Stantec

Our Ref: 47179//CAM/CE/HG/ZM

18 February 2020

Mr R Wheatley and Mr M Nutt
Camey Bee (London) Ltd
C/O Tim Waller
Waller Planning
19-25 Salisbury Square
Old Hatfield
Hertfordshire
AL9 5BT

Attention of: Tim Waller (on behalf of Camey Bee (London) Ltd)

Dear Mr Waller,

RE: STANTEC CAVITIES OCCURRENCE ASSESSMENT FOR THE SITE AT COMET WAY, HATFIELD, AL10 9TF.

The cavities databases search has been carried out for the site centred at National Grid Reference TL 21655 08780, as provided.

NATURAL CAVITY RECORDS

A search of the Stantec Natural Cavities Database indicated that there are 4 natural cavity records within 1km of the site centre, as shown in Table 1 below.

Table 1: Stantec Natural Cavities Database records

Approximate NGR	Approximate distance from site centre (m)	Recorded Location	Geology	Natural Cavity Details	Source
TL 218 085	280 (SE)	Saint Albans Road West, Roe Green, Hatfield, Hertfordshire	**Superficial:** Glacial Till and Morainic drift **Solid:** Chalk Group	1x Sinkhole	'Peter Brett Associates'
TL 217 084	380 (SSE)	Roe Green / Meadow Dell, Roe Green, Hatfield, Hertfordshire	**Superficial:** Glacial Till and Morainic drift **Solid:** Chalk Group	1x Swallow Hole	'Peter Brett Associates'
TL 220 084	480 (SE)	Pond Croft, Roe Green, Hatfield, Hertfordshire	**Superficial:** Glacial Till and Morainic drift **Solid:** Chalk Group	1x Swallow Hole	'Peter Brett Associates'
TL 217 082	590 (S)	Aldykes, Roe Green, Hatfield, Hertfordshire	**Superficial:** Glacial Sand & Gravel **Solid:** Chalk Group	3x Solution Pipes	'British Geological Survey'

MINING CAVITY RECORDS

A search of the Stantec Mining Cavities Database indicated that there are 6 man-made mining cavity records within 1km of the site centre, as shown in Table 2 below.

Table 2: Stantec Mining Cavities Database records

Approximate NGR	Approximate distance from site centre (m)	Recorded Location	Geology	Mining Cavity Details	Source
Centred at TL 216 079	800 (S)	North of Chantry Lane, Hatfield, Hertfordshire	**Superficial:** Glacial Gravel **Solid:** Chalk Group	'Roe Green Farm' 4x Chalkwells	'Pearce, A 1989. Private Mineral Extraction Database, Ove Arup: Cardiff'
TL 223 083	800 (SE)	Adjacent to Briar's Lane, Roe Green, Hatfield, Hertfordshire	**Superficial:** Glacial Till **Solid:** Chalk Group	'Briar's Lane Mine' 1x Shaft Entry Pillar & Stall Chalk Mine – Known Mined Ground	Hyder Consulting, Welwyn Hatfield Council
TL 223 083	800 (SE)	Adjacent to Briar's Lane, Roe Green, Hatfield, Hertfordshire	**Superficial:** Glacial Till **Solid:** Chalk Group	Multiple Crown Hole Collapses/ Structural Damage	'Peter Brett Associates'
In vicinity of TL 220 080	850 (SSE)	Hillcrest, Roe Green, Hatfield, Hertfordshire	**Superficial:** Glacial Gravel **Solid:** Chalk Group	Chalk mining – details unknown	'Pearce, A 1989. Private Mineral Extraction Database, Ove Arup: Cardiff'
Centred at TL 224 083	890 (ESE)	Briar's Lane Primary School, Roe Green, Hatfield, Hertfordshire	**Superficial:** Glacial Till **Solid:** Chalk Group	'Briar's Lane Mine' 1x Shaft Entry Pillar & Stall Chalk Mine – Known Mined Ground	Hyder Consulting, Welwyn Hatfield Council
Centred at TL 226 086	960 (E)	Queensway / Ken Lane, Hatfield, Hertfordshire	**Superficial:** Glacial Gravel, Glacial Till **Solid:** Chalk Group	Suspected Historical Brick Kiln – Potential Chalk Mining	'Peter Brett Associates'

Subject to the following note, according to Stantec Cavities Databases, no records pertaining to natural or mining cavities appear to be present within the site footprint. We draw your attention to the fact that the absence of, or the presence of, existing records for the site should not be considered conclusive – the information provided is indicative only. For any decision on investment, construction or any other actions relating to the project, further investigations will be required to confirm ground conditions.

CAVITY OCCURRENCE ASSESSMENT

National Planning Policy Framework (NPPF 2019) Clause 178-180 requires an assessment for a site potentially at risk from ground instability. The aspects considered with regards to ground instability are related to: Natural hazards or former activities such as mining. Consideration is given below to the risk of these potential causes of instability arising from existing ground conditions across the site, as identified by the desk top data review.

Geology

The geology of the site was determined via reference to online resources (www.bgs.ac.uk) and the 1:50,000 scale Geological Survey map of Hertford, Sheet 239, Soil and Drift (BGS, 1978). The site is situated upon Quaternary deposits of Lowestoft Formation (Diamicton) and Kesgrave Catchment Subgroup (Sand and Gravel), overlying the Cretaceous age Lewes Nodular and Seaford Chalk Formation (Undifferentiated).

The two superficial deposits were deposited following transgression and regression of the Anglian Period glacial ice sheet which extended as far south as the Vale of St Albans. The process often resulted in the deposition of a composite deposit of the Lowestoft and Kesgrave. The dominant deposit in a given area would largely depend on either the rock substrate over which the glacier moved and eroded, or the nature of the rock debris being carried and shed by the glacier as it moved. At the site, the published geology suggests the Lowestoft Formation is the dominant unit, however it could be expected that lenticular inclusions of the Kesgrave Catchment Subgroup would occur within the stratigraphy.

The BGS borehole archive holds records of numerous boreholes within the vicinity of the site boundary, however, it is noted that none of these boreholes were completed to a depth that proves the Chalk interface. A summary of the closest boreholes, with relevance to the site in terms of encountered geology, ground level and presence of the Chalk are detailed in **Table 3** below;

Table 3: BGS Historical Borehole Records

Borehole, Distance from site	Interpreted Lithology	From (m bgl)	To (m bgl)	Thickness (m)
TL20NW430 (175m north-east)	Fill	0.0	3.0	3.0
	Glacial Deposits	3.0	20.0	17.0
	Chalk	20.0	30.0	>10.0
TL20NW184 (290m south-west)	Tarmac	0.0	0.2	0.2
	Glacial Deposits	0.2	22.6	22.4
	Chalk	22.6	30.5	>7.9
TL20NW408 (120m north)	Topsoil	0.0	1.2	1.2
	Glacial Deposits	1.2	21.4	20.2
	Chalk	21.4	26.0	>4.6

On the basis of the above boreholes, at the site it is expected that the Chalk interface is approximately 20m below ground level. The relative level of the Chalk is of significance as it will determine the hazard for natural and mining cavities to have formed.

Hydrogeology

According to online resources (www.bgs.ac.uk), the published hydrogeological map Sheet 14: Hydrogeological Map of Southern East Anglia (1:125,000 scale – 1981) presents the conditions at the site showing that the water table within the chalk aquifer lies approximately 50 to 60 m AOD. The historical well/boreholes in the near vicinity did not record the rest level of the groundwater level. Perched water levels can also occur at shallower levels within the glacial deposits, particularly where granular deposits overlie clay rich deposits.

Based on OS map contours, the site ground level appears to be approximately 75 to 80m AOD, and as such the groundwater within the chalk aquifer is expected to lie at approximately 15 – 30m bgl. The groundwater level has implications for both the hazards posed by natural and mining cavities.

Geomorphology

Information provided from OS maps indicates that the site is situated within a relatively low level plateau in relation to the surrounding area, at approximately 75 – 80m OD. To the south-west of the site, the topography falls away towards a river valley feature at 70m OD. Surface water drainage would be expected to be directed towards the valley of the River Colne. Percolating groundwater would under-drain through the glacial superficial deposits and down into the chalk below at depth.

The Chalk outcrop in this area will have undergone a variety of erosional and depositional episodes, followed by tectonic uplift and initial sub aerial erosion of the chalk surface. During the late Cretaceous/early Palaeogene, the region experienced a series of marine transgressions that resulted in deposition of the Palaeogene deposits (Lambeth Group and London Clay deposits). Subsequently, the area has been subjected to extensive fluvio-glacial erosion during the Anglian times and further periglacial weathering and erosion during the Devensian glacial period. The overall effect has been to erode away most of the Palaeogene cover deposits. Glacial activity formed new superficial deposits such as the Lowestoft Formation (Diamicton) and the Kesgrave Catchment Subgroup, and in turn scoured the chalk surface. At depth sub-glacial channels can also be formed beneath glaciers which cut deeply into the chalk producing sudden changes in depth to the chalk surface.

The fluvio-glacial erosion of Lambeth Group deposits and etching of the then-exposed Chalk surface is largely associated with the former path of the proto-Thames. The proto-Thames originally flowed north eastwards through the Vale of St Albans, before it was blocked by the Anglian ice front and forced to find a new southerly flow route at Maidenhead.

During colder climatic glacial episodes when the ice cover increased, and water/sea levels fell, there were relatively short periods at the onset and finish of such conditions when water table levels fell widely below the chalk surface level. During such times downward percolation of groundwater occurred to initiate karstic weathering of the chalk surface where favourable circumstances allowed. Such conditions might also have allowed more intense dissolution to occur more widely along bedding planes and fissures at times when cold groundwater was able to circulate through the chalk sequence. Colder groundwater has the capacity to hold more dissolved carbon dioxide making it more acidic along with humic and fulvic acids generated by the periglacial tundra. This karstic activity was only possible during times when the ground (and groundwater) was not frozen, such as spring thaws, summer periods, or where taliks (year-round unfrozen ground, often saturated with mineral salts, or below surface water bodies) are present typically underlying surface water bodies.

Each time as the climate warmed after glacial episodes, land drainage patterns were re-established. When water table conditions were favourable this allowed the infiltration of surface water, collecting upon cover deposits and discontinuous permafost, to percolate downwards to initiate dissolution of the Chalk below. As can be appreciated from the above events there have been sometimes when there were favourable conditions for solution feature development and other times when conditions were probably not favourable, together with times when solution features were actively destroyed by erosion.

Cavities Occurrence Assessment – Natural Cavities

In areas underlain by Chalk, the interface with cover deposits often forms a karstic horizon where solution features (swallow holes, sinkholes and solution pipes) are found. The most prominent karstic horizon is the Palaeogene/Chalk interface. At the site however, this interface has been completely removed by fluvio-glacial erosion, during which, the deposition of a substantial cover of the Lowestoft Formation and Kesgrave Catchment Subgroup occurred. When climatic conditions were favourable such circumstances created the potential for under-drainage into the chalk surface from the glacial deposits which could sometimes lead to solution feature formation.

An assessment of the site has been undertaken regarding the potential for solution features to have formed in the geological, geomorphological and hydrogeological setting of the site. This has also taken into consideration the wider spatial area factors pertaining to solution feature hazards, resulting in a rating of **MODERATELY HIGH**.

Cavities Occurrence Assessment – Mining Cavities

Historical chalk mining is well documented in Hertfordshire and was carried out for a range of purposes. The most common uses of mined chalk were for agricultural purposes to obtain lime to spread over clay soils to improve their drainage, lighten the soil texture for ploughing and improve crop yields. Another common usage was to obtain mined chalk to powder and mix with milled clay to make bricks and tiles.

The Stantec mining cavities database search indicated no features within the site boundary, however within the defined 1km search radius, a number of records relating to chalkwells, pillar and stall chalk mines, and brick kilns were present. With reference to available historical OS maps from 1879 onwards, there are no surface workings in vicinity of the site.

It should be noted that whenever chalk mining took place in the past, it was always carried out in dry chalk above the water table. No instances are known where dewatering was employed to create dry chalk for mining. With the understanding that the chalk interface below the site is expected to be circa 20m bgl, and groundwater could be at 15 – 30m bgl, the potential absence of a reasonable thickness of dry chalk rockhead below the site, creates conditions that are potentially unfavourable to past chalk mining.

Therefore, on the basis of the site history, geology, hydrogeology and geomorphology the potential for past chalk mining at the site is considered to be **LOW**.

Recommendations

It would be prudent for foundation and drainage designers to make reference to CIRIA C574 (2002) “Engineering in chalk”. If during site investigation or construction, abnormal ground conditions, such as loose or very loose material or voiding are experienced, a geotechnical engineer should be consulted prior to continuing.

For any decision on investment, construction or any other actions relating to the project, further investigations will be required to confirm ground conditions.

We trust that the information presented will assist you, but if you have any queries then please do not hesitate to contact the writer.

Yours sincerely,

p.p. [redacted]

James Weddle
Associate
For on behalf of Stantec UK Ltd

This report has been prepared by Stantec UK Limited ('Stantec') on behalf of its client to whom this report is addressed ('Client') in connection with the project described in this report and takes into account the Client's particular instructions and requirements. This report was prepared in accordance with the professional services appointment under which Stantec was appointed by its Client. This report is not intended for and should not be relied on by any third party (i.e. parties other than the Client). Stantec accepts no duty or responsibility (including in negligence) to any party other than the Client and disclaims all liability of any nature whatsoever to any such party in respect of this report.

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