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PROPOSED BIOMASS COMBINED HEAT AND POWER PLANT DISCOVERY PARK SANDWICH, KENT

Geoarchaeological Desk-Based Assessment

NGR: TR 335 599

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Written by: Dr C.P. Green

QUEST, School of Archaeology, Geography and Environmental Science, Whiteknights, University of Reading, RG6 6AB

Tel: 0118 378 8941 / 7978
Email: c.r.batchelor@reading.ac.uk
http://www.reading.ac.uk/quest

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1. NON-TECHNICAL SUMMARY

The following report outlines the findings resulting from a geoarchaeological desk-based assessment of the Biomass Discovery Park site. The work was commissioned by CgMs Consulting. The aims of the assessment were: (1) to determine the geoarchaeological and palaeoenvironmental significance and potential of the site, and (2) to outline a strategy for further investigation should the significance and potential of the site be considered high or uncertain. The assessment considered the topographical, geological and historical context of the site, integrating the findings from previous investigations at nearby sites such as Ramsgate Road, Astra Pyrotechnics, the Brown & Mason Yard, Pfizer sites and Sandwich Industrial Estate.

The site has been subject to a 2 month archaeological watching brief whilst ground floor slabs and foundations have been removed. The watching brief has established that the top 2m of the site comprises made ground only and that all archaeological assets that may have existed on the site, including the World War 1 remains have been removed prior to the creation of foundation levels for the Pfizzer development (ASE forthcoming, 2016). The ground floor slabs have proven in places to be 2m+ thick with moulded foundations attached to them descending to 3m+. However, the Holocene sediments underlying the site represent a record of deposition in the eastern arm of the

Wantsum Channel, the open seaway that formerly separated the Isle of Thanet from the Kentish mainland. They also include elements of the Stonar Bank, a shingle accumulation of uncertain origin and age. There is therefore an opportunity to undertake geoarchaeological investigations to improve understanding of the historic development of the eastern arm of the Wantsum Channel with possible implications for its influence on local and regional patterns of navigation and trade. A small number of boreholes is recommended, primarily to recover sample material for dating and palaeoenvironmental investigation.

2. INTRODUCTION

2.1 Site context

The area of investigation at the Biomass Discovery Park site, Ramsgate Road, Sandwich, Kent (centred on NGR: TR 335 599; Figures 1 & 2) is located on the west bank of the River Stour. The British Geological Survey (http://mapapps.bgs.ac.uk) shows the site to be located in an area of complex geology: it is mapped as resting on bedrock deposits of the Thanet Sand Formation (sands, silts and clays) deposited 56-59 million years ago, overlain by superficial Quaternary deposits of sands, silts and clays deposited over the course of the last 2.6 million years. In fact, the latter deposits are more likely to be of Holocene age (last 11,500 years).

An Archaeological Impact Assessment (AIA) has been prepared for the locality in which the site is situated (CgMs Consulting, 2013). It indicates that the stratigraphic sequence beneath the site is likely to comprise bedrock Thanet Sand overlying Chalk (19-20m bgl - below ground level), overlain by a unit of gravel/gravelly sands/sandy gravel (interpreted as storm beach deposits), overlain in turn by a generally fining upwards sequence of alluvial sands, silts and silty clays. The sequence is capped by a late Medieval/post-Medieval ploughsoil, and a variable thickness of Made Ground. The AIA also indicates that the site is located entirely on low lying reclaimed ground recovered from the Wantsum Channel (Figures 3 & 4). Also present beneath the site is a degraded bank of shingle (The Stonar Bank) which has a N-S alignment across the mouth of the Wantsum Channel. To the east of this shingle bank and of the River Stour, northward marine progradation has created a broad spit of sand that separates the lowermost course of the Stour, north of Sandwich, from the sea in Sandwich Bay (CgMs Consulting, 2015).

The conclusions of the Archaeological Impact Assessment is that the site has minimal archaeological significance and potential. During the prehistoric and Roman periods the site lay within an open seaway but during the medieval period was increasingly affected by the deposition of storm beach deposits and alluvial silts. No finds from the medieval period have been made within 500m of the site. The area was farmland in the late medieval and post-medieval periods but was extensively modified by 20th century land-use, including exploitation of the underlying gravel.

2.2 Geoarchaeological and Palaeoenvironmental potential

The stratigraphic sequence beneath the site may be considered to have high significance and potential in one or more of the following ways:

1. Variations in the nature of the deposits recorded represent different environmental conditions that existed from time to time both at or near the site of record and regionally. For example: (1) the sands / gravels may represent storm beach deposits; (2) the deposits of sands/silts/clays represent periods of varying hydrological conditions, and (3) the presence of soils or peat (if present) represent former terrestrial or semi-terrestrial land-surfaces, By studying the sub-surface stratigraphy across the site in greater detail, it will be possible to build a greater understanding of the former landscapes and environmental changes that took place over space and time.

2. Mineral-rich marine sediments have the potential to provide material for Optically Stimulated Luminescence (OSL) dating and may include remains of Mollusca suitable for radiocarbon dating, together with diatoms and Foraminifera which can provide information about the depositional environments represented in the sediment sequence and the history of relative sea level change.

3. Organic-rich sediments and relic soils have high potential to provide a detailed reconstruction and dating of prehistoric/historic environments on both wetland and dryland. In particular, they would contain the potential to increase knowledge and understanding of the interactions between hydrological change, human activity, vegetation succession and climate in this area of the Stour Floodplain. Investigations of such sediments is carried out through the assessment/analysis of palaeoecological remains (e.g. pollen, plant macrofossils & insects) and by radiocarbon dating.

4. Areas of high gravel topography, soils and Peat represent potential areas that might have been utilised or even occupied by prehistoric people, evidence of which may be preserved in the archaeological (e.g. features and structure) and palaeoenvironmental record (e.g. changes in vegetation composition).

2.3 Aims & Objectives

The aims of the Geoarchaeological Desk-Based Assessment are as follows:

1. To determine the geoarchaeological and palaeoenvironmental significance and potential of the site.
2. To determine whether there a justification for further work on the site based on current knowledge
3. To outline a strategy for on-site and laboratory-based investigation should the significance and potential of the site be considered high or uncertain.

In order to address these aims, the following objectives are proposed:

1. To review relevant existing documents and sources related to the geoarchaeological and palaeoenvironmental history of the site

2. To determine a strategy for further investigation (if necessary).

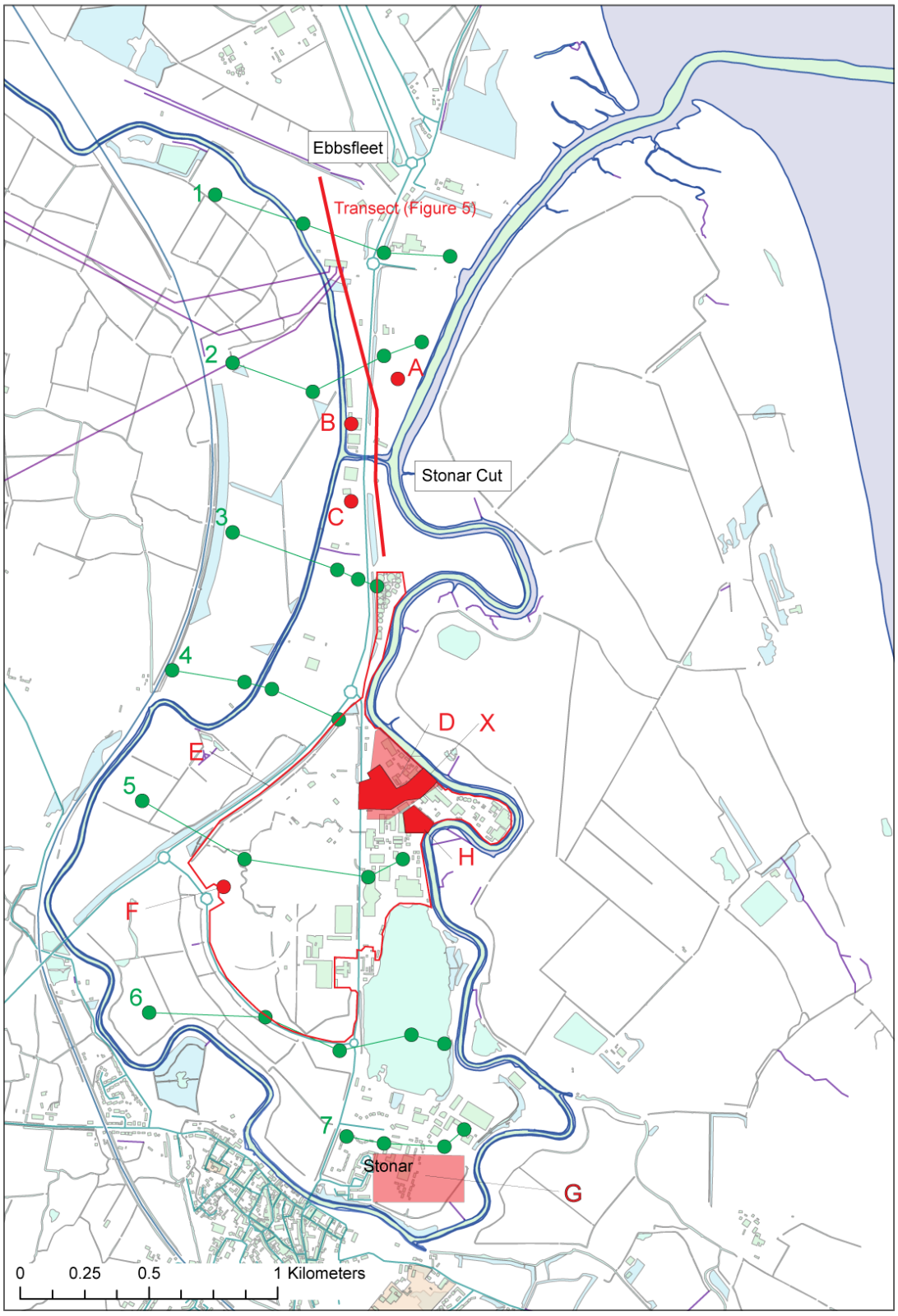

Figure 1: Location of (X) Biomass Combined Heat and Powerplant site; (A) Ramsgate Road, Richborough and location of borehole transect illustrated in Figure 5 (Green *et al.*, 2012); (B) Astra Pyrotechnics (Mills, 1994); (C) Brown & Mason Yard (Spurr, 2005, 2006); (D) Pfizer 1953 site; (E) Discovery Park (CgMs Consulting, 2013); (F) Pfizer Sandwich Campus (Pratt *et al.*, 2000); (G) Sandwich Industrial Estate (Bates & Pine 1994); (H) Instro Discovery Park (Green, 2016); (1) to (7) Borehole transect locations from Robinson & Cloet (1953) (reproduced and modified from CgMs Consulting 2013) *© Crown copyright and database right [2016]*.

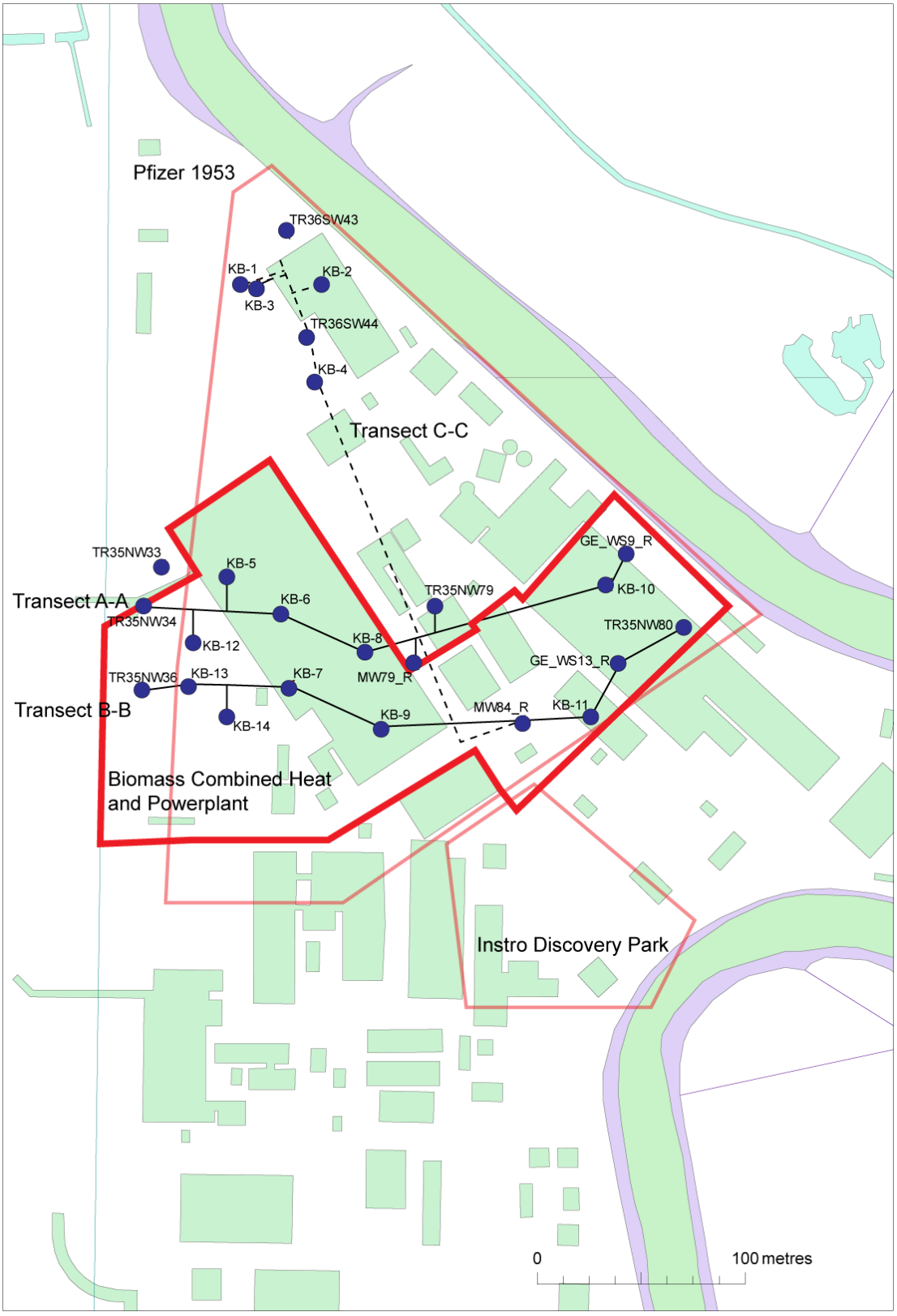

Figure 2: Existing boreholes put down within the confines of Biomass Combined Heat and Powerplant. Illustrating the position of Transects A-A, B-B and C-C (Figures 6-8)

Figure 3: Map from Dover District Heritage Strategy showing presumed extent of Wantsum Channel, generalised position of Stonar Shingle and location of the Instro Discovery Park site (reproduced from: Dover District Heritage Strategy, Appendix 1, Theme 1, Coastal Processes and Landscapes 2013, Figure 1)

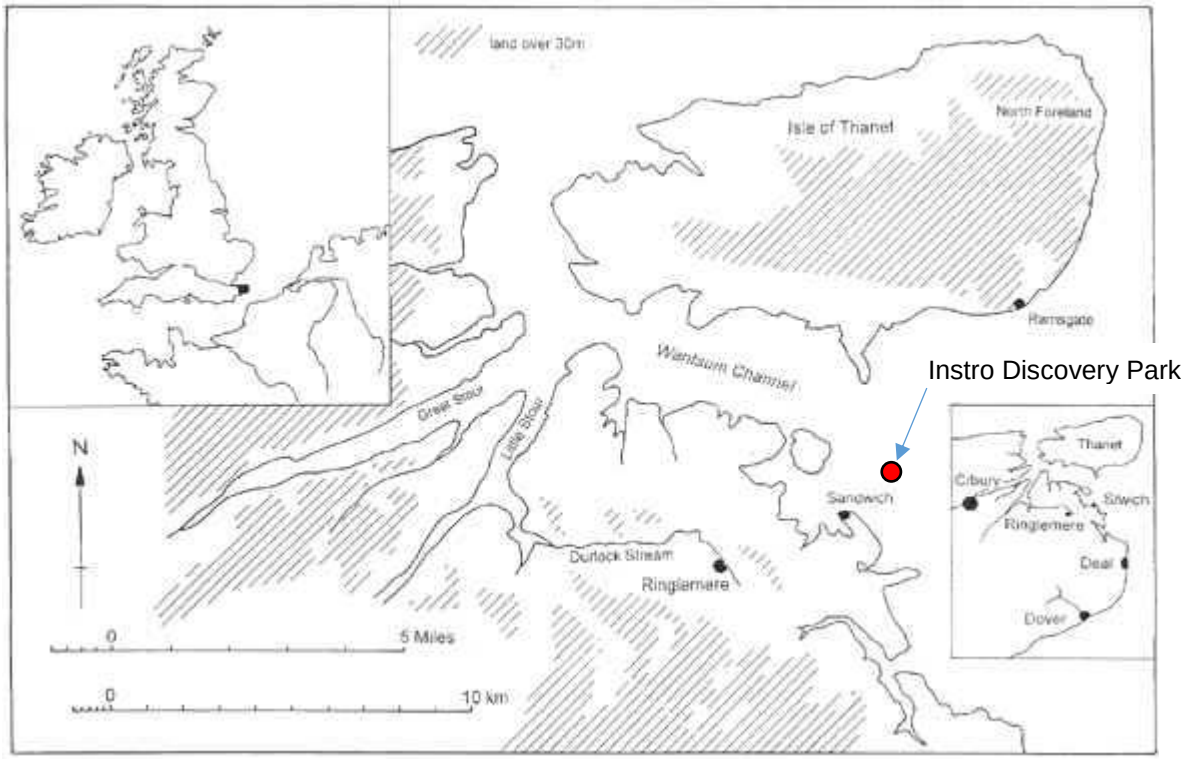

Figure 4: The Wantsum Channel, showing position of Instro site (red dot) (reproduced from Parfitt & Needham, 2007)

3. TOPOGRAPHIC SETTING

The site lies on the estuarine floodplain of the Kentish River Stour (Figures 1 & 2) on the left (west) bank of the river, which here follows a meandering course flowing northward from the town of Sandwich to the mouth of the river where it enters the sea in Pegwell Bay near Ebbsfleet. The site is irregular in outline, bounded on the west by Ramsgate Road (formerly A256), and in the east, towards the southern end of the site, at its widest point, reaching the waterfront of the River Stour. Recorded ground levels within the site range from 2.13m to 4.22m OD (mean: 3.34, n=25) with lower levels recorded adjacent to Ramsgate Road and higher levels near the River Stour. However these levels have been affected by intensive industrial and military land-use since the beginning of the 20th century and Made Ground is recorded in all the boreholes and test pits within the site, varying in thickness from less than 1.0m up to nearly 3.0m. If the base of the Made Ground is regarded as equivalent to the pre-industrial land surface, the mean level is 1.66m OD (n=20).

The course of the River Stour and the form of its estuarine reach in the vicinity of the site (Figure 1) have been significantly shaped by the interaction of the river with marine beach development and coastal landforms in the mouth of the estuary. The Stour flows from the west to a point near Ebbsfleet, about 2.5km north of the site, where it is little more than a kilometre from its mouth in Pegwell Bay. From there it flows south for a distance of about 4.5km to the town of Sandwich where it loops northward for about 4.5km to reach its mouth in Pegwell Bay near Ebbsfleet. About 1.25km to the north of the present site, an artificial channel, the Stonar Cut links the south flowing and north flowing limbs of this great southward loop of the river Stour at the point where they are closest together, separated by a distance of about 150m.

The narrow, elongated area enclosed within the great southward loop of the River Stour and including the present site of investigation, marks the position of a depositional feature often called the Stonar Shingle or Stonar Bank (Hardman & Stebbing 1940). However, in previous investigations (Robinson & Cloet 1953) substantial amounts of shingle at the ground surface were identified only at the southern end of this area, near Sandwich, where the ground rises to about 5.0m OD. Further north Robinson & Cloet (1953, Figure 1) recorded the supposed position of the Shingle as a slight rise in the ground surface, defined in their mapping of the locality by an 8 foot (2.44m) contour. Historical and geological evidence suggested to Hardman & Stebbing (1940, 1941) that the Stonar Shingle developed as a shingle spit extending southward from the Isle of Thanet into the open water, known as the Wantsum Channel, that formerly separated the Isle of Thanet from mainland Kent. There is however debate regarding the direction from which the spit grew. Bates & Pine (1994) for example, suggest that it grew from the south. There is also uncertainty about the period during which this shingle feature developed.

To the west of this great southward loop of the river, the Stour flows from west to east in an area of low ground that extends from the Isle of Thanet in the north to the high ground of mainland Kent in the south. This area of low ground is the silted-up eastern arm of the Wantsum Channel (Figures 3 & 4). This seaway opened both northward into the lower estuary of the Thames and eastward into

Sandwich Bay. The width and depth of this channel and the form of its opening into Sandwich Bay have long been matters of debate (Dowker 1897, Moody 2008) (see below).

To the east of the great southward loop of the River Stour and the lowest reach of the river where it flows northward from Sandwich, there is an area of coastal sand dunes which have been formed by the northward growth of a sand and shingle spit from the vicinity of Deal. Between the present coast and the river, recurves representing successive stages in the development of this spit are clearly visible in satellite imagery. No attempts to date the stages in the development of this spit have been identified during the present investigation.

4. GEOLOGICAL CONTEXT

4.1 History of investigation

The bedrock beneath the Biomass site and underlying much of the former Wantsum Channel is the early Tertiary Thanet Sand Formation. Overlying the Thanet Sand and representing sedimentation within the former Wantsum Channel is a thick sequence of mainly estuarine and peri-marine Holocene deposits. The commercial potential and stratigraphy of these deposits was first explored in boreholes put down by Dorman Long & Pearson (DL&P) in 1926/27 during an investigation of aggregate resources extending across the Stonar Shingle from Ebbsfleet in the north to Sandwich in the south (Figure 1). The borehole logs arising from these investigations were used by Robinson & Cloet (1953) to reconstruct the stratigraphy of the deposits underlying the ground within and immediately to the west of the great southward loop of the River Stour between Ebbsfleet and Sandwich.

The boreholes examined by Robinson & Cloet (1953; Figure 1) record shingle at the surface only beneath the highest ground within the loop of the Stour at its southern end (see Transect 6 in their Figure 2). Further north in their Transects 5 and 4, they recorded shingle only at depths at or below 40 feet (12.19m). To the north of these transects, no shingle was recorded, with boreholes recording finer grained deposits resting directly on 'compact fissile clay', presumed to be Thanet Sand Formation sediments.

The broad pattern of sedimentation recorded by Robinson & Cloet (1953) indicated the presence of a degraded sand and shingle spit represented by shingle at the ground surface in the south (Transect 6), passing northward to sand just reaching the ground surface in their Transect 5, apparently in the form of a substantial sand bar overlying shingle at depth. A sand bar may also be recognisable in degraded form in Transect 4 about 20 feet (6.09m) below the ground surface, again overlying shingle at depth. Beds of sand are present further north in Transects 3, 2 and 1, but no bar-like form is recognisable. The present site of investigation lies close to the eastern end of Transect 4.

With regard to the fine-grained deposits that are recorded in the DL&P boreholes and illustrated by Robinson & Cloet (1953), there is in general a fining-upward pattern, with sand overlain by 'silt', overlain in turn by 'clay'. There is however considerable variation in the sequences recorded to the

north of Transect 4, with substantial beds of 'clay' recorded in the assumed position of the Stonar Shingle and nearby.

More recent investigations have largely confirmed the earlier findings and have extended the understanding of this eastern part of the Wantsum Channel. Investigation of a site immediately to the south of the Stonar Cut (Spurr, 2005, 2006; Figure 1) proved a rather consistent sequence of Holocene sediments overlying the Thanet Sand Formation. At the base of the sequence, generally between -12.0m and -9.5m OD sands were present representing sedimentation on a marine beach. These beach deposits were overlain by sandy silts and clays passing up to silty clays and representing a progressive transformation from estuarine mud and sand flats to low salt marsh. From the upper part of this sequence a radiocarbon date of 2130-1880 BC was obtained. The uppermost natural sediments were organic clays representative of mid to high salt marsh. Similar sediments were recorded in a borehole put down in a previous investigation of the area immediately to the north of the Stonar Cut (Mills, 1994). Further to the south and east, sediments recorded in boreholes put down at a Pfizer site on the west side of the Ramsgate Road and south-west of the present site of investigation (Pratt *et al* 2000) consisted almost entirely of marine sands, gravelly in places and containing a mollusc fauna indicative of a sub-littoral habitat with a few species more commonly found in deeper water off-shore. The sediments recovered from these boreholes also contained at various levels throughout the sequences infrequent fragmentary plant remains including small pieces of wood. These sediments probably accumulated in shallow open water near the southern shore of the Wantsum Channel.

Investigations to establish the context of a site (the Ramsgate Road site) to the north of the Stonar Cut (NGR: TR 3335 6150) (Green *et al* 2012; Figure 1) showed the Thanet Sand Formation at a level of about -4m OD in the Ebbsfleet area, falling southward to about -6.5m to -8.0m OD at the Ramsgate Road site itself, and further to a level of -12.0m OD just south of the Stonar Cut (Figure 5). From this point the surface rose southward. This profile resembles the northern part of the transect illustrated by Spurr (2006 Figure 4), and can be interpreted as showing the north side of the bedrock depression underlying the Wantsum Channel, with its northern edge underlying Ebbsfleet. The profile showed that south of Ebbsfleet, i.e. within the Wantsum Channel, the bedrock surface is uneven, with a relief amplitude of *ca*. 4.0m. The transect also shows a well-marked contrast between the sediments overlying bedrock at and north of Ebbsfleet and those further south occupying the Wantsum Channel.

North of Ebbsfleet, the Thanet Sands Formation is overlain directly by peat, rather consistently *ca*. 5.0m in thickness, between -5.0m and +1.0m OD. The peat is overlain by silty clays which are probably alluvial floodplain deposits of the river Stour. To the south, and within the Wantsum Channel, the bulk of the sediment is also silty clay, but probably largely estuarine in origin. Detailed laboratory examination of three borehole sequences from within the Ramsgate Road site confirmed the sequences recorded in earlier boreholes, with a sandy component in the silts and silty clays in the lower part of the sequences and silty clays in the upper part. Mollusc shell was also present and

remains of the intertidal bivalve species *Scrobicularia plana* were recognised at levels between 0.28m and -0.46m OD.

4.2 The Biomass Site

Interpretation of the sediment sequences underlying the Biomass site is based on records recovered from 25 boreholes within or close to the site (Fig. 4), all with x, y, z coordinates and detailed drillers' logs. Twelve of the 25 boreholes penetrated to the underlying Chalk:

TerraConsult 2014, 2016
KB-1-KB14

URS 2011
GE_WS13_R
GE_WS9_R
MW79_R
MW80_R

BGS archive
TR36SW 43
TR36SW44
TR35NW33
TR35NW34
TR35NW36
TR35NW79
TR35NW80

The stratigraphy based on these borehole records is illustrated in two E-W transects (Figures 6 & 7; A-A & B-B) and one N-S transect (Figure. 8; C-C). The position of the transects is shown in Figure 2. Five statigraphic units are recognisable across the whole site, as follows:

Unit 5. Made Ground
Unit 4. Fine-grained alluvium
Unit 3. Gravel and gravelly sand
Unit 2. Thanet Sand Formation
Unit 1. Chalk

Within Units 3 and 4 sub-units are present, generally identified in drillers' logs in terms of textural variations, e.g. in Unit 4 – gravelly clay, silty clay, sandy clay, silty sand, organic clay, organic silt.

The two E-W transects (Figures 6 & 7) are broadly similar. They show the surface of the Chalk at depths between -20m and -25m OD falling gently towards the east. The surface of the overlying Thanet Sand is mainly between -10m and -15m OD falling gently towards the west. In consequence

the Thanet Sand is thickest in the east (>20m) and thins westward (*ca.* 10m). At the western end of both transects, the surface of the Thanet Sand falls away more steeply to *ca.* -18m OD, leaving a thickness of only about 2m of Thanet Sand above the Chalk.

Immediately overlying the Thanet Sand is a body of sediment (Unit 3) consisting largely of 'gravel', and gravelly sand, described in the borehole logs as 'storm beach deposits' and in some places as 'shelly'. This unit ranges in thickness from 6.9m to 16.2m (mean: 11.41, n=13), with variations reflecting both the form of the underlying bedrock and the surface relief of the unit itself. It forms the natural ground surface, beneath the Made Ground, in the centre of the site (Transect A-A, boreholes KB-8 and TR35NW79 (Figure 6); transect B-B, boreholes KB-9, MW79_R and MW84_R (Figure 7)), with its surface falling away both to the west and to the east. In both transects it is thickest in the west where the surface of the underlying Thanet Sand falls away sharply (transect A-A, borehole KB-12 (Figure 6): 14.1m; transect B-B, borehole KB-13: 16.2m (Figure 7)).

Where the surface of this gravelly unit falls away westward and eastward it is overlain by fine-grained deposits (Unit 4) most often described in drillers' logs as 'silty clay', but with some sandier units and sometimes with gravelly clay present at the surface. In transect B-B and the eastern part of transect A-A the combined thickness of these fine-grained sediments is about 4-5m, but at the western end of transect A-A (boreholes KB-5 and TR35NW33) they are thicker (up to 10m), occupying depressions in the surface of the gravelly unit (Unit 3), which in turn overlie the depression in the bedrock surface of the Thanet Sand (Figures 6 & 7). In boreholes KB-12 and WS9_R, some fine-grained units are described as 'organic' and in boreholes KB-11 and TR35NW80 relic soils are described in the drillers' logs.

The southern end of the N-S transect C-C (Figure 8) is in the area where the gravel and gravelly sand of Unit 3 forms the natural ground surface. At the northern end of the transect, this unit is thinner and largely sandy and the overlying fine-grained deposits of Unit 4 are up to 7.0m in thickness. In none of the boreholes in this northern part of the site does the gravel and gravelly sand of Unit 3 form the natural ground surface and although gravelly sand is present in the sediment sequences, gravel sub-units are absent. These findings are consistent with earlier investigations to the north of the present site (Robinson & Cloet 1953; Spurr 2005, 2006; Green *et al* 2012) all of which indicate that the volume of gravel diminishes northward.

4.3 The Biomass Site: Geological summary

The borehole records from within the Biomass site indicate the presence beneath the site of a ridge of sand and gravel in a position somewhat to the east of the supposed alignment of the so-called Stonar Shingle and rising to a level of about 2.0m OD. These records demonstrate the presence of shingle at the ground surface much further north than previously indicated in the findings of Robinson & Cloet (1953). This ridge represents the local surface expression of a thick and extensive body of gravel and gravelly sand (Unit 3) that rests directly on the bedrock Thanet Sand at levels between -10m and -15m OD. This sediment body can be traced both eastward and westward to and beyond the eastern and western limits of the present site. This accumulation appears to

represent continuity of depositional conditions on this southern margin of the Wantsum Channel for much of the Holocene, and tends to confirm the development there of a broad sand and shingle spit or bar (the Stonar Shingle) across the mouth of the Channel. Within the present site, the only indication of organic remains in this massive accumulation of sand and shingle is in the description of some of the sediment as 'shelly'. This probably reflects the presence of a mollusc fauna similar to the fauna described by Pratt *et al* (2000) from gravelly sand recovered from boreholes to the west of Ramsgate Road. In this detailed laboratory examination of the sediment, scattered and fragmentary woody and herbaceous remains were also recorded.

The seaward and landward slopes of the sand and shingle ridge underlying the present site are overlain by fine-grained sediments (Unit 4) which lap up onto the ridge and are almost certainly the estuarine alluvium of the River Stour and therefore represent the final stages in the infilling of the Wantsum Channel. Organic horizons and relic soils are recorded within these fine-grained sediments and it seems likely that the radiocarbon dates (2130-1880 BC) obtained by Spurr (2005, 2006) came from material preserved within sediment equivalent to Unit 4 of the present investigation.

In summary, the site is underlain by sediments that form part of the infill of the depression formerly occupied by the Wantsum Channel. In their lower part these sediments are probably entirely marine in origin comprising more or less gravelly and sometimes shelly sands which represent the remains of a broad sand and shingle spit or bar. Overlying this feature, finer-grained silts and clays are present reflecting the gradual silting-up of the Wantsum Channel. The bulk of the infill of the Wantsum Channel is mineral sediment of marine or peri-marine origin in which visible organic remains, apart from the shells of marine and estuarine Mollusca, are limited to scattered wood and herbaceous plant fragments. The potential for the survival of organic remains is greater in the overlying estuarine alluvium of the River Stour.

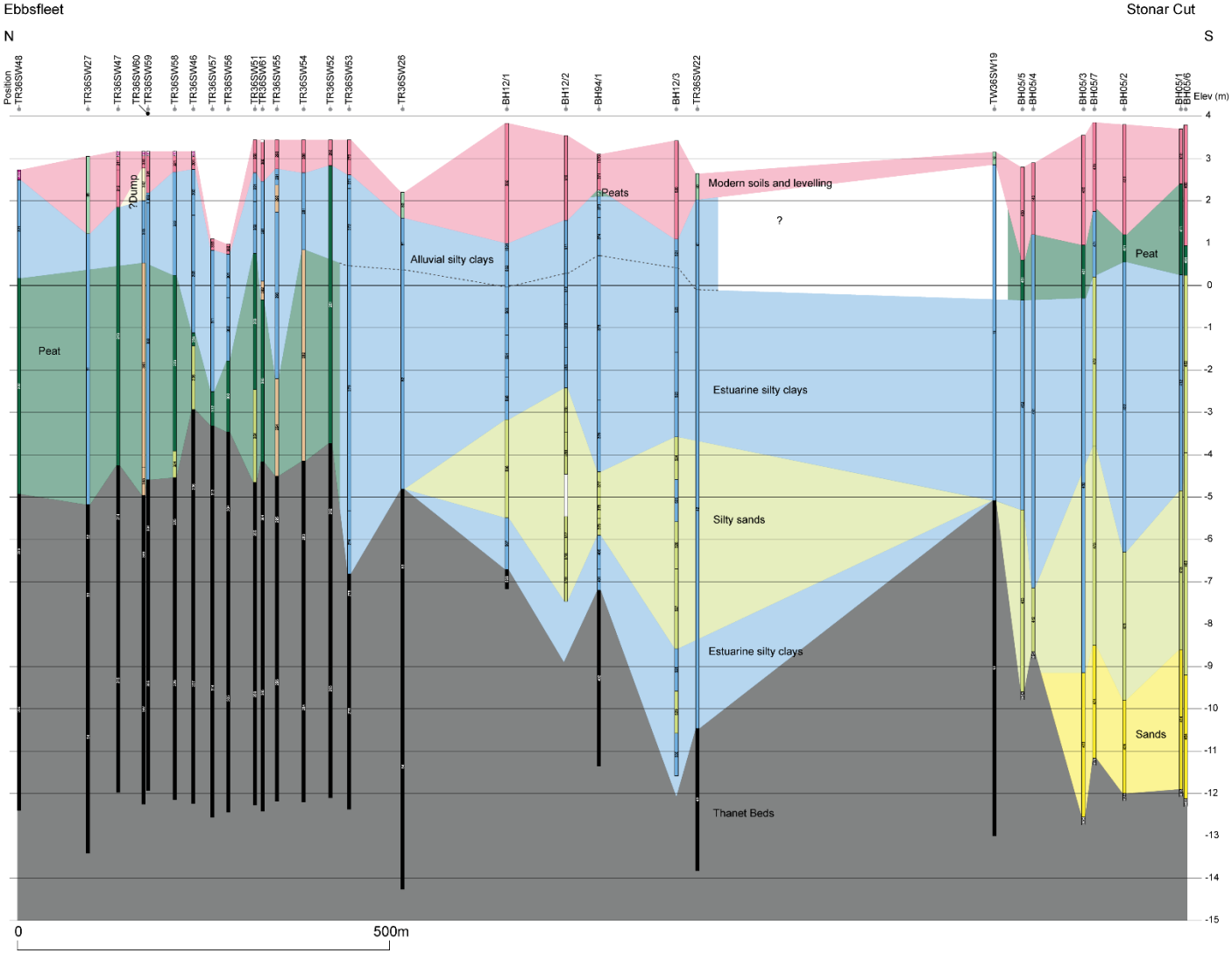

Figure 5: North-South borehole transect of boreholes from Ramsgate Road, Richborough (Green *et al.*, 2011), Sandwich Campus (Pratt *et al.*, 2000), Brown and Mason Yard (Spurr, 2005; 2006), Astra Pyrotechnics factory (Mills, 1994) and BGS boreholes available online (http://www.bgs.ac.uk/data/boreholescans/) (reproduced from Green *et al.*, 2011).

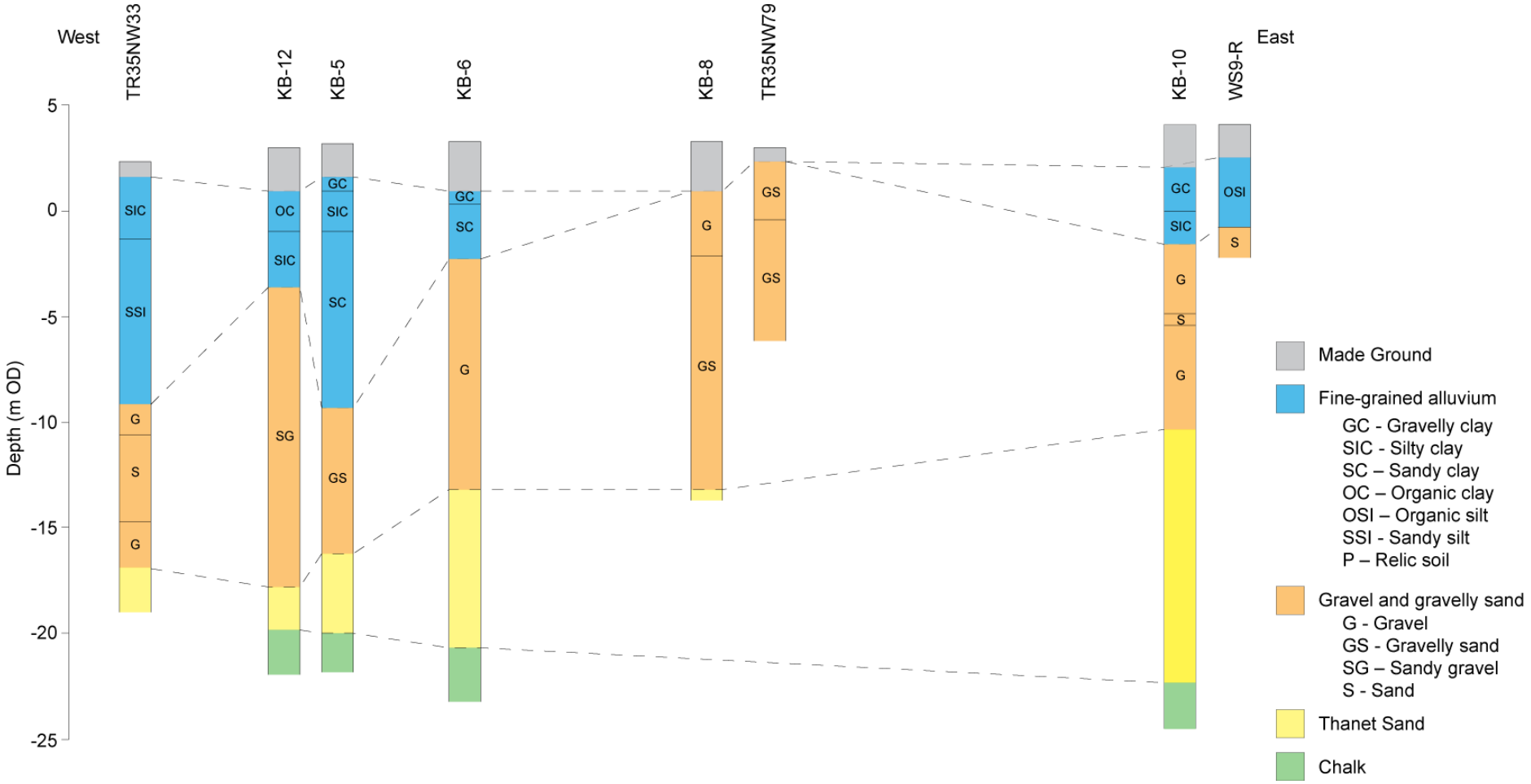

Figure 6: East-west transect of boreholes 'A-A' across the Biomass Combined Heat and Powerplant site (see Figure 2 for location)

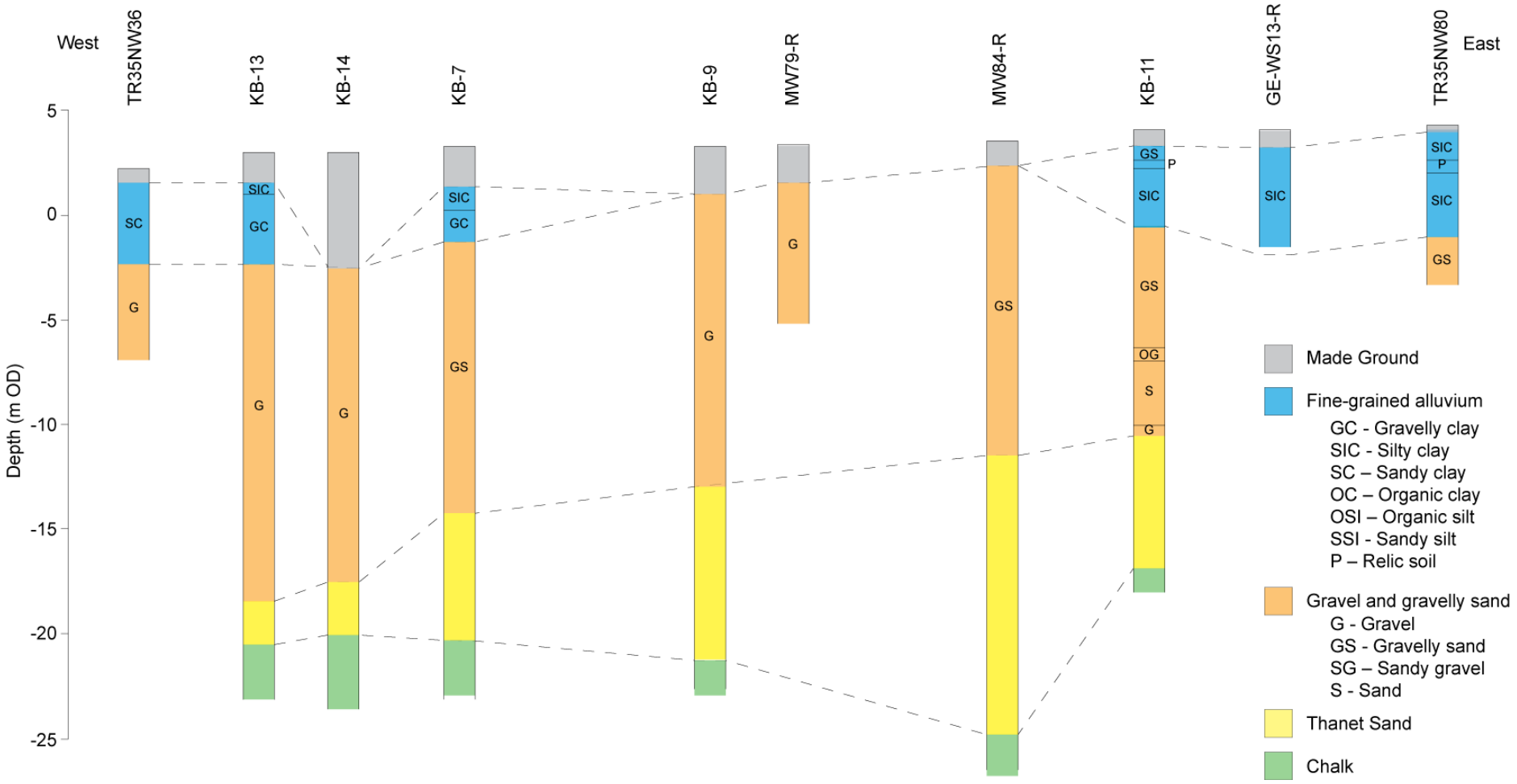

Figure 7: East-west transect of boreholes B-B across the Biomass Combined Heat and Powerplant site (see Figure 2 for location)

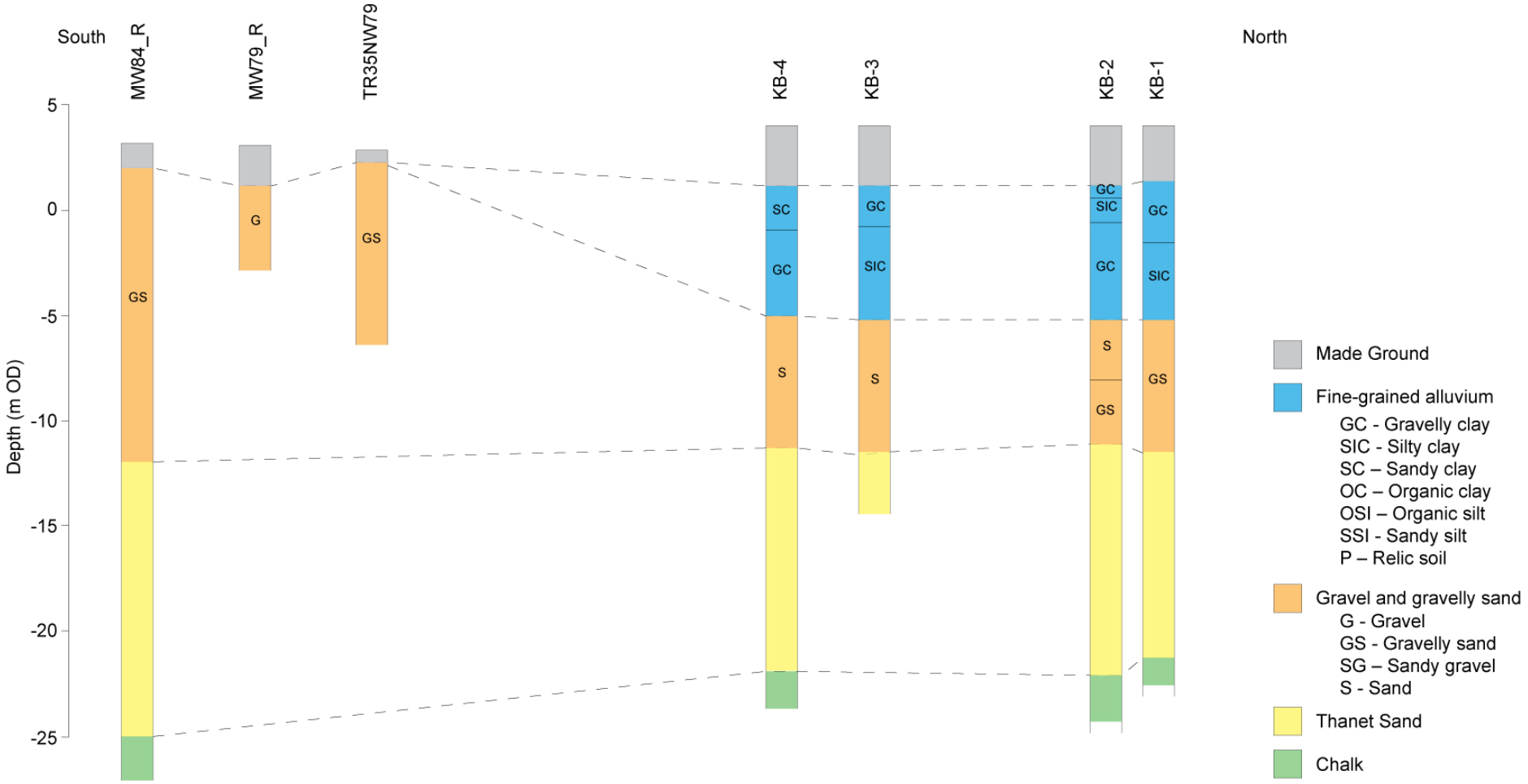

Figure 8: North-south transect of boreholes 'C-C' across the Biomass Combined Heat and Powerplant site (see Figure 2 for location)

5. HISTORICAL BACKGROUND

The Wantsum Channel was an important seaway in Roman times as indicated by the presence of Roman forts close to both the northern end at Reculver (Regulbium) and the eastern end at Richborough (Rutupiae). In Saxon and early medieval times the higher level (5.0m OD) shingle outcrop to the south of the present site of investigation was occupied by the town of Stonar, first mentioned in documentary records in 1087, but thought to have been already in existence in the 8th century. This town was severely damaged by storms in the winter of 1365/6 and was later sacked and burned by the French in 1385, after which it went into rapid decline. No above-ground remains of the medieval settlement survive. There is some debate, summarised by Moody (2008), about whether the Wantsum Channel reached Sandwich Bay through one or two openings, with the possibility that there was a northern channel between Ebbsfleet and Stonar and a narrower southern channel passing to the south of the shingle accumulation at Stonar. The growth of the port of Sandwich adjacent to the putative southern channel and the location of the Roman fort at Richborough suggest that throughout the Roman and later historic period the principal opening lay in the south. If this interpretation is correct, the present site of investigation would have been near the southern edge of the broad northern channel.

Spurr (2006 Fig.5) suggests a possible sequence of landscape evolution at the eastern end of the Wantsum Channel for the period from pre-6000BC (Mesolithic) to the Middle Ages. He shows progressive encroachment of salt marsh from both north and south into the Wantsum Channel from the Neolithic onward, leading in his opinion to closure of the seaway between Thanet and mainland Kent by Saxon times, and development of the present course of the Stour before the end of the medieval period. Other reviews of the historical evidence (e.g. Moody (2008) suggest that closure of the seaway occurred rather later in the Middle Ages. The seaway was evidently silting up by the 11th century when the earliest schemes of reclamation are recorded and by the mid-16th century the whole of the former seaway appears to have been reclaimed (Figure 9), forming in its eastern arm, Minster Marshes and the Ash Levels. Between the 16th and the 18th centuries various engineering attempts were made to sustain the port of Sandwich, all of them eventually ineffectual.

The present site of investigation remained in agricultural use as reclaimed marshland until late in the 19th century when the impact of local industrialisation began to affect the site. At this time the ground level was raised within the site and light railway tracks were laid. Industrial land-use increased rapidly during the First World War in association with the development of the nearby port of Richborough which handled large volumes of military traffic destined for the western front. Within the site these developments led to the construction of warehouses and other industrial and commercial premises and additional railway sidings. Attempts to sustain the port of Richborough as a commercial enterprise in the years immediately following the First World War were largely unsuccessful but during the 1920s and 1930s further industrial premises were constructed and railway sidings associated with the extraction of sand and gravel from the deep quarry immediately to the south of the present site. Commercial premises (mainly the pharmaceutical firm Pfizer) continued to occupy large parts of the site throughout the rest of the 20th century.

Figure 9: Cotton's Map of 1548 (reproduced from CgMs Consulting, 2013)

6. CONCLUSIONS AND RECOMMENDATIONS

A Cultural Heritage DBA that encompassed the site (CgMs Consulting, 2013) concluded that *'The site is thought to have a very low potential for the Prehistoric, Roman, Anglo Saxon and early Medieval periods.*' and *'Overall it is considered that any redevelopment of the site would be unlikely to have either a significant or widespread archaeological or other cultural heritage impact*'.

However the site does present an important opportunity to undertake geoarchaeological investigation of the Wantsum Channel and the so-called Stonar Shingle, to obtain a fuller understanding of their sedimentary history and possible significance in terms of historic patterns of navigation and trade. Of particular interest is the possibility of dating the development of the Stonar Shingle and dating the associated stages in the infilling of the Wantsum Channel.

No further work is recommended on the western part of the site; whilst development is due to take place here, this is restricted to the replacement of the existing slab only. The site has been subject to a 2 month archaeological watching brief whilst ground floor slabs and foundations have been removed. The watching brief has established that the top 2m of the site comprises made ground only and that all archaeological assets that may have existed on the site, including the World War 1 remains have been removed prior to the creation of foundation levels for the Pfizzer development (ASE forthcoming, 2016). The ground floor slabs have proven in places to be 2m+ thick with moulded foundations attached to them descending to 3m+. Thus, on the western part of the site the Holocene sequence of geoarchaeological/palaeoenvironmental interest will not be impacted.

However, it is recommended that four boreholes are put down forming a west-east transect across the site. The aim of the investigation will be to (a) recover sediment from Unit 3 for Optically Stimulated Luminescence (OSL) dating and/or radiocarbon dating of molluscan shell and for the recovery of micro-fauna and -flora; and (b) explore the sequences of the fine-grained and potentially organic sediment of Unit 4, in particular the deeper sequences underlying the western part of the site, with a view to dating and palaeoenvironmental investigation. Proposed approximate locations are outlined in Figure 10: QBH1 and QBH2 are both targeted on areas of the site that have recorded thick unit 3 and 4 deposits, the latter including relic soil remains. The precise location of the boreholes however, can be determined once the development plans are finalised in agreement with the local planning authority.

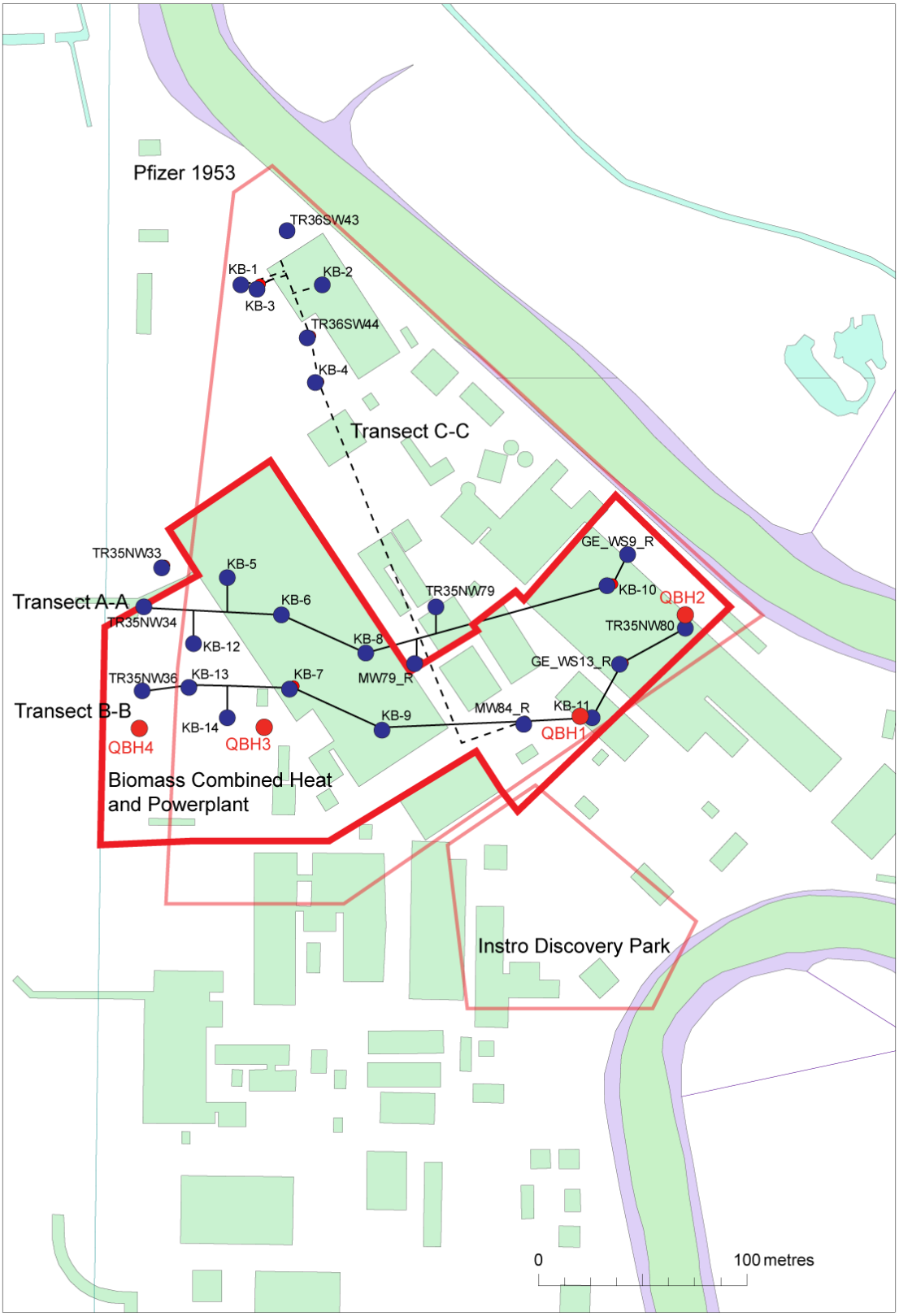

Figure 10: Proposed geoarchaeological borehole locations at the Biomass Combined Heat and Powerplant site

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