to the western corner of the Site. By 1875 two small cottages, 'Hunters Hill Cottages', had been constructed in the south-west of the Site. Whilst the Hunters Hill Farm

buildings are still extant, the cottages no longer exist. The 1899 OS map shows no change within the Site.

Modern (AD 1900–present day)

2.3.16 OS mapping suggests that the Site underwent few changes through the first half of the 20th century. The 1913, 1939 and 1946 OS maps show little change within the Site. There are, however, some significant changes to the surrounding study area The 1913 mapping records historic field boundaries having been removed from the wider study area and a small quarry is recorded next to the Cocker Beck, 260m west of the Site (MNT13652, MNT1957).

2.3.17 The 1939 OS map records the development of the extensive complex of HM Borstal Institution of Lowdham Grange 600m to the north of the Site. This includes the construction of the connecting road (Bockleys View Road) which borders the eastern edge of the Site, leading northwards to the interwar housing estate surrounding HM Lowdham Grange. Filter beds are shown within a field 250m north of the Site. HM Lowdham Grange was the first purpose-built borstal for young offenders, located on a 340 acre Site as an 'open' prison with no walls or fences. The Epperstone bypass bisecting Lowdham was built by the time of the 1946 OS map.

2.3.18 The 1996 OS map records Site and study area having largely taken their current form, and demonstrates that significant changes, both within the Site and surrounding area, took place during the decades following the Second World War. Smaller internal field boundaries have now been removed from the Site to create the two large fields seen today. The 1996 map also shows the strip of land between Cocker Beck and Lambley Road occupied by several buildings along the course of the road, whilst Hunters Hill cottages (formerly located in south-east corner of the Site) have been demolished; the access route to these cottages from Lambley Road is still extant.

2.3.19 The buildings of HM Borstal Institution of Lowdham Grange, although closed in 1982, are still present on the 1996 map. However, these were demolished and replaced by the privately run HM Lowdham Grange Prison in 1998.

Unknown

2.3.20 The CHDBA (ARAP 2021) highlights several features of unknown age located within the study area. These are:

- A subcircular cropmark visible on aerial photographs 200m south-east of the Site (MNT7397). The cropmark shows as a subcircular enclosure with broad external ditch and narrow internal one, with two visible entrances. This may be a later prehistoric enclosure.
- A small rectilinear cropmark visible on aerial photographs located 650m south of the Site, near Bulcote (MNT2017). This may be a later prehistoric or Romano-British enclosure.
- A wide range of lynchets, holloways and wood banks in the study area (MNT10256, MNT10257, MNT10258, MNT10259, MNT27253). These agricultural landscape features may range in date from prehistory to the post-medieval period but are most likely to date from the Early medieval to Medieval periods.
- A linear earthwork feature was recorded on the 1939 county series OS map, located north and south of the Lowdham Grange farmstead (MNT1998, MNT1999).

2.4 Summary of archaeological and geoarchaeological potential

2.4.1 The archaeological and geoarchaeological potential of the Site can be summarised as follows:

- Pleistocene Head deposits occur on the valley margins. These have generally low archaeological and geoarchaeological potential. In broad terms they could contain or bury units with higher Palaeolithic potential (such as a stable land-surfaces).
- Coarse alluvial deposits which may be equivalent to the Holme Pierrepont Sands and Gravels of the River Trent are present within the Site. These are high energy, likely cold stage sediments, which GI monitoring suggests have low archaeological and geoarchaeological potential.
- Sands overlie Head and coarse alluvial deposits. Although likely to be principally Holocene alluvial sediments, they could in places reflect more complex alluvial, colluvial and/or aeolian deposition dating from the terminal Pleistocene and/or Holocene. Given this uncertainty, the archaeological and geoarchaeological potential of these sediments is currently unknown.
- Alluvial clays overlie coarse alluvial deposits. These clays likely reflect overbank alluvial deposition during the Holocene. GI monitoring indicates that these sediments have low paleoenvironmental potential. They have broad potential to be cut by later archaeological features and/or to bury archaeological features and layers.
- Review of the archaeological and historic background to the Site suggests that the principal archaeological potential within the Site boundary is for evidence dating to the Neolithic, Medieval and Post-Medieval periods.

3 AIMS AND OBJECTIVES

3.1.1 The aims of the monitoring of the GI works included:

- Refining the understanding of the presence, nature and distribution of Quaternary superficial deposits across the Site;
- To determine, as far as is reasonably possible, the nature of the detectable archaeological resource in trial pits;
- Assessing the geoarchaeological and archaeological potential of the deposits across the Site;
- Where appropriate, obtaining representative samples from deposits of geoarchaeological potential;
- Correlating the results of the GI works to produce an updated deposit model mapping the extent and depth of deposits across the Site;
- Informing on either the scope and nature of proposed archaeological and geoarchaeological works; the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

4 FIELDWORK METHODOLOGY

4.1 Introduction

4.1.1 All works were undertaken in accordance with the detailed methods set out within the WSI (WA 2021). Any significant variations to these methods will be agreed in writing with the Historic Environment Officer, Nottinghamshire County Council, archaeological advisor to the Local Planning Authority (LPA), and the client, prior to being implemented.

4.1.2 The GI works included the following:

- Monitoring of 13 machine excavated trial pits (TP101-105 and TP201-208), and
- Log review of seven cable percussion boreholes (BH101-105, BH201-202).

4.1.3 Monitoring of the 15 hand dug pits for surface sampling for asbestos (HP201-215) was not required as they were too shallow to impact on archaeology or produce relevant information on the Site stratigraphy.

4.2 Monitoring of machine dug trial pits

4.2.1 Thirteen machine dug trial pits (TP101-105 and TP201-208) were subject to a watching brief by an appropriately experienced archaeologist/geoarchaeologist. All trial pits were monitored in accordance with the relevant CIfA standards and guidance for archaeological watching briefs (CIfA 2014a), with the following specific aims

- *to allow, within the resources available, the preservation by record of archaeological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of development or other potentially disruptive works;*
- *to provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological find has been made for which the resources allocated to the watching brief itself are not sufficient to support treatment to a satisfactory and proper standard*

4.2.2 The monitoring archaeologist maintained written and photographic records and observed the trial pit from a safe vantage point agreed with the GI engineering team / banksman and at a safe distance beyond the limits of the working area and mechanical excavator.

4.2.3 Machine excavation of trial pits used a 360-degree excavator using a toothless bucket with excavation proceeding in horizontal spits, under the control of the attending archaeologist. If the monitoring archaeologist required the excavation to be stopped to view the trial pit, this was communicated immediately to the banksman or supervisor who will stop the excavation.

4.2.4 The excavation if required was momentarily paused to allow the monitoring archaeologist to check for the presence of archaeological features or finds and record the sequence of deposits present to feed into later Site interpretations and deposit modelling. Wessex Archaeology employs a standardised system of recording.

4.2.5 Entry into the trial pit was agreed beforehand with the GI engineering team / banksman. Where deposits of geoarchaeological potential were revealed, the attending archaeologist

liaised with the geoarchaeological team to ensure that deposits were recorded and sampled appropriately, in communication with the GI Contractor.

Arcaheological features and finds

4.2.6 No archaeological features or finds from the excavated contexts were recorded.

4.3 Sediment description

4.3.1 The sequences revealed in the test pits were described by a suitably experienced geoarchaeologist following Hodgson (1997), to include information such as:

- *Depth*
- *Texture*
- *Composition*
- *Colour*
- *Inclusions*
- *Structure (bedding, ped characteristics etc.)*
- *Contacts between deposits*

4.3.2 Interpretations were made regarding the probable depositional environments and formation processes of the sampled deposits.

4.3.3 This data was then tabulated by test pit and depth (**Appendix 1**).

4.4 GI log review

4.4.1 A review of the stratigraphic logs arising from the Ground Investigation (GI) works, included a total of 30 boreholes and 29 test pits. The log review was undertaken by a suitably qualified geoarchaeologist, with an assessment of the quality of the sediment descriptions and a geoarchaeological interpretation of the deposits cross-referencing the GI locations with existing BGS mapping and their topographic context.

4.5 Deposit modelling

4.5.1 A total of 74 data points were used to generate the updated deposit models for the Site, incorporating 16 historic bore records from the BGS borehole archive and 56 GI deposit records from the current and previous phases of GI works.

4.5.2 The deposit modelling was undertaken following the guidelines in Historic England (2020) and consisted of one Digital Elevation Model (DEM) of the upper surface of the Sands (**Figure 2**), two thickness plots of the Sands and Head deposits (**Figure 3–4**) and two transects running northwest to southeast across the Site.

5 RESULTS

5.1 Introduction

5.1.1 Previous monitoring of GI works recorded superficial deposits which may date to the Pleistocene and/or Holocene. Data provided by those GI investigations (Arcadis 2020) and the results of the geoarchaeological monitoring (WA 2020) found that the following Quaternary deposits were present in the Site.:

- Head (Pleistocene)
- Coarse alluvial deposits (?Pleistocene)
- Sands (?Pleistocene and/or Holocene)
- Alluvial clays (?Holocene)

5.1.2 Thirteen machine dug trial pits (TP101-105 and TP201-208) were subject to a watching brief. The monitored test pits were dug to a maximum depth of 3.8m. No archaeological remains were encountered in any of the interventions.

5.1.3 The results from the monitoring are tabulated in **Appendix 1**, summarised below and supported by the results of the deposits modelling of the Site. The modelling includes one Digital Elevation Model (DEM) of the upper surface of the Sands (**Figure 2**), two thickness plots of the Sands and Head deposits (**Figure 3–4**) and two transects running northwest to southeast across the Site (**Figures 5 and 6**).

TP101

5.1.4 A modern silty clay topsoil was recorded overlying a sandy clay colluvium at 0.40m bgl (below ground level) at 33.85m OD over a weathered mudstone bedrock at 32.25m OD.

TP102

5.1.5 A modern silty clay topsoil overlay a slightly sandy slightly gravelly silty clay at 0.45m bgl (31.74m OD) over a dark grey silty clay alluvium at 2.20m bgl (29.99m OD) over weathered bedrock at 2.4m bgl (29.79m OD).

TP103

5.1.6 A modern sandy silty clay topsoil overlay a silty clay alluvium at 0.40m bgl (32.15m OD) over coarse grained alluvium at 1.7m bgl (30.85m OD) over bedrock at 2.3m bgl (30.25m OD).

TP104

5.1.7 A sandy silty clay modern topsoil overlay a silty clay alluvium at 0.25m bgl (32.37m OD) over coarser grained alluvium at 1.7m bgl (30.92m OD) over sandy gravel head deposits at 2.8m bgl (29.82 m OD) over banded bedrock at 3.7m bgl (28.92m OD).

TP105

5.1.8 A sandy silty modern topsoil overlay a silty clay alluvium at 0.35m bgl (32.41m OD) over coarse grained alluvium at 1.8m bgl (30.96m OD) over weathered bedrock at 2.5m bgl (30.26m OD).

TP106

5.1.9 A silty clay modern topsoil overlay a silty clay alluvium at 0.3m bgl (35.04m OD) over coarse grained alluvium at 2.1m bgl (33.24m OD) over weathered bedrock at 2.8m bgl (32.54m OD).

TP201

5.1.10 A concrete surface and made ground overlay a silty clay alluvium at 0.3m bgl (32.51m OD) over a silty clay alluvium at 0.3m bgl (32.51m OD) over Head deposits at 2.5m bgl (30.31m OD).

TP202

5.1.11 Made ground overlay clayey silt alluvium at 1.1m bgl (31.7m OD).

TP203

5.1.12 Made ground overlay a silty clay alluvium at 0.8m bgl (31.38m OD) over coarse grained alluvium at 1.9m bgl (30.28m OD)

TP204

5.1.13 Made ground overlay a clayey silt becoming silty clay alluvium at 0.3m bgl (32.32m OD) over weathered bedrock at 2.0m bgl (30.62m OD).

TP205

5.1.14 Made ground overlay a clayey silt alluvium that became coarser with depth at 0.3m bgl (32.68m OD) over coarse grained alluvium at 1.8m bgl (31.18m OD) over weathered bedrock at 3.3m bgl (29.68m OD).

TP206

5.1.15 Made ground overlay silty clay alluvium at 0.25m bgl (32.64m OD) over coarse grained alluvium at 1.4m bgl (31.59m OD).

TP207

5.1.16 Made ground overlay a sandy clay alluvium at 2.3m bgl (30.81m OD).

TP208

5.1.17 Made ground overlay a sandy silt alluvium at 1.0m bgl (32.12m OD) over coarse grained alluvium at 2.5m bgl (30.22m OD).

5.2 Deposit modelling and stratigraphy

5.2.1 The deposit modelling consisted of one Digital Elevation Model (DEM) of the upper surface of the Sands (**Figure 2**), two thickness plots of the Sands and Head deposits (**Figure 3–4**) and two transects running northwest to southeast across the Site.

5.2.2 A total of 74 data points (deposit records) were used to compile the models for the Site, incorporating the deposit records from the previous ground investigations (Arcadis 2020) and the results of geoarchaeological monitoring (WA 2020) as well as 15 historic boreholes from the BGS online viewer. Together with data from the most recent phase of GI work.

5.2.3 The stratigraphy at the Site was divided into seven main stratigraphic units comprised as follows.

Made ground

5.2.4 This was the uppermost unit occasionally overlain by a modern soil profile and mainly comprised of redeposited gravel and clay with brick rubble, glass and plastic. The unit ranged in thickness from 0.25m in TP206 to 2.3m in TP207.

Colluvium

5.2.5 Colluvium was recorded in 10 of the data records and was mainly comprised of a sandy gravelly clay that ranged in thickness from 0.4m at 31.8m OD in TP06 to 1.8m in TP102 at 31.74m OD.

Sands

5.2.6 Sands were recorded in 22 of the deposit records and was spread evenly throughout the Site but was not recorded at any of the monitored GI locations though some of the sandier alluvium recorded could probably also be identified as Sands. The Sands ranged in thickness from 0.3m thick in TP05 at 33.49m OD to 2.6m in BH05 at 32.83m OD (**Figure 2 & 3**). From the modelling the upper surface of the Sands was shown as at its highest of around 35m OD at the south western end of the Site from where it sloped down to below 32m OD in the east of the Site.

Alluvium

5.2.7 Generally, a fine-grained deposit comprised of silty clay with occasional fine gravels and recorded in 29 of the deposit records and throughout the Site at lower elevations. The alluvium ranged in thickness from 0.1m in TP202 at 31.7m OD to 2.0m in BH102 at 31.4m OD.

Coarse grained alluvium

5.2.8 This was the lowest of the alluvial units representing deposition within a higher energy environment and was recorded in 30 of the deposit records. The coarse-grained alluvium ranged in thickness from 0.15m in BH05 at 30.23m OD to 2.5m in BH08 at 31.17m OD.

Head

5.2.9 The lowest of the stratigraphic units and overlying the bedrock, the Head deposits typically consisted of clayey sandy gravel and were deposited by solifluction processes under periglacial conditions (**Figure 4**). The deposits ranged in thickness from 0.4m in BH104 at 31.44m OD, there was little variation in the thickness of Head across the Site except for in the centre of the Site on the south east side of the Cocker beck where the thickness was recorded at 3.5m in BH202 at 32.35m OD.

Bedrock

5.2.10 The bedrock was recorded in 65 of the deposit records and ranged in height from 26.2m OD in BH02 to 33.9m OD in TP10, with the highest elevations recorded on either side of the valley and the lower elevations recorded in the bottom of the valley.

6 DISCUSSION

6.1 Introduction

6.1.1 A programme of geoarchaeological monitoring and deposit modelling was undertaken as part of the ground investigation works in advance of development associated with a proposed flood alleviation scheme at Lowdham, Nottinghamshire.

6.1.2 Monitoring was undertaken on thirteen machine dug trial pits (TP101-105 and TP201-208). The sequence of deposits recorded within the test pits was broadly consistent across the Site with modern deposits of soil or made ground overlying bedrock at higher elevations with colluvium, alluvial deposits and head deposits overlying the bedrock at lower elevations within the valley of the Cocker Beck (**Figure 5 & 6**).

6.1.3 An updated deposit model for the Site has produced,integrating the results of the geoarchaeological monitoring with existing GI data, historical boreholes and the results of the review of the GI logs, resulting in a total of 74 deposit records for the deposit model. The results of the deposit modelling indicate that the number and distribution of the data points was sufficient to permit modelling within the Site of the proposed flood alleviation scheme.

6.2 Sedimentary sequence and depositional environment

Bedrock

6.2.1 The bedrock was the lowermost unit recorded across the Site and comprised the Triassic mudstones and siltstones of the Gunthorpe Member, laid down 237–247 million years ago (Ma). The surface of the bedrock ranged in height from 26.2m OD in BH02 to 33.9m OD in TP10. Modern deposits of soil or made ground overlay bedrock at higher elevations with colluvium, alluvial deposits and head deposits overlying the bedrock at lower elevations within the valley of the Cocker Beck (**Figure 5 & 6**).

Head

6.2.2 Head deposits are mapped to the NW and SE of the Site along the flanks of the Cocker Beck, recorded as firm to stiff clayey sands and sandy clays, with variable gravel content, above bedrock. They have been deposited by solifluction processes, representing the downslope movement of sediments due to saturation by water and/or freeze thaw processes during periods of periglacial climate.

6.2.3 Head deposits generally have low archaeological and geoarchaeological potential but may contain redeposited artefacts and palaeoenvironmental evidence. Head deposits can sometimes bury or contain units with greater archaeological and geoarchaeological potential, most notably stable past land-surfaces.

6.2.4 The Head deposits were recorded in 19 of the deposit records only one of which (TP205) was recorded during the geoarchaeological monitoring. The Head deposits typically consisted of clayey sandy gravel and were deposited by solifluction processes under periglacial conditions. The deposits ranged in thickness from 0.4m in BH104 at 31.44m OD to 3.5m in BH202 at 32.35m OD (**Figure 4**). There was little variation in the thickness of Head across the Site except for in the centre of the Site on the south east side of the Cocker beck where the thickness was recorded at 3.5m in BH202. The locations where Head deposits were recorded were fairly evenly distributed throughout the Site along the valley sides.

Coarse alluvial deposits

6.2.5 Sands, gravels and sandy clayey gravels were recorded in previous GI interventions located in the south of the Site, adjacent to the Cocker Beck, representing deposits laid down under relatively high energy fluvial processes. The age of these fluvial sediments is unknown, but they have been suggested to broadly correlate with the Holme Pierrepoint Sands and Gravels (HPSG) of the River Trent (WA 2020).

6.2.6 The HPSG form the youngest Pleistocene unit of the of the Middle Trent Valley terrace stratigraphy (Bridgland et al. 2013). Deposited during cold climatic conditions, probably during the Loch Lomond Stadial (see **Table 2**) a period in which humans may have been absent from Britain (Jacobi and Higham 2011). Investigations at Holme Pierrepoint identified organic silts and peats infilling channels at the base of sands and gravels and cut into bedrock. Radiocarbon dates on material from these channel sediments suggest that date to the Windermere Interstadial (15–12.9 Ka), supporting a latest Devensian date (12.9 –11.7Ka) for the HSPG (Howard et al. 2011).

6.2.7 The Coarse alluvial deposits have limited archaeological and geoarchaeological potential, although they could contain reworked artefacts, which could include Palaoelithic material. No organic sediments have been identified, akin to those at Holme Pierrepoint

Sands

6.2.8 The GI data from the Site (Arcadis 2020) records fine to coarse sands, with variable clay content, overlying the Head and coarse alluvial deposits. Much of these sands are undoubtedly alluvial; however, they could include colluvial and, possibly aeolian, units in some instances, though no specific evidence of this was recorded within the test pits.

6.2.9 The age of these sands is currently unknown, but they are likely to be terminal Pleistocene and/or Holocene in date. At Farndon Fields, 14km north-east from the Site, comparable sandy sediments originally considered to be Holocene alluvium were shown to reflect much more complex, polygenetic deposition, including two phases of alluvial sedimentation, one which may date to late Pleistocene to early Holocene (c. 8–13 Ka) and one to later Holocene (c. 3–1 Ka) (Wessex and Cotswold Archaeology 2017). These alluvial units are separated by coversands which reflect aeolian sediments; these coversands were dated by OSL to the Loch Lomond Stadial and Early Holocene, 10,500–9400 BC (Harding et al 2014). At Farndon Fields artefacts of multiples dates have been recovered from field walking and excavations distributed over a wide area (15 ha). These include Upper Palaeolithic (LUP) and Mesolithic material (Cooke and Mudd 2014**;** Ice Age Insights 2019). Excavations identified two LUP in situ lithic scatters. The typo-technological characteristics of the lithic artefacts in the two scatters are indicative of two phases of activity within the Windermere Interstadial (15–12.9 Ka; Harding et al 2014).

6.2.10 Sands were recorded in 22 of the deposit records but not at any of the monitored GI locations though some of the more sandy alluvium recorded could probably also be identified as Sands. The Sands ranged in thickness from 0.3m thick in TP05 at 33.49m OD to 2.6m in BH05 at 32.83m OD (**Figure 2 & 3**). From the modelling the upper surface of the Sands was shown as at its highest of around 35m OD at the south western end of the Site from where it sloped down to below 32m OD in the east of the Site. Where present, Sands were distributed evenly throughout the Site.

Alluvium

6.2.11 Alluvial clays overlie the coarse alluvial deposits in GI interventions in the Site (Arcadis 2020, WA 2020); sands recorded in similar stratigraphic position are also likely to belong to the same alluvial sequences (see above). Theses finer alluvial sediments are likely to be mostly Holocene. Although the sediments have the potential to be cut by archaeological features and bury earlier archaeological features and layers no evidence of this was recorded within the latest phase of GI monitoring.

6.2.12 The finer alluvial sediments are generally minerogenic, reflecting active alluvial overbank deposition, and therefore have generally low palaeoenvironmental potential. However, if

peats were to occur, such deposits would have high palaeoenvironmental potential; no peats were identified in the latest phase of GI monitoring (WA 2020).

7 CONCLUSIONS

7.1.1 Depending on the construction design, the implementation of the flood alleviation scheme across the Site may impact upon deposits with archaeological and/or geoarchaeological potential. Consequently, archaeological and geoarchaeological evaluation is likely to be required.

7.1.2 Head deposits are recorded in the Site. These generally have low archaeological and geoarchaeological potential but may contain redeposited artefacts and palaeoenvironmental evidence. Head deposits can sometimes bury or contain units with greater archaeological and geoarchaeological potential, most notably stable past land-surfaces.

7.1.3 The Sands and surface of the underlying coarse alluvial depicts present in the Site may, dependent on their age have potential for Late Upper Palaeolithic archaeology. The coarse gained alluvium may also contain artefacts, but these are likely to be fluvially reworked.

7.1.4 The alluvium of the Cocker Beck has generally low geoarchaeological potential, however, it has the potential to contain and/or seal archaeological layers or features.

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WebSites

British Geological Survey, Geology of Britain viewer Geology of Britain viewer | British Geological Survey (BGS)

APPENDIX

Monitored GI logs

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP101
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 33.85m OD
Length: 2.80 m	Width: 0.70 m	Depth: 2.90 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
10100	Soft dark brown slightly sandy slightly gravelly silty CLAY. Sand is fine to medium. Gravel is rare angular fine to medium mudstone. Bioturbated. Abrupt contact.	Modern soil profile. Ploughsoil.	0-0.40	33.85	
10101	Stiff mid reddish brown slightly sandy slightly gravelly friable CLAY. Sand is fine to medium. Gravel is very common angular fine to medium mudstone. Abrupt contact.	Alluvium/colluvium	0.40-1.60	33.45	
10102	Weathered mid reddish brown mudstone with grey siltstone bands. Recovered as a gravel.	Weathered bedrock. Probably Radcliffe or Gunthorpe member.	1.60-	32.25	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP102
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 32.19m OD
Length: 3 m	Width: 0.70 m	Depth: 3.10 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
10200	Soft dark grey brown silty CLAY. no clasts. Bioturbated. Frequent fine roots and rootlets. Abrupt contact.	Modern soil profile. Ploughsoil.	0-0.45	32.19	
10201	Firm mid reddish brown slightly sandy slightly gravelly silty CLAY. Sand is fine to medium. Gravel is rare angular to sub-rounded fine to medium mudstone ≤20 mm. Abrupt contact.	Alluvium/colluvium	0.45-2.20	31.74	
10202	Stiff dark grey silty CLAY. No clasts. extremely rare wood and root fragments. Sharp contact.	Alluvium.	2.20-2.40	29.99	
10203	Weathered reddish brown mudstone, rare siltstone. Recovered as angular fine to coarse gravel.	Weathered bedrock. Probably Radcliffe or Gunthorpe member.	2.40-	29.79	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP103
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 32.55m OD
Length: 4 m	Width: 0.70 m	Depth: 3.60 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
10300	Soft dark grey brown sandy silty CLAY. Sand is fine to coarse. No clasts. Abrupt contact.	Modern soil profile. Ploughsoil	0-0.40	32.55	
10301	Soft mid brown silty clay. No clasts. Diffuse contact.	Alluvium/colluvium	0.40-1.00	32.15	
10302	Soft mid reddish brown clayey SILT. No clasts. Abrupt contact.	Alluvium.	1.00-1.70	31.55	
10303	Mid grey slightly clayey gravelly slightly silty fine to coarse SAND. Gravel is angular to sub-angular fine to coarse mudstone and siltstone ≤60 mm. Sharp contact.	Coarser grained alluvium/Sands.	1.70-2.30	30.85	
10304	Weathered reddish brown mudstone. Interbedded with light grey siltstone. Recovered as angular fine to coarse gravel.	Bedrock geology. Probably Radcliffe or Gunthorpe member.	2.30-	30.25	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP104
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 32.62m OD
Length: 3.80 m	Width: 0.70 m	Depth: 3.80 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
10400	Soft dark brown grey slightly sandy silty CLAY. Sand is fine to coarse. No clasts. Bioturbated. Abrupt contact.	Modern soil profile. Ploughsoil.	0-0.25	32.62	
10401	Soft mid reddish brown silty CLAY. No clasts. Abrupt contact.	Alluvium/colluvium.	0.25-0.90	32.37	
10402	Soft light to mid grey slightly sandy slightly gravelly very silty CLAY. Sand is fine to coarse. Gravel is moderate angular fine to coarse extremely weak sandstone ≤60 mm. Diffuse contact.	Alluvium.	0.90-1.70	31.72	

10403	Mid reddish brown slightly sandy slightly gravelly clayey SILT. Sand is fine to medium. Gravel is common angular to sub-angular fine to coarse extremely weak siltstone and mudstone ≤60 mm. From 2.40 m bgl with lenses of very sandy gravelly CLAY. Abrupt contact.	Alluvium. Coarser grained.	1.70-2.80	30.92	
10404	Mid reddish brown clayey sandy GRAVEL. Sand is fine to coarse. Gravel is super abundant to near complete angular to sub-angular fine to coarse mudstone ≤60 mm, very low cobble content ≤100 mm. Abrupt contact.	Head gravels/weathered bedrock.	2.80-3.70	29.82	
10405	Mid grey SILT interbedded with reddish brown sandy clay and rare sub-angular medium. to coarse siltstone.	Head. Or possibly band within bedrock.	3.70-	28.92	

Site Code: 236063	**Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI**	**Test Pit ID: TP105**
Coordinates (NGR) X:	**Coordinates (NGR) Y:**	**Level (top): 32.76m OD**
Length: 4 m	**Width: 0.70 m**	**Depth: 3.20 m**

Context Number	**Description**	**Interpretation**	**Depth m bgl**	**Depth m OD**	**Samples**
10500	Soft dark grey brown sandy silty CLAY. Sand is fine to coarse. Frequent fine roots and rootlets. No clasts. Abrupt contact.	Modern soil profile. Ploughsoil.	0-0.35	32.76	
10501	Mid reddish brown silty CLAY. No clasts. Diffuse contact.	Alluvium/colluvium.	0.35-0.90	32.41	
10502	Mid reddish brown clayey SILT. No clasts. From 1.60 m bgl pockets of reddish brown silty CLAY. Abrupt contact.	Alluvium	0.90-1.80	31.86	
10503	Mid grey tending reddish brown slightly clayey silty gravelly fine to coarse SAND. Gravel is abundant angular to sub-angular fine to coarse mudstone and siltstone ≤60 mm. Sharp contact	Coarse grained alluvium/ sand and gravels.	1.80-2.50	30.96	
10504	Weathered light grey mudstone.	Weathered bedrock. Possibly head deposit	2.50-2.70	30.26	
10505	Weathered grey siltstone recovered as fine to coarse angular gravel ≤60 mm with low cobble content ≤180 mm.	Bedrock geology. Either Radcliffe or Gunthorpe member.	2.70-	30.06	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP106
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 35.34m OD
Length: 3.40 m	Width: 0.70 m	Depth: 4.10 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
10600	Soft dark grey brown silty clay. Bioturbated. No clasts. Abrupt contact.	Modern soil profile. Ploughsoil.	0-0.30	35.34	
10601	Soft mid reddish brown clayey SILT. Extremely rare rounded medium to coarse chert ≤60mm. Diffuse contact.	Alluvium/colluvium.	0.30-1.10	35.04	
10602	Soft dark reddish brown mottled and speckled orangish brown very silty CLAY. Abrupt contact.	Alluvium.	1.10-1.60	34.24	
10603	Firm mid grey tending to reddish brown slightly gravelly silty CLAY. Rare partings of grey fine sand. Gravel is sparse extremely weak angular fine to medium sandstone ≤20 mm. Abrupt contact.	Alluvium.	1.60-2.10	33.74	
10604	Brownish red speckled grey silty gravelly fine to medium SAND. Gravel is abundant angular to sub-angular fine to coarse extremely weak sandstone ≤60 mm with medium cobble content ≤100 mm. Abrupt contact.	Coarse grained alluvium? More of a sand layer. Possibly Head.	2.10-2.80	33.24	
10605	Firm to stiff mid reddish brown fissured gravelly silty CLAY. Gravel is super abundant angular fine to coarse mudstone ≤60 mm. Possibly interbedded. From 3.20 m bgl, lenses of light grey silt. Diffuse contact.	Head. Weathered bedrock.	2.80-3.60	32.54	
10606	Soft reddish brown clayey sandy silty GRAVEL. Sand is fine to coarse. Gravel is super abundant to near complete angular fine to coarse mudstone ≤60 mm. Low cobble content ≤100 mm.	Head/weathered bedrock.	3.60-	31.74	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP201
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 32.81m OD
Length: 4.50 m	Width: 0.60 m	Depth: 3.80 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20100	Concrete slab. No rebar. Sharp contact	concrete surface. probably a barn floor.	0-0.10	32.81	
20101	Loose black ashy fine to coarse gravelly sand. Gravel is abundant fine to medium chert ≤20 mm. Sharp contact.	Made ground. Probably levelling layer under concrete slab.	0.10-0.30	32.71	
20102	Mid reddish brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is rare fine angular mudstone ≤10 mm. Abrupt contact.	alluvium/colluvium	0.30-2.00	32.51	
20103	Light brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is sparse angular fine mudstone. Abrupt contact.	Alluvium	2.00-2.50	30.81	
20104	Light brown gravelly SAND with clay pockets. Sand is fine to coarse. Gravel is common angular fine to medium mudstone and siltstone ≤20 mm.	Head/weathered natural.	2.50-	30.31	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP202
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 32.8m OD
Length: 3.70 m	Width: 1.20 m	Depth: 1.20 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20200	Soft dark grey brown slightly sandy silty CLAY. sand is fine to coarse. Very common cobbles of brick fragments and whole bricks, Angular cobbles and boulders of concrete. Fragments of plastic, metal, wood. Sharp contact.	Made ground.	0-1.10	32.8	
20201	Soft mid reddish brown clayey SILT. no clasts. no obvious laminations.	Alluvium/colluvium.	1.10-	31.7	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP203
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 32.18m OD
Length: 3 m	Width: 0.70 m	Depth: 3.60 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20300	Soft dark grey brown sandy gravelly CLAY. Sand is fine to coarse. Contains brick, plastic, concrete, paving slabs, wood, metal, glass, carpet and modern ceramic fragments. Sharp contact.	Made ground.	0-0.80	32.18	
20301	Mid reddish brown soft silty clay. no clasts. Abrupt contact. From 1.60 m bgl becomes slightly sandy and light grey brown.	Alluvium	0.80-1.90	31.38	
20302	Mid reddish brown mottled grey soft to firm very sandy gravelly CLAY. Sand is fine to coarse. Lenses of mid reddish brown gravelly clay. Gravel is abundant angular to sub-rounded fine to coarse extremely weak to medium strong sandstone ≤60 mm. From 3.30 m bgl becomes grey with rare sandstone cobbles.	Coarse grained alluvium.	1.90-	30.28	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP204
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 32.62m OD
Length: 3.70 m	Width: 0.60 m	Depth: 3.60 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20400	Soft dark grey brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to rounded fine to coarse flint ≤60mm. brick fragments, concrete, plastic, metal, glass, wood. Boulder sized concrete partial slabs at 0.20m bgl. Sharp contact.	Made ground.	0-0.30	32.62	
20401	Soft (friable) light reddish brown clayey silt. Diffuse contact. No clasts.	colluvium/alluvium	0.30-0.90	32.32	
20402	Soft mid reddish brown silty CLAY with rare black fine organic fragments. Abrupt contact.	alluvium	0.90-2.00	31.72	

20403	Light reddish brownish grey silty gravelly fine to coarse SAND. Gravel is common fine to coarse angular to sub-angular extremely weak sandstone and siltstone ≤60 mm. From 2.50 m bgl becomes brownish red. Clay lenses from 2.70 -3.00 m bgl. From 3.20-3.60 m bgl with medium strong sandstone and siltstone.	Head. Possibly weathered Gunthorpe member.	2.00-	30.62	

Site Code: 236063	**Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI**	**Test Pit ID: TP205**
Coordinates (NGR) X:	**Coordinates (NGR) Y:**	**Level (top): 32.98m OD**
Length: 2.70 m	**Width: 0.70 m**	**Depth: 3.45 m**

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20500	Dark grey brown soft sandy clay. Rare brick fragments. Rare sub-rounded fine to coarse flint ≤50 mm. very rare plastic and wood fragments. Abrupt contact.	Made ground	0-0.30	32.98	
20501	Soft mid reddish brown clayey SILT. No clasts. Sharp contact.	Alluvium.	0.30-1.80	32.68	
20502	Light grey mottled brownish red clayey silty gravelly fine to coarse SAND. Lenses of light grey gravelly sandy clay. Gravel is abundant angular to sub-angular fine to coarse weak to medium strong sandstone ≤60 mm with low angular cobble content ≤120 mm. Poorly sorted. Structureless. From 2.70 m bgl clasts become sub-rounded and extremely rare rounded coarse flint ≤60 mm. From 3.00 m bgl becoming brownish red with rare medium rounded quartzite ≤20 mm. Lenses of clay are extremely closely fissured. Tabular cobbles of medium strong sandstone. Abrupt contact.	Alluvium. More coarse grained material. Possibly Pleistocene sands or head material.	1.80-3.30	31.18	
20503	Stiff reddish brown speckled black slightly gravelly CLAY. Gravel is moderate fine medium, rarely coarse sub-angular to rounded sandstone and flint ≤60 mm. Extremely closely fissured.	Head. Possibly weathered natural?	3.30-	29.68	

Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP206
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 32.89m OD
Length: 2.70 m	Width: 0.70 m	Depth: 3.20 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20600	Soft dark grey brown and black slightly sandy gravelly silty CLAY. Gravel is angular concrete cobbles and bricks. Abrupt contact.	Made ground.	0-0.25	32.89	
20601	Soft mid reddish brown very silty CLAY. No clasts. Abrupt contact.	Alluvium.	0.25-1.40	32.64	
20602	Light grey tending to mid reddish brown slightly clayey gravelly silty fine to coarse SAND. Gravel is abundant angular to sub-angular fine to coarse extremely weak to medium strong sandstone with low cobble content ≤100 mm. Becomes reddish brown 1.80 m bgl. From 2.50 m bgl lenses of mid reddish brown slightly gravelly sandy CLAY.	Coarse grained alluvium.	1.40-	31.59	

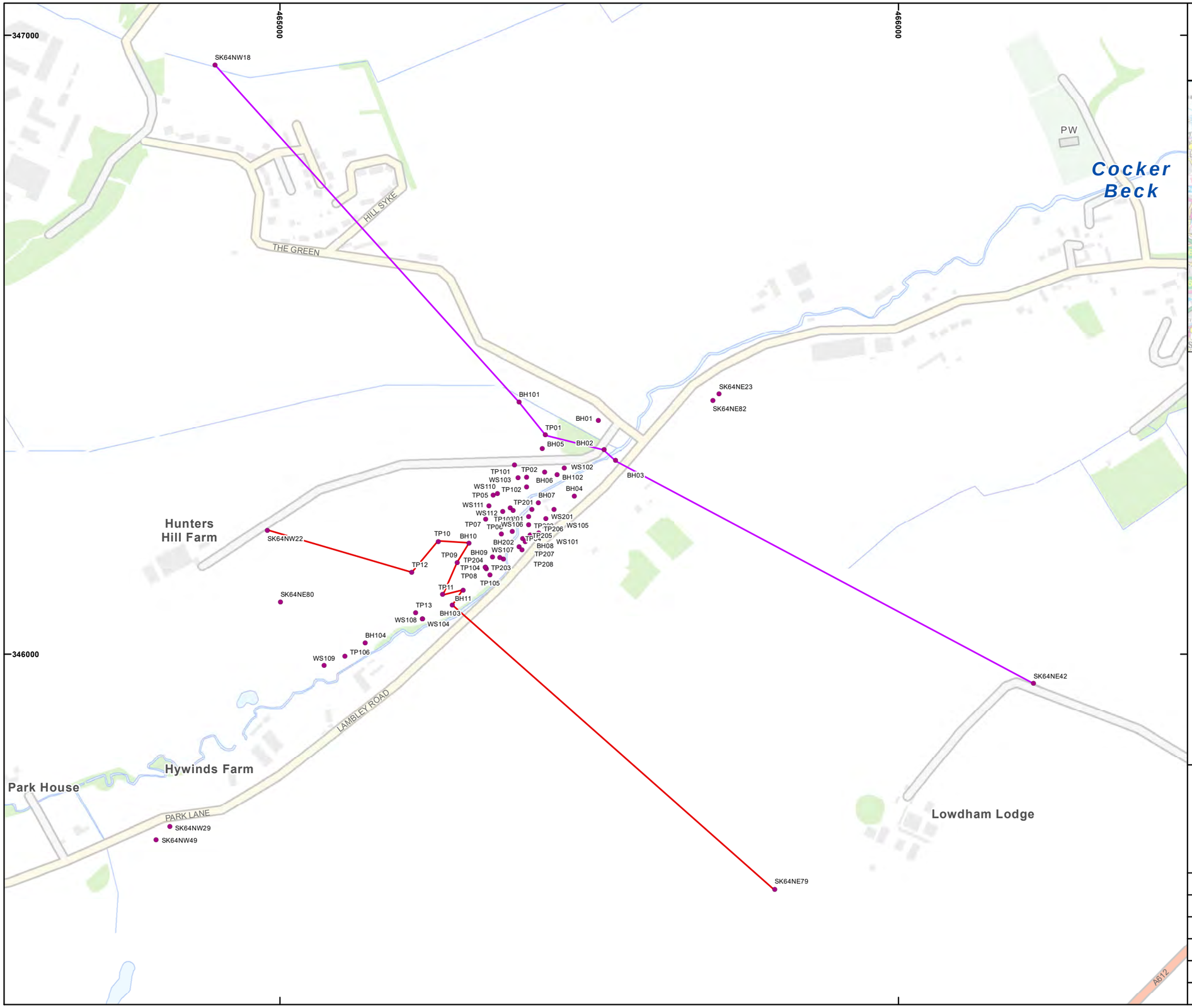
Site Code: 236063	Site Name: Lowdham 1-Cocker Beck Flood Alleviation Scheme GI	Test Pit ID: TP207
Coordinates (NGR) X:	Coordinates (NGR) Y:	Level (top): 33.11m OD
Length: 2.60 m	Width: 0.70 m	Depth: 2.50 m

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20700	Soft dark grey brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is brick, plastic, ceramic, glass and metal fragments. Sharp contact	Made ground	0-0.25	33.11	
20701	Firm mid reddish brown slightly gravelly CLAY. Gravel is rare angular coarse brick fragments. Sharp contact.	Made ground. Redeposited natural used as capping for dumped material beneath.	0.25-0.60	32.86	
20702	Soft blackish brown gravelly clayey fine to coarse SAND. Gravel is brick, wood, glass, tile, tyres, metal, ropes, fabrics, ceramics, skateboard, potential asbestos containing material. Strong organic odour. Sharp contact	Made ground. Dump of modern rubbish.	0.60-2.30	32.51	

20703	Soft mid reddish brown slightly sandy CLAY. Hard to describe as contaminated by collapsing made ground.	Alluvium	2.30-	30.81	

Site Code: **236063**	**Site Name:** **Lowdham 1-Cocker Beck Flood Alleviation Scheme GI**	**Test Pit ID:** **TP208**
Coordinates (NGR) X:	**Coordinates (NGR) Y:**	**Level (top):** **33.12m OD**
Length: **2.50 m**	**Width:** **0.65 m**	**Depth:** **3.50 m**

Context Number	Description	Interpretation	Depth m bgl	Depth m OD	Samples
20800	Soft dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is sparse angular brick, wood and flint ≤60 mm. Abrupt contact.	Made ground.	0-0.25	33.12	
20801	Firm mid reddish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rare angular cobbles of brick and rare sub-angular fine to coarse mudstone ≤60 mm. Very rare modern ceramic fragments Abrupt contact. From 0.65-1.00 m becomes dark brown	Made ground	0.25-1.00	32.87	
20802	Mid reddish brown soft - friable slightly sandy SILT. Sand is fine. Very rare fine black organic fragments. No clasts. Diffuse contact.	Alluvium.	1.00-1.90	32.12	
20803	Soft - friable mid reddish brown very silty CLAY. Very rare fine organic fragments. No clasts. Abrupt contact. From 2.40 m bgl becomes sandy.	Alluvium.	1.90-2.50	31.22	
20804	Soft mid reddish brown sandy gravelly CLAY. Pockets of grey fine to coarse sand. Gravel is very common extremely weak to medium strong angular to sub-rounded fine to coarse sandstone ≤60 mm. Clay is extremely closely to very closely fissured. From 3.00 m bgl becomes firm, gravel becomes finer and sparse. Very rare very fine ironstone fragments.	Coarse grained alluvium. Possibly weathered top of natural.	2.50-	30.22	

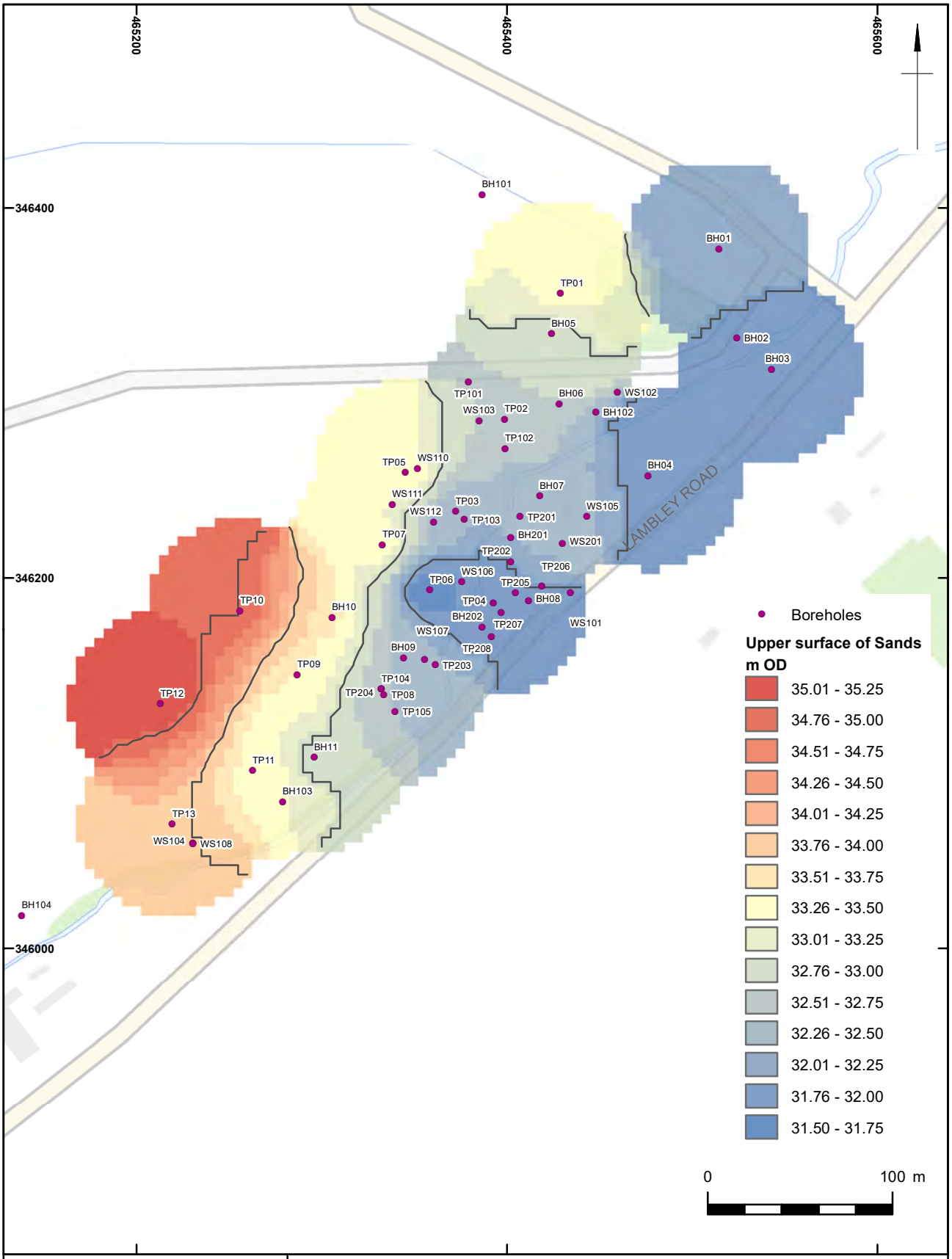


Coordinate system: OSGB36

Date:	25/03/2022
Revision Number:	0
Scale:	1:6,250 at A3
Illustrator:	KJF
Path:	X:\Projects\236063\GIS\
FigsMXD\Geoarch\2022_03_24	

Site location

Figure 1



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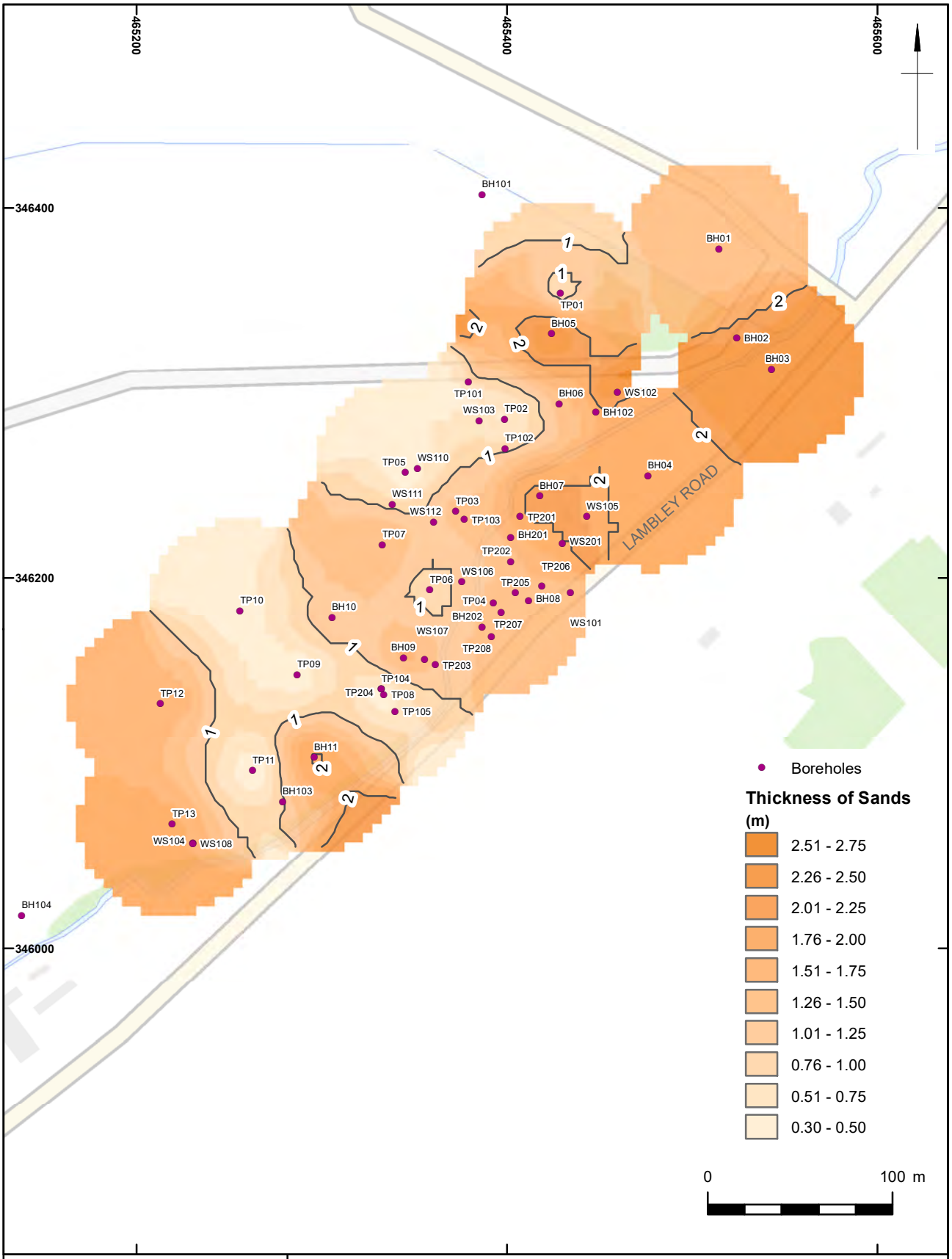
Scale:	1:3,000 at A4	Illustrator:	RP/KJF
Path:	X:\PROJECTS\236063\GIS\FigsMXD\2022_3_16		

Surface of Sands

Figure 2



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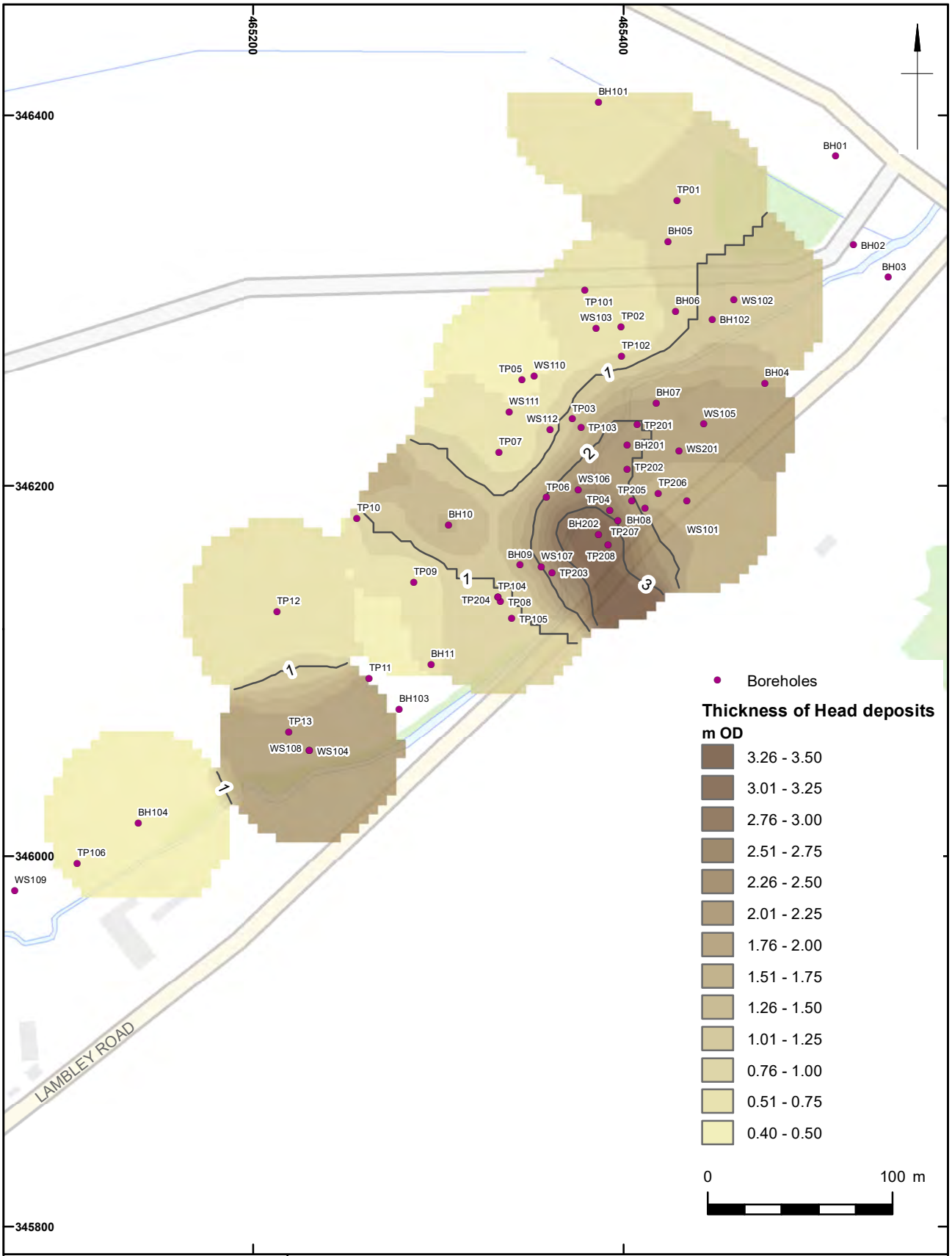
Scale:	1:3,000 at A4	Illustrator:	RP/KJF
Path:	X:\PROJECTS\236063\GIS\FigsMXD\2022_3_16		

Thickness of Sands

Figure 3



Coordinate system: OSGB36

Date:	25/03/2022	Revision Number:	0
Scale:	1:3,000 at A4	Illustrator:	RP/KJF
Path:	X:\PROJECTS\236063\GIS\FigsMXD\2022_3_16		

Thickness of Head deposits

Figure 4

North west

South east

SK64NW22

SK64NE79

Approximate extent of Quaternary deposits

TP12 TP10 BH10 TP09 TP11 BH11 BH103

Depth (m OD)

64.0 60.0 56.0 52.0 48.0 44.0 40.0 36.0 32.0 28.0 24.0 20.0

0 100 200 300 400 500 600 700 800 900 1,000 1,100 1,200

Distance (m)

Stratigraphy Index

- Made Ground
- Topsoil
- Colluvium
- Sands
- Alluvium
- Coarse Grained Alluvium
- Head
- Bedrock

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Transect A

Figure 5

North west

South east

Depth (m OD)

72.0
68.0
64.0
60.0
56.0
52.0
48.0
44.0
40.0
36.0
32.0
28.0
24.0
20.0
16.0

SK64NW18

SK64NE42

Approximate extent of Quaternary deposits

BH101

TP01

BH02

BH03

Stratigraphy Index

- Made Ground
- Topsoil
- Colluvium
- Sands
- Alluvium
- Coarse Grained Alluvium
- Head
- Bedrock

Metres

0
200
400
600
800
1,000
1,200
1,400
1,600

Metres

Date:	25/03/2022	Revision Number:	0
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Transect B

Figure 6

Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www. wessexarch.co.uk

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