

Desk Study

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Geotechnical & Environmental Consultants

Phase I Desk Study

On

**Great Grovehurst Farm, Grovehurst Road,
Sittingbourne, Kent, ME98RB**

For

PFA Consulting Ltd

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REPORT 13838/DS

Phase I Desk Study

**Job Title: Great Grovehurst Farm, Grovehurst Road, Sittingbourne,
Kent, ME98RB**

Client: PFA Consulting Ltd

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Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.



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Report On a Phase I Desk Study

On

Great Grovehurst Farm, Grovehurst Road, Sittingbourne, Kent, ME98RB

For

PFA Consulting Ltd

Section 1 Commission

1.1 Commission

Soils Limited was commissioned by PFA Consulting Ltd to carry out a Phase I Desk Study and Site Walkover on land at Great Grovehurst Farm, Grovehurst Road, Sittingbourne, Kent, ME9 8RB.

1.2 Caveat

Whilst reasonable skill and care has been taken to determine the site history and the environmental setting within the time constraints applied by the programme, it should be appreciated that it may be that site conditions are better or worse than those indicated by the desk study, particularly on sites with a history of past development. No responsibility can be accepted should such conditions alter the recommendations made in this report.

Section 2 Introduction

2.1 Objective

The Phase I Desk Study was undertaken to advise the client on the risk pertaining to the site, with special reference to former and present day potential contaminative uses. This will also include their impact on sensitive receptors, such as, human health, controlled waters, buildings, building materials and services.

2.2 Location

The site was located in north Sittingbourne, north of Kemsley railway station and on the eastern side of the A249. The site had an O.S. National Grid Reference, at its approximate centre, and area of TQ 90537 66631 and 4.87ha respectively. The Site Location Map is outlined in Figure 1 and the full site walkover discussed in Section 3.1 of this report.

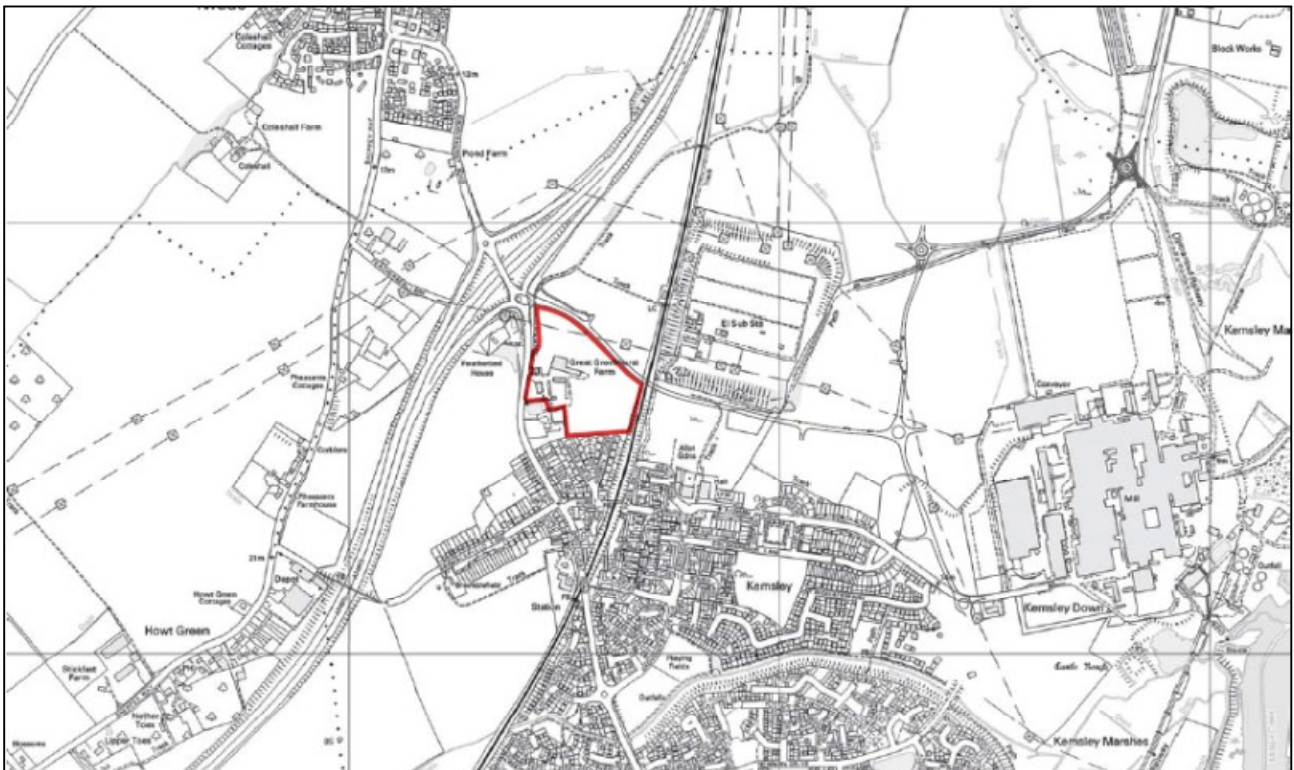


Figure 1 - Site Location Map

2.3 Proposed Development

The proposed comprised the building of a new housing development, which would likely have areas of soft landscaping for domestic gardens and recreational areas.

2.4 Liability

Part IIA of the Environment Act 1995 provides powers in relation to the identification, remediation and apportionment of liability for contaminated land.

Local Authorities are required to identify contaminated land and serve on every person who is an appropriate person a remediation notice setting out what is to be done by way of remediation and the period within which it must be done.

If the person who caused, or knowingly permitted the contaminating substance cannot be found, the owner and/or occupier for the time being of the property can be the appropriate person.

For the first time in the United Kingdom there is a legal meaning to the term Contaminated Land as: -

Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused.

Where the Act defines harm as: -

'harm to the health of living organisms or other interference with the ecological systems of which they form a part and, in the case of man, includes harm to his property.'

and pollution of controlled waters is defined as: -

'the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter.'

In addition, The Radioactive Contaminated Land (Modification of Enactments) (England) Regulations 2006 introduced the additional definition of harm to include: lasting exposure to any person resulting from the after-effects of a radiological emergency, past practice or past work activity.

With regard to contaminated waters, the Environment Act 1995 amends the Water Resources Act 1991 and provides the Environment Agency with the power to force clean-up of historical contamination by issuing a Works Notice, with remediation paid for by the responsible parties.

The Groundwater Regulations (1998) stated that entry of List 1 substances into groundwater must be prevented, and List II substances must be controlled. This was revoked when the Groundwater Regulations 2009 came into force in October 2009. The key changes are that: the term 'hazardous substances' is used instead of List I substances as in the 1998 Regulations and 'non-hazardous pollutants' is used instead of List II substances; a larger range of substances come within control; and the approach is generally more risk-based and less prescriptive.

2.5 Limitations and Disclaimers

This Phase I Desk Study Report relates to the site located on land at Great Grovehurst Farm, Grovehurst Road, Sittingbourne, Kent, ME98RB and was prepared for the sole benefit of PFA Consulting Ltd (The "Client") for the brief described in Section 1.1 of this report.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the contract with the Client, incorporation of our General Conditions of Contact of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

There may be other sources of information not included in those listed that hold data relevant to the Phase I Desk Study undertaken at the site that could materially affect the conclusions made in this report.

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as:

"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused".

Where a contaminative use is identified in the Phase I Desk Study this does not determine whether contamination has actually occurred, or if it has the degree to which it may have taken place. An intrusive investigation(s) and analysis is required to establish the nature and degree of any contamination present.

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Section 3 Site Conditions

3.1 Site Walkover

A Site Walkover was undertaken in September 2013 and the details are presented in Table 3.1 and 3.2.

Table 3.1 Site Walkover Record (Onsite)		
Onsite	Use of site	Agricultural and light industrial located on the western boundary.
	Structures (refer to Figure 2)	<ol style="list-style-type: none"> 1. 2-Storey brick house. 2. Corrugated metal warehouse (Grovehurst Cars – car dealer). 3. Septic tank. 4. Septic tank (overflowing). 5. Possible location of former aboveground fuel storage tank. 6. Corrugated metal warehouses (Pet food storage). 7. Aboveground fuel storage tank (unbunded). 8. Brick warehouses and aboveground storage tank.
	Site topography	Dipping towards the north east.
	Site covering	Agricultural area – crops. Light industrial area – tarmac, concrete and grass.
	Vegetation	Trees and shrubs along the boundaries.
	Contamination sources	<ul style="list-style-type: none"> • Current and former site use of light industrial area. • Aboveground fuel storage tanks. • Overflow from septic tank.

Table 3.2 Site Walkover Record (Offsite)		
Offsite	Use of surrounding land	North: Agricultural. East: Agricultural and residential. South: Residential. West: Agricultural and some residential.
	Area topography	Dipping in a north easterly direction.
	Vegetation	Trees and shrubs.
	Contamination sources	None observed.



Figure 2 - Site Activity

3.2 Site Drainage

No surface water drainage systems were observed at the site, with current drainage assumed to be via direct infiltration into the underlying natural soils.

3.3 Photographs

The photographs are attached in appendix D and see the key on Figure 2 for the location of each of the photographs.

Section 4 Geology, Hydrogeology, Hydrology and Radon

4.1 Anticipated Geology

The 1:50,000 BGS Map showed the site to be located on bedrock of the London Clay Formation, with areas of overlying superficial deposits consisting of Head.

4.1.1 Head

Head deposits are drifts produced by solifluxion, the downslope movement of debris outwash during the periglacial period, and characteristically comprise soils of local derivation. These are generally poorly sorted clays, silts, sands, gravels and chalk of relatively local origins.

4.1.2 London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay, and precautions against sulphate attack to concrete are sometimes required.

The lowest parts of the formation are sandy beds with black rounded gravel and occasional layers of sandstone and are known as the Basement Beds.

4.2 Hydrogeology

To assess the vulnerability of groundwater to contamination, consideration must be given to the leaching characteristics of the overlying soils and the characteristics of the strata in the unsaturated zone. Information on the geological strata, such as lithological type and permeability characteristics has been combined with the physical properties of the soil to produce varying degrees of vulnerability.

Table 4.1 Hydrogeology				
Data		Comment	Hazard	
			Yes	No
On-site Aquifers	Superficial	Unproductive Strata		√
	Bedrock	Unproductive Strata		√
Source Protection Zones (SPZ)		None within 1000m		√
Abstraction	Potable	None within 1000m		√
	Non-potable	252m NW/2006/General Agriculture		√
Surface Water Features		1m SW/Pond		√
Flood Risk		192m NE		√

The overall groundwater vulnerability of the site was **Unproductive Strata (Non-Aquifer)**.

'Unproductive Strata' was defined as, '*rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.*'

Any works or development, which may have an impact on surface water, aquifer or groundwater quality, must be approved by the Environment Agency prior to implementation.

According to Environment Agency guidance given to Local Authorities, a Flood Risk Assessment may be required as a part of the application for planning permission and guidance should be obtained from the Planning Department. If required, Soils Limited can undertake Flood Risk Assessment.

4.3 Hydrology

The anticipated groundwater flow direction is given in Table 4.2

Table 4.2 Groundwater Flow Direction	
Direction	Comment
North East	In alignment with the wider topography

The approximate elevation of the site was 11m AOD.

4.4 Radon Gas

The site was **not situated** within an area where protection or risk assessment against the ingress of radon was required. This means that **no radon protection measures** will need to be installed within the proposed new development. It is not possible in the course of a survey or inspection to determine whether radon gas is present as the gas is colourless and odourless. Tests can be undertaken to assess the concentration of radon in existing structures.

Section 5 Site History

5.1 Historic Map Study

The object of this search was to report on the evidence of site history and redevelopment of the site and its environs from available County Series and Ordnance Survey Maps dating from the mid to late 19th Century to the present day as downloaded from Landmark Environmental.

Maps only represent a “snap shot” of the site and its environs at the date of the survey. Changes that had occurred either to the site and/or the environs may well not have been recorded on the maps and could represent a hazard to the site.

Any distances quoted for features remote from the site have been scaled from the maps and are only approximate. Where dates have been noted in brackets, these are the actual dates applicable to the map editions.

The information reported might not represent all pertinent information that could be obtained.

The interpretation of the maps and/or other data commented on in this report is subjective.

In the following sections dealing with individual maps, only features considered to have a potential contaminative impact on the site and usually within a notional 250m radius of the site boundaries are discussed. The north point and approximate extent of the site are indicated on each figure. The historic maps referred to are given within Appendix A.

A précis of the environs identified, if any from the maps are given in Tables 5.1 and 5.2, with an overview of the environs in Figure 3.

Table 5.1 Environmental Significance of Data From Historic Maps				
Environ	Direction ¹	Distance (m)	Date Range	
			From	To ²
Great Grovehurst Farm	SW	Onsite	1869	2013
Tile Works	NW	23	1869	1896
Brick Works	E	20	1896	1964
Allotment Gardens	SE	72	1908	1938
Allotment Gardens	E	27	1938	1993 ³
Tank	SW	Onsite	1938	1977
Tank	W	Onsite	1977	2013
Electric Sub-Station	W	Onsite	1977	2013
Electric Sub-Station	S	119	1979	1993 ³

Notes:

¹ For on-site relative to the centre of the site;

² First date environ not observed;

³ No/conclusive data from this point.

**Table 5.2
Historic Development of the Site**

Site Development	Date Range	
	From	To
Great Grovehurst farm located in the SW section of the site. Landuse of agricultural/fallow, orchard in the corner NW corner.	1869	2013
Landuse orchard.	1909	1979
Landuse agricultural/fallow.	1979	2013

Section 6 Environmental Records and Consultation

6.1 Dataset Information and Landmark Envirocheck Report

A Landmark Envirocheck Report was obtained for the site by Soils Limited. Unless the data indicates otherwise only information within a 250m buffer zone has been included.

A copy of the Landmark Envirocheck Report is presented in Appendix B of this report and a summary is given in Tables 6.1 and 6.2.

Table 6.1 Environmental Significance Of Data Search	
Source	Nearest distance from site/Dated/Type
Contaminated Land Register Entries and Notices	<i>None within 1000m</i>
Discharge Consents	<i>None within 250m</i>
Integrated Pollution Prevention and Control	
Local Authority Pollution Prevention and Controls	<i>None within 1000m</i>
Local Authority Pollution Prevention and Control Enforcements	
Nearest Surface Water Feature	<i>1m SW/Pond</i>
Pollution Incidents to Controlled Waters(Significant Incidents only)	<i>None within 250m</i>
Prosecutions Relating to Authorised Processes	
Registered Radioactive Substances	<i>None within 1000m</i>
Substantiated Pollution Incident Register	<i>None within 250m</i>
Nearest potable abstraction point	<i>None within 1000m</i>
Nearest non-potable abstraction point	<i>252m NW/2006/General Agriculture</i>
Water Industry Act Referrals	
Source Protection Zones	<i>None within 1000m</i>
Extreme Flooding from Rivers or Sea without Defences	<i>192m NE</i>
Flooding from rivers or sea without defences	<i>212m NE</i>
Areas benefiting from flood defences	<i>212m NE</i>
Flood Water Storage Areas	
Flood Defences	<i>None within 250m</i>
BGS Recorded Landfill Sites	<i>None within 1000m</i>
Historical Landfill Sites	<i>100m SW/Not supplied/Deposited waste including inert</i>
Licensed Waste Management Facilities	<i>None within 250m</i>
Local Authority Recorded Landfill Sites	<i>None within 1000m</i>
Registered Landfill Sites	<i>None within 250m</i>
Registered Waste Transfer Sites	
Registered Waste Treatment or Disposal Sites	
Control of Major Accident Hazards Sites (COMAH)	<i>None within 1000m</i>
Notification of Installations Handling Hazardous Substances (NIHHS)	
Planning Hazardous Substance Consents	
Contemporary Trade Directory (Those likely to impact the underlying soil and/or groundwater, date not supplied)	<i>Onsite W/Active/Car dealers; Onsite NW/Inactive/Trailers & Towing Equipment; 38m SW/Inactive/Agricultural engineers; 38m SW/Inactive/Car dealers;</i>
Fuel Station Entries	<i>None within 250m</i>

Table 6.2
Geological Hazards

Source	Nearest distance from site/type
Coal Mining Affected Areas	<i>None within 250m</i>
Mining Instability	<i>None within 250m</i>
Natural and Mining Cavities	<i>None within 250m</i>
Potential For Collapsible Ground Stability Hazards	<i>Onsite: Very Low</i>
Potential For Compressible Ground Stability Hazards	<i>Onsite: No Hazard</i>
Potential For Ground Dissolution Stability Hazards	<i>Onsite: No Hazard</i>
Potential For Landslide Ground Stability Hazards	<i>Onsite: Low</i>
Potential For Running Sand Ground Stability Hazards	<i>Onsite: No Hazard</i>
Potential For Shrinking or Swelling Ground Stability Hazards	<i>Onsite: Moderate</i>
Shallow Mining Hazards	<i>None noted.</i>

6.2 Site Sensitivity Maps

No other significant potential sources of contamination were shown on the Landmark Envirocheck Site Sensitivity Maps, which have not been listed in Table 6.1 & 6.2 and copies of which are presented in Appendix C.

6.3 Soil Geochemistry

For metals lead, arsenic, cadmium, chrome and nickel the potential levels were assessed against the appropriate environmental quality standards (SSV, SGV & GAC) for the sites purposed end use.

The results are indicated in Table 6.3.

Table 6.3 Soil Geochemistry			
Determinand	Proposed Landuse	Potential Hazard	
		Yes	No
Lead	Residential with plant uptake		✓
Arsenic			✓
Cadmium			✓
Chrome			✓
Nickel			✓

These results are only indicative of the area, so specific site testing may be required. Please note that there are only a limited number of land uses for which data on determinands have been published or can be readily determined.

Section 7 Discussion

7.1 Summary

The findings of the Phase I Desk Study are summarised below:

1. The 1:50,000 BGS Map showed the site to be located on bedrock of the London Clay Formation, with areas of overlying superficial deposits consisting of Head.
2. The overall groundwater vulnerability of the site was **Unproductive Strata (Non-Aquifer)**.
3. Examination of the Environment Agency records showed that the site **did not fall** within a GSPZ.
4. Groundwater was anticipated to be flowing in a north-west direction in alignment with the wider topography.
5. The Building Research Establishment report BRE211 (2007) showed that **no radon protection measures** were required.
6. Environment Agency records showed that the site **was not** at risk from flooding.
7. Summary of **potential onsite and offsite contamination sources** identified during the study of the historic maps, the Dataset Information and Landmark Envirocheck Report and the Site Walkover are outlined in Table 7.1.

Table 7.1 Potential Contamination Sources						
Sources/Environmental impact		Direction ¹	Distance (m)	Date Range Observed		Data Origin
				From	To	
Onsite	Tank	SW	Onsite	1938	1977	HM
	Electric Sub-Station	W	Onsite	1977	2013	
	Aboveground fuel tanks	W	Onsite	1977	2013	HM/SW
	Trailers & Towing Equipment	NW	Onsite	Inactive		DS
	Former/Current site use (Car Dealers, Former Farm)	W	Onsite	Active		DS/SW
	Septic tank spillage	W	Onsite	2013		SW
Offsite	Tile Works	NW	23	1869	1896	HM
	Brick Works	E	20	1896	1964	
	Allotment Gardens	SE	72	1908	1938	
	Allotment Gardens	E	27	1938	1993 ²	
	Electric Sub-Station	S	119	1979	1993 ²	DS
	Car Dealers	SW	38	Inactive		
	Agricultural engineers	SW	38	Inactive		
	Landfill	SW	100	Not Supplied		

Data Origin: HM=Historic Maps; DS=Data Sheets; TD=Trade Directory; SW=Site Walkover;

NAR= National Archive Records

¹ For on-site relative to the centre of the site; ² No/conclusive data from this point.

8. The data search identified that there was a hazard potential of moderate for shrinking and swelling ground.

Section 8 Preliminary Conceptual Site Model

8.1 Legislative Background

The primary legislative mechanism for contaminated land management in the UK is Part 2A of the Environmental Protection Act, 1990 (EPA). Part 2A was introduced into the EPA under Section 57 of the Environment Act 1995 to help deal with the substantial legacy of land contamination. Part 2A applies where there is unacceptable risk, assessed on the basis of the current use and the relevant circumstances of the land. It is not directed to assessing risks in relation to a future use of the land that would require a specific grant of planning permission.

Revised Part 2A Statutory Guidance was issued by the Secretary of State in April 2012. As part of this guidance, a new category system has been proposed to define whether land should be classified as Contaminated Land. Land falling under Categories 1 and 2 designated as Contaminated and 3 and 4 as non-contaminated. New Category 4 screening levels are proposed, but are not yet available.

The control of development and land use in the future is the responsibility of the planning system, which is the principal regulatory driver for this site. In March 2012, the Government released the National Planning Policy Framework (NPPF) which replaced all previous planning policy statements and guideline (PPS/PPG) documents including Planning Policy Statement (PPS) 23 Planning and Pollution Control. However, it should be noted that the NPPF does not change the statutory basis on which planning decisions are founded and emphasises the requirement for sustainable development.

A fundamental principle of sustainable development is that the condition of land, its use and its development should be protected from potential hazards. The NPPF states that:

120. To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

121. Planning policies and decisions should also ensure that:

...the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation; after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990; and adequate site investigation information, prepared by a competent person, is presented.

Following a review of the background geo-environmental information for the site, a preliminary conceptual site model has been formulated to identify sources of contamination, potential pathways and potential receptors on and in the immediate vicinity of the site.

Potential contaminants and receptors have been identified based on the desk based site review. Pathways have been established on reasonable scientific knowledge of the behaviour of the contaminants in the ground.

Environment Agency guidance provided in CLR11 indicates the Conceptual Site Model should identify those contaminants, pathways and receptors which are 'likely' to represent an 'unacceptable' risk either to human health or the surrounding environment.

8.2 Ecological Risk Assessment

The Ecological Risk Assessment (ERA) Framework for contaminated soils has been developed by the Environment Agency in collaboration with DEFRA, Natural England, Welsh Assembly Government, the Countryside Council for Wales, local authorities and industry. It aims to provide a structured approach for assessing the risks to ecology from chemical contamination in soils that is a requirement under Part 2A (Contaminated Land) of the Environmental Protection Act 1990.

The ERA documentation sets out a three-tiered risk assessment process that has been designed to:

- *Establish whether pollutant linkages are likely to exist between the contamination and the designated ecological receptors;*
- *Gather sufficient information for making decisions regarding whether harm to those receptors is, or could, occur.*

The Phase I Desk Study process can identify ecological receptor (as defined by the ERA guidance), which was in potential influence distance of the site. The results are given in Table 8.1.

Table 8.1 Ecological Receptors	
Receptors	Comment
Pond	1m SW

Section 8.6 outlines the risk assessment, reviewing information about the site and nature of the contamination to assess whether pollutant linkages are feasible.

8.3 Sources of Contamination

From the study of the Landmark Envirocheck Report and Site Walkover the Phase I Desk Study has assessed and outlined potential contaminative sources (Table 7.1). Initial assessment of the likelihood each contaminative source poses a hazard to the site are considered in section 8.3.1 & 8.3.2.

8.3.1 Onsite Potential Contamination Sources

Map evidence, study of Landmark Envirocheck Report and Site Walkover showed the following potentially contaminative sources, given in Table 8.2:

Table 8.2 Onsite – Potentially Contaminative Sources			
Sources	Direction ¹	Likelihood	
		Likely	Unlikely ²
Tank	SW	✓	
Electric Sub-Station	W	✓	
Aboveground fuel tanks	W	✓	
Trailers & Towing Equipment	NW		✓
Former/Current site use (Car Dealers, Former Farm)	W	✓	
Septic tank spillage	W	✓	

¹ Relates to the centre of the site; ² Sources are marked as 'Unlikely' if the hazard to the site was considered negligible. These considerations are based on type of contamination, age of source and anticipated significance.

8.3.2 Offsite Potential Contamination Sources

Map evidence, study of Landmark Envirocheck Report and Site Walkover showed the following potentially contaminative sources, given in Table 8.3.

Table 8.3 Offsite – Potentially Contaminative Sources				
Sources	Direction	Distance(m)	Likelihood	
			Likely	Unlikely ¹
Tile Works	NW	23	✓	
Brick Works	E	20	✓	
Allotment Gardens	SE	72		✓
Allotment Gardens	E	27		✓
Electric Sub-Station	S	119		✓
Car Dealers	SW	38		✓
Agricultural engineers	SW	38	✓	
Landfill	SW	100	✓	

¹ Sources are marked as 'Unlikely' if the hazard to the site was considered negligible. These considerations are based on type of contamination, age of source, anticipated significance and taking account of the source distance from the site.

8.4 Potential Pathways

A pathway's a route or routes by which a receptor is exposed to a contamination source. Pathways can also determine the likelihood of the contamination source contacting a receptor.

Anthropogenic (or artificial) pathways for contaminant migration can be present in the form of land drains etc. Leaking sewage supply pipes and site drainage could also provide pathways for potential contaminant migration. Granular backfill to trenches for cables, gas pipes, water pipes etc. can also provide pathways for movement of mobile contaminants and contaminated groundwater.

The 1:50,000 BGS Map showed the site to be located on bedrock of the London Clay Formation with areas of overlying Head deposits. The permeability of the site and surrounding areas was considered to be negligible and the underlying geology would not be considered as a potential migration pathway.

Potential on-site and off-site pathways are assessed in Tables 8.4 and 8.5.

Table 8.4 On-Site Potential Pathways		
On-Site Potential Pathways	Likely	Unlikely
Ingestion of soil	✓	
Dermal contact	✓	
Inhalation of dust (indoor and outdoor)	✓	
Inhalation of vapours (indoor and outdoor)	✓	
Consumption of home-grown produce	✓	
Inhalation of soil gases	✓	
Potential explosive risk	✓	
Location of service supply pipes in contaminated soils	✓	
Direct contact of concrete to high-sulphate soils	✓	
Via anthropogenic pathways (services trenches)	✓	
Via surface water runoff	✓	
Migration downwards via natural granular soils		✓

Table 8.5 Off-Site Potential Pathways		
Off-Site Potential Pathways	Likely	Unlikely
Migration via surface water runoff	✓	
Migration via air	✓	
Migration via groundwater		✓

8.5 Potential Receptors

With respect to land contamination, potential receptors include human health, controlled waters, buildings & materials and Ecosystems.

The presence of potential receptors has been evaluated from our understanding of the current and future land use of the site, an assessment of surrounding land uses and currently available information pertaining to the site.

The assessment for potential receptors at the site is shown in Table 8.6.

Table 8.6 Potential Receptors			
Receptors		Likely	Unlikely
Human Health	Future users of the site	✓	
	Visitors to the site	✓	
	Construction workers on site	✓	
	Service and maintenance workers	✓	
	Site neighbours and wider public	✓	
Groundwater/Controlled Waters	Groundwater/Future Potable Water Supply		✓
	Surface Water	✓	
Buildings & Materials	Construction materials	✓	
	Buildings and confined spaces	✓	
Ecosystems		✓	

8.6 Risk Assessment

A preliminary risk assessment has been undertaken relating to the potential proposed development based on a qualitative assessment of the likely presence of a pollutant linkage. A pollutant linkage is the relationship between a contaminant source, a pathway and a receptor. Unless all three elements of a pollutant linkage are present, a risk is not considered to exist. Each of the three elements was considered in sections 8.3, 8.4 & 8.5.

The approach adopted was to screen the site based on assigning a risk category. The preliminary risk assessment is presented in Table 8.7 with the risk assessment criteria presented in Appendix E.

Table 8.7 Risk Assessment					
Environ	Direction	Distance(m)	Pathway	Receptor	Risk ¹
Former/Current site use (Car Dealers, Former Farm)	W	Onsite	✓	✓	Moderate
Septic tank spillage	W		✓	✓	
Tank	SW		✓	✓	
Electric Sub-Station	W		✓	✓	
Aboveground fuel tanks	W		✓	✓	
Tile Works	NW	23	None	✓	None
Brick Works	E	20	None	✓	
Agricultural engineers	SW	38	None	✓	
Landfill	SW	100	None	✓	

¹Risk assessment criteria outlined in Appendix E.

The classification tables are presented in Appendix E are modified from, 'Contaminated land risk assessment: A guide to good practice, 2001, CIRIA C552'.

8.6.1 Potential Contamination

From the Risk Assessment in Table 8.6 the sources identified cover a broad range of possesses and the main groups of contaminants are:

- Metal and metallic compounds (like; Arsenic, Chromium, Copper, Lead, Mercury);
- Inorganic compounds (like; ammonia, sulphate);
- Organic solvents (like; chlorinated solvents, non-chlorinated solvents);
- Organic compounds (like; diesel, oils, PAHs, BTEX/MTBE, TPH);
- Others (like; PCB, Asbestos, pH);

8.7 Preliminary Conceptual Site Model

The preliminary conceptual site model is presented in Table 8.8.

Table 8.8
Preliminary Conceptual Site Model

Table 8.8 Preliminary Conceptual Site Model				
	Potential Sources	Potential Migration Pathway	Potential Absorption Pathway	Potential Receptor
Onsite	Contaminants introduced onsite by previous and current site usage (Former/Current site use (Car dealers, former farm), Aboveground tanks, Septic tank spillage, Electric sub-station): <ul style="list-style-type: none"> • Metal and metallic compounds (like; Arsenic, Chromium, Copper, Lead, Mercury). • Inorganic compounds (like; ammonia, sulphate). • Organic solvents (like; chlorinated solvents, non-chlorinated solvents). • Organic compounds (like; diesel, oils, PAHs, BTEX/MTBE, TPH). • Others (like; PCB, Asbestos, pH). <p>RISK: MODERATE</p>	<ul style="list-style-type: none"> • Via soils. • Via anthropogenic pathways such as service trenches. • Airborne dust fibres or volatile contaminants. • Via surface water. 	<ul style="list-style-type: none"> • Dermal Exposure to uncovered ground. • Dust or volatiles from uncovered ground becoming airborne and inhaled. • Dust from the ground outside, collecting inside the building where occupants are subject to dermal exposure or contaminants become airborne and are inhaled. • Ingestion of soil via elevated concentration of determinands. 	<p>Human Health:</p> <ul style="list-style-type: none"> • Future users of the site. • Visitors to the site. • Construction workers on-site. • Service and maintenance workers. • Site neighbours and wider public. <p>Groundwater/Controlled Waters</p> <ul style="list-style-type: none"> • Surface waters. <p>Buildings and Materials:</p> <ul style="list-style-type: none"> • Constructions materials. <p>Ecological:</p> <ul style="list-style-type: none"> • Constructions materials.
		<ul style="list-style-type: none"> • Growth of vegetables. 	<ul style="list-style-type: none"> • Consumption of vegetables. 	<p>Human Health:</p> <ul style="list-style-type: none"> • Future users of the site. • Visitors to the site.
Offsite	RISK: NONE			

The intrusive investigation may reveal on site sources of contamination that were not established by the Phase I Desk Study and Site Walkover that could modify the Conceptual Site Model.

Section 9 Recommendations

9.1 General

Based on the information obtained during the desk study and the preliminary conceptual site model derived for the site, an intrusive contaminated land investigation is required to determine actual pollution linkages and to quantify the risk to the receptors.

The intrusive investigation may reveal on-site sources of contamination that were not established by the Phase I Desk Study and Site Walkover and thus require modification of the conceptual model.

9.2 Impact of Construction Activities on Controlled Waters and Site Neighbours

A demolition and construction risk assessment must be undertaken and appropriate measures taken to mitigate against mobilisation and to monitor impact to groundwater and surface waters.

9.3 Proposed Site Works

The combined geotechnical and Phase II Intrusive Investigation planned to obtain information regarding the following:

1. To investigate and assess the preliminary Conceptual Site Model.
2. Obtain data regarding engineering properties of the soils to enable the design of foundations, pavements and drainage.

The works to be undertaken on the site would comprise the following items:

1. Drilling boreholes with windowless sampler and percussion drilling rig at selected locations within the site.
2. Soil sampling appropriate to the potential sources.
3. Probing using either DPH or DPSH to permit the establish foundation design engineering parameters for foundation design.
4. Testing for the potential contaminants given in the CSM or other sources identified during the intrusive investigation.

9.4 Identification of Satisfied Pollutant Linkages

In order to show which of the scenarios in the CSM constituted satisfied pollutant linkages, a risk assessment using data from an intrusive investigation will be conducted.

9.5 Selection of Test Parameters

The Preliminary CSM allows for the identification of the test parameters relevant to the investigation, though this may require modification or addition from the findings of the intrusive investigation.

9.6 Discovery Strategy

There may be areas of contamination not identified during the course of the intrusive investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Ground workers should be instructed to report to the Site Manager any evidence for such contamination; this may comprise visual indicators, such as fibrous materials within the soil; discolouration, or odours and emission. Upon discovery, advice must be taken from a suitably qualified person before proceeding, such that appropriate remedial measures and health and safety protection may be applied.

Should a new source of contamination be suspected or identified then the Engineer and if appropriate the Local Authority must be informed.
