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Deposit Model

Cambridge County Council

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CAMBRIDGE SOUTHEAST TRANSPORT

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Executive Summary

The *Cambridge South East Transport Deposit Model* presents a desk-based geoarchaeological assessment of the proposed 8.5 km public transport route extending from the Cambridge Biomedical Campus to a new travel hub southeast of Babraham, South Cambridgeshire. The study focuses on understanding the subsurface stratigraphy and archaeological potential of the landscape, particularly where the route intersects the River Granta.

The report synthesises data from the Tetra Tech geotechnical investigations completed in 2022 to construct a deposit model that characterises the stratigraphy across four transects. These transects span both river crossings and the intervening landscape, revealing sequences of bedrock, river terraces, alluvium, and made ground.

Key findings highlight the presence of three distinct river terraces, with potential for Pleistocene and early Holocene archaeology and geoarchaeological deposits, particularly in the downstream valley where peat and organic-rich alluvium suggest high preservation potential for paleoenvironmental remains. The upstream valley also contains these deposits, however there is considered to be lower geoarchaeological potential due to modern landscape modifications.

The model identifies discrepancies between British Geological Survey (BGS) mapping and field data, suggesting the need for refined mapping and further targeted geoarchaeological evaluation. The report concludes with recommendations for additional boreholes, paleoenvironmental sampling, and scientific dating to better understand the formation processes and archaeological significance of the deposits.

1. Background

1.1 Project

The Scheme comprises an 8.5 km long segregated public transport route from Cambridge Biomedical Campus to a new travel hub south east of Babraham village, South Cambridgeshire, the full extent of the Scheme is shown in Figure 1-1.

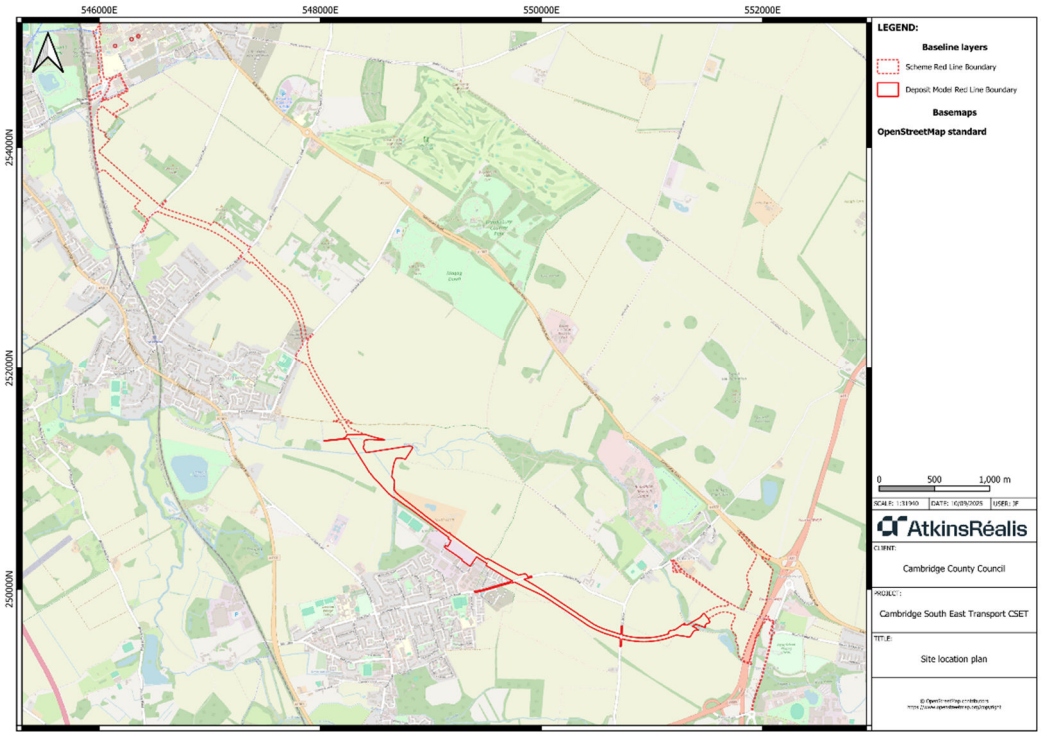

Figure 1-1 - Scheme location

1.2 Rationale

The Scheme crosses the River Granta in two locations at the northern end (TL 48457 51143) and at the southern point (TL 50648 50521).

Rivers, and river valleys are associated with human activity, and have been utilised as a resource for hunting and fishing, as well as providing an attractive environment for settlement and agriculture, and a key routeway through the landscape. River terrace deposits, as present here are noted as locations which have high potential for archaeology. In addition, the alluvium and peat deposits, both of which are recorded in the landscape around the River Granta have high potential for preserving archaeology, in particular organic archaeology, and paleoenvironmental remains.

As such there is a high likelihood of archaeology from the Palaeolithic, through to the Modern period to be preserved within the surrounding landscape.

This deposit model aims to consolidate the understanding of the superficial geology across the Scheme by reviewing the available information online, and in the geotechnical investigation (GI) completed in 2022 by Tetra Tech for the Cambridge South East Transport Scheme (CSET), hereafter referred to as the Scheme.

2. Aims and Objectives

2.1 Aims

The general aims (or purpose) of the deposit model follows the standards and guidance for desk-based research as set out in the CIfA Standards and guidance for historic environment desk-based research (2014) and English Heritage Guidance on Deposit Models in Archaeology (Historic England 2020):

They are to:

- determine, as far as is reasonably possible the nature, extent and significance of the deposits, and their stratigraphic relationships within a specified area
- provide information about the geoarchaeological potential of the specified area;
- consider the possible significance of any geoarchaeological evidence present, or potentially present, in the context of national and regional research priorities and agendas, and
- inform either the scope and nature of any further archaeological and geoarchaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource).

2.2 Objectives

The overarching objectives of this document are to:

- Create a basic deposit model of the data from the GI data in order to map the extent, thickness and depth of superficial deposits at the point the Scheme crosses the River Granta;
- Interpret the probable environments represented;
- Determine the palaeoenvironmental potential and relative chronology of any appropriate deposits;
- Determine the importance of the deposits with regard to their archaeological and geoarchaeological (including palaeoenvironmental) potential; and
- Make specific recommendations for further work, where appropriate, which may include additional purposive geoarchaeological boreholes, palaeoenvironmental analysis and/or scientific dating.

3. Baseline Data

3.1 Location

The overall Scheme is linear and runs from the Cambridge Biomedical Campus, in the South Cambridge District to the A11 at Babraham and Little Abington, South Cambridgeshire District.

The specific area discussed in this deposit model is the points at which the Scheme crosses the valley of the River Granta and the land between the valleys, the Scheme boundary can be seen in Figure 3-1.

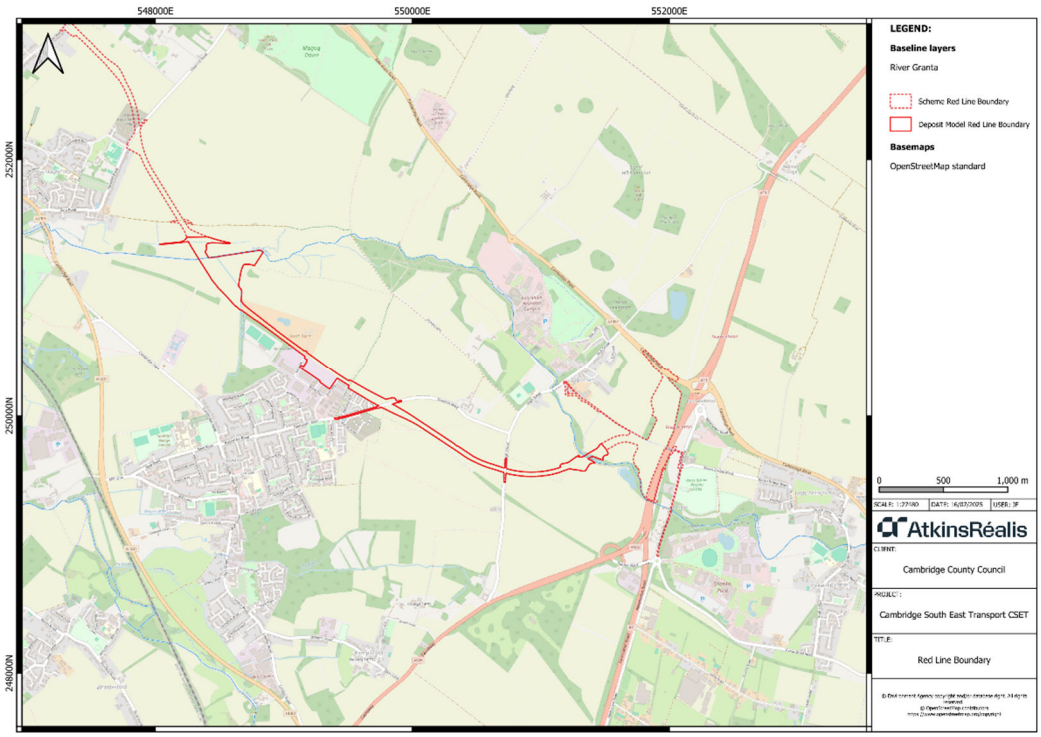

Figure 3-1 - Scheme boundary

3.2 Geology

Solid geology across the whole Scheme consists of various Chalk members (West Melbury Marly Chalk Formation, Zig Zag Chalk Formation – Chalk and Holywell Nodular Chalk Formation – Chalk).

Over the River Granta, the Scheme crosses 1st , 2nd and 3rd Holocene era River Terrace Gravels (12,000 BCE to present day) and Alluvium. Of these three river terraces, two are thought to have formed within the Holocene (River Terraces 1 and 2), whereas the 3rd River Terrace is recorded as forming in the Quaternary period and therefore is potentially older.

River Terrace Gravels are frequently associated with rich archaeological landscapes, in particular early prehistoric (Palaeolithic and Mesolithic) activity.

Alluvium is associated with high potential for preserved ecofacts and organic material.

The Gog Magog Hills are capped with gravel deposited by ancient river systems during the Anglian glaciation (478,000 to 424,000 years ago) and are the oldest Pleistocene sediments in Cambridgeshire.

3.3 Topography

The Scheme considers the area of the north-western valley of the River Granta crossed by the overall Scheme. The land here slopes down from the Gog Magog Hills, with the start of the Scheme being 19m AOD, it drops slightly to ~18m AOD before rising again to cross an area of higher land which increases in height up to 35m AOD at the southern edge of the area of land. The Scheme then drops down again into the south-eastern valley to approximately 30m AOD. The topographic relief of the Scheme is shown in Figure 3-2.

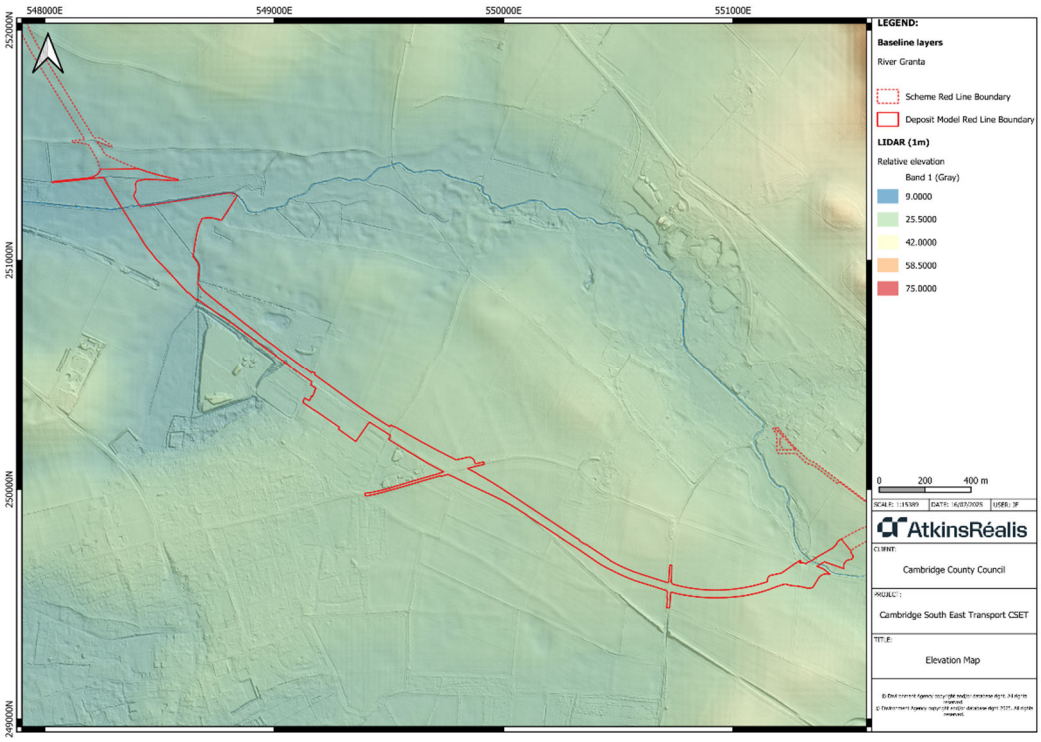

Figure 3-2 - DEM of the Scheme area (1m lidar)

Figure 3-2 also shows the river widening out from the south-eastern (upstream) valley with the valley here being 190m wide, to 1.3km wide in the north-western (downstream) portion of the valley. The Lidar imagery also picks out the flood plain within the downstream valley and the presence of paleochannels, whilst also highlighting the field systems crossing the higher area of land between the sections of the valley.

3.4 Archaeological Background

For a full review of the findings of the archaeological evaluation undertaken for this Scheme please see Oxford Archaeology East (2021) *Cambridge South-East Transport Project Phase 2, Archaeological Evaluation Report*. OAE Report 2506.

3.4.1 Palaeolithic

Within the Scheme red line area, south of Sawston Road, a small flake was found in 1945 that was originally believed to be a Levallois flake, but since considered to be later prehistoric rather than Palaeolithic (CHER 0323, on 1st to 2nd River Terrace Gravels). Close to the Scheme red line at the proposed junction with the A11, a Palaeolithic hand axe (CHER 11317B) was recovered during fieldwalking at Bourn Bridge, in 1993 (again, this site was on 1st to 2nd River Terrace Gravels). In 1st -2nd river terrace gravels at Hinxton further south along the River Granta, outside of the Study Area, a Late Upper Palaeolithic lithic scatter was excavated, that had been preserved within a natural hollow (OA 2019).

3.4.2 Mesolithic

Trial trenching associated with the CSET Scheme recovered two flint flakes dating from the Mesolithic/early Neolithic within a pit fill to the south of Babraham (MCB31481, Field 14, Trench 108). Further flint scatters were also present within the study area; for example, adjacent to Nine Wells LNR, flints dating from the Mesolithic to early Neolithic period have been recorded (CHER MCB24762-3). At the eastern end of the study area, at Bourn Bridge, evidence of Mesolithic-Neolithic activity (CHER 11317) suggests the presence of a possible settlement; other flint flakes and a blade (of this date) have been found in the Bourn Bridge area, but these were unstratified (CHER CB14748). A single prismatic blade flake was found within a pit during excavations of features at Babraham Road, Sawston (CHER MCB27477).

3.4.3 Neolithic

Within the study area there are two causewayed enclosures, both of which are scheduled. The causewayed enclosure at Little Trees (1011717) dates to the earlier Neolithic, the second causewayed enclosure is at Great Shelford (1452825). Both are outside of the Scheme but overlook it.

Within the Study Area Neolithic activity has largely been identified through flint scatters. There are three of these within the Scheme red line (MCB24763, 04886, 04893, see below).

Flint scatters are abundant throughout the Scheme and study area, particularly within the gravel terraces that follow the river.

3.4.4 Bronze Age

A possible rectilinear/D shaped enclosure was identified within Field 13 at Babraham, during the evaluations carried out for this Scheme. These D shaped enclosures are a type that forms a distinctive component of the local settlement geography and contemporary land divisions were observed nearby within Field 14 (CHER 09353).

Finds within the west of the study area demonstrate a long period of occupation within the landscape. Further indication of activity during the prehistoric period within this area is evidenced by a flint working site at Babraham Hall (MCB17433) dated to between the Early Neolithic and Late Bronze Age. Bronze Age pottery was recovered from features in Fields 13-4 (CHER MCB31480 and CHER MCB31481).

Worked flint was identified surrounding former river channels where river terrace gravels were utilised as a source of material, with potential for burnt mounds near watercourses and wetland.

3.4.5 Iron Age

Close to the River Granta just south of Stapleford, middle Iron Age settlement features were identified on the terrace gravels (CHER MCB 31477 and MCB27669) on both sides of the river. Archaeological fieldwork identified evidence of activity dating to this period in the form of a pond or watering hole (7315, Trench 73) containing a large quantity of Middle Iron Age pottery, with five sherds of early Roman pottery also being identified. This evidence is indicative of sustained localised settlement presence at this location on the gravel terraces of the River Granta (MM391). To the south of the River Granta, trial trenching associated with the CSET Scheme also identified pottery dating from the Late Bronze Age through to the Middle Iron Age within a pit fill (7505, Trench 75). Quantities of fragmentary animal bone were also recovered from the same location. It is possible that this evidence is indicative of settlement on either side of the River Granta, however, it is not clear as to whether this settlement was permanent in nature or utilised seasonally.

A double ditched enclosure system of some complexity was identified at Babraham (Field 14, CHER 09353) during geophysical survey, which were not dated during subsequent fieldwork. Iron Age artefacts were found during the excavation of the Roman quarrying site of Field 15 at Babraham and in Field 16, and large Late Iron Age/Roman field systems have been identified at Bourn Bridge (CHER 11317C).

3.4.6 Romano-British

Within the flood plain of the River Granta at Stapleford, there is evidence of activity from this period, through recovered sherds of pottery from both subsoil and ditch fill deposits to the north of the River Granta (Trenches 72 and 73), indicating a continuation in settlement activity from the Iron Age to Roman period (MCB31477). Sherds, along with fragment of Roman brick, were also identified to the south of the River Granta within Trenches 172, 75,180, 182 and 184 within and near to an area of cropmarks previously recorded at this location (MCB27669) . These are likely to be contemporary features. It is possible that this area south of the river was an area of settlement or landscape drainage activity during the period.

To the east of High Street, the CSET Scheme crosses an open field to the south of the watercourse through an area of cropmarks that were targeted by archaeological evaluation carried out as part of the CSET Scheme (MCB31481). The trial trenching identified a series of ditches within Trenches 168 and 169, that correspond with the possible Roman D-shaped enclosure complex and associated ditches of CHER 09353. The dating of this complex has not been confirmed by evaluation; the regularity in layout of the enclosures may suggest a Roman date which fits with the broader landscape framing of the area as densely occupied during this period. However, the enclosure may also have its origins in the Late Iron Age.

Roman quarry activity was also discovered to the north of the River Granta at Babraham during archaeological evaluation trial trenching associated with the CSET Scheme (MCB31482). These quarry pits were dated through recovered sherds of Roman pottery from within pit fill located in Trench 110. A large quantity of Roman pottery (68 sherds) was also recovered from a ditch fill within Trench 113. This large assemblage, indicative of occupation, is roughly contemporary with Roman activity identified elsewhere surrounding the River Granta and from previous excavations at the Babraham Institute. It may also represent peripheral activity to the ditched enclosure/rectilinear enclosures (MCB31482) to the north.

3.4.7 Early Medieval

Early medieval activity within the study area to the north of Stapleford is represented by a burial site/cemetery (08211), where a group of skeletons was found in the 18th century. A further Anglo-Saxon skeleton was found nearby in the early 20th century, during the construction of a house at the edge of the Fox Hill development (08193). Evidence for activity within this period was also identified during test pitting as part of a community dig within Stapleford village between 2013 and 2017 which suggests that this period saw the settlement of a village at Stapleford, though it was not consolidated until the Norman period.

Archaeological evaluation undertaken to the east of High Street, as part of the CSET Scheme to the north of the proposed route, identified evidence for early medieval activity to the south of Babraham, in the form of a possible Anglo-Saxon cemetery. Located on higher ground overlooking the River Granta at Babraham

3.4.8 Medieval

Babraham, to the north of the CSET Scheme, is recorded as a large settlement by the Domesday Survey (1086). Although there is limited CHER evidence for medieval activity within the eastern end of the study area, medieval horseshoes and horse bells (04330) and a medieval quern (grinding stone) (04761) were identified within the north-east of the study area within the environs of the River Granta.

3.4.9 Post Medieval

The predominantly rural and agricultural nature of the study area in the 19th century is illustrated on historic mapping. Mapping dating to 1812 records the area up to the River Granta and shows that this area was also dominated by land parcels attributed to different owners and planned for enclosure at this time.

The 1851 map of the Parish of Babraham records that the land use within the study area was a mixture of arable, grass and woodland at this time. Mapping from 1885 also indicates that the land use of the surrounding area was agricultural.

At Babraham the River was utilised, with weirs and a potentially formally metalled surface on the north bank with the brick inclusions potentially reused from earlier structures (Regan 1995 7). The channel has in sections been canalised and efforts made to stabilise the banks with the addition of material, though it is also possible that the hardened surface represents a compaction of the surface (Regan 1995 8).

4. Methodology

4.1 Data Sources

The following sources of data were consulted during preparation of this assessment:

- British Geological Survey (BGS): Online digital solid and superficial geological data and historic borehole records (Map viewers - British Geological Survey);
- National Library of Scotland Mapping (Georeferenced Maps viewer - Map images - National Library of Scotland);
- Lidar data (Environment Agency) ;
- Geotechnical Investigation (Tetra Tech 2022);
- Geophysical Investigation (Magnitude Surveys 2020); and
- Evaluation Trenching Report (Oxford Archaeology 2021).

4.2 Methods and software

The geotechnical investigation data from the 2022 Tetra Tech survey is stored and managed with Open Ground Software. This software allows for the interrogation of logs, in order to create transects and sections. The transects were subjected to lithological assessment by an AtkinsRéalis Archaeological Consultant.

The data was also imported into QGIS, where it was assessed against the available lidar data. QGIS was also used to generate maps.

Forty-eight survey interventions were assessed within this report, including 20 rotary cored boreholes, 26 test pits and two window sampling rig boreholes. A full gazetteer of the survey interventions used to inform this deposit model can be found in appendix C.

The interventions and transects were selected as they provided sufficient information to address the aims and objectives of this report.

4.3 Limitations

The survey data used to inform this deposit model, produce the transects and characterise the deposits was undertaken for a geotechnical survey. No archaeological input in the form of a watching brief, or review at the time of fieldwork was included in the survey. As such, the reporting conforms to the geotechnical standards, with key deposits such as river terrace deposits described as largely undifferentiated within the AGS data available for this report. Further detail was provided within the geotechnical report and was subjected to critical examination by a geoarchaeologist in order to review the geoarchaeological and archaeological potential. However, the absence of a geoarchaeologist at the time of field recording does negatively impact upon the archaeological confidence of the dataset. Key concerns include the potential lack of recognition of archaeological deposits encountered in the GI interventions, and the nature of the term ‘Made Ground’, which does not differentiate between modern deposit and those of archaeological interest.

5. Results

5.1 Introduction

The Scheme crosses the River Granta twice. At both locations river terraces deposits and alluvium are noted. Between the two points the geotechnical survey variously shows alluvial deposits, peat deposits and organic inclusions. Some deposits labelled as made ground can also be interpreted as re-worked gravels that have been redeposited through historic land use across the landscape or that are potentially associated with paleochannels or other riverine features. These deposits typically contain gravels of similar description to the upper terrace though with other components such as coal, ash and brick (i.e. BH-PTR-42), or otherwise gravels within topsoil deposits (i.e. BH-OBC-07).

Four transects have been created which allow for the areas to be characterised (section 5) and discussed (section 6). The maps showing the locations of the transects can be seen in appendix A, the transect drawings can be found in appendix B.

The overall deposit sequence across the Scheme comprises bedrock geology, overlain with river terrace deposits, overlain with alluvium, overlain with made ground (described variously as made ground or topsoil).

5.2 Transects

5.2.1 Transect one

Transect one includes eight boreholes and covers the northerly points at which the Scheme crosses the valley of the River Granta. These boreholes were selected as they can provide information as to deposits across the valley in this location and can support the characterisation of the river system here, alongside transect two.

5.2.2 Transect two

Transect two includes five test pits on a E-W alignment within the valley of the River Granta. They were selected as they targeted the landscape immediately adjacent to the river and could provide information as to the nature and extent of the deposits, and the stratigraphic relationship between these deposits. This transect provides the ability to make a statement on archaeological and geoarchaeological potential.

5.2.3 Transect three

Transect three comprises 20 test pits and four boreholes. It covers the area from the northern point at which the Scheme crosses the river Granta (transects one and two), to the southerly point at which the Scheme crosses the river (transect four).

These boreholes were selected as they can provide information as to deposits across the higher area of land between the two valleys in this location and can support characterisation of the sediments, and the processes of deposition across the area.

5.2.4 Transect four

This transect, which comprises data from 10 boreholes coveromg the area of the southern point at which the Scheme crosses the river Granta. These boreholes were selected as they can provide information as to deposits across the valley in this location and can support the characterisation of the river system here.

A summary of the transects, their location and GI data used to inform them can be found below in table 5-1.

Table	Location	Length	TPs	BH
1	Across the profile of the downstream valley	0.4km		8
2	Within downstream valley	0.3km	5	
3	Across the landscape between transects 1 and 4	2.9km	20	4
4	Across the profile of the upstream valley	0.25km	4	10

Table 5-1 - Transect summary table

5.3 Stratigraphy and lithology

The stratigraphic units identified in the geotechnical survey are:

- Bedrock
- River terrace deposits
- Alluvium
    - Peat
- Buried soils
- Made Ground

5.3.1 Bedrock

The bedrock across the western edge of the deposit model is predominantly the Zigzag chalk formation, however this transitions to Holywell Nodular Chalk formation towards the eastern extent of the study area.

5.3.2 River terrace deposits

River terrace deposits are present across 20 of the boreholes or test pits considered in this deposit model but are not recorded in every survey intervention. There are three distinct river terraces noted in the borehole, and test pit data. This accords with the description on the BGS website. These are not represented within the logged data available for this report which described and recorded all river terrace deposits with the same ID. However, the descriptions do clearly demonstrate the presence of three distinct lithological sequences.

BH-PTR-37 (18.61 AOD) for example records these three distinct deposits:

- 0.25m-1.20m (18.36-17.41 AOD) the deposit is defined by loose orangish brown, medium to coarse SAND with sub angular to sub-rounded fine flints,
- 1.20m to 4.00m (17.41- 14.61 AOD) the deposit is more varied, variously described as ‘Medium dense orange, with dark orange banding, very sandy clayey GRAVEL. Gravel is fine to medium with angular and sub-angular flint with some clay laminations or pockets but with a deposit (1.85m to 2.70m bgl) that is more greyish brown with sand medium to coarse, the deposit underlying this also comprises orange-stained chalk (likely iron oxide).
- 4.00m-5.85m (14.61 12.76 AOD) the deposit is described as ‘loose greyish brown with very gravelly fine to coarse SAND, gravel is angular and sub-rounded with fine to coarse flint and chalk. This deposit overlays the bedrock of Zig Zag Chalk.

BH-PTR-35 (18.41 AOD), to the north of BH-PTR-35 (18.61 AOD) also records this sequence, however within the test pits TP-BP-01 (18.20 AOD) through to 05 (18.35 AOD), only the upper sequence was reached and described.

A similar sequence is described in the southern valley where the elevation is greater, with BH-OBC-01 (Transect Four), taken at a height of 26.71 AOD, here the upper deposits are typically defined by larger sediment compositions with the upper deposit (26.31 AOD to 26.11 AOD) containing SAND and GRAVEL. The second terrace however is defined by smaller particles, with SAND being predominant from 26.11 AOD to 24.71 AOD. The lowest terrace (24.71 AOD to 23.27 AOD) is likewise defined by a higher component of gravel.

The upper terrace likely reflects the re-working of the post glacial sediments with the second sequence reflecting a change in river conditions, with the upstream valley (Transect Four) containing larger particles which were deposited sooner by the fluvial processes than at the downstream valley (Transect One). In addition, the downstream valley is wider than the upstream one, causing a difference in depositional environments.

The lowest terrace likely reflects another change in river conditions, which caused an increase in erosion and reworking of the bedrock. The bedrock in the downstream valley (Transect One) is Zig Zag Chalk whereas in the upstream valley (Transect Four) the bedrock is Holywell Nodular Chalk Formation.

The difference in the form and lithology of the gravels could reflect the different bedrocks between the two locations from which they derived. The BGS describes the Holywell Nodular Chalk as 'generally hard nodular chalks' whereas the Zig Zag Chalk formation is described as 'mostly firm'. The borehole data also indicates that the Holywell Nodular Chalk has a higher gravel content than the Zig Zag Chalk formation.

This would suggest that there was at the downstream location where the river interacts with the softer bedrock there was greater levels of erosion and with a broader range in sediment size (reflecting the greater range in derived material) than the terrace lithology at the upstream location where the bedrock is harder and with a higher gravel content, limiting the scale of potential erosion.

5.3.3 Alluvium

Alluvial deposits are recorded across the area considered in this deposit model, within 27 different boreholes or test pits. The logged data describes the alluvium as either cohesive or granular, reflective of the composition of the deposit. The cohesive deposits are primarily defined by higher clay component, compared to sand or gravel. This reflects depositional conditions and an indication or the environment at the time of deposition.

Within the downstream valley (Transect Two) there are alluvial deposits recorded in each test pit at various thicknesses. The thickest deposit is recorded in TP-BP-03 (17.46m AOD), which is also the test pit located at the lowest elevation within the valley. Here there is 1m of alluvium, recorded across three alluvial layers, with the upper one (17.16m AOD to 16.76m AOD) containing soft orange, brown mottled silty Clay with angular gravel and flint and shell fragments. This was overlain with a peat layer (16.76m AOD to 16.61m AOD), with a further Gravel alluvial layer underlaying the peat (16.61m AOD to 16.16m AOD). This alluvial layer is formed on top of River Terrace deposits.

Across the profile of the downstream valley (Transect One) alluvial deposits have formed on both sides of the river with the cohesive alluvium predominantly recorded, though more granular deposits are recorded to the northern bank. The thickest deposits are approximately 5m deep in BH-PTR-25 (18.32m AOD) with the deposit starting at 17.92m AOD before ending at the bedrock layer at 13.12m AOD. The alluvium is typically thinning out towards the east.

Within Transect Three, which covers the area between the two valleys, the deposit model clearly shows the elevation increasing, with being bedrock and made ground, however within two locations, the elevation decreases and alluvial deposits of up to 1m thickness are recorded within these depressed areas.

There are fewer alluvial deposits recorded in Transect Four, with only three of the nine logs looked at for this deposit model containing these deposits, the thickest deposit are in BH-OBC-08 (25.21m AOD). They start at 24.81m AOD below topsoil and extend some 0.70m to 21.81m AOD. and located south of the river.

5.3.3.1 Peat

Peat deposits are recorded in six interventions across Transects One, Two and Three, there are no recorded peat deposits present in Transect Four.

Within Transect One, two interventions recorded a peat deposit, BH-PTR-23B (18.30m AOD) and BH-PTR-27 (18.37m AOD) located at approximately 1.5m bgl in both locations with a maximum thickness of 20cm, and both within a sequence of alluvium . peat recovered from these boreholes was described as amorphous or slightly organic and alongside other sediment, BH-PTR-23B records peat within a deposit high in fine to medium grained sand with some silts and gravels, whereas BH-PTR-27 records peat within a deposit with angular gravels. BH-PTR-27 contains a further peat deposit (15.92-15.67m AOD, approximately 0.45m, below the upper one, separated by a clay alluvium layer. BH-PTR-27 records a relatively lower upper bedrock base than the logs taken adjacent to it, suggesting that the alluvium and peat deposit formed in a natural depression at the river edge.

Within Transect Two, located within the river valley, peat was observed in three test pits, TP-BP-01, TP-BP-02 in which the layer was between 17.30m to 17.20m AOD in both, and in TP-BP-03 which had a lightly thicker layer, (16.76 to 16.61m AOD). The deposits in TP-BH-01 and 02 overlay river terraces, whereas the peat layer in TP-BP-03 overlays an alluvial layer which overlays the river terraces. This peat, in contrast to the peat described in Transect One is pseudo-fibrous, retaining some recognisable plant structure. From TP-BP-01 to TP-BP-03 there is a 0.75m drop in elevation, with TP-BP-03 being the lowest at 17.46m AOD, which indicates that it may lie within the base of a paleochannel.

Within Transect Three, only one intervention contains peat, approximately 0.45m in thickness 17.69 to 17.24m AOD. This deposit is described at pseudo-fibrous ,however the reliability of the record is compromised by potential compression from deposits above and possible collapse of the deposit during the survey.

5.3.4 Buried soils

One record includes a comment on a potential buried land surface. BH-PTR-41, within Transect Three records an alluvial layer 0.20m thick alluvial layer at 17.98 AOD which was postulated by the survey team to be a relict land surface. It comprises Sand with low gravel and silt content and is described as having an organic odour with possible relict burrows. This deposit overlays layers of alluvium, typically with high slit or clay content and with pockets of organic material.

This deposit is overlain by a 0.02m thick orange, clayey sandy layer, which is overlain with 1.48m of sandy/gravelly clay, described in the GI report as made ground. The upper 0.35m of the borehole is described as Topsoil.

5.3.5 Topsoil

The topsoil, where recorded across the four transects is typically up to 0.40m thick and is defined by a high silt or sand content. It typically contains angular gravels with flints, and occasionally brick or concrete fragments.

Where the survey locations are adjacent to the two roads, Sawston Road and High Street, deposits containing material such as asphalt, brick and mortar are notable to depths of 2.35m.

6. Discussion

This model has allowed for characterisation of the subsurface stratigraphy at both locations at which the Scheme crosses the River Granta, and within the area of land between these two locations.

6.1 Characterising the deposits

The model indicates that within both valley locations there are three distinct river terraces. The BGS records that of these, one is Pleistocene, with the other two having formed in the Holocene period. No alluvial deposits are recorded between these terraces; however alluvial deposits are recorded throughout the Scheme. The nature of these would suggest that the river course has changed somewhat within the Holocene, but within a relatively enclosed valley space. The largest deposits of alluvium can be seen in the north-western/downstream valley, which is also wider, and at a lower elevation than the south-eastern, upstream one where the topography constrains the river channel to a greater degree.

In the downstream valley location, there are also greater amounts of peat recorded within the deposit sequence, with deposits at a higher elevation typically described as amorphous and within deposits also containing silts, clays and gravels, suggesting that they were at one time the margins of the river or paleochannels where water was slow moving and were potentially areas of static water or pools allowing the peat to form. These deposits were typically overlain with further alluvium indicating a change in water level or river position that led to more active deposition across the valley.

Peat was also recovered within the valley bottom, the deposit was semi-fibrous, suggesting potential for species identification, however no analysis of the species present has been undertaken. The alluvium overlaying this deposit was discontinuous suggesting spatial movement in the course of the river in the changes within the wider river channel as well as changes in fluvial energy at different periods casing changes in the manner of deposition.

There is relatively little alluvium formed in the upstream valley, and no peat. This is likely due to the more constrained valley at this location with less opportunity for deposits to remained waterlogged for peat to form. Though changes in the river course are still expected, this area has been subject to a greater degree of landscaping, with the channel altered and the banks potentially stabilised in order to utilise the river as a resource. This may have removed some deposits.

Across the area between the two valley locations, the ground is at a higher elevation. This is notable in the boreholes, with no river terrace deposits formed across this central area, and a typical deposit sequence of made ground overlaying bedrock. However, in two locations the elevation dips slightly, in which alluvium can be found. This is typical of floodplain deposits. Aerial imagery would support this, with the channels clearly showing paleochannels crossing this area. As demonstrated in the archaeological background, this area has been used for agriculture, and it is likely that some upper deposits may have been lost and eroded out, potentially contributing to the alluvial deposits in the valleys, though the Oxford Archaeology East report does not record any colluvium in the area under consideration. However, it is possible that thin or reworked colluvial deposits were under-recorded in test pits or within the GI.

Where alluvium is recorded it typically changes in description, indicating multiple episodes of deposition. The layers typically range from being minerogenic in description, to having a high organic content.

6.2 Analysis against BGS records.

The deposit model broadly supports the BGS Mapping of Superficial Deposits however some discrepancies between the mapped deposits and the finding of the survey are notable.

Within Transect One the survey locations fall within areas of mapped alluvium, however BH-PTR-35 and BH-PTR-37, do not record any alluvial deposits. All boreholes in Transect One, aside from BH-PTR-23B and BH-PTR-25 record river terrace deposits underlaying alluvium. This suggests that the alluvial layer is not as continuous as far south-east as indicated on the BGS maps, within the Scheme boundary.

The presence of alluvium within the area of higher elevation covered by Transect Three is not recorded on the BGS maps. TP-PTR-43 to TP-OBC-03A, and TP-OBC-08 to TP-OBC-10 in the transect show a lower area of elevation in contrast to the logs either side of it. Within these dips in elevation alluvium is recorded, in contrast to the Made Ground, bedrock sequence record adjacent. This indicates areas of alluvium likely formed in paleochannels within the Scheme boundary.

In addition, within Transect Four BH-OBC-08, to BH-OBC-12 are located within recorded alluvial layers, however this is not supported by the results of these boreholes, with a (70cm) layer of alluvium comprising sandy, gravelly clay recorded (24.81m to 24.11m bgl). BH-OBC-10 and 12 do not record any alluvium. All three record River terrace deposits suggesting they extend further into the valley than recorded on the BGS within the Scheme boundary.

Figure 6-1 - Heatmap showing alluvial deposits identified in the GI against mapped BGS records

6.3 Archaeological Potential

This deposit model clearly identifies three sequences of river terrace deposit throughout the two sections of the Granta valley assessed in this report. As discussed, River terraces hold potential for evidence that is Pleistocene in date and early Holocene archaeology. The BGS records that only one of three terraces being Pleistocene in date (terrace three). The previous finds of late Palaeolithic and Early Mesolithic flints within Terraces 1 and 2 demonstrate that there is potential for the River Terraces to contain early prehistoric archaeology. As the chronology and periods of formation of the River Terraces is not well defined any archaeology that could provide dating and chronological control to understand their formation would be of regional significance for understanding this period.

The alluvium across the Site formed throughout the Holocene, though no dating evidence is available. The OAE excavation and analysis showed significant activity in later prehistory through to the medieval period, especially focused on the village of Babraham. The alluvium across site has potential for preserving waterlogged archaeology and paleoenvironmental remains, in particular the peat and organic alluviums deposits. There is greatest potential for this within the north-western, downstream valley. These deposits could be of medium to high significance for the regional understanding of various periods. The south-eastern, upstream valley is considered to have lower geoarchaeological potential.

7. Conclusion

Based on the observations in this deposit model a general sequence of Bedrock, overlain by three River Terraces, overlain by alluvium, overlain by topsoil/made ground, can be observed across each of the valley profiles. Of these, the River Terraces are of medium potential for early prehistoric archaeology and alluvial and peat deposits are of medium to high potential for Holocene archaeology. Any further geoarchaeological survey should aim to better understand the nature of the alluvium and the potential for paleoenvironmental assessment. It is unlikely that any further works will cause impact to the depth that impact upon the sequence of the river terraces.

This model should be used to inform a management strategy for further archaeological fieldwork. This could comprise a further targeted programme of purposive geoarchaeological evaluation to fully characterise these deposits and inform the requirement for and the scope of any further geoarchaeological fieldwork or analysis that may be required to mitigate against damage/loss of the geoarchaeological resource as a result of the scheme.

The requirement for and scope of any geoarchaeological evaluation works will need to be considered against any below-ground works as this will have a direct impact on the requirement for and extent of any geoarchaeological evaluation works.

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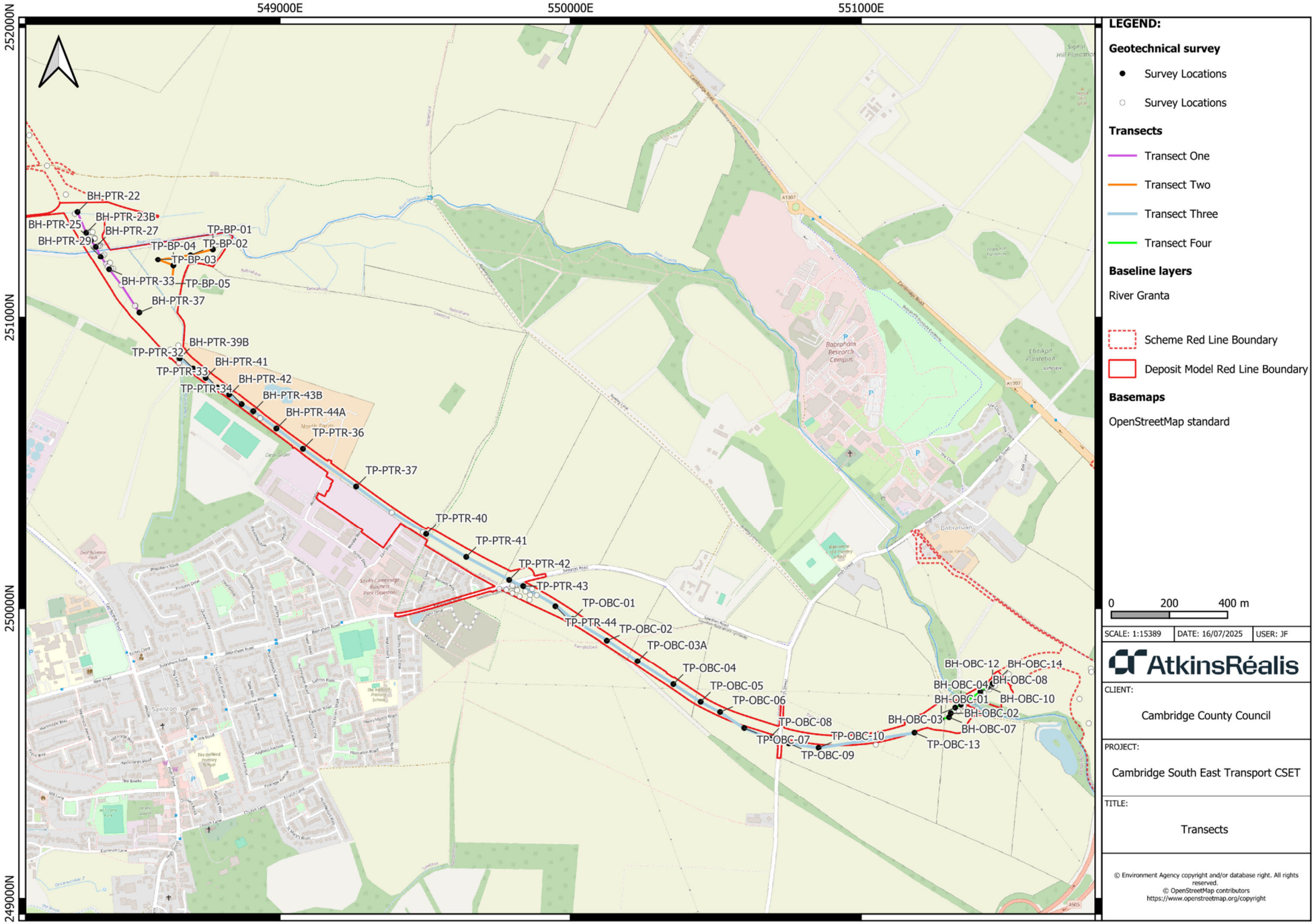
APPENDICES

Appendix A. Maps

AtkinsRéalis - Sensitive / Sensible [FR]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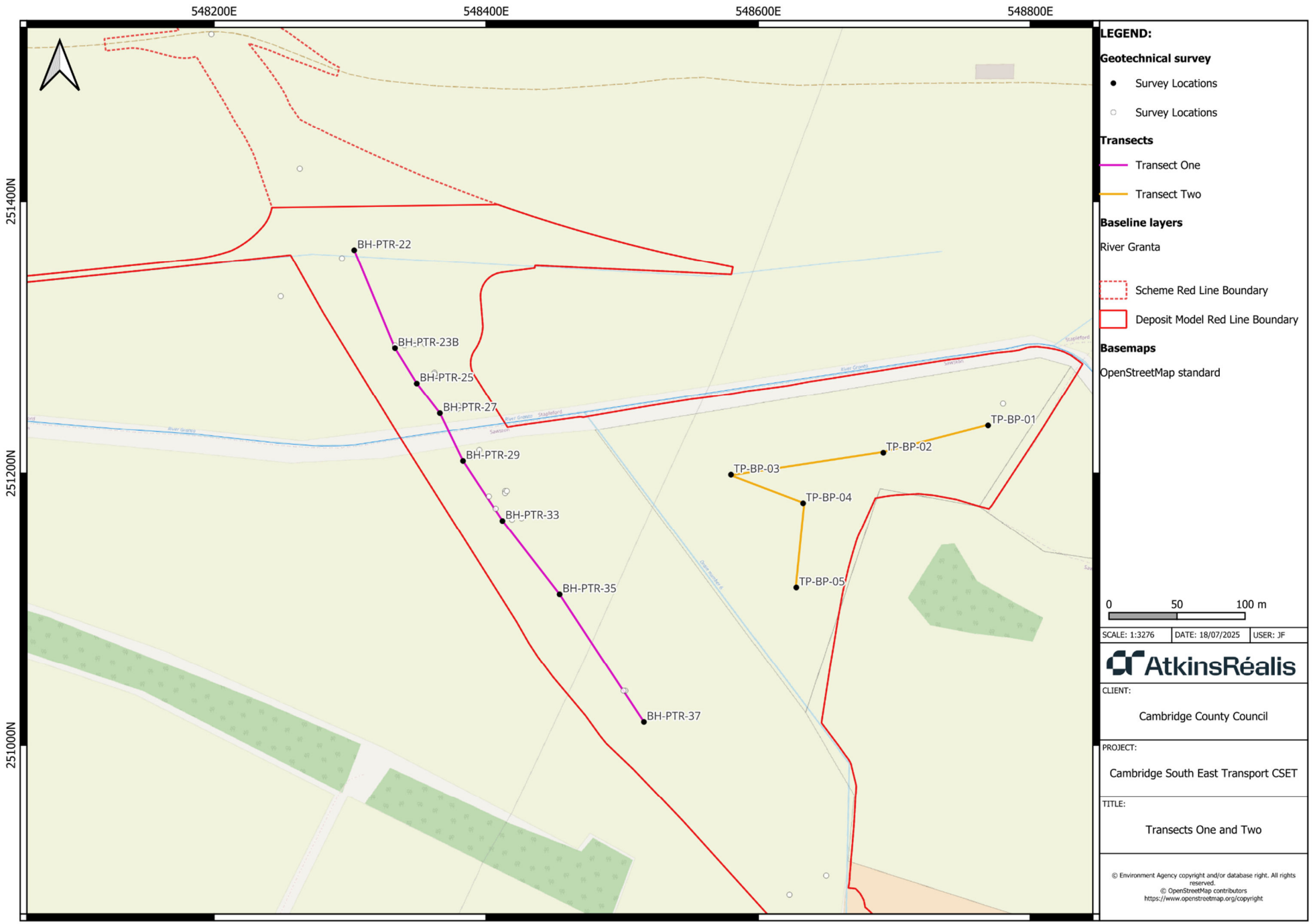
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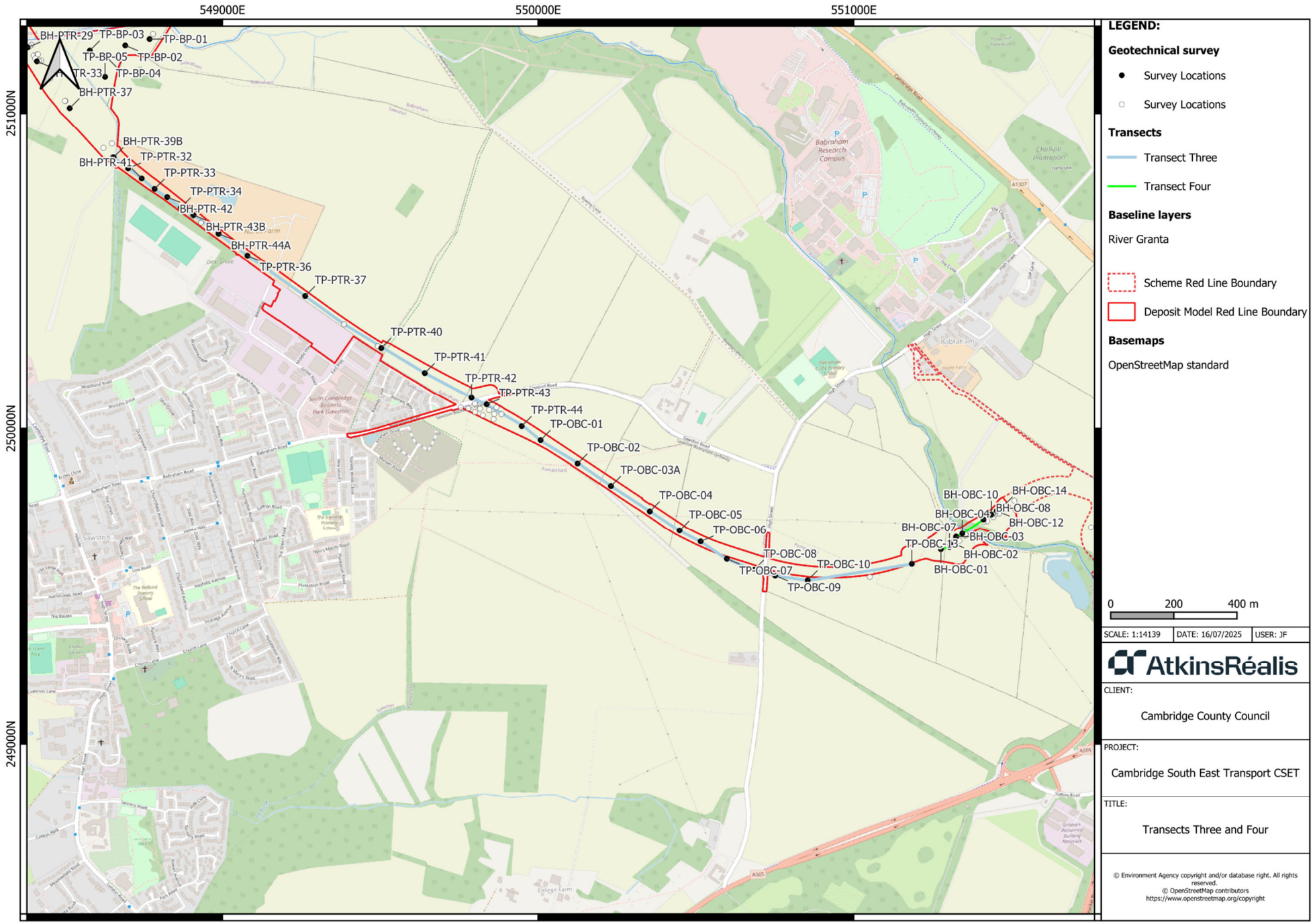
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Appendix B. Transects

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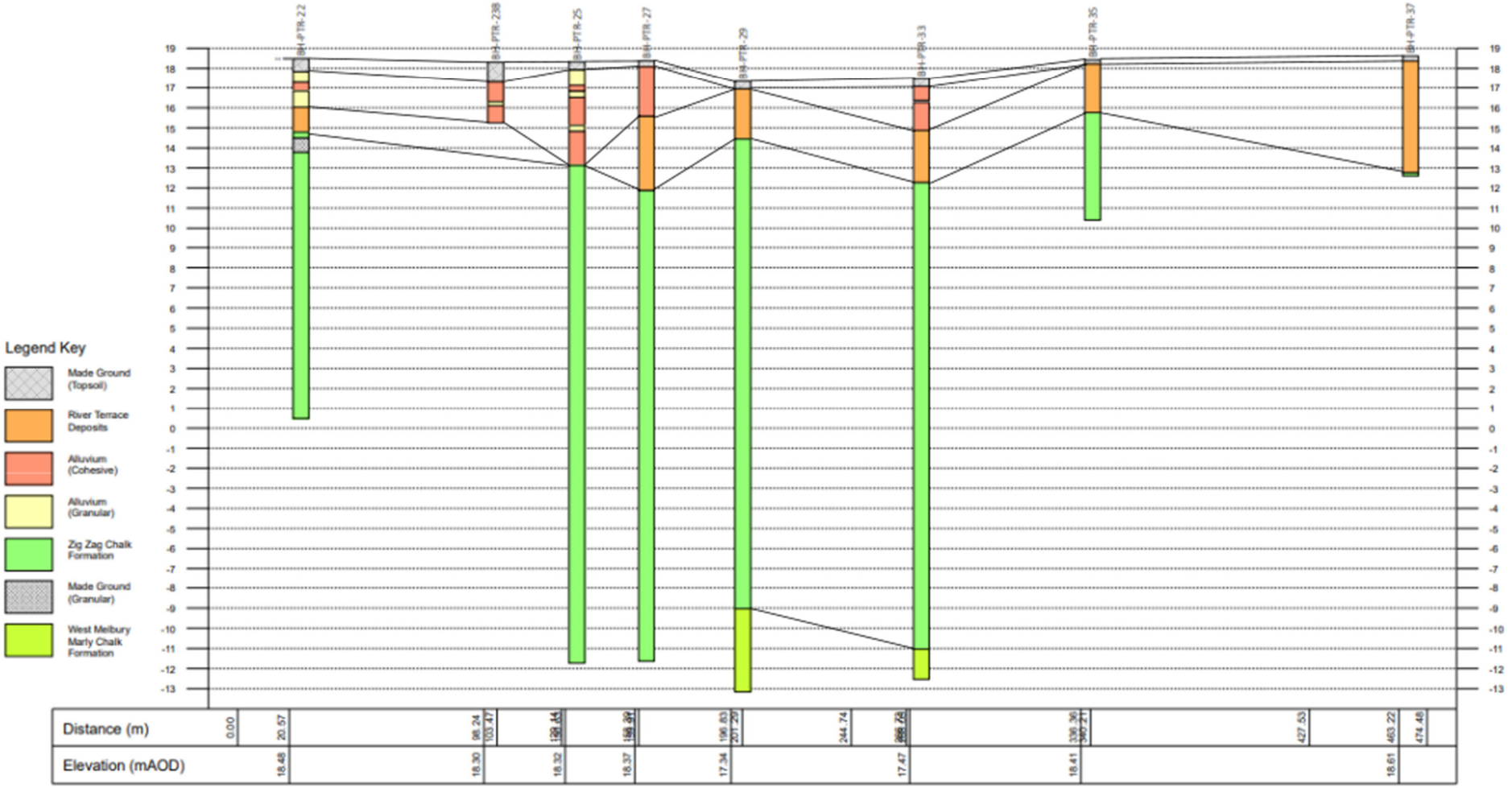

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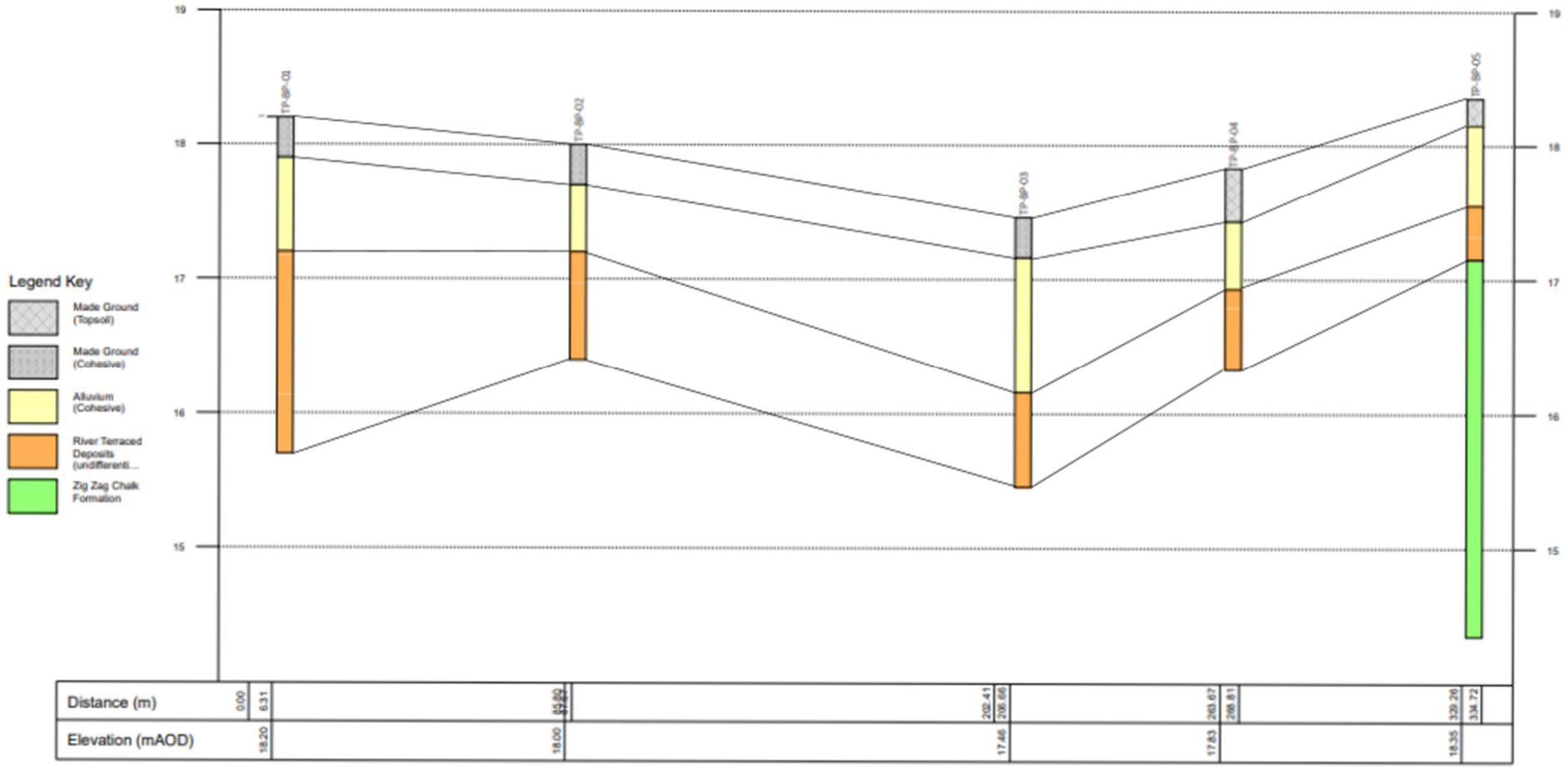

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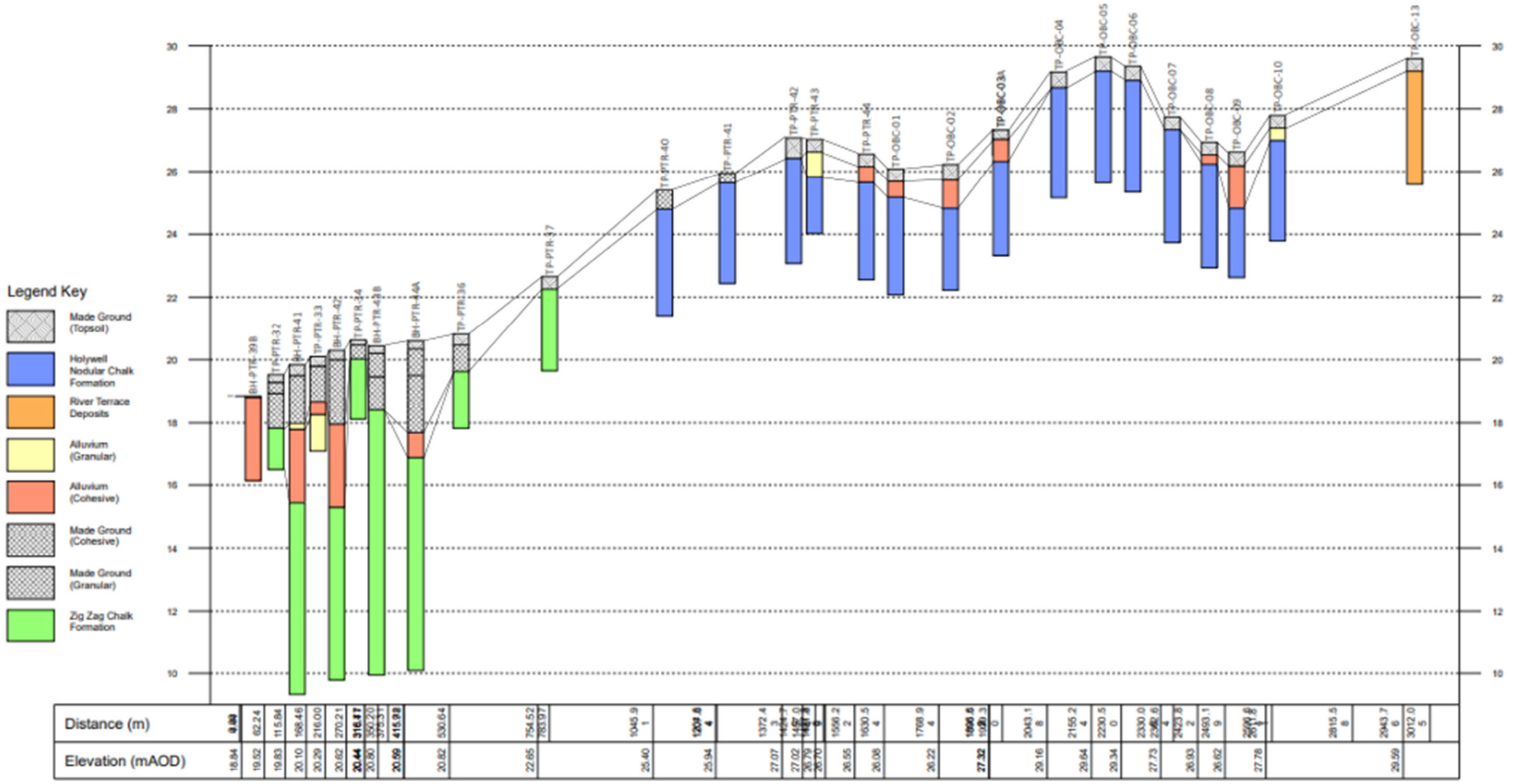

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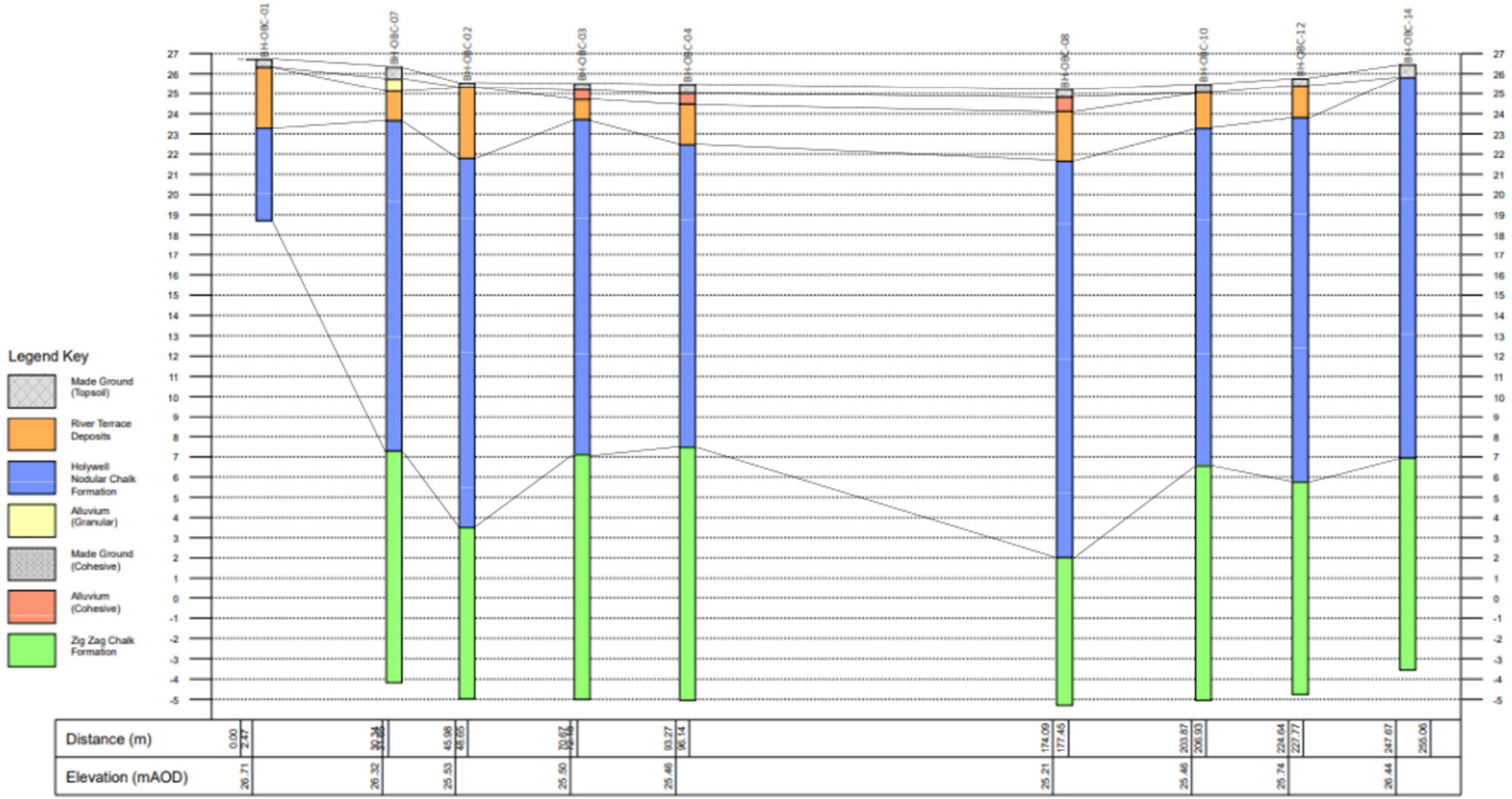

Appendix C. Geotechnical Survey Gazetteer

Transect	ID	Type	Elevation AOD (m)	Depth (m)
1	BH-PTR-22	RC	18.48	18.00
1	BH-PTR-23B	WLS	18.30	3.05
1	BH-PTR-33	RC	17.47	30.00
1	BH-PTR-27	RC	18.37	30.00
1	BH-PTR-25	RC	18.32	30.05
1	BH-PTR-29	RC	17.34	30.50
1	BH-PTR-37	RC	18.61	6.00
1	BH-PTR-35	RC	18.41	8.00
2	TP-BP-05	TP	18.35	4.00
2	TP-BP-02	TP	18.00	1.60
2	TP-BP-03	TP	17.46	2.00
2	TP-BP-01	TP	18.20	2.50
2	TP-BP-04	TP	17.83	1.50
3	BH-PTR-39B	WLS	18.84	2.70
3	BH-PTR-41	RC	19.83	10.50
3	BH-PTR-42	RC	20.29	10.50
3	BH-PTR-43B	RC	20.44	10.50
3	BH-PTR-44A	RC	20.59	10.50
3	TP-PTR-36	TP	20.82	3.00
3	TP-PTR-40	TP	25.40	4.00
3	TP-PTR-42	TP	27.07	4.00
3	TP-PTR-44	TP	26.55	4.00
3	TP-PTR-34	TP	20.62	2.50
3	TP-PTR-33	TP	20.10	3.00
3	TP-PTR-41	TP	25.94	3.50
3	TP-PTR-32	TP	19.52	3.00
3	TP-PTR-37	TP	22.65	3.00
3	TP-PTR-43	TP	27.02	3.00
3	TP-OBC-09	TP	26.62	4.00
3	TP-OBC-07	TP	27.73	4.00
3	TP-OBC-03A	TP	27.32	4.00
3	TP-OBC-04	TP	29.16	4.00
3	TP-OBC-13	TP	29.59	4.00
3	TP-OBC-06	TP	29.34	4.00
3	TP-OBC-01	TP	26.08	4.00
3	TP-OBC-02	TP	26.22	4.00
3	TP-OBC-05	TP	29.64	4.00
3	TP-OBC-10	TP	27.78	4.00
3	TP-OBC-08	TP	26.93	4.00
4	BH-OBC-14	RC	26.44	30.00
4	BH-OBC-02	RC	25.53	30.50
4	BH-OBC-04	RC	25.46	30.50

4	BH-OBC-08	RC	25.21	30.50
4	BH-OBC-01	RC	26.71	8.00
4	BH-OBC-07	RC	26.32	30.50
4	BH-OBC-10	RC	25.46	30.50
4	BH-OBC-03	RC	25.50	30.50
4	BH-OBC-12	RC	25.74	30.50

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