Happisburgh I

GIS data sets

Internal Report, version 1.0.0

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Picture on the cover presents an overview of all excavation pits at Happisburgh I (see Chapter 1).

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1. HAPPISBURGH

This internal report from the faculty of Archaeology of the University of Leiden provides an overview of excavations done at the coastal area referred to as Happisburgh I at the east Anglian coast. Here several excavations have produced archaeological and biological material relevant to early hominin occupation on the British coastal area.

1.1 Background

Happisburgh is a part of Norfolk, eastern England, that used to be a salty marsh. It was drained in the 11th century AD but still most parts are only a few feet above sea level with some large areas below sea level. The defenses against the waves along stretches of the coast have been abandoned, partly because they are considered too expensive. The coastline is rapidly eroding (see Figure 1 which also shows the locations of some of the archaeological excavations at Happisburgh). In some areas meters of cliff-face per year are removed. A local disaster but an opportunity for researchers as the erosion exposes materials that have been buried for hundreds of thousands of years. This includes archaeological material from some of the earliest Britons, making this location one of the most interesting sites in the area (Parfitt *et al*. 2010, Roberts and Grün 2010). Continued erosion including removal of the modern beach sands during the winter storms, have recently revealed the oldest known hominin footprints outside Africa (Ashton et al. 2014).

Figure 1 - The danger of a shifting shoreline taken by the winds and the waves. The red arrow indicates a crumbled road and disappearing houses. From here southwards the coast line is heavily eroded away. Figure from GoogleEarth, accessed 8 May 2012.

Collection of archaeological material from the coastal area has a long history. Due to natural erosion of the cliffs incidental finds have been retrieved for over a century. On the beach along large stretches of the coastline sometimes a complex sedimentation layer with a large organic component is exposed, the Cromer Forest-bed Formation (CR-bF) (Field and Paglar 2010). Collected by amateur archaeologists and generally stored at the Norwich museum the finds include cut-marked bones, a hand-axe and other flint tools from the organic mud at the foreshore. Inspired by these finds several formal excavations were undertaken at Happisburgh, thus creating sites named Happisburgh 1, Happisburgh 3, etc. (see Figure 1) (Ashton *et al*. 2008, Field 2012, Parfitt *et al*. 2010). Work is expected to continue at these locations for years to come. In chronological order past excavations here include (a more detailed overview up to 2011 is given in Knul (2012):

- 2000 – onwards: along the beach, archaeologists and amateurs collected and sieved organic mud and other elements of the CF-bF at low tide or when exposed;

- 2000 – onwards: Materials from Happisburgh 5 (HAP 5), located off the beach at an unknown position, often wash ashore during strong wave action in the form of large iron rich accretions. They are collected and examined, often revealing well preserved organic contents, including bones bearing cut-marks;
- 2002: Happisburgh 1 (HAP 1), by the Royal Holloway University of London and the British Geological Survey: studying the relationship between the organic mud and the glacial sediments on top;
- 2004: Happisburgh 3 (HAP 3), by the British Museum, Ancient Human Occupation of Britain (AHOB) project and Norfolk Museums Service: retrieving archaeological, faunal and macro plant remains from the organic mud by excavating a 2x3m trench producing seven tons of sediment bearing 30 artefacts;
- 2004: HAP 1, excavating the organic mud (top level fluvial deposits) where a hand-axe was found. Several flint flakes were retrieved next to organic materials;
- 2004-2010: HAP 3 and Happisburgh 2 (HAP 2)[1], retrieval of archaeological and paleoenvironmental material from several trenches and exposed soils;
- 2009-2012 Happisburgh 1, by the University of Leiden: collecting archaeological and paleoenvironmental material. The eroding and retreating coastline allows tracking the sedimentation channel that marks HAP 1 (see Figure 2).

See Figure 4 for an overview of all excavated pits from all seasons (which is also the frontal image of this internal report).

[1] HAP 2 is located 500m north-west of the old slipway, HAP 3 is located 300 m north-west from the slipway.

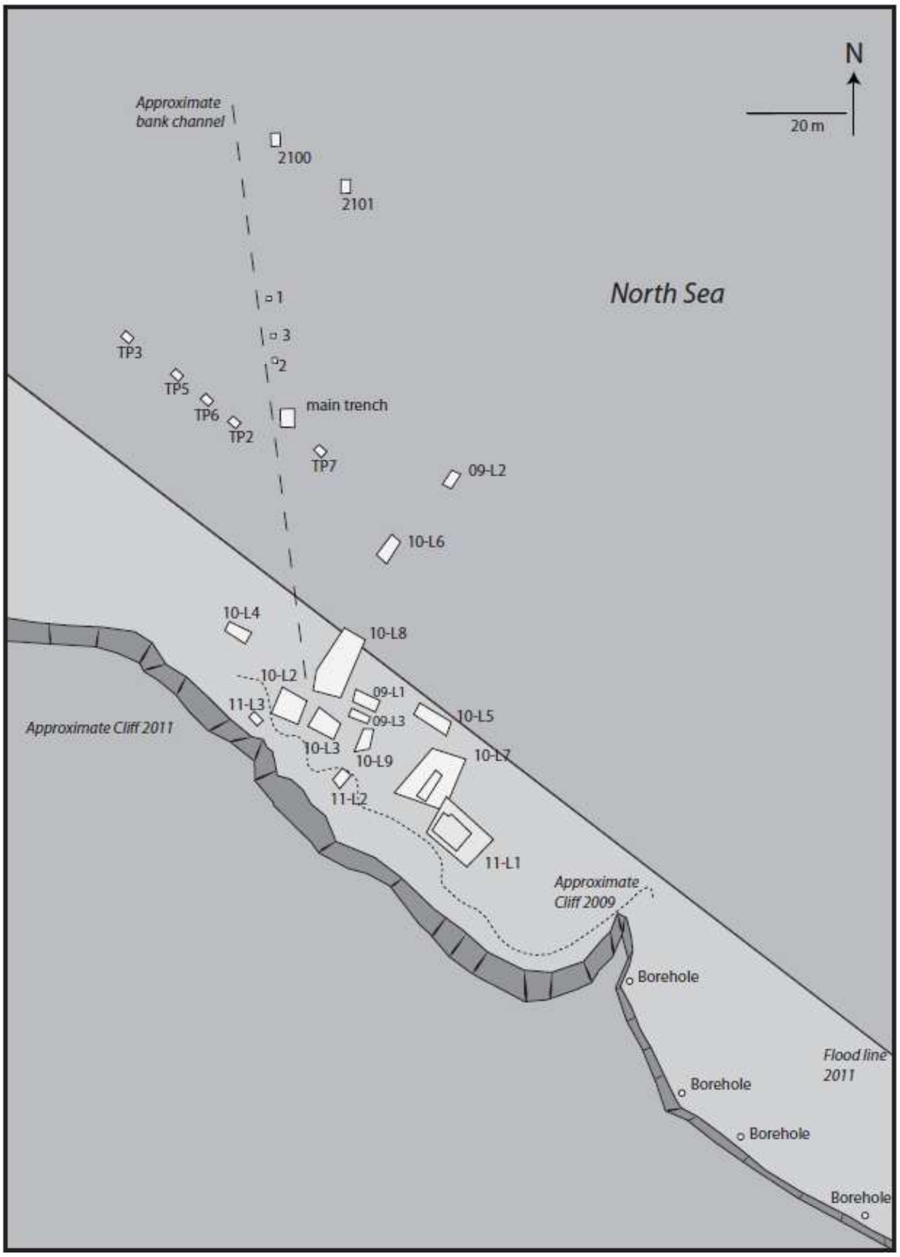

Figure 2 - Excavation overview of Happisburgh 1 up to 2011 inclusive (Knul 2012, Figure 8), adapted from the MapInfo GIS dataset. GIS data courtecy of E. Dullaart.

The main components of the stratigraphy at HAP 1 have been analyzed extensively and occur at and underneath the modern beach along the coast stretching from Weybourne down to Pakefield (Ashton and Lewis in press, Field 2012, Hosfield 2011, Preece and Parfitt in press). Table 1 presents a summary of these stratigraphical layers at HAP 1.

Table 1 - Stratigraphic layers at Happisburgh 1 (for more detail, see Knul (2012)).

1.	***Modern beach sand***, from 0 up to 1.5 meters thick in some places.
2.	***Happisburgh Formation, containing the Happisburgh Till***, a diamiction containing erratic clasts, the lowest part of this formation extending underneath the beach sands. The cliffs

	along the beach are glaciogenic deposits containing this formation.
3.	***Cromer Forest-bed Formation (CR-bF),*** including the organic mud which contains well preserved wood and other remains (sometimes 80 centimeters thick). Due to acidic conditions the calcareous fossils including most skeletal material have disappeared. This formation is deposited in Pleistocene interglacial conditions and forms a complex sequence of fresh-water, estuarine, and marine sediments.
4.	***Grey sandy silts with clay lenses***. A fluvial deposit in which numerous artefacts were found.
5.	***Wroxham Formation*** with Early Pleistocene marine sands (formerly known as the Weybourne Crag) and reaching a bedrock of Chalk at around 27 meter deep.
At certain locations elements from some layers have penetrated other layers, mainly due to glaciogenic forces of the Anglian ice sheets. For instance clay lenses penetrating the organic mud layer (Field 2012, 3, see Figure 1 therein), or parts of the Happisburgh Till pushed into the organic mud (2011 excavation results at HAP 1).	

Stratigraphic layers 3 and 4 in HAP 1 are complex fluvial deposits in marine sands and are attributed to the pre-diversion Thames, the Bytham and the Ancaster rivers (Ashton *et al.* 2008, Hosfield 2011, Westaway 2011). Controversies around dating of the stratigraphy have led to two contrasting age models (Preece and Parfitt in press). One model, the 'New Glacial Stratigraphy' dates the Anglian Till according to glacial formation processes and suggests that the Happisburgh Till can be dated to MIS 16, implying an early date for the underlying CR-bF beds (Lee *et al*. 2004, 2008, Hamblin *et al*. 2005, Rose 2009).

A biological oriented approach, apptly named the 'Biostratigraphic Age Model', suggests a more recent date of MIS 12 for the Till (Preece *et al*. 2009, Westaway 2011). This fits the biological evidence. The presence of *Arvicola terrestris cantiana* in the underlying CR-bF (Ashton *et al*. 2008) suggests a recent MIS 13 (or 15) origin, similar to Waverley Wood where this species is also found (Shotton *et al.* 1993). Also the beetle signature suggests MIS 13, based on similarities with the collection found at High Lodge (Lee *et al*. 2004). Handaxe technology in these parts of Europe has so far been dated to MIS 13 or later, also suggesting a recent origin of the CR-bF from which in-situ hand-axes have been retrieved (Ashton *et al.* 2008, Preece and Parfitt in press). OSL dating and aminostratigraphy seem to support this age model as well (Preece *et al.* 2009, Preece and Parfitt in press).

Exact dating of the underlying grey sandy silts is also not straightforward. The surprising retrieval of part of a seed of *Actinidia faveolata*, a lone Tertiary relic, from this layer could suggest an Early Pleistocene age, opposed to the early Middle Pleistocene date for the CR-bF (Field 2012). Another possibility is that both fluvial layers are of the same age, with the *Actinidia* seed an outlier being either reworked from earlier sediments or an odd survivor indicating a late range and date extension into north-west Europe for this species. A sedimentation hiatus caused by erosion might be present, especially if the lower fluvial deposits could be correlated with Dutch Early Pleistocene sediments (Field 2012). West (1980) has described a similar layer overlain by a thin gravel bed, which has not been observed in all excavated pits.

Both the organic muds as well as the grey sandy silts are fluvial deposits (see Figure 3). Research at HAP 3, around one km north-west of HAP 1, suggests an origin of mainly pre-diversion Thames and with some contribution by the Bytham river, due to the presence of for instance Rhaxella chert that is not present in the Thames (Parfitt *et al.* 2010). The approximate location of the river channel associated with the deposits in the 2004 excavation in relation to the 2009-2011 excavations is indicated in Figure 2. The location and height of former river terraces more inland from these rivers are used in geologically dating the sites (Hosfield 2011). However, the exact former positions of these rivers, the contribution of each of these rivers to the sediments as reflected in the ratio of flint, quartz, and chert and the followed interpretations within the dating method are not uncontested (Westaway 2011).

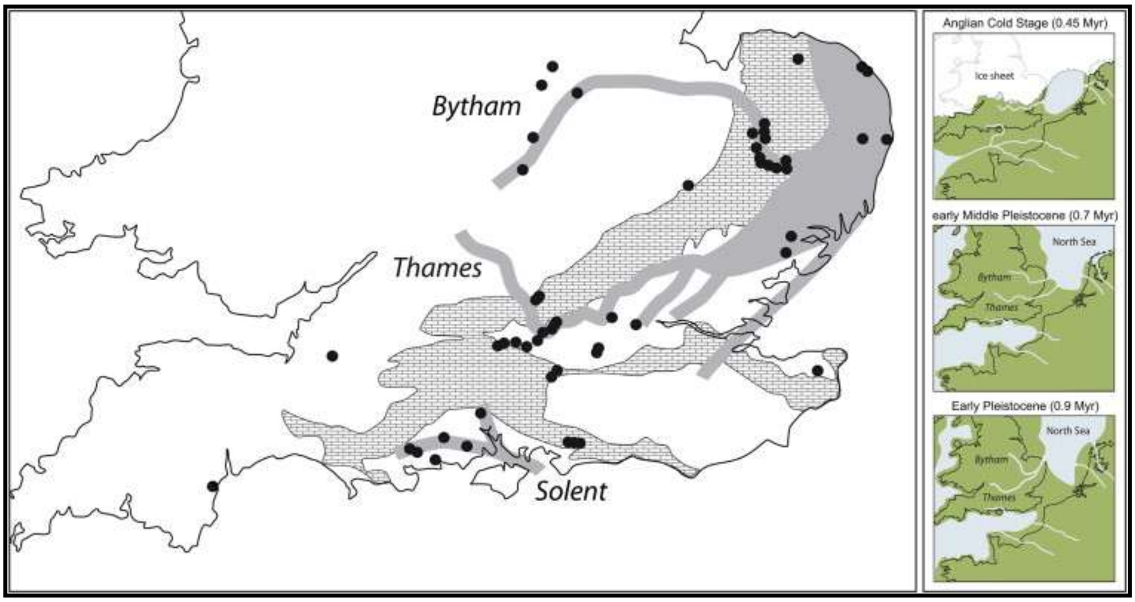

Figure 3 - Overview of Lower Paleolithic sites from before the Anglian glaciation with suggested river beds of the Thames and Bytham pre-Anglian river systems and shaded the chalk layer from which most flint derives. On the side a changing English Channel for the three different relevant time periods. Figure taken from (Preece and Parfitt in press, Figure 3).

The archaeological excavations and the collecting efforts throughout the years have resulted in a diverse collection of paleoenvironmental material from the CR-bF layers. These include vertebrate faunal remains, beetles, pollen, and plant macro fossils. The information obtained from the coleopteran species suggests a slightly colder environment than today with marshy, wet conditions

(Coope 2006). The vertebrates from HAP 1 suggest interglacial conditions in a rather open, moist environment with some trees and fresh water flowing nearby (Ashton *et al*. 2008). The few preserved bones bear cut-marks, breakage to obtain marrow, and carnivore gnawing marks. Wood charcoal is preserved in most samples but anthropogenic origin is unclear (Ashton *et al*. 2008).

The palynological information for both CR-bF and the grey sandy silts at HAP 1 similarly suggests presence of a coniferous forest with diverse fresh water vegetation, including species indicating slow moving water and marshes (Field 2012). Plant macro fossils from the CR-bF layer suggest a brackish element, whereas pollen results indicate fresh water with damp open ground at the margins of the river channel. There is heath land in the area. Recent analysis also points to a deepening through time of the channel, with a higher concentration of edge oriented and marshy plants like *Eleocharis palustris, Cyperus fuscus, Potentilla palustris* and *Lythrum portula* in the lower layers. With little proof for marine influence the CR-bF could have become a cut-off channel with decreasing fluvial characteristics[2].

Besides organic materials also artefacts were recovered from the different stratigraphical layers. These include a hand-axe found by Mike Chambers (Ashton *et al*. 2008) and some 53 other flint pieces collected from the beach and the cliffs throughout the years, 101 flints retrieved during the 2004 excavation and 118 flint pieces collected in the 2009 and 2010 excavation campaigns by Leiden University (Knul 2011). Included are cores, flakes, chunks and modified pieces. Generally these artefacts are in fresh, not rolled condition from a possible primary archaeological context and created using a similar, unprepared core technology applying hard-hammer percussion[3]. Dating this technology is difficult. Not all material has a local origin, but generally it is a dark grey, fine grained flint with shiny black patination. Due to the used excavation techniques (see Figure 8) spatial clustering or activity zones cannot be distinguished.

1.2 Excavations

Excavation data is digitally collected in the following years:

- 2004
- 2009
- 2010

[2] Personal communication with F.J. Feijen, 7 May 2012.
[3] Personal communication Jonathan Croese, 31 May 2012, suggesting a transient use of the implements with little visible use-wear. There is no obvious technological difference between HAP 1 and HAP 3 flint material.

- 2011
- 2012

All data has been processed in MapInfo, using separate tables for each type of object (see Appendix). Data is presented in the next chapters, one chapter for each year of excavation. Where useful, tables are exported from MapInfo to Excel using the Export Wizard. Column titles are kept.

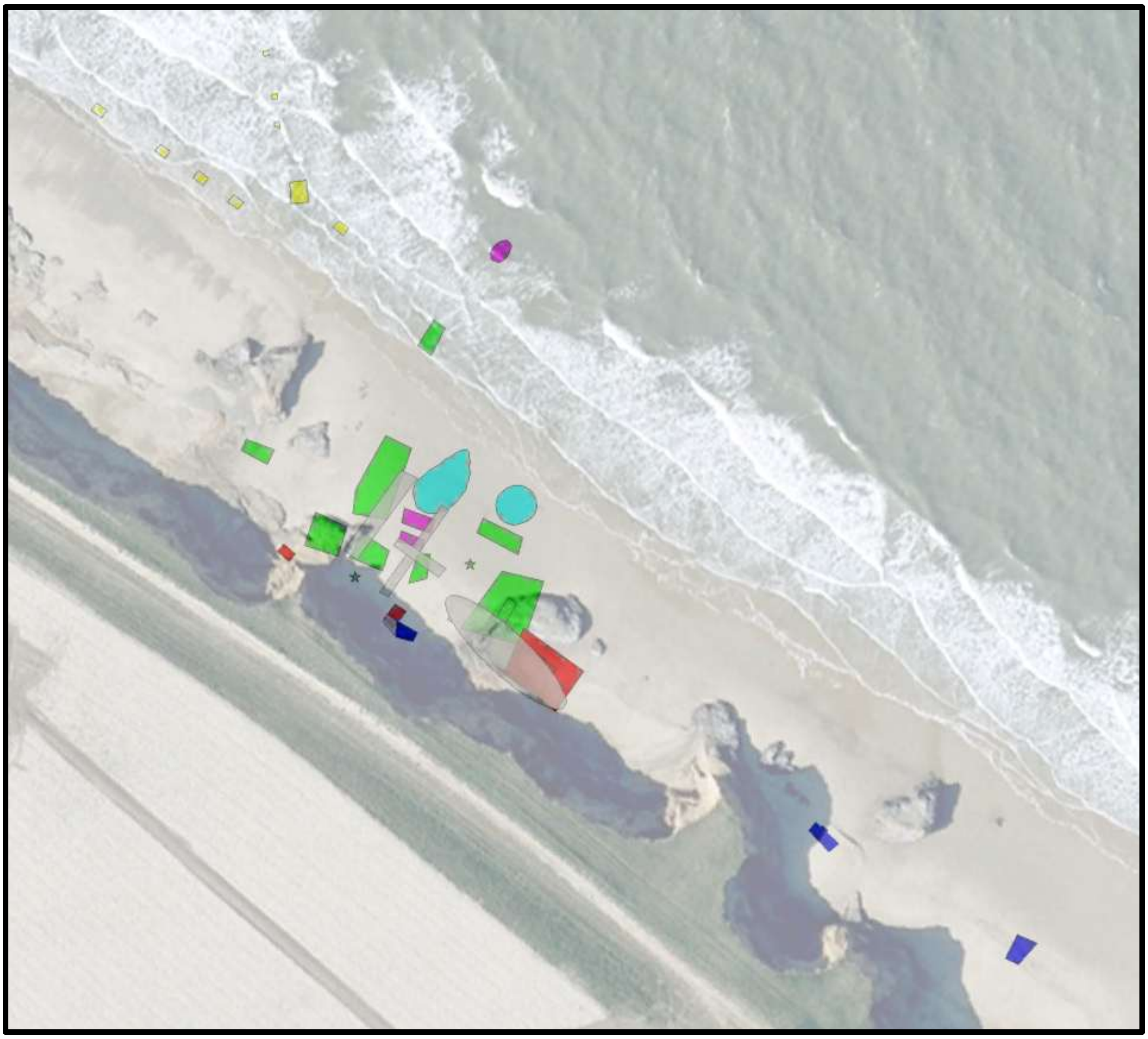

Figure 4 - Excavated pits at Happisburgh I: 2004 (yellow), 2009 (purple), 2010 (green), 2011 (red) and 2012 (dark blue and translucent grey).

Cross-sections and detailed descriptions of stratigraphy are available for the excavations of 2009 and 2010 in (Knul 2012, Appendix 1 Field Reports Happisburgh Site 1 2009-2010). Some cross section measurements were made for 2011 and 2012 field seasons by Robin Nieuwenkamp (email 20 June 2014), but these have not been digitized yet.

2. EXCAVATION 2004

Main objective of the first excavation in this area is to confirm the presence of hominins at this locality.

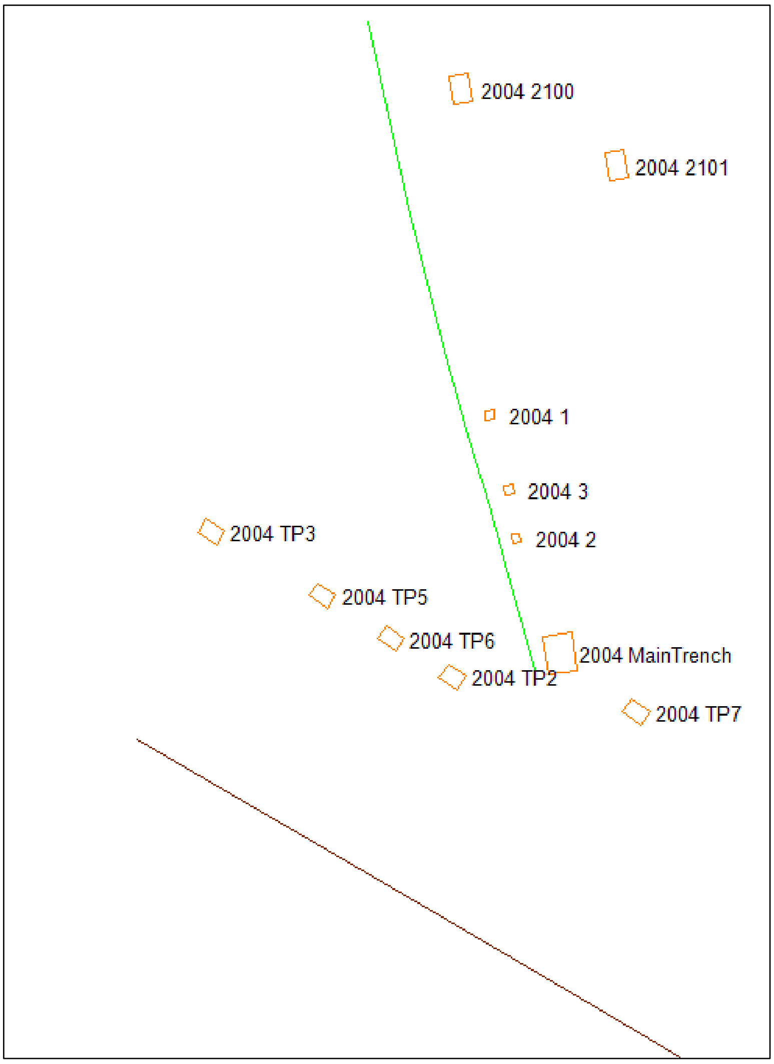

Figure 5 - All data recorded in the 2004 Happisburgh excavation.

Data for 2004 was initially manipulated using AutoCAD in British location, and only later converted to MapInfo. With this conversion the measuring points themselves were lost, the drawn figures were preserved. For instance, for a trench the four corner points are not individually stored, only the square figure.

2.1 Excavated pits

The following pits were recorded:

2004 TP7
2004 MainTrench
2004 2
2004 3
2004 1
2004 2100
2004 2101
2004 TP2
2004 TP6
2004 TP5
2004 TP3

2.2 Measured features: edge channel and cliff position

Furthermore the edge channel and the cliff position were recorded. Both of these are interpretations, from which the measured points are lost. The values of these objects is limited as no further information is available on how these were constructed/drawn.

3. EXCAVATION 2009

In 2009 three excavation pits were dug, mainly to excavate artefacts to increase the sample size and to understand the stratigraphy of the site and to retrieve paleoecological data. Furthermore two wells were identified and the coastline was mapped. Only geographical X and Y coordinates are available for all these elements. See Figure 6. No height is recorded and individual measuring points were not stored.

Figure 6 - 2009 mapped features and pits superimposed upon a Google Earth view of the area.

3.1 Excavated pits

The following pits were recorded, for each pit an autocad_elevation of 3.620543 is given:

2009 L1
2009 L2
2009 L3

3.2 Measured features: two wells and coastline

Two wells (unnamed) were identified on the beach, and mapped.

The coastline was mapped.

GPS coordinates for station points and excavation features are available in Knul (2012).

4. EXCAVATION 2010

In the 2010 excavation season ten pits were dug, researching the stratigraphy of the site and the relationships between the different layers. Geography of the channel was mapped (see Knul (2012, Chapter 4), more artefacts excavated and paleobotanical and palaeomagnetic samples were taken (Knul 2012, see also detailed excavation report in the supplementary information). From the ten pits, two pits (1 and 10) were recorded with center point only. L1, L2 and L10 would locate previous pits and expand these. The position of two boreholes was recorded, five measuring points and three location leveller points were mapped and the location of the cliff was stored. See Figure 7.

Figure 7 - Stored elements in the 2010 season.

4.1 Excavated pits

The following pits were recorded with elevation information for each object preserved through the AutoCAD conversion process, see Table 2. For pits L1 and L10 only the center point is stored, without elevation information. In pit L7 a subsection has been excavated deeper, this is referred to as 2010 L7_2.

Table 2 - 2010 excavated pits L2 through L9 with elevation information.

Name	***Elevation***	***Remarks***
2010 L7	1.55200000000000	
2010 L7_2	1.55200000000000	
2010 L9	1.37200000000000	
2010 L2	1.33200000000000	
2010 L3	1.33200000000000	
2010 L8	0.69600000000000	
2010 L5	0.59200000000000	
2010 L6	3.62054300000001	This elevation is expected to be lower than the others?
2010 L4	1.40200000000000	

4.2 Measured features: leveller and measuring points, boreholes, cliff position

Five measuring points and three location leveller points were mapped, all unnamed. No further information is available for these points but geographical X and Y coordinates. Two boreholes were recorded: BH 1 2010 and BH 2 2010. The position of the cliff has been measured, but is only indicated by a single linear feature (see Figure 7).

GPS coordinates for station points and excavation features are available in Knul (2012).

5. EXCAVATION 2011

The main aims of this season are similar to the 2010 excavation (Knul 2012, see also detailed excavation report in the supplementary information). In the 2011 season three pits were excavated, of which one was deepened for further research. Many features were mapped, including the cliff base and top and five boreholes. An exact height was for the first time transferred to the site from the locality of the lighthouse, where an elevation of 20.1615 meter is recorded (email E. Dullaart 3-7-2012).

Figure 8 - Mechanical digger used to expose and excavate the deposits in the 2011 excavation by Leiden University (Photo courtesy of H. Kamermans).

5.1 Excavated pits

Three pits were excavated in 2011, see Figure 9. Z-coordinates are not stored with the HAP2011_Pitts objects, but were saved with the individual data points from which the pits were drawn.

Figure 9 - 2011 Excavated pits and mapped cliff base and top.

The following pits have been excavated:

2011 L1	
2011 L1_2	Deepened section of 2011 L1
2011 L2	
2011 L3	

5.2 Measured features: coastline, boreholes, sightlines, HAP3

All features have been stored in data points. These are shown in Figure 10. For each point a PointID (the label), coordinates Xcoord, Ycoord, Zccord, a Code field and a Remark column are stored.

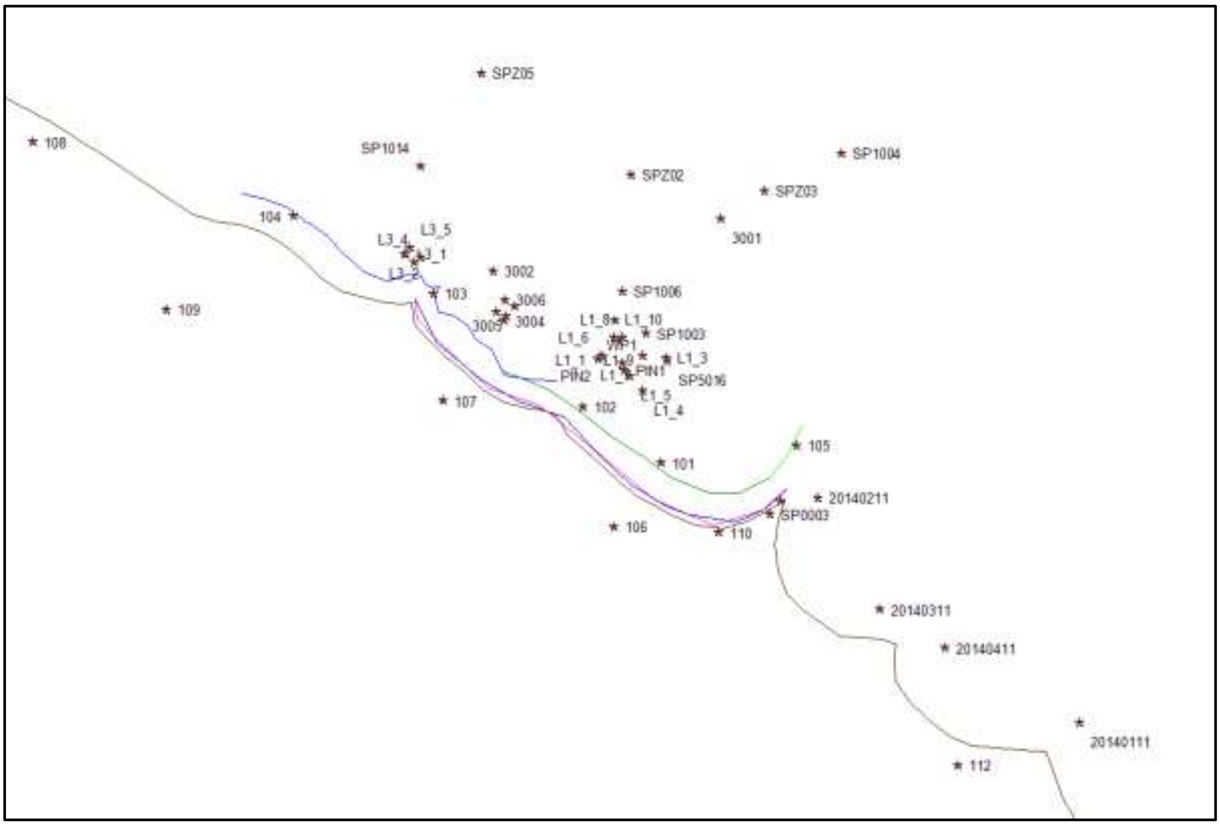

Figure 10 - Data points mapped in 2011.

The following features have been mapped:

- The coastline has been mapped in great detail, see Figure 12.
- Four boreholes are stored: 20140211, 20140311, 20140411, and 20140111.
- Points PIN1, PIN2 and 2003 are sight lines.
- Several data points were taken at the location of Happisburgh 3, see Figure 11 and compare Figure 1. Height for these points has been transferred through SP1015 (not visible in Figure 10) and SP1014.

Note: the coordinates for the following data points are incorrect: Lighthouse, ATTL, WEYB, and GORS. In the blue line forming the cliff base some inconsistencies are visible at the end to the right. In the table for HAP2011 the column Zccord should be named Zcoord.

Figure 11 - Data points mapped in 2011 at the location of Happisburgh 3, shown on Google Earth.

Figure 12 - 2011 Measured points along the coastline, mapping cliff bottom and top.

6. EXCAVATION 2012

Figure 13 - 2012 Excavating near promontory (Photo courtecy of F. Scherjon).

The 2012 GIS measured data can be distinguished into two major categories:

- Excavation pits
- Measured surface data: features, finds and structures

In the 2012 season two different types of excavation pits were dug: excavation pits to retrieve archaeology and trenches to locate past excavation features. The measured data can be subdivided into three broad categories: boreholes, surface features and mapping of the current coastline. Identification of the measuring points also fits into the measured surface data major category.

6.1 Excavated pits and trenches

Figure 14 - Location of the 2012 Pits and Trenches in the excavation area superimposed upon a detailed GoogleEarth view of the area.

Figure 15 - Excavation area in relation to Happisburgh town.

Several pits and trenches have been renamed for consistency reasons:

Old name	*New name*
2012 L2 (duplicate)	2012 L1
2012 L1	2012 L1_2
2012 L4	2012 L4 (unchanged)
2012 L4_1	2012 L4_2
2012 L5 (duplicate)	2012 L6
2012 L6	2012 L6_2

6.1.1 Pits

Pits to excavate new archaeology:

- 2012 L1
- 2012 L1_2
- 2012 L4 – but excavation materials are not sieved and not completely analysed on finds

6.1.2 Trenches

Several trenches were dug to locate previous excavation traces, see Figure 16 with identification of past features.

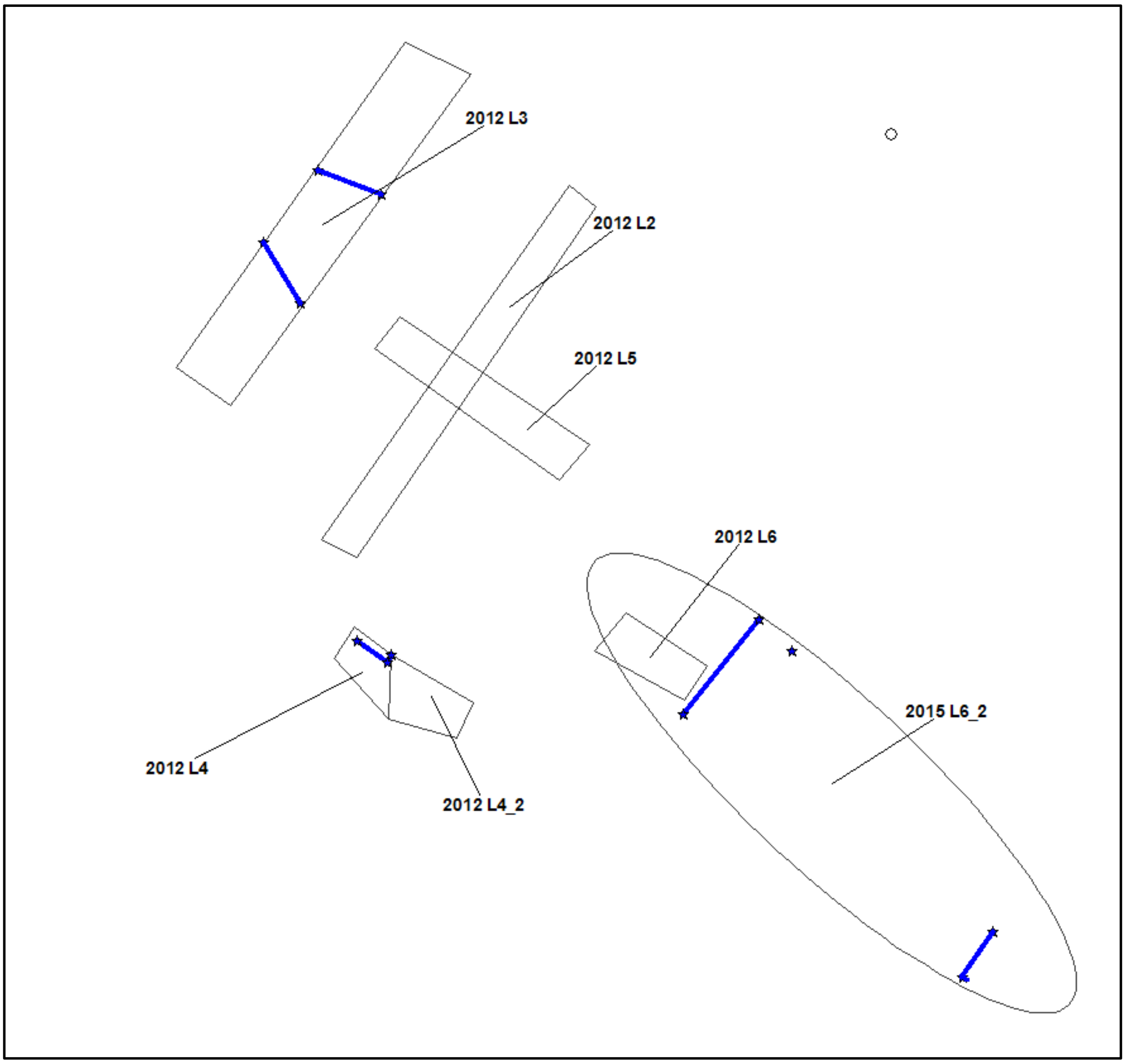

Figure 16 - Excavation trenches, with features from previous excavations in Blue.

Trenches to locate previous excavation pits:

- 2012 L2
- 2012 L3
- 2012 L4
- 2012 L5
- 2012 L6
- 2012 L6_2

6.2 Measured features: cliff position, boreholes, measuring points, exposed layer

- 2012 E1 – English excavation pit (see Figure 14)

- BH 1 2012, BH 2 2012, BH 3 2012, BH 4 2012, BH 5 2012, BH 6 2012: Borehole data
- MP01, MP02, MP03, MP04, MP05, MP06: measuring points (with known coordinates)
- SI501, SI502, SI503, SI504: feature identified on the beach: exposed layer
- MP1019, SPEPOST1: orientation markers on pole
- Cliff position, see Figure 18.

The boreholes are described in detail in the next subparagraph.

6.2.1 Borehole data

Six borehole positions were recorded in the 2012 season. Naming and position details shown in Figure 17 and presentted relative to the cliff base in Figure 18.

Figure 17 - Position of the 2012 boreholes relative to the excavation pits.

Xcoord	*Ycoord*	*Zcoord*	*Label*
638968.66	330511.30	1.563	BH 4 2012
639005.05	330486.89	174	BH 5 2012
638888.56	330518.65	10.799	BH 1 2012
638920.40	330540.03	1.462	BH 2 2012

638990.29	330502.72	1.683	BH 3 2012
638938.21	330517.53	1.679	BH 6 2012

Boreholes Happisburgh I July 2012, height corrected, final results.

1	638888,561	330518,648	11,233	Top of the cliff
2	638920,399	330540,034	1,896	North of promontory
3	638990,293	330502,715	2,117	Furthest south
4	638968,660	330511,300	1,997	
5	639005,048	330486,888	2,174	
6	638938,213	330517,533	2,187	South of promontory

Conversion of height: 102 has measured height of 3.611; real height is 4.045; add 0.434 meter

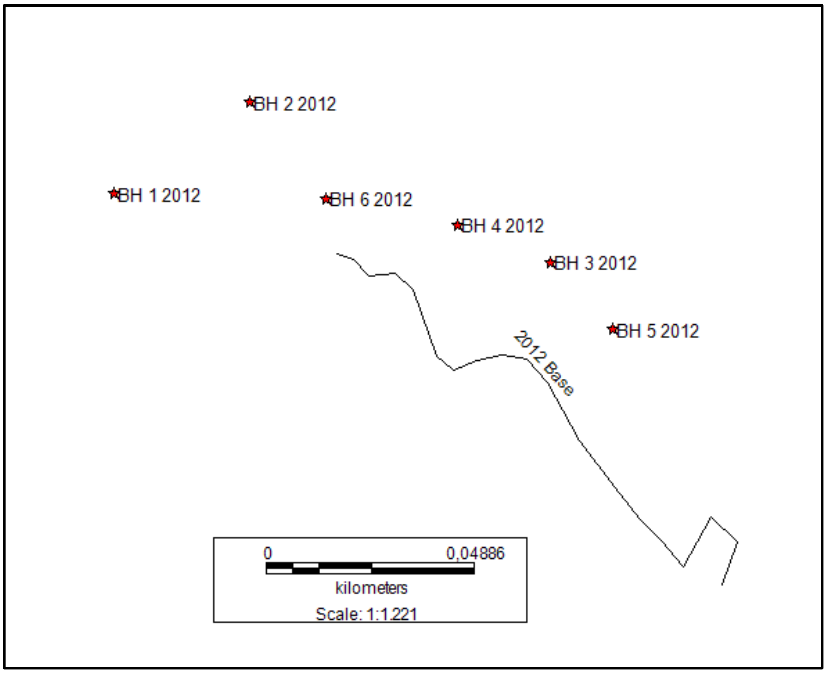

Figure 18 - Current cliff base position

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Appendix I – MapInfo data tables

This Appendix lists the data points for season 2011 and 2012 respectively.

HAP2011 data points

The following table presents all available data points for the 2011 excavation season.

Table 3 - Data points 2011 season

Point_ID	*Xcoord*	*Ycoord*	*Zccord*	*Code*	*Remark*
106	638891,16	330515,70	10,928	FP	Cliff top november 2011
110	638912,84	330515,47	10,857	FP	Cliff top november 2011
101	638900,23	330529,19	3,639	FP	Cliff top november 2011
102	638883,41	330539,97	3,578	FP	Cliff top november 2011
103	638851,47	330561,78	3,891	FP	Cliff top november 2011
104	638821,66	330576,30	4,510	FP	Cliff top november 2011
105	638927,95	330534,20	4,004	HMP	Cliff top november 2011,Houten paaltje
107	638854,64	330539,77	11,147	FP	Cliff top november 2011
108	638767,18	330588,86	10,935	FP	Cliff top november 2011
112	638964,58	330470,12	12,164		VP (geel/zwart) van Engelsen
CT501	639019,70	330426,99	7,644		
CT502	639015,33	330429,50	7,879		
CT503	639011,32	330433,34	8,103		
CT504	639007,21	330436,47	8,359		
CT505	639003,54	330440,07	8,659		
CT506	639000,10	330443,61	9,007		
CT507	638996,32	330447,39	9,443		
CT508	638993,55	330451,34	9,914		
CT509	638990,75	330455,54	10,435		
CT510	638989,17	330460,32	10,948		
CT511	638986,51	330464,50	11,406		
CT512	638984,64	330469,40	11,804		
CT513	638982,70	330473,51	12,056		
CT514	638977,51	330473,66	12,093		
CT515	638972,40	330473,92	12,118		
CT516	638967,37	330474,03	12,123		
CT517	638962,58	330475,99	12,086		
CT518	638958,10	330478,96	12,048		
CT519	638954,15	330482,58	11,933		
CT520	638950,85	330486,65	11,808		
CT521	638950,55	330489,93	11,699		
CT522	638950,43	330492,10	11,665		
CT523	638950,48	330494,17	11,498		
CT524	638947,89	330495,03	11,439		
CT525	638944,21	330495,23	11,519		
CT526	638939,14	330495,34	11,338		
CT527	638934,91	330497,87	11,219		
CT528	638931,18	330500,24	11,157		
CT529	638927,59	330503,46	11,111		
CT530	638925,65	330508,17	11,101		
CT531	638924,72	330513,42	10,789		
CT532	638925,00	330518,28	10,704		
CT533	638925,68	330520,60	10,652		
CT534	638926,23	330522,66	10,510		
CT535	638922,62	330520,35	10,624		
CT536	638918,89	330518,03	10,655		
CT537	638918,92	330518,04	10,651		
CT538	638913,90	330516,31	10,864		
CT539	638908,07	330516,56	10,758		
CT540	638903,12	330518,35	10,783		
CT541	638898,45	330520,80	10,680		
CT542	638895,94	330521,71	10,673		
CT543	638892,24	330524,40	10,559		
CT544	638888,41	330527,83	10,391		
CT545	638884,58	330530,75	10,249		

CT546	638880,63	330533,91	10,125		
CT547	638879,47	330535,99	10,044		
CT548	638878,05	330537,72	9,971		
CT549	638875,89	330538,58	9,943		
CT550	638872,38	330538,85	9,946		
CT551	638867,06	330539,95	9,964		
CT552	638862,52	330542,43	9,939		
CT553	638858,63	330546,07	9,848		
CT554	638854,60	330548,98	9,820		
CT555	638850,48	330552,36	9,776		
CT556	638847,99	330554,86	9,787		
CT557	638847,49	330557,23	9,748		
CT558	638847,24	330559,51	9,763		
CT559	638844,85	330559,14	9,719		
CT560	638841,88	330559,36	9,740		
CT561	638837,10	330560,10	9,756		
CT562	638832,30	330561,28	9,798		
CT563	638827,92	330563,95	9,834		
CT564	638823,86	330567,40	9,856		
CT565	638819,77	330570,35	9,817		
CT566	638815,62	330572,50	9,781		
CT567	638810,75	330573,78	9,750		
CT568	638805,61	330574,25	9,741		
CT569	638800,81	330575,59	9,717		
CT570	638796,20	330578,24	9,686		
CT571	638791,93	330580,81	9,679		
CT572	638787,36	330583,57	9,689		
CT573	638783,15	330585,97	9,690		
CT574	638779,02	330588,21	9,668		
CT575	638779,31	330588,13	9,676		
CT576	638775,25	330590,49	9,676		
CT577	638771,18	330592,91	9,656		
CT578	638766,32	330595,11	9,668		
CT579	638763,05	330596,73	9,675		
CT580	638759,83	330598,21	9,710		
CT581	638758,33	330600,66	9,723		
CT582	638753,77	330602,21	9,683		
CT583	638749,46	330604,91	9,671		
CT584	638745,69	330607,26	9,674		
CT585	638741,41	330609,48	9,669		
CT586	638737,07	330611,33	9,686		
CT587	638732,69	330613,23	9,835		
CT588	638727,14	330614,82	9,861		
CT589	638721,95	330617,07	9,878		
CT590	638717,27	330619,45	9,885		
CT591	638712,93	330622,32	9,906		
CT592	638708,93	330625,19	9,936		
CT593	638704,70	330628,12	9,968		
CT594	638700,57	330631,48	10,012		
CT595	638696,71	330635,46	10,019		
CT596	638692,83	330639,01	10,062		
CT597	638688,98	330642,88	10,103		
CT598	638685,44	330646,45	10,151		
CT599	638682,14	330650,25	10,194		
CT600	638678,56	330654,01	10,211		
CT601	638674,78	330659,11	10,302		
CT602	638674,79	330659,10	10,303		
CT603	638671,68	330663,07	10,384		
CT604	638668,73	330667,40	10,500		
CT605	638665,53	330671,05	10,599		
CT606	638662,98	330675,68	10,519		
CT607	638660,16	330680,10	10,600		
CT608	638657,08	330684,21	10,713		
CT609	638654,74	330687,81	10,746		
CT610	638655,64	330689,22	10,761		
CT611	638653,29	330692,38	10,786		
CT612	638650,15	330697,00	10,907		
CT613	638647,45	330701,38	11,016		
CT614	638643,87	330705,01	11,040		
CT615	638642,27	330709,41	10,964		
CT616	638642,62	330711,94	10,995		
CT617	638637,53	330710,67	11,138		

CT618	638632,22	330710,62	11,178		
CT619	638627,42	330712,22	11,289		
CT620	638623,08	330714,67	11,402		
CT621	638619,28	330717,82	11,502		
CT622	638616,51	330721,77	11,522		
CT623	638612,25	330724,77	11,587		
CT624	638608,64	330728,42	11,604		
CT625	638604,98	330732,25	11,631		
CT626	638602,74	330736,90	11,561		
CT627	638603,01	330739,85	11,554		
CT628	638604,85	330741,22	11,645		
CT629	638601,40	330745,58	11,671		
CT630	638598,53	330750,25	11,566		
CT631	638595,24	330754,07	11,564		
CT632	638591,97	330758,12	11,579		
CT633	638588,25	330761,72	11,569		
246	638273,10	331153,90	12,098		
247	638273,18	331153,95	12,092		
248	638273,52	331154,31	12,091		
249	638262,21	331139,53	12,364		
Pub	638028,95	331108,66	11,754		
200-2	638273,07	331154,50	4,829		
202-2	638273,13	331154,44	4,870		
203-2	638273,36	331154,71	4,961		
204-2	638337,68	331128,71	-4,178		
ATTL	602845,44	295190,44	34,566		
GORS	652959,26	304070,32	5,920		
WEYB	610420,61	343195,52	27,050		
Farm	637596,89	331196,30	11,110		
SP0003	638923,13	330519,76	11,781	STP	
109	638796,41	330555,84	11,960	FP	
SP1015	638621,72	330864,36	-0,869	STP	
Lighthouse	0,00	0,00	-	CP	
SPZ05	638859,16	330607,61	1,114	STP	
SPZ02	638890,99	330588,30	0,841	STP	
SPZ03	638918,94	330586,29	0,174	STP	
SP1006	638890,53	330564,17	1,340	STP	
3001	638910,07	330580,14	2,420	?	
3002	638863,53	330567,03	1,033	PUT	HAP10-L2 of L9
3004	638866,22	330556,90	1,637	PUT	HAP11-L2
3005	638868,43	330560,01	1,349	PUT	HAP11-L2
3006	638866,36	330561,26	1,260	PUT	HAP11-L2
3007	638864,63	330558,55	1,586	PUT	HAP11-L2
3008	638866,79	330557,84	1,555	WPL	Waterpaslijn van put HAP11-L2
SP1003	638895,71	330555,73	1,175	STP	
CT512-2011-07	638926,32	330525,16	10,405	CliffTop	Clifftop july 2011
CT513-2011-07	638921,76	330520,51	10,620	CliffTop	Clifftop july 2011
CT514-2011-07	638916,30	330517,78	10,674	CliffTop	Clifftop july 2011
CT515-2011-07	638906,48	330518,75	10,740	CliffTop	Clifftop july 2011
CT516-2011-07	638901,82	330520,41	10,672	CliffTop	Clifftop july 2011
CT517-2011-07	638894,32	330524,28	10,495	CliffTop	Clifftop july 2011
CT518-2011-07	638887,28	330530,14	10,309	CliffTop	Clifftop july 2011
CT519-2011-07	638879,83	330537,60	10,003	CliffTop	Clifftop july 2011
CT520-2011-07	638870,49	330540,14	9,903	CliffTop	Clifftop july 2011
CT521-2011-07	638861,98	330544,66	9,843	CliffTop	Clifftop july 2011
CT522-2011-07	638852,90	330551,55	9,777	CliffTop	Clifftop july 2011
CT523-2011-07	638847,67	330560,17	9,773	CliffTop	Clifftop july 2011
PIN1	638891,80	330547,88	-0,227	WPL	
PIN2	638887,24	330550,58	-0,203	WPL	
WP1	638891,15	330549,37	-1,259	PUT	Rand put L1, van de grote verdieping,
L1_1	638886,11	330549,92	1,292	PUT	
L1_2	638889,33	330558,12	1,142	PUT	
L1_3	638900,25	330551,01	0,986	PUT	
L1_4	638895,64	330543,78	1,238	PUT	
L1_5	638892,98	330546,85	0,244	PUT	
L1_6	638886,78	330550,73	0,364	PUT	
L1_7	638895,44	330551,18	0,209	PUT	
L1_8	638890,88	330554,57	0,138	PUT	
L1_9	638890,40	330554,03	0,151	PUT	
L1_10	638889,15	330554,65	0,117	PUT	
SP1014	638847,52	330587,82	1,780	STP	
L3_1	638845,40	330569,69	0,064	PUT	Contact till en gesorteerd zand

L3_2	638845,18	330569,51	0,222	PUT	
L3_3	638847,25	330567,86	0,210	PUT	
L3_4	638848,34	330569,22	0,076	PUT	
L3_5	638846,18	330570,90	0,066	PUT	
CB512-2011-07	638810,83	330580,23	4,417	CliffBase	Cliff bottom july 2011
CB513-2011-07	638815,64	330579,45	3,916	CliffBase	Cliff bottom july 2011
CB514-2011-07	638820,55	330577,98	3,642	CliffBase	Cliff bottom july 2011
CB515-2011-07	638824,83	330574,91	3,832	CliffBase	Cliff bottom july 2011
CB516-2011-07	638829,05	330572,28	3,961	CliffBase	Cliff bottom july 2011
CB517-2011-07	638832,21	330569,16	4,050	CliffBase	Cliff bottom july 2011
CB518-2011-07	638836,90	330565,55	3,293	CliffBase	Cliff bottom july 2011
CB519-2011-07	638841,93	330563,76	3,476	CliffBase	Cliff bottom july 2011
CB520-2011-07	638846,36	330565,41	3,135	CliffBase	Cliff bottom july 2011
CB521-2011-07	638848,88	330565,19	2,588	CliffBase	Cliff bottom july 2011
CB522-2011-07	638849,89	330563,53	2,675	CliffBase	Cliff bottom july 2011
CB523-2011-07	638851,19	330562,88	2,679	CliffBase	Cliff bottom july 2011
CB524-2011-07	638852,74	330563,07	2,573	CliffBase	Cliff bottom july 2011
CB525-2011-07	638851,68	330561,59	3,696	CliffBase	Cliff bottom july 2011
CB526-2011-07	638852,86	330557,91	3,646	CliffBase	Cliff bottom july 2011
CB527-2011-07	638855,93	330557,45	3,191	CliffBase	Cliff bottom july 2011
CB528-2011-07	638858,80	330555,44	2,941	CliffBase	Cliff bottom july 2011
CB529-2011-07	638860,82	330552,81	3,665	CliffBase	Cliff bottom july 2011
CB530-2011-07	638864,16	330550,66	3,787	CliffBase	Cliff bottom july 2011
CB531-2011-07	638867,00	330545,54	4,257	CliffBase	Cliff bottom july 2011
CB532-2011-07	638872,87	330545,01	3,464	CliffBase	Cliff bottom july 2011
CB533-2011-07	638877,92	330545,01	2,884	CliffBase	Cliff bottom july 2011
SP5016	638900,56	330550,34	2,779	STP	
BCL101	638866,71	330546,40	4,881	CliffBase	
BCL102	638875,81	330543,24	4,973	CliffBase	
BCL103	638881,96	330539,74	4,961	CliffBase	
BCL104	638889,94	330533,86	4,898	CliffBase	
BCL105	638896,66	330530,18	4,804	CliffBase	
BCL106	638902,41	330526,28	4,984	CliffBase	
BCL107	638910,55	330523,45	5,233	CliffBase	
BCL108	638916,56	330523,72	5,076	CliffBase	
BCL109	638922,88	330527,04	4,625	CliffBase	
BCL110	638926,46	330532,16	4,879	CliffBase	
BCL111	638928,92	330538,13	4,651	CliffBase	
TCL101	638926,40	330524,94	11,573	CliffTop	
TCL102	638922,21	330520,72	11,725	CliffTop	
TCL103	638911,68	330516,75	11,920	CliffTop	
TCL104	638899,34	330521,47	11,791	CliffTop	
TCL105	638889,53	330528,67	11,493	CliffTop	
TCL106	638874,63	330539,63	11,017	CliffTop	
TCL107	638863,80	330542,70	10,941	CliffTop	
TCL108	638852,95	330551,90	10,892	CliffTop	
TCL109	638848,34	330556,25	10,844	CliffTop	
TCL110	638847,71	330560,32	10,917	CliffTop	
SP1004	638934,44	330594,80	-0,842	STP	
20140211	638932,89	330523,66	1,719	BOOR	
20140311	638946,81	330501,28	2,085	BOOR	
20140411	638960,72	330494,00	2,245	BOOR	
20140111	638989,42	330480,07	2,270	BOOR	
111	638925,27	330522,60	10,442	HMP	

HAP2012 data points

This table presents all measured data points for the 2012 excavation season.

Table 4 - Data points 2012 season.

Point Id	*Xcoord*	*Ycoord*	*Zcoord*	*PointCode*	*Remark*
SPE0101	638900,200	330529,200	3,639		101
SPE0102	638883,400	330540,000	3,578		102
SPE0106	638891,103	330515,663	10,947	MP	106
BPE01	638888,561	330518,648	10,799	MP	BP english 1 cliff

SPE0107	638854,408	330539,680	10,083	MP	107
BPE02	638920,399	330540,034	1,462	MP	BP english 2 beach
SPE0103	638852,858	330557,470	3,672	MP	~103
SPEPOST1	638876,375	330653,500	-1,490	MP	direction post in sea
SI501	638760,107	330678,531	-0,332	MP	site 5
SI502	638758,584	330681,292	-0,468	MP	site 5
SI503	638760,018	330684,285	-0,554	MP	site 5
SI504	638761,996	330683,029	-0,514	MP	site 5
SPE30103	638852,789	330557,280	3,686	MP	103
SPE30110	638981,002	330505,788	1,740	MP	empty pit English
SPE30111	638982,754	330506,967	1,632	MP	empty pit English
SPE30112	638979,605	330503,212	1,931	MP	empty pit English
SPE30113	638977,140	330504,113	1,924	MP	empty pit English
SPE30114	638979,222	330508,311	1,651	MP	empty pit English
BPE03	638990,293	330502,715	1,683	MP	BP English 3
MPE301	638958,218	330499,260	3,904	MP	MP section drawing
MPE302	638965,167	330470,881	12,234	MP	MP Black Yellow
MPE303	638943,715	330525,925	-0,779	MP	pit
MPE304	638944,777	330525,122	-0,745	MP	pit
MPE305	638942,541	330524,777	-0,655	MP	pit
MP01	638900,252	330529,052	3,528	MP	101
MP02	638883,400	330540,012	3,611	MP	102
MP03	638853,083	330557,644	3,652	MP	103
MP04	638767,193	330589,089	9,804	MP	108
MP05	638854,559	330539,847	10,041	MP	107
MP06	638891,092	330515,659	10,907	MP	106
MP07	638964,491	330469,977	12,196	MP	MP Black Yellow
MP08	638990,820	330502,883	1,817	MP	BP English 3
MP09	638957,850	330498,447	3,876	MP	point near cliff
MP10	638942,640	330526,452	0,750	MP	pit
MP11	638945,127	330521,459	0,461	MP	pit
MP12	638946,771	330522,942	0,581	MP	pit
MP13	638941,382	330525,001	0,615	MP	pit
MP14	638940,573	330504,429	3,646	MP	Cliff edge
MP15	638944,496	330503,267	3,628	MP	Cliff edge
MP16	638948,085	330499,461	3,704	MP	Cliff edge
MP17	638954,152	330499,861	3,425	MP	Cliff edge
MP18	638958,559	330496,138	3,600	MP	Cliff edge
MP19	638964,001	330480,678	3,748	MP	Cliff edge
MP20	638967,965	330477,410	4,041	MP	Cliff edge
MP21	638973,444	330479,638	3,691	MP	Cliff edge
MP22	638979,012	330480,881	3,526	MP	Cliff edge
MP23	638984,823	330479,944	3,622	MP	Cliff edge
MP24	638989,933	330474,338	3,619	MP	Cliff edge
MP25	638993,501	330467,810	3,738	MP	Cliff edge
MP26	638997,157	330460,952	3,944	MP	Cliff edge
MP27	639001,451	330455,220	3,952	MP	Cliff edge
MP28	639006,766	330448,548	3,931	MP	Cliff edge
MP29	639011,550	330442,295	3,905	MP	Cliff edge
MP30	639016,458	330437,441	3,977	MP	Cliff edge
MP31	639021,610	330431,480	4,570	MP	Cliff edge
MP32	639027,961	330443,017	3,138	MP	Cliff edge
MP33	639034,056	330437,210	3,226	MP	Cliff edge
MP34	639030,527	330427,096	4,579	MP	Cliff edge
MP35	638968,660	330511,300	1,563	MP	BP English 4
CP09L30	638870,470	330573,440	1,000		Centre point pit 09L3
MP1000	638883,387	330540,006	3,612	MP	
MP1001	638870,460	330573,446	1,691	MP	Centre point pit 09L3
MP1002	639005,048	330486,888	1,740	BP	BP English 5
MP1003	638883,386	330540,005	3,612	MP	
MP1004	638874,801	330578,264	0,515	MP	empty pit
MP1005	638865,133	330562,520	0,942	MP	empty pit
MP1006	638863,532	330563,179	0,957	MP	empty pit
MP1007	638873,584	330579,131	0,439	MP	empty pit
MP1008	638861,209	330574,574	0,660	MP	pit
MP1009	638866,118	330585,017	1,064	MP	pit
MP1010	638861,579	330578,344	1,638	MP	pit
MP1011	638859,277	330568,833	1,695	MP	pit
MP1012	638862,614	330573,772	1,528	MP	pit
MP1013	638869,043	330583,786	1,160	MP	pit
MP1014	638865,381	330578,352	1,762	MP	pit
MP1015	638862,096	330573,477	1,468	MP	pit

MP1016	638860,348	330576,017	1,283	MP	pit
MP1017	638862,600	330579,296	1,418	MP	pit
CP11L20	638866,200	330556,900	1,637		Corner pit 11L2
MP1018	638866,164	330556,873	2,751	MP	Corner pit 11L2
MP1019	638874,415	330658,868	-1,697	MP	direction post in sea
MP1020	638928,020	330534,170	3,930	SP	
MP1021	638928,030	330534,190	3,929	SP	
MP1022	638895,410	330538,900	2,603	SP	
MP2006	638869,456	330570,921	1,577	SP	Centre point pit
MP2007	638865,335	330558,899	0,399	SP	Corner old pit
MP2008	638866,666	330557,983	0,108	SP	Corner old pit
MP2009	638866,838	330558,362	0,293	SP	edge old pit
MP2010	638864,356	330558,027	1,632	SP	pit
MP2011	638865,184	330559,473	1,434	SP	pit
MP2012	638866,873	330555,508	2,252	SP	pit 12L3
MP2013	638869,864	330554,825	1,420	SP	pit 12L3
MP2014	638870,526	330556,460	1,276	SP	pit 12L3
MP2015	638871,941	330568,367	1,605	MP	Centre Point pit 10L9
MP2016	638875,041	330567,928	0,732	MP	pit
MP2017	638875,042	330567,928	0,732	MP	pit
MP2018	638866,486	330573,062	0,675	MP	pit
MP2019	638865,447	330571,623	0,775	MP	pit
MP2020	638868,273	330569,583	0,548	MP	pit
MP2021	638873,785	330566,321	0,631	MP	pit
MP2022	638892,437	330545,560	1,173	MP	edge old pit
MP2023	638893,705	330547,579	1,148	MP	edge old pit
MP2024	638892,484	330545,543	1,175	MP	
MP2025	638880,662	330558,542	0,890	MP	pit
MP2026	638876,993	330560,672	0,896	MP	pit
MP2027	638879,737	330556,966	0,992	MP	pit
MP2028	638875,695	330558,963	1,313	MP	pit
MP2029	638881,560	330558,200	0,390	MP	edge untouched till
MP2030	638880,216	330556,346	0,792	MP	edge untouched till
MP2031	638884,327	330559,350	1,144	MP	in old pit
MP2032	638882,808	330560,687	1,460	MP	edge old pit
MP2033	638879,697	330556,411	1,497	MP	edge old pit

Appendix II – Technical procedures and data

How to create Google Earth input files

In the Tool Manager from MapInfo it is possible to activate the Google Earth Connection Utility. This will open a tool menu from which the current view can be exported as kml file, with associated jpg. Within GoogleEarth, layer properties, the Transparency of the MapInfo Saved view can be adjusted. For clarity reasons, pits should have be 4mm thick lines and text should be bold and 10pnts.

Figure 19 - Exported MapInfo view, with transparency set to 60%.

By default this exports a map window screenshot as a registered image in Google Earth. To export vector objects, select the objects you wish to export first. These can be either shapes or points, not both. An alternative method is described in the caption of Figure 20.

Figure 20 - GIS data converted from British National Grid, Ordnance Survey 1936 format into WGS84 lat/lon using ExpertGPS and then projected in Google Earth upon the satellite imagery showing exact positions of the 2004 (yellow), 2009 (purple), 2010 (green) and 2011 (red) excavation trenches.

MapInfo Data Files:

HAP2004_Cliff_position.tab

HAP2004_Edge channel.tab

HAP2004_Pitts.tab

HAP2009_Cliff_position.tab

HAP2009_Pitts.tab

HAP2009_Wells.tab

HAP2010_Boreholes.tab

HAP2010_Cliff_position.tab

HAP2010_Location leveller.tab

HAP2010_MP_pitt_1_pitt_10.tab

HAP2010_Pitts.tab

HAP2010_Set measuring points.tab

HAP2011.TAB

HAP2011_Cliff base.tab

HAP2011_Cliff top.tab

HAP2011_New fixed point.tab

HAP2011_Pitts.TAB

HAP2012.TAB

HAP2012_Boreholes.TAB

HAP2012_Cliff_base.TAB

HAP2012_Old_pitts.TAB

HAP2012_Pitts.TAB