Southern Testing
Environmental & Geotechnical

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Desk Study & Preliminary Site Investigation Report

Desk Studies | Risk Assessments | Site Investigations | Geotechnical | Contamination Investigations | Remediation Design and Validation

Site: Land off Shawstead Road, Hale, Kent, ME5

Client: KD Attwood & Partners

Report Date: October 2018

Project Reference: J13752

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SUMMARY

The site, which extends to about 48ha, comprises open agricultural land and woodland. It is proposed to redevelop the site with residential housing. At this stage no layout plan has been provided.

Geological records indicate the site to be underlain by Upper Chalk, with areas of overlying superficial Head and Clay-with-flints deposits.

A historical Ordnance Survey map search and desk study was carried out and indicates that the site has a history of agricultural use.

A single preliminary phase of investigation has been carried out.

The soils encountered comprised a covering of ploughed Topsoil and Subsoil over Chalk, with some locations overlain by Clay-with-flints and Chalk Head superficial deposits.

No groundwater was encountered during this investigation.

The sulphate content of the fill and natural soil was found to fall within Class DS-1. The ACEC classification for the site is AC-1s.

An allowable bearing capacity of 120kPa is available for normal strip or trench fill foundations set upon the firm to stiff clays or medium dense chalk strata. NHBC Medium Volume Change Potential precautions will apply where foundations are emplaced upon cohesive soils. Some piling may be required in areas of existing woodland.

Suspended floor slabs are advised.

There is evidence of soil contamination in the form of benzo(a)pyrene. It is recommended extensive further sampling and testing is carried out to identify and delineate the extent of any contamination within soils across the site. Should no further testing be carried out, an allowance would need to be made for the removal of the existing topsoil and replacement with certified imported soils.

There is also the potential for contamination from land gases from an adjacent former landfill. A programme of land gas monitoring should be carried out to determine the risk from land gases and to determine any requirement for the incorporation of land gas protective measures in the development.

The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

A formal remediation strategy and verification plan should be agreed with the regulatory authorities prior to commencement of any remedial works.

The findings and opinions conveyed via this Site Investigation Report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd believes are reliable. Nevertheless, Southern Testing Laboratories Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

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(Countersigned)

J M Whibberley BSc MSc FGS
(Signed)

For and on behalf of Southern Testing Laboratories Limited

STL: J13752
26 October 2018

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A INTRODUCTION

1 Authority

Our authority for carrying out this work is contained in a completed project order form signed by Mr K Attwood representing KD Attwood & Partners, dated the 22nd August 2018.

2 Location

The site is located to the south of the villages of Hale and Luton, to the south and south east of the Medway towns of Gillingham and Chatham.

The site is situated approximately 2.5km from Gillingham railway station.

The approximate National Grid Reference of the site is TQ 77462 65211.

3 Proposed Construction

It is proposed to develop the 48ha site with residential housing.

At this stage, proposed layout plans or ground loadings have not been provided.

For the purposes of the contamination risk assessment, the proposed development land use is classified as **Residential with plant uptake (CLEA model[1]/C4SL report[2]). The gas sensitivity of the site is rated as High (CIRIA C665[3]).**

4 Object

This is a Phase 1 Desk Study and Walkover and Phase II geotechnical and contamination (risk estimation and evaluation) investigation (Tier 1). The client and clients engineer specified the scope of this investigation.

The object of the investigation was to assess foundation bearing conditions and other soil parameters relevant to the proposed development, and to assess the likely nature and extent of soil, groundwater and soil gas contamination on the site.

5 Scope

This report presents our desk study findings, exploratory hole logs and test results and our interpretation of these data.

As with any site there may be differences in soil conditions between exploratory hole positions.

This report is not an engineering design and the figures and calculations contained in the report should be used by the Engineer, taking note that variations will apply, according to variations in design loading, in techniques used, and in site conditions. Our figures therefore should not supersede the Engineer's design.

[1] Environment Agency Publication SC050021/SR3 'Updated technical background to the CLEA Model' (2009).
[2] SP1010 Development of Category 4 Screening Levels DEFRA (2014)
[3] CIRIA C665 (2006) Assessing risks posed by hazardous ground gases to buildings.

The findings and opinions conveyed via this Site Investigation Report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd believes are reliable. Nevertheless, Southern Testing Laboratories Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

The site investigation was conducted and this report has been prepared for the sole internal use and reliance of KD Attwood & Partners and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Ltd. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The recommendations contained in this report may not be appropriate to alternative development schemes. The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

B DESK STUDY & WALKOVER SURVEY

6 Desk Study

A desk study has been carried out. Reference has been made to the following information sources.

- Geological Maps
- Hydrogeological/Groundwater Vulnerability maps
- Aerial Photographs
- Historical Ordnance Survey Maps
- Environmental Databases
- Discussions with Site Owner
- Environment Agency website
- Bomb Maps
- BRE Radon Atlas[4]

The environmental databases search report compiled for this desk study contains site-specific environmental data drawn from data sets that comprise publicly available information together with data from third parties, some of which is under review. Accordingly, Southern Testing Laboratories Limited does not warrant its accuracy, reliability or completeness.

The full report is included in Appendix F and a summary of the salient features is included in the following sections of this report.

6.1 Geology

The British Geological Survey 1:50,000 scale Map No. 272 'Chatham' indicates that the site geology consists of Upper Chalk (Lewes Nodular Chalk Formation), with some areas of the site mapped as underlain by Head and Clay-with-flints superficial deposits over the chalk.

[4] BR 211 (2015) 'Radon: guidance on protective measures for new buildings'

Clay-with-Flints

Clay with flints is a superficial deposit which is usually less than 4 m deep and which is found in plateau areas and on the interfluve ridges on the back slopes of chalk escarpments.

Its origin is not fully understood, but clay with flints is believed to be a remanié deposit of the solutioning residuum of upper chalk with flints, mixed with soliflucted Tertiary debris. The clay content is variable and may range from about 35%-75%. While the clay is often highly plastic and shrinkable the soil does not usually cause the problems normally experienced in highly shrinkable clays. The amount of shrinkage is reduced in direct proportion to the percentage of flints in the mass, and because the interlocking effect of the flints and gravel reduces volumetric shrinkage by causing small voids to form. However some shrinkage problems do occur when the clay content is high.

Clay with flints has a very variable interface with the underlying chalk, which is always weathered.

Head

Head is a superficial deposit predominantly formed by solifluction processes during cold, periglacial periods in the Ice Ages. Shallow soils were frequently waterlogged during these periods and together with freeze/thaw cycles caused a gradual downward migration of shallow soils. Although the climate has since changed, poorly designed engineering works, or periods of adversely high rainfall may still reactivate the relic slip surfaces.

Head soils characteristically comprise sandy silty clay containing randomly oriented fragments of angular materials of local derivation. Stratification, if present, is generally poor and the upper and lower surfaces of the deposits are rarely horizontal.

Upper Chalk (Lewes Nodular Chalk)

Upper Chalk is a well known soft white friable limestone of organic origin which is composed of shell debris embedded in a fine matrix of microscopic calcareous bodies produced by planktonic algae (coccoliths).

Upper Chalk is frequently highly fractured and highly permeable, when excellent drainage can be achieved via soakaways. On the other hand, Chalk Head and Chalk under a cover of Reading Beds may have very poor soakage characteristics.

Chalk is slightly soluble in water and, while it has excellent bearing properties when unweathered, this solubility can lead to deep weathering and softening, producing some undesirable characteristics, as far as a building construction is concerned.

The chalk itself may be softened by solution to a depth of 5-15 metres and bearing capacities and engineering properties improve with depth. Where there is an outcrop of impermeable soil overlying the chalk there may be a dramatically increased solution effect. Water may collect over the clay and flow in large quantities to the chalk and cause very rapid solution and settlement at the junction.

Man has worked the chalk for flints, and for other purposes for thousands of years and any signs of old workings should be carefully investigated.

The upper layers of chalk are often highly weathered, softened and remoulded, and form an irregular boundary with the overlying strata. Where the holes are still actively decaying the "holes" are sometimes marked by shallow surface depressions but they are more commonly bridged by superficial deposits and in which case they are not evident in the topography. They could be termed "invisible".

6.2 Hydrology and Hydrogeology

Data from the Environment Agency and other information relating to controlled waters is summarised below.

Data		Remarks	Possible Hazard to/from Site Y/N
Aquifer Designation	Superficial Deposits	Head deposits mapped in the north eastern corner of the site are classified as a Secondary A Aquifer. Clay-with-flints deposits mapped in the centre of the site are classified as Unproductive.	Y
	Bedrock	Upper Chalk – Principal Aquifer.	Y
Groundwater Vulnerability		The site is mapped as underlain by Major Aquifers with Intermediate to High Leaching Potential.	Y
Abstractions		Licences for potable groundwater abstraction are held for Capstone Pumping Station, adjacent to the north eastern corner of the site and for Luton Pumping Station, 30m north of the site. No licences for surface water abstraction are held within 2000m of the site.	Y
Source Protection Zones (SPZ)		The northern half of the site is mapped within a SPZ 1 – Inner Catchment. The southern half of the site is mapped within a SPZ 2 – Outer Catchment.	Y
Surface Water Features		The nearest surface water feature is a man-made lake within Capstone Country Park, approximately 100m to the east of the site.	N
Marine/Fluvial Flood Risk		The north eastern corner of the site is shown to be at Medium risk. The remainder is unclassified.	Y
Surface Water Flood Risk		The north eastern corner of the site is shown to be at Low risk. The remainder is	Y

Data	Remarks	Possible Hazard to/from Site Y/N
	unclassified.	
Reservoir Flood Risk	The site and surrounding area is not shown to be at risk.	N
Discharge Consents	229m NW: Hopewell Drive, Chatham, Kent – storm sewer overflow.	N

The site is underlain by a principal bedrock aquifer (Upper Chalk), with some overlying Head and Clay-with-flints superficial deposits. The Head deposits are classified as a Secondary A Aquifer, whilst the Clay-with-flints are classified as Unproductive. Soils on site are classified as having Intermediate to High Leaching Potential. Sources of contamination in areas of the site underlain by superficial Head deposits or directly underlain by Upper Chalk bedrock may migrate into and have a significant impact on the underlying groundwater table. In addition, there is a risk that off-site sources of contamination may migrate onto the subject site through groundwater. However, the Clay-with-flints deposits are classified as Unproductive, suggesting this strata would not act as a pathway for the migration of contaminants through groundwater.

Based on the local topography and with reference to a Hydrogeological map of the area[5], groundwater flow is likely to be in a northerly direction, towards the River Medway and Thames Estuary. The site is located within a sensitive groundwater resource (SPZ 1 & 2), with a groundwater abstraction well identified adjacent to the north eastern corner of the site, with another approximately 30m to the north. Any sources of on-site contamination could migrate towards these abstraction wells, particularly as they are to the north/ north east of the site, in the anticipated direction of groundwater flow.

6.3 Historical Map Search

Copy extracts of historical Ordnance Survey plans dating from 1865 to 2014 were obtained and are presented in Appendix H together with a summary of the salient features.

In brief, the site is shown from the earliest available map dated 1865 to be open land, presumably farmland, with some areas of deciduous woodland. The site is subdivided into multiple irregular fields by fenceline boundaries, with a road mapped as bisecting the site in a south east to north west orientation (Shawstead Road). A shallow earthwork/ excavation is shown in the southern half of the site on the map dated 1909. A single detached house is shown within the southern half of the site ('Maunders House') until the map of 1955. A house is also shown within the north eastern site corner until 1964. The map of 1979 shows Shawstead Road to have been diverted at the mid-point of the site so as to now meet the centre of the western site boundary. No further significant changes are shown on site on later available maps.

Off site, the earliest available maps show the surrounding area to principally comprise open agricultural land with scattered housing. The hamlet of Upper Luton is mapped to the north of the site, with a waterworks and brick field (Darland Brick Works) also shown to the north and north east. A small brick works is shown adjacent to the northern site boundary by the map of 1896, whilst by 1907 a pumping station is shown adjacent to the north eastern corner, with quarry and tramway beyond, as well as an area of orchard immediately to the east of the site. No significant

[5]Sheet 3b : Hydrogeological Map of the Chalk and Lower Greensand of Kent - Folkestone Beds and Hythe Beds (1:126,720) – 1970

changes occur thereafter until the 1930's, where after significant development of housing is shown on later available maps, primarily to the north and west of the site. The brick works immediately to the north of the site is shown to have been redeveloped with housing by the map dated 1932. By the map of 1964, a refuse tip is labelled on land adjacent to the eastern/ south eastern site boundaries, the tip having been extended southwards by the map of 1973/1974. A newly constructed road is mapped adjacent and parallel to the western site boundary by the map dated 1979, with the further development of housing on land also shown on the far side of this road. By the map of 1990, orchards to the east of the site are no longer shown whilst the refuse tip is labelled as disused. Part of the former refuse tip is labelled as in use as a recycling centre with the majority shown to be open land on the map dated 2010.

Historical aerial imagery was accessed via Google Earth on the 28th September 2018. The aerial image dated 1940 shows the site to be open fields. To the east of the site, on the far side of Shawstead Road, are a series of spoil piles which are assumed to be associated with a council yard labelled on historical mapping. An aerial image dated 1960 shows an area of workings, presumably landfill activities, immediately to the east of the site.

6.4 Environmental Databases

	Distance (m)	Direction	Details	Possible Hazard to site
Historical Industrial Land Uses (Within 250m of the site)	0	/	Unspecified Ground Workings (1907)	Y
	1	SE/E	Refuse Heap (A further four within 250m of the site) (~1964 to 1990)	Y
	1	NE/E	Pumping Station (Capstone Pumping Station) (1907 to present)	Y
	1	NE	Smithy (1897 to 1932)	Y
	1	E/NE	Brick Works (Darland) (1866 to ~1938)	Y
	1	E	Orchards (1896 to 1979)	Y
	6	E	Council Yard (1967 to 1990)	Y
	64	NE	Electrical Substation (A further four within 250m of the site)	N
	72	NE	Unspecified Tank (A further four within 250m of the site)	N
	79	N	Brick Works (1896 to 1932)	Y
	145	W	Gravel Pit	N
	148	W	Unspecified Depot/ Warehouse	N
	166	E	Unspecified Ground Workings	N
	202	W	Unspecified Works	N
	218	W	Unspecified Commercial/ Industrial	N
	219	N	Water Works	N
	241	SE	Unspecified Quarry	N

	Distance (m)	Direction	Details	Possible Hazard to site
Current Industrial Land Uses	1	NE/E	Pumping Station (Capstone Pumping Station)	Y
	11	E	Household Waste Recycling Centre	N
	70	NE	Electrical Substation (A further six within 250m of the site)	N
	80	W	Commercial Premises (A further twenty two within 250m of the site)	N
	175	W	Works/ Depot (A further five within 250m of the site)	N
Current and Historical Landfills (Within 1000m of the site)	0	/	Unspecified Ground Workings (1907)	Y
	1	E/SE	Shawstead, Rochester – inert & household waste. Licence held 1937 until 1991.	Y
	617	SE	Sows Bottom, Gillingham - Inert	N
	790	W	Street End, Rochester - Inert	N
Fuel Sites	/	/	None identified within 250m of the site.	N
Pollution Incidents (Within 250m of the site)	24	SE	Atmospheric Pollutants and Effects – Smoke; Air impact – Category 3, Water and Land impact – Category 4.	N
	150	S	Microbiological Pollutant; Water impact – Category 3, Land and Air impact – Category 4.	N
	164	W	Oils and Fuel Oils; Water, Land and Air impact – Category 4. Also Organic Chemicals –Paint and Varnishes; Air impact – Category 3, Water and Land impact – category 4.	N
IPC Part B Authorisations (Within 250m of the site)	245	W	Custom Wytelyne, Chatham – coating processes – current permit	N
Hazardous Substances Consents	/	/	None identified within 500m.	N
Sensitive Land Use Designation	0	/	Ancient and Semi-Natural Woodland (Small area of woodland adjoining the western site boundary in the centre of the site) A further six areas shown within 1000m of the site.	N
	143	NE	Local Nature Reserve - Darland Banks (A further two areas shown within 1000m of the site)	N

The site is mapped as agricultural land from the earliest available map until the present day. Considering long-term site use as farmland, it is anticipated that chemicals may have been applied to the field to promote plant growth/ and or discourage insects at some point in the site history. These chemicals may still be present within the near surface soils.

A small area of ground workings was identified within the environmental database within the southern half of the site. Upon a historical map dated 1909, a minor excavation is shown in this area, possibly indicating a slight reprofiling of the slope. The feature does not appear on mapping to be a substantial excavation that may have subsequently been infilled. The potential contaminative hazard from this feature is considered low at this stage.

A number of potentially contaminative land uses have been identified in the area surrounding the site. An assessment has been made of the potential contaminative hazard these land uses may pose to the subject site. Some historical land uses have been dismissed as potential sources of contamination based on size, time since operation and distance from the site. Land uses that may be considered to be a viable potential source of contamination are discussed further below.

A refuse heap is shown immediately to the east of the site from aerial imagery dated 1960 and on subsequent historical maps until 1990, upon which it is labelled as disused. The licence for this landfill was held between 1937 and 1991, suggesting landfill operations were ongoing prior to the dates inferred by aerial imagery and historical mapping. Based on the close proximity to the site, the former landfill is considered a significant potential source of land gas.

Brick works are mapped to the north and north east of the site from the earliest available map of 1866 until around the middle of the Twentieth Century. The database infers tanks, kilns, clay mills and shallow excavations were present within the area of these works, as well as an adjacent former chalk quarry, possibly associated with the brick works. Contaminants associated with the brickworks are unlikely to migrate to the subject site based on the distance to site, likely groundwater flow direction, intervening road and recent housing development. The chalk quarry as shown on 1907 mapping does not appear to have been backfilled, rather abandoned to become vegetated with woodland. Based on the above, the hazard risk to the site from these contaminant sources may be considered to be negligible.

Land immediately to the east of the site is shown to have been in use as an orchard from the late nineteenth to the latter half of the twentieth century. Pesticides and fertilisers may have been applied to soils to promote orchard growth during this time. Contaminants could have theoretically leached into and migrated as surface run-off or within groundwater. However, as the former orchard is below the level of the site, rainfall surface run-off would likely be downslope to the east, carrying any contaminants away from the site. If contaminants were to enter groundwater, contaminants are likely to be transported to the north, away from the site. The orchard is therefore considered to pose a negligible hazard risk to the site.

6.5 Geological Hazards and Mining Activities

Data from various sources relating to potential geological hazards at the site are summarized below. The Hazard Potentials listed for the BGS data are as presented in the Groundsure report, derived from various generic BGS sources, which are not considered as site-specific. It is important that this information is considered in context of the actual site topography, ground

conditions encountered during future investigation, and development proposals.

Data Source	Hazard	Hazard Potential to Site	Remarks
BGS	Potential for Collapsible Ground Stability Hazard	Very Low	
	Potential for Compressible Ground Stability Hazard	Negligible	
	Potential for Ground Dissolution Stability Hazard	High	The Clay-With-flints deposits are classified as Moderate to High. This likely to be an anomaly in the database. We would classify the Clay-with-flints as Very Low. Head deposits in the north eastern site corner are classified as Low.
	Potential for Landslide Ground Stability Hazard	Low	Superficial deposits on site are classified as Low to Very Low.
	Potential for Running Sand Ground Stability Hazard	Very Low to Negligible	Head deposits in the sites north eastern corner are classified as Very Low.
	Potential for Swelling or Shrinking Clay Ground Stability Hazard	Low	Head deposits within the north eastern corner of the site are classified as Very Low The majority of the site not underlain by Clay-With-flints superficial deposits is classified as Negligible.
	Shallow Mining Hazard	Moderate	Multiple listings of 'old shafts' in general area, likely deneholes/ chalkwells.
ARUP	Mining Instability	Moderate	The site is shown to be within an area with multiple listings of conclusive deneholes, chalkwells and chalk quarries.
CSS/KURG*	Underground openings	Moderate	The nearest underground openings identified within our database are multiple listings for deneholes/ chalk wells from 500m south east and north of the site.

**Chelsea Spelaeological Society/ Kent Underground Research Group*

6.6 Underground Workings

Literature detailing chalk workings on the North Downs to the south of the Medway towns has been reviewed. The chalk was generally mined for soil improvement, as well as for flint for building materials. Multiple listings for Deneholes and Chalkwells are held in the general area surrounding the site, mostly in present day woodland, although no records are held for any features on the site itself. These features are generally recorded as having been infilled and are identifiable as light depressions.

Underground workings may be present in areas of the site where superficial deposits are mapped as overlying chalk bedrock. As the site is primarily mapped as directly underlain by chalk bedrock, it is considered that the likelihood of such features being present on site is low at this stage of the investigation.

6.7 Borehole Records

Borehole records were accessed online via the BGS borehole viewer on the 26th September 2018. One borehole record is mapped on site (BGS Ref. TQ76NE52) in the location of the former 'Maunders House', at the approximate centre point of the site, adjacent to Shawstead Road. The borehole refers to a former well, dug to 289ft bgl. The well is recorded as having been infilled.

Three borehole records are mapped adjacent to the north eastern site corner, in the area of Capstone Pumping Station (TQ76N15A, B & C). The records were access restricted and were therefore unable to be viewed. It is assumed these are records of the abstraction wells sunk for the pumping station.

A further three records are held for locations on the opposite side of Capstone Road, within the now redundant 'Darland Brickworks' (TQ76NE51, TQ76NE186 & TQ76NE187). The records detail boreholes associated with a disused engine house sunk to a depth of 150ft, presumably for the abstraction of water. No information on strata is detailed.

6.8 UXO

A Preliminary UXO Risk Assessment has been carried out. The assessment detailed a high density of bombing during the Second World War around Chatham and Gillingham, to the north of the site. Three bombing decoys were identified in the surrounding area, with the closest identified approximately 0.8km south of the site. The Preliminary Risk Assessment recommended that a Detailed UXO Risk Assessment be carried out prior to ground works being undertaken on site.

6.9 Radon Risk

With reference to BRE guidance, no radon protection is required on this site.

7 Walkover Survey

A walkover survey was carried out on the 11th September 2018, at the time of the sitework.

For the purposes of the site description the site has been sub-divided into three parcels of land; the southern field, central field and north eastern field and woodland. These parcels of land are defined in Figure 2 in Appendix A.

7.1 General Description and Boundaries

The site comprises a large area of land to the east of North Dane Way and to the south of Capstone Road, Hale. The site is currently primarily in use as arable farmland, with some areas of deciduous woodland.

In general, the site is bounded by residential housing to the north, scattered housing, commercial units, Capstone Farm Country Park and a waste recycling centre to the east, open agricultural land and woodland to the south and North Dane Way to the west, beyond which is residential housing.

7.2 Topography and Drainage

The site is situated at the crest and across the western slope of a large dry valley, as well as partially across the eastern slope of an adjacent valley to the west. The dry valleys continue northwards and then north westwards towards the River Medway.

Within the north eastern field and woodland parcel of land, the western third is set to young woodland, with the eastern two thirds comprising open ploughed field. This parcel of the site slopes down gently to the east, steepening within the woodland section to an estimated 10 degrees or more, levelling out at the base of the valley near to the north eastern site boundary. Within the open field, three evenly spaced concrete ring chambers mark a bisecting sewer orientated north-south.

The central field comprises an open ploughed field and generally occupies the crest between the two dry valleys. This parcel principally dips downslope to the north east at around 4 degrees, with localised steepening downslope near to the northern site boundary of around 12 degrees and to the eastern site boundary of around 5 degrees. The western third of this parcel slopes at around 3-4 degrees to the west (all visually estimated).

The southern parcel is set to ploughed field and occupies the western slope of the dry valley except for a level and slight westward downslope trend within the north west of this parcel. The parcel generally slopes eastwards at around 8 degrees into the dry valley, with some localised steepening to around 9-10 degrees in the south eastern corner of this parcel (all visually estimated). This parcel is also predominantly set to ploughed field, with some areas of woodland, including a thin strip of trees in the extreme south of the parcel. Within the strip of trees was observed a 'step' in gradient of around 1m in height.

7.3 Vegetation

Fields on site at the time of our investigation had recently been harvested and re-seeded. The woodland within the north eastern parcel comprises young mixed deciduous woodland including trees such as Silver Birch, Oak and Beech. Other areas of woodland on site also comprise mixed but mature deciduous woodland, including Oak and Horse Chestnut, amongst others. Site

boundaries generally comprise cut bramble hedgerows with sporadic mature trees of multiple species.

7.4 Buildings and Land Use on Site and Nearby

No buildings are present on site. The well as shown adjacent to the former 'Maunders House' on historical mapping was located within the area of the former house in the central parcel and was found to be capped by a concrete pad. Upon removal of the concrete pad using an excavator, the well was found to have been infilled to 1.6mgl with what appeared to be brick rubble, possibly from the demolished house. The abandoned well is approximately 1m in diameter and appeared to be flint lined.

Also within the central parcel was observed a heavily overgrown single-track road which is believed to represent Shawstead Road prior to its diversion towards the western site boundary around the middle of the twentieth century. The former road continues from the present day Shawstead Road across the site to the north west, becoming heavily wooded and impassable near to the north western site boundary.

The north and south of the central field, northern boundary of the north eastern field and the centre of the southern field are bisected by public footpaths orientated east-west. Some light domestic waste fly-tipping was noted along field boundaries with Shawstead Road, in the centre of the site.

7.5 Photographs

A series of photographs showing the site and immediate surrounding area is included in Appendix E.

C PRELIMINARY CONCEPTUAL MODEL

8 Introduction

In the context of this report, the conceptual model summarises the potential pollutant linkages identified for the site and forms the basis of the risk assessment for the site. The preliminary model comprises the potential sources of contamination, receptors that could be harmed and exposure pathways identified from the desk study and walkover survey. These potential linkages form the basis upon which the investigation is designed and reported.

9 Potential Sources of Contamination

The site has a history of agricultural use and is located within a semi-rural area, with urban areas to the north and west.

A number of potentially contaminative uses have been identified, both on site and in the locality.

Potential contaminants associated with these uses have been compiled from our experience of such sites.

9.1 On Site Sources

Source	Potential Contaminants
Agricultural Activities	Organic Compounds (Pesticides & Herbicides)
Former Houses (Possible Made Ground)	Metals, Asbestos, PAH's

Historical use as agricultural farmland suggests chemicals may been applied to the soil at some stage of the sites history in the form of pesticides and herbicides. There is a risk therefore that residue from these chemicals may remain within the soil profile. The likelihood of such contaminants being present on site is considered low at this stage.

Two houses were identified on mapping to have been present on site. These have since been demolished. Made Ground associated with these former buildings may be present in their vicinity.

A small area of unspecified ground workings was identified within the environmental database and on historical mapping within the southern field. No indication of this feature was observed during the site walkover and it therefore may represent some degree of slope re-profiling rather than an excavation. The contaminative risk to the site from this possible feature is therefore considered to be negligible.

9.2 Off Site Sources

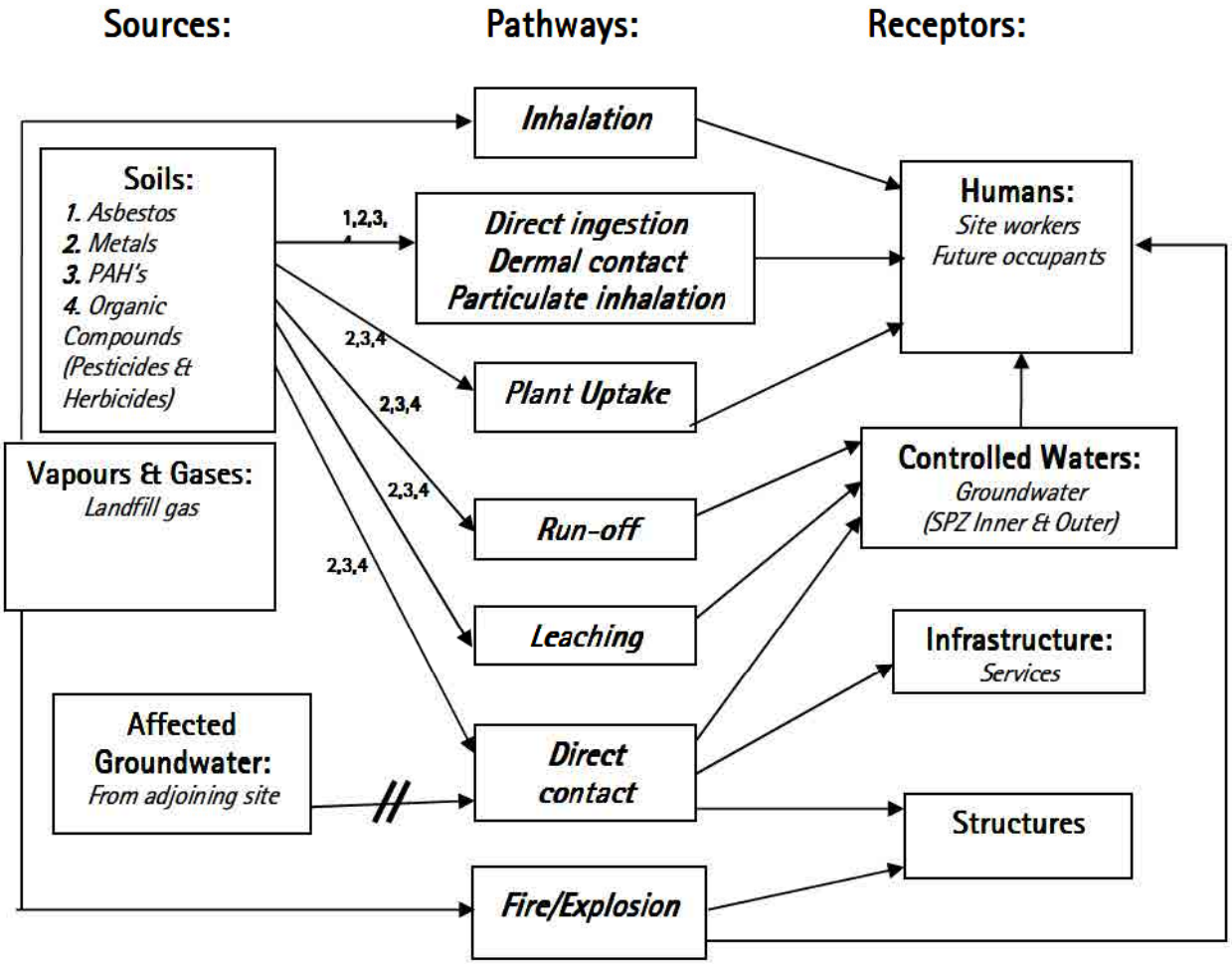
The site may be impacted by contamination migrating from beyond the site boundary. The following potential off-site source has been identified.

Source	Distance from Site Boundary	Direction	Potential Contaminants	Likely Hazard to Site
Refuse Heap/ Landfill	1m	E/SE	Land Gas	High

Land immediately to the east of the site was in use as a refuse heap/ landfill during the middle of the twentieth century. From the information obtained to date and based on the profile of surrounding land, it appears likely that the refuse heap was raised from ground level and did not infill any excavation or quarry workings. The landfill is still however considered to constitute a significant potential source of contamination in the form of land gas, particularly as the site is at an elevation above that of the landfill workings, providing a plausible pathway for land gas migration.

10 Pollutant Linkages and Model Summary

The following diagram shows the potential pollutant linkages identified for the site and summarises the preliminary conceptual model.



// Denotes potential pollutant linkage not complete

D SITE INVESTIGATION

11 Method

The strategy adopted for the preliminary intrusive investigation was specified by the client and comprised the following:

- 5 No. 20m deep boreholes were drilled using a light percussion, 150mm diameter, shell and auger boring rig.
- 5 No. 5m deep boreholes were drilled using a tracked windowless sampler rig.

- A series of 7 No. trial pits were excavated using a 5T tracked excavator.
- Soakage testing was carried out in accordance with BRE 365 within the trial pits.

Exploratory hole locations were specified by the client prior to the works being undertaken and are shown in Figure 3 in Appendix A.

With agreement of the client, BH5 was re-located approximately 70m upslope to the west of the location detailed within the specification of works to an area of shallower gradient where the rig could be safely positioned.

12 Weather Conditions

The fieldwork was carried out between Monday 10th and Friday 15th September 2018, at which time the weather was generally sunny and warm, with occasional spells of rain.

13 Soils as Found

The soils encountered are described in detail in the attached exploratory hole logs (Appendix A), but in general comprised a covering of ploughed Topsoil and Subsoil over Chalk, with some locations overlain by Clay-with-flints and Chalk Head superficial deposits.

A summary is given below.

Depth	Thickness	Soil Type	Description
GL to 0.2m/0.9m	0.2m to 0.9m	Topsoil	Dark to mid brown, slightly gravelly slightly sandy CLAY. Gravel is fine to coarse chalk and flint with rare brick fragments.
0.2m/0.9m to 0.3m/2.8m **(BH1, TP1, WLS1-5 only)**	0.1m to 2.6m+	Gravelly/ sandy Clay	Firm to stiff orange brown, gravelly sandy CLAY. Gravel is fine to medium flint with rare flint cobbles and rare chalk. **(Chalk Head)**
0.2m/0.3m to 1.4m/2.1m+ **(BH3, TP4-6 only)**	1.1m to 1.9m+	Stiff gravelly Clay	Stiff to very stiff orange brown very gravelly slightly sandy silty CLAY with medium cobble content. Gravel is fine to coarse flint. Cobbles are flint. **(Clay-with-flints)**
0.2m/2.8m to 0.3/5.0m	0.2m to 2.3m	Structureless Chalk	Structureless Chalk recovered as gravelly silty putty CHALK with occasional brown and orange brown staining. Gravels are extremely weak fine to coarse