



**Phase 1 Land
Contamination
Assessment at Abbey
Way, Willesborough,
Ashford, Kent TN24 0HY**



Report

Ecologia[™]
experts on the ground

**Phase 1 Land
Contamination Assessment
at Abbey Way,
Willesborough, Ashford,
Kent TN24 0HY**

Prepared for: BDB Design LLP

Reference: 14.049.1

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Report

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Executive Summary

Site Location	Abbey Way, Willesborough, Ashford, Kent, TN24 0HY.
Site Description	The site is currently open land / field at present and is relatively low lying. The land is overgrown with vegetation and shows a wide variety of wildlife, including nesting birds. There is a public footpath that runs through the site which is used by neighbouring residents.
Reason for Investigation	A Phase 1 Land Contamination Assessment is required in the support of a planning application for the residential redevelopment of the site, with the indicative capacity of 20 residential housing units (with private gardens) with associated areas for parking and landscaping.
Geology / Hydrology / Hydrogeology	<p>The site is underlain by superficial alluvium deposits comprising Clay, Silt, Sand and Gravel. The superficial deposits are underlain by bedrock geology comprising the Sandgate formations. The eastern boundary of the site is situated over a Secondary A Aquifer, related to alluvial gravel superficial deposits, with permeable layers, and a secondary aquifer, related to the Sandgate formation.</p> <p>The site is located directly adjacent to Folkestone formation bedrock geology to the north, this bedrock geology is recognised as a principal aquifer.</p> <p>The site is not located in a groundwater source protection zone.</p> <p>A secondary river of The Great Stour, runs directly adjacent to the eastern boundary of the site.</p>
Site History	Historical Ordnance survey maps indicate the site has remained undeveloped in the past, however, formed part of the surrounding agricultural land.
Possible Sources	<p>From information obtained by the client, the GroundSure report and observations from the walkover survey, the site has not been developed historically, however, may have potentially been used for agricultural purposes in the past.</p> <p>The following potential contaminants of concern (CoC) relating to agricultural activities have been identified;</p> <ul style="list-style-type: none"> • Compounds related to food production, comprising fertilizers, pesticides and insecticides and including persistent organic pollutants; • Compounds related to farm plant and machinery, including Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAH) and BTEX compounds. <p>Potential off site sources include agricultural land, electricity sub station and waste treatment facilities.</p>
Possible Receptors	<p>The following potential receptors have been identified:</p> <ul style="list-style-type: none"> • Groundwater (Secondary A Aquifer); • Surface Waters (Ponds, water courses and Great Stour River); • Ground workers; • Future residents / users of site; • Plastic utilities.
Conclusions	<p>Based on the Phase 1 Assessment works including the inspection of available historical information, the walkover survey and environmental sensitivity of the site, the following conclusions can be made:</p> <ul style="list-style-type: none"> • Historical Ordnance Survey maps indicate the site has remained undeveloped in the past, however, formed part of agricultural land and, therefore, the only potential source of contamination is from potential agricultural processes undertaken on or adjacent to the site. • Considering the historical land use, risks to future site residents from the potential presence of contamination within the underlying shallow soils are considered to be moderate. • Potential moderate to low risks have been identified with respect to controlled waters including the underlying Secondary A aquifer, nearby ponds and Great River Stour. Groundwater underlying the site is likely to be present and, therefore, dissolved or free phase contaminants entering the soil have the

	<p>potential to impact groundwater.</p> <ul style="list-style-type: none"> • Potential low risks have been identified with respect to the production of ground gas from neighbouring waste treatment facilities. However, as the proposed development is for a residential end use, monitoring of the ground gas and completion of a gas risk assessment will be required.
<p>Recommendations</p>	<p>Ecologia recommends the following action to be taken:</p> <ul style="list-style-type: none"> • As part of the development works, further site investigation within key areas to characterise shallow ground conditions at the site and to quantify any soil contamination due to the potential agricultural and /or neighbouring site activities. Investigation works should also include further assessment of the potential risks to groundwater subsequent to findings of intrusive investigation works. • Refinement of the conceptual site model and production of a semi-quantitative risk assessment subsequent to intrusive investigation will enable greater understanding of potential remediation or mitigation measures that are required as part of appropriate redevelopment. • During development, any new services (potable supply pipes) should be placed in 'clean' material and screened against UKWIR Guidance thresholds. • Precautions should be taken by ground workers, including the use of appropriate personal protective equipment, when developing the site to protect against dermal contact. Good housekeeping rules should be observed on site i.e. washing hands before eating etc. • During re-development works in the event that unforeseen contamination is encountered, the client should stop work and further assessment undertaken by experienced Environmental Consultant.

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1. Introduction

1.1. Background

Ecologia was instructed by BDB design to conduct a Phase I Land Contamination Assessment, (Desk Study and Walkover Survey) at Abbey Way, Willesborough, Ashford, Kent, TN24 0HY.

Ecologia understands a Contaminated Land Assessment is required in support of a planning application to develop the site to incorporate 20 residential housing units (with private gardens) with associated areas for parking and landscaping.

This Desk Study has been undertaken in accordance with 'Model Procedures for the Management of Land Contamination (CLR11), BS 10175 'Investigation of Potentially Contaminated Sites – Code of practice - 2001' and the NHBC & CIEH 'Guidance for the Safe Development of Housing on Land Affected by Contamination - 2008'.

This report details the findings of the Desk Study, which is interpreted in conjunction with the findings of a site walkover visit conducted on 5th June 2014.

1.2 Objectives

The objective of the work is to produce a preliminary risk assessment for the site based upon a conceptual model derived from a review of available information and a site walkover. The preliminary risk assessment will be used to define the required parameters and scope of any site investigation should it be required.

The programme of work for the Phase I investigation included the following:

- A search of the GroundSure™ database.
- Review of the site history.
- Review of geological information.
- Review of groundwater vulnerability and flood map information.
- Site walkover survey.
- Assessment of the future use of the site in terms of risk receptors.
- Development of a conceptual model.
- Design of any required intrusive investigation.
- Interpretive report.

2. Site Description and Walkover Survey

2.1 General

The site address is:

Abbey Way

Willesborough

Ashford

Kent

TN24

The site is centred at grid reference 603027,142645.

The location of the site is shown in Figure 1 below and the approximate outline of the development area (outlined in Red) is shown in Figure 2 overleaf.

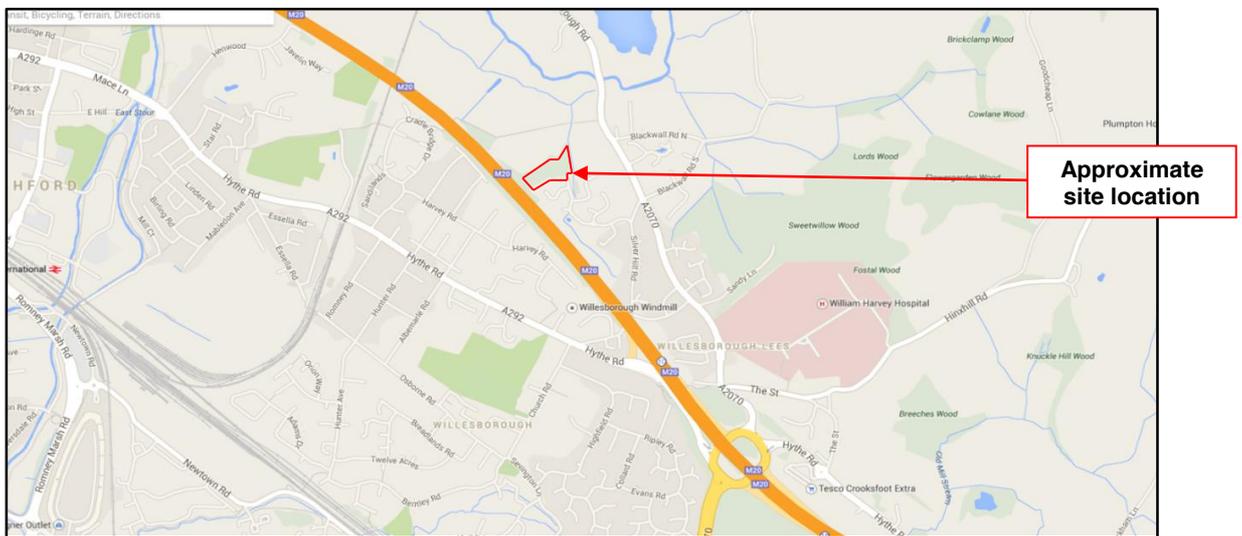


Figure 1: Location Map



Figure 2: Approximate Proposed Development Area

2.2 Site Walkover Survey

A walkover survey was conducted on 5th June. The walkover was attended by Noelia Ferrer and Robert Kay of Ecologia. The findings of the walkover survey are presented within the following sections.

2.2.1 Site Setting

The site is situated in Ashford, located between the M20 motorway to the west and the rear curtilage of the listed properties on Kennington Road to the East. The southern boundary of the site is directly adjacent to an existing housing development on Waltham Close. The site area is approximately 1.24 ha and the surrounding land use is a mixed rural and residential area.

2.2.2 General Site Description

The site description should be read in conjunction with the photographic report presented in Appendix I.

The site is currently open land / field at present and is relatively low lying. The land is overgrown with vegetation and shows a wide variety of wildlife, including nesting birds. There is a public footpath that runs through the site which is used by neighbouring residents. The north side of the site is adjacent to open farmland. The main access to the property is via Abbey Way, where a pond is located.

No visual evidence of potential contamination was noted on site.

2.3 Description of Proposed Development

From information provided by BDB Design LLP it is understood by Ecologia that planning consent is sought for the following:

- Development of 20 residential housing units (with private gardens) with associated areas for parking and landscaping.

3. Site Information

In order to provide a comprehensive assessment of the site, a report on the potential environmental receptors and hydrological sensitivity of the area, was commissioned from the GroundSure Database. Information was also obtained from the British Geological Society (BGS) website and the Environment Agency (EA) website.

The full GroundSure report is included in Appendix II with the key information outlined below.

3.1 Geology

Information obtained from the British Geological Society (BGS) website and GroundSure report indicate that the site is underlain by superficial alluvium deposits comprising clay, silt, sand and gravel. The superficial deposits are underlain by bedrock geology comprising the Sandgate Formation, consisting of sandstone, siltstone and mudstone. In close proximity (7m north west and 11m east) of the site the bedrock geology comprises the Folkestone Formation which consists mainly of Sandstone.

The maximum permeability for the superficial ground is graded as high with an inter-granular flow type and very low minimum permeability. The bedrock ground has a high maximum permeability with a mixed flow type and a low minimum permeability. At a distance of 7m north west and 11m east the maximum permeability is high with an inter-granular flow type and a high minimum permeability.

Information provided by the BGS and GroundSure report indicates there are thirteen (13No.) boreholes within 250m of the site. One (1No.) borehole can be found on site (borehole record TR04SW621). The drilled depth of the borehole is recorded as 3.05m and it belongs to the Ashford Sewage disposal.

A sequence of five boreholes (5No.) are located north of the site at 86m, 165m, 223m, 245m and 245m. The drilled depths are recorded as 3.05m, 11m, 1.0m and 10.01m.

A sequence of two (2No.) boreholes are located 220m north west of the site. One belongs to the Channel Tunnel Rail Link, the other one to the Union Railway.

3.2 Hydrogeology

The GroundSure report identifies a Secondary A Aquifer within the superficial deposits on site and 139m north of site, as well as an Unproductive Aquifer 333m north of site. The Secondary A Aquifer is detailed as containing permeable layers which are capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of base flow to rivers. The unproductive aquifer has rock layers and drift deposits which have a low permeability and are of negligible significance for water supply or river base flow.

Within the bedrock deposits a Secondary A Aquifer has been identified on site. Three (3No.) records of Principal Aquifers have been identified at 7m north-west, 11m east and 333m north west of the site. The geology is of high inter-granular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale.

Information obtained from the Environment Agency website indicates the site is not located in a groundwater source protection zone.

3.3 Hydrology

Information provided by the BGS website and the GroundSure report indicates that there are detailed river network entries within 500m of the site. There are eighteen (18No.) records of secondary river entries and six (6No.) records of tertiary river entries. All of them are designated as drains.

There are four (4No.) entries for the Great Stour River, with the nearest located at 238m north of site.

There are nine (9No.) records of surface water features within 250m of the study site. One is located on site in an easterly direction. No further information is provided, although it is understood that it is related to a pond.

3.4 Ground Hazards

The GroundSure report classified the maximum hazard of natural subsidence within the site as moderate and indicates the following ground hazards within a 50m buffer:

- The maximum Shrink-Swell hazard rating identified for the site is negligible. It is noted that ground conditions are predominantly non-plastic.
- The maximum Landslide hazard rating identified for the site is very low. It is noted slope instability problems are unlikely to be present.
- The maximum Ground Dissolution of Soluble Rocks hazard rating for the site is identified as Null – Negligible.
- A hazard rating of Negligible as well as Moderate is noted for Compressible Ground on site. It is noted that significant potential for compressibility problems is present. It is recommended to avoid large differential loadings of ground, to not drain or de-water ground near the property without technical advice. For the new building the possibility of compressible ground should be considered as well as effects of groundwater changes. Extra construction costs are likely.
- The maximum Collapsible Rock hazard rating identified for the site is Negligible.
- The maximum Running Sand hazard rating identified for the site is Low.

Further information provided indicates that the site is not located within a former coal mining site. It is indicated, however, that sand mining has taken place historically on site. Some infrequent mining may have occurred but was restricted in extent.

3.5 Ground Workings

The GroundSure report indicates that three (3No.) historical ground working features can be found within 250m of the study site boundary. An unspecified 'pit' is located 101m west of the site and is dated from 1955. Two cuttings are located 111m north-west of the site and are dated from 1993 and 1984.

There are no historical underground working features within 1k m of the study site.

Several current ground workings have been identified within 1km of the study site boundary. The following four (4No.) ground workings have all been classified as surface mineral working and may be termed quarry, sand pit, clay pit or opencast coal site:

- 625m and 720m south east, named White Horse and producing sandstone, now ceased operations.
- 748m south west, named Albemarle Road and producing limestone, now ceased operation.

- 798m north, named Conningbrook Quarry and producing sand & gravel, listed as dormant.
- 920m east, named White Horse Gravel Pit and producing sand & gravel, now ceased operations.
- 926m north east, named Sales Wood Sand Pit and producing sand, now ceased operations.
- 988m south, named Church Villa and producing limestone, now ceased operations.

3.6 Radon Affected Areas and Protection Measures

The GroundSure report indicates that the property is not located in a Radon Affected Area, as less than 1% of properties are above the Action Level and that no Radon Protective Measures are necessary. The GroundSure information is sourced from the British Geological Survey (BGS) and Health Protection Agency (HPA).

3.7 Flooding

The GroundSure report indicates that the site is located in an Environment Agency Zone 2 floodplain area. This estimates the annual probability of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea.

There are twenty-two (22No.) floodplain records available. One (1No.) is a Zone 2 (Fluvial Models and Fluvial Events) and the rest are all Zone 2 (Fluvial Events). These are located within 250m of the site, mostly located to the north, north-east and north-west of the site. This information was updated on 27th February 2014.

The report also shows that the site is within an Environment Agency Zone 3 floodplain. There is only one record available and it is located 90m north of the site.

There are no records of flood defences near the site.

Groundwater flooding susceptibility areas are indicated within 50m of the site which relate to Clearwater Flooding and may potentially occur on the surface. The British Geological Survey confidence rating with this result is identified as Low.

3.8 Environmentally Sensitive Areas

The GroundSure report indicates the following Environmentally Sensitive Sites within 2km of the site:

- Eight (8No.) records of Ancient Woodlands. 'Sweetwillow Wood' is the closest one located at 811m east.
- Twelve (12No.) records of Local Nature Reserves (LNR). All of them belong to the Ashford Green Corridors. Located at 1206m, 1334m and 1583m south of the site, 1253m, 1378m, 1427m, 1552m, 1998m west of the site, 1557m north west and 1610m, 1774m, 1843m south west of the site.
- One (1No.) record of a Nitrate Vulnerable Zone located on site.

3.9 Discharge Consents

The GroundSure report shows six (6No.) records of Licensed Discharge Consents within 500m of the study site. The first one is located 157m south east of the site. The effluent type is detailed as sewage discharge and storm sewer overflow.

The second one is located 295m north of the site. The effluent type is listed as miscellaneous discharges and surface water. The licence was effective from 1993 until 2010, when it was revoked.

The third recorded licence is located 308m north west of the site and is listed as carrying groundwater mostly from wells and adits. It was effective from 2009 until 2010.

The next two licences are located 310m and 313m north east of the site and the effluent type is listed as sewage discharge from a pumping station of a water company.

The last one is located 472m north of the site and the effluent type is listed as trade discharge from cooling water. It was effective from 1994 until 2004.

3.10 Water Abstractions

The GroundSure report indicates that there are six (6No.) groundwater abstraction licences within 2km of the site. Three (3No.) of them are located 671m west of the site at a Borehole at Henwood Ps and have an annual abstraction volume of 227,300m³.

The next abstraction is located 1,086m north of the site at Point A, Gravel Excavation at Conningbrook and is used for Mineral Washing. The annual abstraction volume is 755,068m³. The third abstraction is located 1,488m south of the site at Point B, Nr. Crow Corner, Wilesborough and is used for dust suppression.

The last recorded groundwater abstraction is located 1,882m west of the site at Points A-B, Chart Road to Beaver Bridge, Ashford and is used for dust suppression.

The GroundSure report details three (3No.) potable water abstraction licences within 2km of the site. They are located 671m west of the site at Boreholes at Henwood Ps and have an annual volume of 227,300m³.

Three (3No.) surface water abstraction licences are also detailed within 2km of the site. The first one is located 853m north west of the site at Points A-B, River Great Stour at Hinxhill and is used for Spray Irrigation with an annual volume of 1,1024m³. The next is located 1,393m south of the site at Point A, Aylesford Stream, Ashford and is used for dust suppression. The last is located 1,915m north of the site at Reach Ab on The Great Stour River, and is used for spray irrigation and has an annual volume of 16,436m³.

Records shown in the report regarding the biological quality of the river indicate that the quality of the East Stour River, which is located 1,438m west of the site, has been alternating between A and B (A 'Very Good' to F 'Bad') over a period of five years.

The chemical quality of the Great Stour River, which is located 281m north east of the site was graded C from 2005 to 2008, with a recent grade of B in 2009. The East Stour River was graded B over the last five years.

3.11 Landfill and Other Waste Sites

The GroundSure report presents records of the following two (2No.) historic landfill sites within 1,550m of the site:

- One (1No.) record of a landfill located 1,166m south west of the site at Hunter Close, Ashford, Kent. The waste type is indicated as Inert.
- One (1No.) record of a landfill located 1,348m north of the site at Conningbrook Quarry, Wilesborough Road, Ashford, Kent. The waste type is also indicated as Inert. The licence was surrendered in 2009.

There are eighteen (18No.) records of the following Environment Agency licensed waste sites within 1,500m of the site:

- Three (3No.) records are located 466 m south east of the site at Willesborough Ind. Est., Units 1&2, Kennington Road, Willesborough, Ashford, Kent. They are operated by Cannon Hygiene Ltd. Two (2No.) are clinical waste transfer stations and the other is a physical treatment facility.
- Four (4No.) records located 747m south east of the site at William Harvey Hospital, Kennington Road, Willesborough Road, Ashford, Kent named The Estates Compound. These are operated by the hospital and are classified as in-house storage facilities with a size of less than 25,000 tonnes.
- Two (2No.) records located 839m north west of the site at Ashford Highway Depot, Javelin Way, Henwood Ind. Est., Ashford, Kent and is designated for mechanical biological treatment.
- One record located 1,055m north at Conningbrook Recycling Facility, Willesborough Lane, Ashford, Kent. It is designated as a material recycling treatment facility with an annual tonnage of 175,000 tonnes.
- One record located 1,072m north west at Bybrook, Ashford, Kent named Ashford Wastewater Treatment. It is a landfill gas engine ($\leq 3\text{mW}$) and with a size $\leq 25,000$ tonnes.
- Two records of biological treatment facilities located 1,105m and 1,111m north west at Ashford Wastewater Treatment Works with an annual tonnage of 690,000 and 285,000.
- One record located 1,134 m north west at Units 5-6 Henwood Industrial Estate and it is designated as a metal recycling site (mixed MRS's).
- One record 1,268m north west indicates a mobile plant.
- Two records located 1,346m north west at Unit 18, Henwood Ind. Est. named Autoeconomics. They are designated as a vehicle depollution facility with an annual tonnage of 74,999 tonnes.
- One record located 1,461m north at Conningbrook Quarry taking Non-Biodegradable wastes.

3.12 Contemporary Trade Directory Entries

The GroundSure report indicates the presence of three (3No.) potentially contaminative industrial sites within 250m of the site:

- A company named Kortlang & Kortlang Ltd listed as a poultry farm located 133m east of the site.
- An airline services company is located 232m south of the site.
- An electricity sub station located 236m south of the site.

3.13 Fuel Station Entries

There are no records of petrol and fuel sites in close proximity to the site.

3.14 Local Authority Pollution Prevention, Control Activities

The report identifies seven (7No.) records of historic IPC Authorisations within 500m of the site. They are all located 472m north of the site and are operated by Quest International UK Ltd. The main purpose was the Manufacture and Use of Organic Chemicals. They were

effective between the years of 1994 and 2000. Their status has been either revoked and changed to IPPC or was superseded by variation, the details are not provided.

Furthermore there are four (4No.) records of A (1) IPPC Authorised Activities within 500m of the site. They are located 472m north of the site and operated by Quest International Limited and are registered under the name Ashford Fragrances. They process organic chemicals and oxygen containing compounds such as alcohols. Three of them have 04.01.2014 noted as the last date effective and another one was effective until 2009.

There are no records of COMAH & NIHHS sites within 500m of the site.

3.15 Pollution Incidents

Information provided by the GroundSure report and the EA website indicate eight (8No.) recorded pollution incidents within 500m of the site.

Five (5No.) incidents occurred 285m south of the site. The pollutants are categorised as oils and fuels and include diesel and lubricating oils. The incidents had a significant (category 2) effect on water and a minor (category 3) effect on land and air. The incidents occurred in February 2002.

One incident occurred 439m east of site and involved no specific pollutant. The impact on land and air was minor and there was no impact on water. Another incident occurred 482m south east of the site and involved inert materials and wastes such as soils and clay. It had a minor effect on soil and no impact on water and land. The incident dates back to 2001 and 2003. No incidents have been recorded in recent times.

3.16 Historical Site Description

Historical Ordnance Survey maps used and detailed within this report date from 1872 (1:2500) to 2012 (1:2500). A summary of the historical maps is provided below and all maps are included within Appendix II.

The historical maps available indicate the site has been undeveloped and remained as rural, possible agricultural land throughout the years.

A review of the historical map dated 1872 shows the site to be embedded within agricultural fields. On the east side of the site a few buildings, possibly farmhouses, are visible as well as several sheepfolds that are located within the area. The first outline of Willesborough centre is visible to the south, including several residential areas and amenities such as church, vicarage, windmill and various villas along the main road that is to become the future M20 motorway. The South Eastern Railway connection is also visible in the west.

By 1896 several new developments in the wider area such as water works, quarries, sand and gravel pits as well as a Sunday school in the south and Ashford Grammar School in the west are indicated. The site itself is still surrounded by fields and rural landscape. No buildings are visible on or in close proximity to the site.

The map of 1906 shows a growing development of Willesborough in the south. More residential buildings are visible as well as a parsonage, chapel, sanatorium and the East Ashford Union Workhouse. Along the north border of the site a field appears to be replanted with trees. A new Sewage Works appears in the north west as well as a ballast hole in the north, a smithy in the south east and a cemetery in the south. The site itself remains unchanged.

The map of 1931 shows a considerable development of residential areas to the south and south west of Willesborough. Several new amenities such as a cricket ground, rectory, engine shed, sewage works, allotment gardens and pump house are indicated.

By 1955 the main road along Willesborough has been developed into the Ashford Bypass and a considerable development has taken place along this road. The area south of the road comprises residential areas and buildings. The site itself is situated north of the road / motorway and, therefore, separated from Willesborough centre. The area is indicated as Willesborough Lees. Still undeveloped the site is situated in the midst of agricultural fields and a few buildings are visible on the east side along Kennington Road. A new factory is visible in the north as well as tanks, a viaduct and a hospital.

The maps of 1984, 1993 and 2002 indicate a rapid development of the area south of the motorway as well as the area adjacent to the site. Up until 1993 the surrounding fields have been undeveloped. The map of 2002 now shows an extensive development along the south border of the site on Waltham Close. The fields are still undeveloped to the northern side of the site. The site still has no land use indicated and is relatively low lying.

The changes in historical land use with regard to potentially contaminative land use, both on and off site, and within 1km, are summarised from the available maps (dated 1872 - 2012) and presented in the Table 1 overleaf.

Table 1: Historical Site Summary

Dates	On Site	Significant land use changes within 250 m	Significant land use changes over 250 m
1872	Site is part of and surrounded by agricultural fields.	Few buildings visible on the east side. Sheepfolds in the west.	Potentially contaminative land use over 250m includes: Sheepfold, Windmill, Union Workhouse, farms, S.E. Railway Co. Works, a graveyard and railway.
1896	The site is made up of agricultural fields.	No potentially contaminative land use under 250m visible.	Potentially contaminative land use over 250m include: water works, tanks, sewage works, inns, quarry, a school, a gravel pit, sand pit, hospital and a smithy.
1907	Site is made up of agricultural fields.	No potentially contaminative land use under 250m visible. No residential buildings within a 100m radius.	Potentially new contaminative land use over 250m: Cemetery and reservoir.
1933	No change in landscape around site.	No new potentially contaminative land use under 250m visible. In the south Willesborough is growing in size. More residential buildings and works visible.	Potentially new contaminative land use over 250m include: allotment gardens, sanatorium tank, cricket ground, and engine shed.
1955	The site remains undeveloped.	New potentially contaminative land use includes: Sheepfold, Ashford Bypass (M20) and a drain.	Potentially new contaminative land use includes: a factory and works.
1972	The site remains undeveloped. Next to the site Lees Farm is visible. Otherwise no developments.	New potentially contaminative land use includes: farms, a pumping Station and ponds.	Potentially new contaminative land use includes: Piggery, a swimming pool, a depot, goods yard, playgrounds, factories and an ambulance station.
1984	No development on site.	No new potentially contaminative land use visible. Residential area is avidly developing south of M20.	Potentially new contaminative land use includes: sludge beds, nursery, tanks, warehouses, South Eastern steam centre, car park, electricity sub station, Henwood Industrial Estate and a factory.
1992	The site is still undeveloped and areas immediately adjacent also.	No new potentially contaminative land use visible.	Potentially new contaminative land use includes: Willesborough Industrial Estate and Old Railway Works Industrial Estate, Conveyor,
2002	No change on site.	South and south east border of the site is now residential area.	Potentially new contaminative land use includes: Council Depot, Water Tower, Channel Tunnel Rail Link, Superstore, Athletics Ground
2012	No change on site.	Potentially contaminative land use within 250m includes: Pond and a tennis court.	Potentially contaminative land use over 250m includes: Highways Depot, Industrial Estate,

4. Conceptual Site Model

The conceptual model for the site must follow the source-pathway-receptor pollution linkage and for a risk to exist the linkage must be complete.

A source of contamination may be contaminated soils or groundwater. A pathway is the mechanism by which a pollutant is transferred to an entity (a receptor) which may be damaged by that contaminant. Receptors may, amongst others, include environmental receptors, such as groundwater, and human receptors, such as future and current users of the site and structures.

Should a source-pathway-receptor link (pollutant linkage) be found then an intrusive investigation is required to investigate the possible linkage. The next stage of the process is to quantify the risk to determine site specific targets for any contaminants that may have been found dependant on the proposed future use of the site.

The sections outlined below detail the potential sources, pathways and receptors for the site.

4.1 Potential Sources of Contamination on Site

From information obtained by the client, the GroundSure report and observations from the walkover survey, the site has not been developed historically, however, may have potentially been used for agricultural purposes in the past.

The following potential contaminants of concern (CoC) relating to agricultural activities have been identified;

- Compounds related to food production, comprising fertilizers, pesticides and insecticides and including persistent organic pollutants;
- Compounds related to farm plant and machinery, including Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAH) and BTEX compounds.

4.2 Potential Sources of Contamination Off-Site

The GroundSure report and a review of historical maps indicate the following potential sources of contamination are located in the vicinity of the site.

- Adjacent agricultural fields;
- Poultry farm located 133m east of site;
- An Airline Services company located 232m south;
- Electricity Sub Station 235m south of site;
- Waste treatment site 466m south east of site; and
- A Factory that manufactures and uses Organic Chemicals 472m north of site.

The following potential contaminants of concern (COC) have been identified with regards to these off-site land uses:

- Compounds related to food production, comprising fertilizers, pesticides and insecticides and including persistent organic pollutants;
- Compounds related to farm plant and machinery, including Total Petroleum Hydrocarbons (TPH), Polycyclic Aromatic Hydrocarbons (PAH) and BTEX compounds.

- Polychlorinated Biphenyls (PCBs) related to the nearby substations;
- TPH, PAHs including BTEX compounds, associated with garage works and airline services;
- Pathogens and organic compounds associated with poultry farming; and
- Heavy Metals.

4.3 Environmental Pathways

In order for a receptor to be impacted by a source of contamination, a migration pathway must link the receptor and source. The following potential pathways have been identified for the site:

- Migration of dissolved phase contaminants (fertilizers/pesticides) within the ground (via recharge) through infiltration and subsequent vertical and / or lateral migration to controlled water receptors (underlying Secondary (A) aquifer and identified controlled water receptors; surface waters)
- Mobilisation of contaminants in the sub-soil from off-site sources (nearby waste treatment site and sub station) via infiltration and recharge and subsequent leaching and lateral migration onto the site;
- Vertical migration of contaminants to the underlying soils and Secondary A Aquifer through piling during re-development resulting in a preferential migration pathway.
- Migration of accumulated ground gas via soil pores and rock fractures.

4.4 Human Health Pathways

The following possible human health pathways exist:

- Dermal contact – Skin contact with soil derived dust and skin contact with soil;
- Dust inhalation – Inhalation of soil derived indoor and outdoor dust and from potentially contaminated soil;
- Vapour inhalation – Inhalation of soil vapours indoor and outdoor;
- Soil ingestion – Direct soil ingestion and direct soil derived dust ingestion;
- Consumption of site grown fruit and vegetables and indirect soil ingestion via site grown fruit and vegetables as part of the future development;
- Potential permeation of plastic water supply pipes for potable water are installed during the new development within potentially contaminated soils.

4.5 Receptors

The following potential receptors have been identified:

- Groundwater (Secondary A Aquifer);
- Surface Waters (Ponds, water courses and Great Stour River);
- Ground workers;
- Future residents / users of site;
- Plastic utilities.

Ecological receptors such as Sweetwillow Wood is located 811m east and Sales Wood 1,088m north east of site which are unlikely to be affected by the future redevelopment due to the distance.

Short term human health risks to ground workers during redevelopment are deemed to be low on the basis that risks of acute exposure can be addressed through the use of appropriate PPE and good standards of health and safety practice.

4.6 Conceptual Model Summary

The conceptual model and qualitative risk assessment for the site has been summarised in Table 2 overleaf. A full quantitative risk assessment is beyond the scope of this investigation. The qualitative risk assessment methodology has been included within Appendix III.

Table 2: Conceptual Model Summary

Potential Source	Potential Receptor	Possible Pathway	Probability	Consequences	Risk
Presence of potential contaminants within the shallow soils underlying the site from previous on site land use and / or adjacent previous land use	Future site users	Direct dermal contact, inhalation and ingestion	Low Likelihood – Considering previous use of site there is a low likelihood of contaminants to be present on site. However, as the land may have been used for agricultural purposes in the past limited investigation may be required to confirm shallow soil conditions.	Medium – Potential chronic damage to human health is considered from potential agricultural activities, however, further investigation may be required to confirm this.	Moderate to Low Risk
	Maintenance/ Construction workers			Mild – Potential risks to future site workers can be mitigated with the appropriate use of PPE.	Low Risk
	Plastic Utilities	Permeation of plastic pipes		Mild – Potential risk to plastic utilities and pollution of potable water supply considered to be low. However, any new utility pipes should be placed in 'clean' material which has been screened using UKWIR guidance thresholds.	Low Risk
	Groundwater (Secondary A Aquifer) Surface Water Features (Nearby ponds and River)	Leaching of contaminants from potentially impacted ground Creation of preferential pathways through piling methods		Likely – there is a potential for off-site contamination from nearby current and historical activities. It is unknown whether shallow unsaturated soils are impacted or not and similarly whether groundwater is impacted or not. However, further investigation may be required.	Mild – Based on the likely presence of shallow groundwater it is considered likely that any potentially mobile contaminants from off site (ie. dissolved phase contamination or liquid product) entering the subsoil has the potential to impact the underlying groundwater. Since the layers of the aquifer are permeable of supporting water the potential for contamination is present. However, agricultural fields and residential estate are adjacent with potential commercial activities >200m from site
Potential production of ground gas (CH ₄ and CO ₂) in shallow organic impacted soils	Future Site Users	Potential for explosive atmospheres (CH ₄) or asphyxiation (CO ₂)	Low likelihood – The proximity of several waste treatment facilities could lead to potential migration of ground gas. However, information will be required on the ground gas regime for the residential development.	Mild– Considering the end use of the site as residential buildings, ground gas monitoring and risk assessment will likely be required.	Low Risk
	Maintenance/ Construction workers			Minor – the use of appropriate PPE and suitable health and safety procedures will mitigate any potential risk to future site workers	Low Risk

5. Conclusions

Based on the Phase 1 Assessment works including the inspection of available historical information, the walkover survey and environmental sensitivity of the site, the following conclusions can be made:

- Historical Ordnance Survey maps indicate the site has remained undeveloped in the past, however, formed part of agricultural land and, therefore, the only potential source of contamination is from potential agricultural processes undertaken on or adjacent to the site.
- Considering the historical land use, risks to future site residents from the potential presence of contamination within the underlying shallow soils are considered to be moderate.
- Potential moderate to low risks have been identified with respect to controlled waters including the underlying Secondary A aquifer, nearby ponds and Great River Stour. Groundwater underlying the site is likely to be present and, therefore, dissolved or free phase contaminants entering the soil have the potential to impact groundwater.
- Potential low risks have been identified with respect to the production of ground gas from neighbouring waste treatment facilities. However, as the proposed development is for a residential end use, monitoring of the ground gas and completion of a gas risk assessment will be required.

6. Recommendations

Ecologia recommends the following action to be taken:

- As part of the development works, further site investigation within key areas to characterise shallow ground conditions at the site and to quantify any soil contamination due to the potential agricultural and /or neighbouring site activities. Investigation works should also include further assessment of the potential risks to groundwater subsequent to findings of intrusive investigation works.
- Refinement of the conceptual site model and production of a semi-quantitative risk assessment subsequent to intrusive investigation will enable greater understanding of potential remediation or mitigation measures that are required as part of appropriate redevelopment.
- During development, any new services (potable supply pipes) should be placed in 'clean' material and screened against UKWIR Guidance thresholds.
- Precautions should be taken by ground workers, including the use of appropriate personal protective equipment, when developing the site to protect against dermal contact. Good housekeeping rules should be observed on site i.e. washing hands before eating etc.
- During re-development works in the event that unforeseen contamination is encountered, the client should stop work and further assessment undertaken by experienced Environmental Consultant.

The above recommendations are made based on the proposed development plans supplied to Ecologia for the development of residential apartments and housing with gardens and associated parking areas. If the use of the site was to change the qualitative risk assessment would need to be re-addressed.

The above recommendations are made based on the information obtained on site. The recommendations should be presented to the Local Authority for comment and agreement in case further work is required.

This report is produced solely for the benefit of BDB Design LLP. No liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing.

- *This report refers, within the limitations stated, to the conditions of the site at the time of the inspection and data review. No warranty is given as to the possibility of future changes in the condition of the site.*
- *The report is based on a visual inspection and information supplied by other parties indicated in the text. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further more extensive investigation.*
- *The opinions expressed cannot be absolute due to limitations of time and resources imposed by the agreed brief.*

APPENDIX I

PHOTOGRAPHIC RECORD



Plate 1: Entrance to site via Abbey Way, with pond to the right



Plate 2: South east end of site adjacent to residential area



Plate 3: View of site to the north



Plate 4: View of site to the south



Plate 5: View of site to the east