

HERTS & ESSEX SITE INVESTIGATIONS

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GEOTECHNICAL ASSESSMENTS – ENVIRONMENTAL ASSESSMENT - DESKTOP STUDY – CONTAMINATED LAND

Report For :

Mrs Pat Healy and Mr Jas Healy

Phase I DESK TOP STUDY REPORT

Site location :

***Land at Orchard Way,
Chigwell Row.
IG7 6EE***

***February 2019
Report No. 15249***

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LIST OF ABBREVIATIONS

BGS	British Geological Society
CIRIA	Construction Industry Research and Information Association
EA	Environment Agency
EFDC	Epping Forest District Council
GL	Ground Level
GW	Groundwater
HESI	Herts & Essex Site Investigations
LAPPC	Local Authority Pollution Prevention and Control
NOS	Not Otherwise Specified (waste material)
NHBC	National House-Building Council
OS	Ordnance Survey
PAH	Poly Aromatic Hydrocarbons
SPZ	Source Protection Zone
TPH	Total Petroleum Hydrocarbons
UFST	Underground Fuel Storage Tanks

DESK STUDY GENERAL NOTES

This report has been prepared based on the findings of investigations into the site conditions using current available data which has been recovered from Envirocheck to provide environmental data in relation to the site and surrounding area. Where possible, local sources have been researched to gain a better understanding of the site conditions. As part of this review, research has been undertaken with the Local Authority and the Environment Agency as to the site condition.

We can confirm that this report has been prepared based on the information gained and that this information is not exhaustive and that subsequent research may reveal additional facts that may influence the reporting. Where possible, this information has been researched.

All geological information has been researched using the British Geological Society website, (the geology viewer). The disclaimer associated with this portal confirms 'The British Geological Society accept no responsibility for omissions or misinterpretations of the data from their Data Bank as this may be old or obtained from Non-BGS sources and may not represent current interpretation.

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The accuracy of map extracts cannot be guaranteed and it should be recognized that different conditions on site may have existed between subsequent to the various map surveys.

We can confirm that within the assessment of the site, various websites have been visited and as such, we cannot confirm the validity of these sites and as such, this information is accepted de facto and without prejudice. Anyone relying on these sources does so at their own risk, however, Herts & Essex Site Investigations does undertake all reasonable care to ensure this data is relevant and correct.

It should be confirmed that the extent of review of this report has undertaken a broad review of on site features which would promote a contamination ground risk, however, this does not include ecological features and in particular Japanese Knotweed which should be reviewed under separate cover.

A review of the site will be made to confirm the extent of obvious Asbestos product or sheet materials either on the surface of the site soils or evident above ground, however, does not constitute a full Asbestos Survey by any means. This should be sought under separate cover.

DOCUMENT INFORMATION AND CONTROL SHEET

Client

Mrs Pat Healy and Mr Jas Healy
C/O The Tooley & Foster Partnership
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116 Palmerston Road
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Essex
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Principal Author :

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Qualifications

C.S.Gray

- ONC - Civil Engineering
- HNC – Civil Engineering
- P.G. Certificate – Geotechnical Engineering, (Inc. Environmental Engineering)
- P.G. Diploma – Geotechnical Engineering, (Inc. Environmental Engineering),
- Master of Science, (Geotechnical Engineering), (Inc. Environmental Engineering)
- SNIFFER modelling course
- CONSIM Groundwater Assessment Course.
- (30 Years in Geotechnical and Environmental Engineering)
- Asbestos Awareness Course;
- Non-Licensed Work with Asbestos Including>NNLW
- Site Supervisors Safety Training Scheme, (SSSTS).
- First Aid Course in Construction – 3 Day Course – 3 years

Document Status and Approval Schedule

Issue No	Status	Date	<i>Prepared by :</i> Rebecca Chamberlain Signature / Date	<i>Technical review by :</i> Chris Gray Martyn Smith Signature / Date	<i>Checked By :</i> Chris Gray Martyn Smith Signature / Date
1	Final	February 2019			

REPORT ISSUE RECORD

As part of Herts & Essex Site Investigations approved Quality Management System, the company is required to document the issue of all reports to provide the client with a traceable control mechanism to prevent the issue of unauthorised copies.

All final copy reports are issued to the client on paper headed with Herts & Essex Site Investigations to assist in the identification of copied reports. Additionally, final copies are printed 'Velum' coloured paper for easy identification of final copy reports.

Notwithstanding the above, clients are at liberty to make copies of full or parts of these reports as they see fit, should they wish to do so. Additional controlled copies of documents may be supplied upon request, although, may be charged for, dependent upon the number of copies.

Please note, this reports has not been sent to the Local Authority, NHBC or Environment Agency with only the below issues made. Should copies be required for sending the relevant authorities, this can be undertaken upon request.

Controlled copies of this report have been issued according to the following schedule :-

Issue No	Recipient	Type	No. of copies	Date
1	HESI, (File Copy)	Electronic Copy	1	February 2019
2	The Tooley & Foster Partnership	Electronic Copy	1	February 2019
3				
4				
5				
6				
7				
8				

EXECUTIVE SUMMARY				
PHASE 1 DESK TOP STUDY REPORT				
Client		Mrs Pat Healy and Mr Jas Healy		
Site Location		Land at Orchard Way, Chigwell Row. IG7 6EE		
Existing Development		Open Land		
Proposed Development		It is proposed to develop dwellings within the south of the site area and with garden proposed to the north of the site area.		
Site Settings and Previous Uses		The site area is recorded as open land from the earliest map reference and remains such to date. Surrounding the site area residential land is in place to the east from pre 1872, In about 1972 residential dwellings were developed to the west and south east of the site area (within the planning file the southern section of the site forms part of the development area, although remained open land). Surrounding the site area ponds were also recorded in place the closest being 1m to the east of the site area which from 1969 were infilled.		
Nearest Surface Water Feature		The nearest surface water feature is recorded as 66 meters to the east of the site which is recorded as a pond. The nearest controlled water feature is recorded 95 meters to the north of the site area, where a surface ditch is in place.		
Geological and Hydrological Profile	Geology		Aquifer Classification	
	Made Ground	Shallow Made Ground Anticipated	Not Classified	
	Lowestoft Formation	Chalky till, together with outwash sands and gravels, silts and clays	Secondary A Aquifer	
	Claygate Beds	Clay	Secondary Undifferentiated	Aquifer
Groundwater Abstractions		The nearest abstraction well is located 638 meters to the south west of the site which is recorded as a Private Water Supply (Pisciculture)		
Source Protection Zone		The site is not recorded within a Source Protection Zone		
Potential Sources of Contamination	Off Site			
	On Site	• Infilled Ponds – E 1m–INFILLED - W 20m –INFILLED -S 100m –INFILLED • Potentially Infilled Land – N 113m - S 134m		
Previous Investigations		No reports relating to contaminated land are known to us at the time of writing this report relating to the site.		

Human Health Risk	We would suggest that there is potential sources of contamination relating to the historical land use of the site that, may be in place within the upper subsoil which will require assessment. Potential pathways in place within the site area recorded as : - <ul style="list-style-type: none">• Dermal Contact;• Inhalation of dust and fibres;• Ingestion of home grown produce;• Ingestion of dust and fibres• Ingestion of contaminated water through water main pipework;• Inhalation of vapours from soils;• Inhalation Asbestos dust and fibres (from Asbestos within the building);• Inhalation Asbestos dust and fibres (from asbestos within the soil).• Inhalation of vapours from Groundwater.
Ground Water Risk	Considering the Secondary Aquifer within the site area there is a potential for groundwater to be in place and to be impacted on by the site area, although risks of contamination within the site area recorded as low, the follow pathways may be in place: - <ul style="list-style-type: none">• Leaching, lateral migration of shallow groundwater system underlying the site and subsequent abstraction well;• Leaching, lateral migration of shallow surface water system adjacent to the site.
Surface water Risk	In light of the pond to the east of the site area and the controlled water feature further to the north of the site area, direct links between the site conditions and the stream may be in place, although sources of risk within the site area low, the follow pathways may be in place: - <ul style="list-style-type: none">• Leaching, lateral migration of shallow surface water system adjacent to the site
Vapour Risk	Sources of contamination that may promote a vapour risk are recorded in place as such risk maybe in place. Potential pathways in place within the site area recorded as: - <ul style="list-style-type: none">• Inhalation of vapours from soils - Visual and chemical tests to be completed initially;
Land Gas Risk	Infilled land is recorded in place in the form of a historic pond located 1 meter to the east of the site area as well as further from the site area. As such, this will have been infilled with potentially waste product and degradable materials and as such, the potential for contamination and land gas risk is in place. Potential pathways in place within the site area recorded as: - <ul style="list-style-type: none">• Inhalation of Land Gases - Complete Land Gas Assessment ;
Recommend ations	Next Steps <ul style="list-style-type: none">• Intrusive shallow based excavation using window sampler to assess the geological conditions and recover samples;• Initially assess soils for presence / absence of fuels and if encountered :-<ul style="list-style-type: none">◦ Install standpipe for the monitoring of both groundwater and land gas / vapour risks;• Targeted sampling to assess on site source risk;• Spatial sampling for use in statistical analysis;• Consideration through the site assessment as to the presence of Asbestos product within the site and subsoil within the site;• Assess the risk to and from the groundwater - Leachate testing and groundwater sampling if required;• Visual observations of the subsoil encountered to make initial assessment of the potential risk from contamination.• Watching brief to record assess and report on unexpected contamination. Based on the above, a risk assessment should be completed when the findings of the investigation have been completed. This will result in a revised conceptual model based on actual site conditions and confirm the risks in place.

Human Health Risk	<p>We would suggest that there is potential sources of contamination relating to the historical land use of the site that, may be in place within the upper subsoil which will require assessment.</p> <p>Potential pathways in place within the site area recorded as : -</p> <ul style="list-style-type: none"> • Dermal Contact; • Inhalation of dust and fibres; • Ingestion of home grown produce; • Ingestion of dust and fibres • Ingestion of contaminated water through water main pipework; • Inhalation of vapours from soils; • Inhalation Asbestos dust and fibres (from Asbestos within the building); • Inhalation Asbestos dust and fibres (from asbestos within the soil). • Inhalation of vapours from Groundwater.
Ground Water Risk	<p>Considering the Secondary Aquifer within the site area there is a potential for groundwater to be in place and to be impacted on by the site area, although risks of contamination within the site area recorded as low, the follow pathways may be in place: -</p> <ul style="list-style-type: none"> • Leaching, lateral migration of shallow groundwater system underlying the site and subsequent abstraction well; • Leaching, lateral migration of shallow surface water system adjacent to the site.
Surface water Risk	<p>In light of the pond to the east of the site area and the controlled water feature further to the north of the site area, direct links between the site conditions and the stream may be in place, although sources of risk within the site area low, the follow pathways may be in place: -</p> <ul style="list-style-type: none"> • Leaching, lateral migration of shallow surface water system adjacent to the site
Vapour Risk	<p>Sources of contamination that may promote a vapour risk are recorded in place as such risk maybe in place. Potential pathways in place within the site area recorded as: -</p> <ul style="list-style-type: none"> • Inhalation of vapours from soils - Visual and chemical tests to be completed initially;
Land Gas Risk	<p>Infilled land is recorded in place in the form of a historic pond located 1 meter to the east of the site area as well as further from the site area. As such, this will have been infilled with potentially waste product and degradable materials and as such, the potential for contamination and land gas risk is in place.</p> <p>Potential pathways in place within the site area recorded as: -</p> <ul style="list-style-type: none"> • Inhalation of Land Gases - Complete Land Gas Assessment ;
Recommend ations	<p>Next Steps</p> <ul style="list-style-type: none"> • Intrusive shallow based excavation using window sampler to assess the geological conditions and recover samples; • Initially assess soils for presence / absence of fuels and if encountered :- <ul style="list-style-type: none"> ◦ Install standpipe for the monitoring of both groundwater and land gas / vapour risks; • Targeted sampling to assess on site source risk; • Spatial sampling for use in statistical analysis; • Consideration through the site assessment as to the presence of Asbestos product within the site and subsoil within the site; • Assess the risk to and from the groundwater - Leachate testing and groundwater sampling if required; • Visual observations of the subsoil encountered to make initial assessment of the potential risk from contamination. • Watching brief to record assess and report on unexpected contamination. <p>Based on the above, a risk assessment should be completed when the findings of the investigation have been completed. This will result in a revised conceptual model based on actual site conditions and confirm the risks in place.</p>

PRELIMINARY RISK ASSESSMENT – DESK TOP STUDY - PHASE 1 REPORT

1 Context and Objectives of this report

1.1 Introduction

We have been asked by Mrs Pat Healy and Mr Jas Healy to undertake an investigation of the above site in order to assess the potential environmental impact of the existing and historical use of the site on the proposed development sufficient to document the level of risk and impact on future users and the environment.

At this stage, we have been asked to carry out this report without further environmental works proposed, on completion of this report. We would suggest that the protocols for the investigation of the site should form this desk top study, an intrusive investigation and environmental report, a remediation strategy report and a final validation report, where required. This is the basis on which this report has been prepared and as such, these protocols are expected to follow this report.

1.2 Reference to the Current Planning Application Details

No current application is in place for the site, A pre-commencement consultation has been made with Epping Forest District Council. The Planners require a Phase 1 Desk Top Study report to be submitted with the full application.

1.3 Decision Notice Relating to Contaminated Land

No conditions to contaminated land are in place within the above application.

1.4 Report Objectives

The objectives of the project were as follows:

- To anticipate regulatory action;
- To assess the site for Part IIA;
- To ensure development is 'suitable for use' status;
- To assess the site in other regulatory contexts;
- To inform acquisition, transfer or sale plans;
- To support funding decisions;
- For valuation purposes;
- For insurance purposes

1.5 Timescales of the Assessment

The timescales for the site investigation process are based on immediate site investigation data and the assessment of the site conditions based on this report at present. The scope of this report which define the following:-

- Any immediate risks identified within the site that may promote a high risk to the immediate site conditions;
- Any current site use features that would promote a risk that required 'quick' action;
- Any construction or medium-term risks within the site which may be present during the construction process within the site;
- Any long-term risks within the site that may require long term assessments or interim monitoring;
- Any risks within the site that may change upon the change in use of the site to form the proposed development.

1.6 Level of Technical Confidence Expected

The scope of this report has been prepared in order to assess the historical impact of the site and any previous site uses on the existing and proposed development scheme. The level of risk will be prepared and assessed based on historical mapping and environmental information which has been gained to support the development of this report.

Whilst this is the case, gaps in map records and information will be in place that would reduce the readers confidence of the information sought. As such, this report has been prepared as a preliminary or Indicative Report with a Medium Confidence Level.

1.7 Management Constraints

The site investigation has been prepared based on a budget and time scales which has been agreed with the client. The desk top study fees have been agreed at this time which will dictate a way forward.

2 Broad Characteristics of the site

2.1 The Site

The site is located within a Residential area of Chigwell, the details of which are summarised in Table 1 with the location plan of the site shown in Appendix 2, Sheet 1.

Table 1 Site Detail

Site Address :	Land at Orchard Way, Chigwell Row. IG7 6EE
Site assessed under	Site Owners Request - Aid as part of planning
Current use of land :	Open Land
Previous use of site, (if known)	As above
Grid Reference	NGR 546400, 193520
Site Area	0.12 Hectares
Local Authority	Epping Forest District Council
Gradient of the site	The site and the surrounding area slopes down to the north.
Proximity of Controlled Waters, (if known)	The nearest surface water feature is recorded as 66 meters to the east of the site where a pond is in place within open land.

2.2 Existing Site Use

The site area forms a section of open land.

2.3 Surrounding Land Uses

The surrounding land uses are detailed below :-

- To the north of the site area grass land is in place, used for grazing of horses;
- To the east and west of the site area residential land is in place;
- To the south of the site area Orchard Way is in place.

2.4 Site Reconnaissance

The site walk over visit was undertaken in February 2018 on which the weather conditions were recorded slightly overcast.

Access

The site area forms two sections of open land, pedestrian access to the southern section is freely accessible from Orchard Way. A wire fence is in place between the two sections of the site, which impeded access to the section of the site.

Site Area

The site area forms a rectangle parcel of land, divided into two sections, A northern and southern sections, with a wire fence between them. The land forms overgrown grass land, with some shrubs and brambles in place within the southern section of the site.

Vegetation

Plants and vegetation are recorded in place across the site area, some trees are in place to the east of the site area.

Above or below ground fuel or oil storage tanks

By examination of the site, no tanks are in place and no features to suggest that any underground fuel tanks are present.

Asbestos Containing Materials

No Asbestos containing materials were reviewed on site from our walk over inspection. A full Asbestos survey will be required in order to fully consider Asbestos within any fill material on site.

Surrounding Area

To the east and west of the site area residential land is in place with terraced dwelling present to the west of the site; and rear garden to semi-detached dwelling in place to the east of the site area.

To the north of the site area there is grazing land for horses in place. To the north east of the site area the section of land that the site forms part of is in place with a large willow tree in place.

To the south of the site area Orchard Way is in place with forms a turning area to the south of the site, with a grass verge in place opposite.

Site Levels and Ground Cover

The site area and the surrounding land slopes down to the north, along western boundary there is a slope down from the ground level of the garden off site to the west down to the site ground level, there is about 0.50m difference in ground level.



Current site activities

The site is currently vacant open land, with no activities taking place on site.



Effluent, Site Drainage and Services

Drainage and services are unlikely to be in place within the site area although services associated with the residential land surrounding the site may encroach on the site area.

2.5 Site Reconnaissance – Photos

Print 1	View of the front of site area, looking from Orchard Way	Print 2	View within the south of the site area looking to the east
			

Print 3	View across the southern section of the site area looking to the south	Print 4	View across the southern section of the site area looking to the south west
			

Print 5	View across the northern section of the site looking to the north west	Print 6	View across the northern section of the site looking to the north
			





Print 7	View across the northern section of the site looking to the north west	Print 8	View of the dwelling in place off site to the west
			
Print 9	View of Orchard Way in place to the south of the site area – looking to the south	Print 10	View of the dwellings in place to the South west of the site area
			

Table 2 **Walk Over Inspection Risk**

Feature	Location	Elevation	Is Risk Present?	Location To Target
Open Land	On Site Off Site – N	At GL.	X	
Residential Land	Off Site – S, E, W	At GL.	X	

3 **Details of Searches Undertaken**

Within this report, various searches have been undertaken in order to assess the risk associated with the development of the site from the historical and current use of the site and surrounding area. These include :-

- Environmental Data Search 1 : 10,000;
- Environmental Data Search 1 : 2,500;
- Site Sensitivity Maps and Data Sheets;
- Historical Maps;
- Internet Search;
- Local Authority Search – Planning Files;
- Consultation with Site Owner / Architect.

4 *Information on Historical and Current Activities on the Site and Surrounding Area*

The history of the site's land-use and development from Victorian times onwards has been researched from Ordnance Survey, (O.S.) maps. Extracts of the O.S. Maps and plans are presented in Appendix 4. Reference to historical maps provides invaluable information regarding the land use/history of the site, but historical evidence may be incomplete for the period pre-dating the first edition and between successive map references.

4.1 Discussion of the Development History

A summary of the historical development of the site and surrounding area, based on the information obtained from the above sources is provided in Table 3. It should be noted that these maps are only a small section of time and represent the timescales given in each of the map records. It is highly possible that development or features may have been developed within or surrounding the site which may influence the site and this should be bourn in mind when assessing the history of the site.

Table 3 **Historic Maps Assessment**

Date	On Site Feature	On Site Mitigation (considering all possible pathways)	Off Site Feature	Off Site Mitigation (considering all possible pathways)
1872 Source Map Scale 1:2 500	Open Land	No Sources	Pond – E 1m W 20m S 100m N 100m	No Sources
			Open Land – N & E	No Sources
			Residential land S & W	Limited Sources
1880 Source Map Scale 1:10 560				
1896 Source Map Scale 1:2 500				
1920 Source Map Scale 1:2 500				
1921 Source Map Scale 1:10 560				
1938 Source Map Scale 1:10 560				
1951 Source Map Scale 1:10 000				
1953 Source Map Scale 1:10 560				
1969 Source Map Scale 1:2 500			Pond – E 1m - REMOVED W 20m - REMOVED S 100m - REMOVED	Possible Land Gas Risks
1970 Source Map Scale 1:10 000				

Table 3a **Historic Map Assessment - Continued.....**

Date	On Site Feature	On Site Mitigation (considering all possible pathways)	Off Site Feature	Off Site Mitigation (considering all possible pathways)
1971 Source Map Scale 1:2 500				
1972 Source Map Scale 1:10 000			Residential land – NE, S & W	Limited Sources
1990 Source Map Scale 1:10 000				
1992 Source Map Scale 1:1 250				
1999 Source Map Scale 1:10 000				
2006 Source Map Scale 1:10,000				
2019 Source Map Scale 1:10,000				

Table 4 **Overview of Historic Map Assessment Risk**

Identified Risk	Distance & Direction	Year	Is risk in place?	Considering All Pathways	
				Assessment Required.	Method of Assessment
Open Land	On and Off Site	Pre 1872 – Present	X		
Pond	Off Site – E 1m–INFILLED W 20m –INFILLED S 100m –INFILLED	Pre 1872 – 1969 INFILLED from 1969- present	✓	Possible Land Gas Risk	Install Standpipes Vapour Assessments
Residential land	Off Site - S & W - NE, S & W	Pre 1872 – Present 1972 - Present	X		

5 *Details of the Intended Future Use of the Site*

It is proposed to develop dwellings within the south of the site area and with garden proposed to the north of the site area.

6 *References of Planning Applications*

No current planning application is in place for the site area.

From a review of the Epping Forest District Council web site no historical applications specific to the existing site area in place.

The southern section of the site formed part of a historical application for the development of Orchard Way in about 1970 are recorded for the site area.

An application is in place with Council as follows:-

File Number 001239

Application No: CHI/0445C/70

Proposal: EREC OF 18 DWELLINGS & CONSTRUCTION OF NEW ROAD

Decision: Grant Permission (With Conditions) 19-04-1972

No Microfiche files are in place for the above.

7 *Discussion with Local Authority*

No discussion with the Local Authority has been completed.

8 *Consultation with Environment Agency*

Consultation has not been made with the Environment Agency at this time. The information gained from Envirocheck and the EA web site has provided sufficient information at this stage. The assessment of the site should take into account the groundwater regime within the site area and the possible risk from both on site and off site contamination.

Should heavy or persistent contamination be identified within any Phase 2 or intrusive investigation, consultation will be required and will be undertaken.

9 *Consultation with Appropriate Bodies/Local Sources*

Limited consultation with the Local Authority has taken place a review of the online planning files has been made. This forms the level of assessments made.

10 *Previous Reporting*

No previous reports are known to us at the time of writing this report.

11 *Environmental Settings*

11.1 *Superficial Deposits and Solid Geology*

The ground conditions based on geological maps and BGS information shows the site to be located within an area Lowestoft Formation. This is seen to overlie Claygate Member.

11.2 *BGS Boreholes*

No BGS Boreholes are reported surrounding the site.

Table 5 Geological Information

Geological Unit	Brief Description	Anticipated thickness, (m)	Aquifer Type
<i>Superficial Deposits/Drift</i>			
<i>On Site</i>			
Filled/Re-worked ground	Made Ground, (Potentially Contaminated Stratum).	0.5-1.00 meters+	Not Classified
Lowestoft Formation	Chalky till, together with outwash sands and gravels, silts and clays	4-6 meters	Secondary Aquifer Undifferentiated
<i>Solid Geology Deposits</i>			
Claygate Member	Clay	15m +	Secondary A Aquifer

11.2 Hydrology

The nearest surface water feature is recorded as 66 meters to the east of the site which is recorded as a pond.

The nearest discharge consent is recorded 138 meters to the south west of the site, for Discharge Of Other Matter-Surface Water.

11.3 Hydrogeology

The published Environment Agency Groundwater Vulnerability Map of the area, (Sheet 40 Thames Estuary), indicates the site to be located within an area classified as a Secondary Aquifer. The underlying geology is also recorded as a Secondary Aquifer.

The nearest abstraction well is located 638 meters to the south west of the site which is recorded as a Private Water Supply (Pisciculture)

The site does not lie within a Source Protection Zone.

11.4 Implication of groundwater

In light of the underlying Secondary Aquifer, groundwater links are possible and therefore some degree of assessment will be required to classify the extent of risk to a groundwater system, as well as abstraction wells and surface water features surrounding the site area.

In accordance with Environment Agency guidance document: -

- Groundwater Protection: Principles and Practice (GP3) Part 5 – Remedial Targets Methodology,

The document confirms :-

- “Selecting compliance points for use in land contamination risk assessments the distance to a set compliance point should not exceed 50 metres for hazardous substances or a maximum of 250 metres for non-hazardous pollutants unless there are specific physical constraints on the ability to use the groundwater resource. Any increases above these specified distances may be justified but must be supported by a sustainability assessment that takes into account environmental, social and economic factors.”

Considering the above, groundwater risk may be in place if significant contamination or a persistent source of contamination are encountered or recorded within the site area, within the information to date risk is considered unlikely.

11.5 Flooding

The site does not lie within an area which is susceptible to flooding.

11.6 Landfill Sites

No landfill sites are recorded are recorded in place.

Infilled land has been identified as in place some 113 meters to the north of the site and 134 meters to the south of the site area, which is noted as Unknown Filled Ground (Pond, marsh, river, stream, dock etc) and likely forms infilled ponds as noted in section 4 of this report.

Table 6 Sensitivity of Environmental Receptors in the Vicinity of the Site

Receptor Type	Receptor(s)	Sensitivity	Comments
Groundwater	Secondary Aquifer	Moderate	Possible risks of groundwater being in place with in the site area
Water Abstraction	Private Water Supply (Pisciculture)	Low	The nearest abstraction well is located 638 meters to the south west of the site
Source Protection Zone	NONE		
Surface Water	Pond	Low	The nearest surface water feature is recorded as 66 meters to the east of the site which is recorded as a pond.
Flooding	NONE		
Ecological	NONE		

12 Site Drainage and Other Potential Man Made Pathways

Within the site area no drainage is recorded in place,

To the south of the site area within the road system of Orchard Way there are surface water gullies in place, to collect and surface run off from the road.

13 Regulatory Data

Information relating to the potential hazards associated with environmental regulatory controls are summarised in Table 7 and 8. This information is recorded in full within the Envirocheck data provided within Appendix 5. The salient points recorded within this data are re-created below.

Table 7 **Summary of Regulatory Data - Sources**

Data	On Site	Off Site	Distance from site.	Is potential risk in place?
Sources				
Discharge Consents	None	Discharge Of Other Matter-Surface Water	SW 138m	X
Pollution Incident to Controlled Waters	None	Unknown Sewage	N 274m	X
Potentially Infilled Land	None	Unknown Filled Ground (Pond, marsh, river, stream, dock etc) in 1961	N 113m	✓
		Unknown Filled Ground (Pond, marsh, river, stream, dock etc) in 1951	S 134m	✓
Radon Potential - Radon Protection Measures	No radon protective measures are necessary in the construction of new dwellings or extensions			X

Table 8 **Summary of Regulatory Data - Receptors**

Data	On Site	Off Site	Distance from site.	Is potential risk in place?
Receptors				
Nearest Surface Water Feature	None	Pond	E 66m	X
Water Abstractions	None	Private Water Supply (Pisciculture)	SW 638m	X
Detailed River Network Lines	None	Inland river – Ditch	N 96m	X
Source Protection Zone	None			X

Table 9 BGS Estimated Chemistry Data

BGS Estimated Soil Chemistry Pollutant	BGS Estimated Soil Chemistry	BGS Urban Soil Chemistry Averages(mg / kg)		
		Minimum	Average	Maximum
Arsenic	15-25	1.00	17.00	161.00
Cadmium	<1.8	0.10	0.90	165.20
Chromium	60-90	13.00	79.00	2094.00
Lead	<100	11.00	280.00	10000.00
Nickel	15-30	2.00	28.00	506.00

Considering the background concentrations present, Potential for human health risk is not anticipated within this area.

Table 10 Geological Hazards

Geological Hazard	Distance & Direction	Feature	Risk Assessment Required
Non Coal Mining Areas of Great Britain	On Site		Negligible
Collapsible Ground	On Site		Very Low
Compressible Ground	On Site		Negligible
Ground Dissolution Features	On Site		Negligible
Landslide	On Site		Negligible
Running Sand	On Site		Negligible
Shrinking or Swelling Clay	On Site		Moderate

Table 11 Summary of Contemporary Trade Entries

Trade Name	Trade Use	Distance & Direction from Site	Is potential risk in place?	Comment
No trades are recorded within 140 meters of the site (See Envirocheck Data)				

*NB The above information is taken from the Envirocheck trade directories

14 Identification of Potential Contaminants of Concern and Source Areas

Potential sources of contamination are brought forward for further risk assessment which are detailed in Table 12 :-

Table 12 Table of Source Risk

Source Risk	Additional Features	Source of Information	Location	Date	Considering Site Specific Pathways	
					Assessment Required.	Method of Assessment
On Site Features					Possible Soil Risk	Recover Soil Samples
Made Ground			Site Wide	Possible GW Risk	Install Standpipes	
				Possible Vapour Risk	GW & Vapour Assessments	
Off Site Features						
Infilled Ponds		Historical Maps	Off Site – E 1m–INFILLED W 20m –INFILLED S 100m –INFILLED	INFILLED from 1969- present	Possible Soil Risk Possible Land Gas Risk	Recover Soil Samples Install Standpipes GW & Vapour Assessments
Potentially Infilled Land		Envirocheck Data	Off Site – N 113m - S 134m			

15 Outline Conceptual Model

What must now be considered is what contamination should be identified as a potential hazard as a result of the use of the site specific areas. In order to undertake this task, the **Contaminated Land Reports, (CLR10)**, has been used which details some trades and potential sources of contamination. In addition to this, the Department of Environment Industry Profiles have been incorporated which detail trade, and also, specific site usage of the trade and contaminant sources.

The information below incorporates a hazard assessment of the features surrounding the site that could potentially impact on the proposed development. This is based on the information below :-

Table 13 CIRIA Contaminated Land Risk Assessment Table

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

Extracted from CIRIA Publication C552 Contaminated Land Risk Assessment

Table 14 Risk Assessment A

Source (Potential Contaminating Use)	Potential Contaminants	Receptors	Pathways	Associated Hazard, [Severity]	Proposed Site Use Risk Assessment		
					Likelihood of occurrence	Potential Risk	Notes
Made Ground Site Wide	TPH's Naphthalene,	Site Users Construction Workers.	Direct contact; Inhalation dust and fibers. Dermal contact	Medium	Low Likelihood	Moderate / Low	Limited risk in place
			Ingestion of home grown produce	Medium	Low Likelihood	Moderate / Low	Limited risk in place
			Ingestion of contaminated water through water main pipework	Medium	Low Likelihood	Moderate / Low	Limited risk in place
			Inhalation of vapours	Medium	Low Likelihood	Moderate / Low	Limited risk in place
			Inhalation of vapours through contaminated ground waters	Medium	Low Likelihood	Moderate / Low	Limited risk in place
		Adjoining Land Owners	Direct contact; Inhalation dust and fibers. Dermal contact	Medium	Unlikely	Low	Low risk in place unlikely to migrate
			Ingestion of home grown produce	Medium	Unlikely	Low	Low risk in place unlikely to migrate
			Ingestion of contaminated water through water main pipework	Medium	Unlikely	Low	Low risk in place unlikely to migrate
			Inhalation of vapours	Medium	Unlikely	Low	Low risk in place unlikely to migrate
			Inhalation of vapours through contaminated ground waters	Medium	Unlikely	Low	Low risk in place unlikely to migrate
		Controlled Surface Water;	Leaching, lateral migration of shallow groundwater to a target receptor.	Medium	Low Likelihood	Moderate / Low	Limited risk in place
		Ground Water; Abstraction Well.	Leaching, migration through fissures / cracks which may migrate to a groundwater receptor.	Medium	Low Likelihood	Moderate / Low	Limited risk in place
		Flora	Plant Uptake Direct Contact	Medium	Low Likelihood	Moderate / Low	Limited risk in place
	Asbestos	Site Users Construction Workers.	Inhalation dust and fibers (from Asbestos within the building)	Severe	Unlikely	Low	No building in place within the site area
			Inhalation dust and fibers (from asbestos within the soil)	Severe	Low Likelihood	Moderate	Possible risk in place
	Metals Metalloids PAH's	Site Users Construction Workers.	Direct contact; Inhalation dust and fibers; Dermal contact;	Medium	Low Likelihood	Moderate / Low	Limited risk in place
			Ingestion of home grown produce	Medium	Low Likelihood	Moderate / Low	Limited risk in place
		Controlled Surface Water;	Leaching, lateral migration of shallow groundwater to a target receptor.	Medium	Low Likelihood	Moderate / Low	Limited risk in place
		Ground Water; Abstraction Well.	Leaching, migration through fissures / cracks which may migrate to a groundwater receptor.	Medium	Low Likelihood	Moderate / Low	Limited risk in place
	TPH's Naphthalene,	Buildings; Construction Materials. Services	Direct contact with contaminated soils;	Medium	Low Likelihood	Moderate / Low	Limited risk in place
			Direct contact with contaminated groundwater	Medium	Low Likelihood	Moderate / Low	Limited risk in place

Table 15 Risk Assessment B

Source (Potential Contaminating Use)	Potential Contaminants	Receptors	Pathways	Associated Hazard, [Severity]	Proposed Site Use Risk Assessment		
					Likelihood of occurrence	Potential Risk	Notes
Infilled Ponds E 1m W 20m S 100m Potentially Infilled Land N 113m S 134m	Naphthalene.	Site Users Construction Workers.	Direct contact; Inhalation dust and fibers. Dermal contact	Medium	Likely	Moderate	Possible risk in place
			Ingestion of home grown produce	Medium	Likely	Moderate	Possible risk in place
			Ingestion of contaminated water through water main pipework	Medium	Likely	Moderate	Possible risk in place
			Inhalation of vapours	Medium	Likely	Moderate	Possible risk in place
			Inhalation of land Gases	Medium	Likely	Moderate	Possible risk in place
			Inhalation of vapours through contaminated ground waters	Medium	Likely	Moderate	Possible risk in place
		Adjoining Land Owners	Direct contact; Inhalation dust and fibers. Dermal contact	No liability from third parties			
			Ingestion of home grown produce				
			Ingestion of contaminated water through water main pipework				
			Inhalation of vapours				
			Inhalation of vapours through contaminated ground waters				
		Controlled Surface Water;	Leaching, lateral migration of shallow groundwater to a target receptor.				
		Ground Water; Abstraction Well.	Leaching, migration through fissures / cracks which may migrate to a groundwater receptor.				
		Flora	Plant Uptake Direct Contact				
		Asbestos	Inhalation dust and fibers (from asbestos within the soil)	Severe	Likely	High	Possible risk in place
	Metals Metalloids PAH's	Site Users Construction Workers.	Direct contact; Inhalation dust and fibers; Dermal contact;	Medium	Likely	Moderate	Possible risk in place
			Ingestion of home grown produce	Medium	Likely	Moderate	Possible risk in place
		Controlled Surface Water;	Leaching, lateral migration of shallow groundwater to a target receptor.	No liability from third parties			
		Ground Water; Abstraction Well.	Leaching, migration through fissures / cracks which may migrate to a groundwater receptor.				
		TPH's Naphthalene.	Direct contact with contaminated soils;	Medium	Likely	Moderate	Possible risk in place
			Direct contact with contaminated groundwater	Medium	Likely	Moderate	Possible risk in place

Table 17 Overview of Risk Assessments - Proposed Site Use

Receptors	Pathways	A	B
		Made Ground	Infilled Ponds E 1m W 20m S 100m Potentially Infilled Land N 113m S 134m
Site Users Construction Workers	Direct Contact, Inhalation of Dust and Fibres, Dermal Contact	✓	✓
	Ingestion of home grown vegetation	✓	✓
	Ingestion of contaminated water through water main pipework	✓	✓
	Inhalation of vapours from soils	✓	✓
	Inhalation of vapour from contaminated ground waters	✓	✓
	Inhalation of land gas vapours	X	✓
	Inhalation Asbestos dust and fibers (from Asbestos within the building)	X	X
	Inhalation Asbestos dust and fibers (from asbestos within the soil)	✓*	✓*
Adjoining Land Owners	Direct Contact, Inhalation of Dust and Fibres, Dermal Contact	X	No Liability from third parties
	Ingestion of home grown vegetation	X	
	Ingestion of contaminated water through water main pipework	X	
	Inhalation of vapours from soils	X	
	Inhalation of vapours from contaminated ground waters	X	
Flora	Plant Uptake / Direct Contact	✓	✓
Groundwater; Abstraction Well & Surface Water	Leaching, lateral migration of shallow groundwater to a River or surface water receptor.	✓	No Liability from third parties
	Leaching, lateral migration of shallow groundwater system underlying the site and subsequent abstraction well or SPZ	✓	
Buildings	Direct contact with contaminated soils.	✓	✓
	Direct contact with contaminated groundwater	✓	✓

*NB : Due to Severe Consequence from Asbestos and Explosive Gases, some risk is assessed and potentially in place and therefore highlighted above.

GW Only: Some risks have been assessed as a direct result of potential mobilisation of groundwater contamination that may influence the site. A pictorial conceptual model has been reproduced within this report to confirm the above findings

16 Discussion on Sources of Contamination

The assessments of the site have drawn conclusions of historical and ongoing land uses which may impact on the proposed development which will be further considered through location, (either on or off site) and nature of risk. These are discussed below:-

Table 18 Pollutant Risk

Risk Assessment	Land Use	Pollutant
Soil, Groundwater & Vapour Risk		
Risk Assessment A	Made Ground	Moisture Content, pH, Electrical Conductivity, Cyanide, (Free), Cyanide, (Total), Organic Matter, Boron, Sulfate, (2:1 water soluble), Chromium, (Hexavalent), Sulfate, (Total), Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc, Speciated PAH's, (EPA Priority 16), Phenols, Asbestos, Naphthalene
Soil Sampling Groundwater & Vapour Assessment		
Soil, Groundwater & Vapour Risk		
Risk Assessment B	Infilled Ponds E 1m W 20m S 100m	Moisture Content, pH, Electrical Conductivity, Cyanide, (Free), Cyanide, (Total), Organic Matter, Boron, Sulfate, (2:1 water soluble), Chromium, (Hexavalent), Sulfate, (Total), Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc, Speciated PAH's, (EPA Priority 16), Phenols, Asbestos, Naphthalene Total Petroleum Hydrocarbons (aliphatic/ aromatic 8-Band)
	Potentially Infilled Land N 113m S 134m	Land Gas Risks – CO ₂ , CH ₄ .
Soil Sampling Groundwater & Vapour Assessment		
Spatial Sampling, (General Assessment)		Moisture Content, pH, Electrical Conductivity, Cyanide, (Free), Cyanide, (Total), Organic Matter, Boron, Sulfate, (2:1 water soluble), Chromium, (Hexavalent), Sulfate, (Total), Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Lead, Zinc, Speciated PAH's, (EPA Priority 16), Phenols.
		25 meter Centres In accordance with BS10175: 2011+A2:2017.
	Asbestos	5-10 meter Centres In accordance with BS10175: 2011+A2:2017.

17 Next Steps

Considering the information gathered to date, we would suggest that an appropriate way forward would be to assess the condition of the subsoil within the site resulting from the historical and former uses of the site as detailed within previous sections of this report. We would suggest that the most viable way of assessing risk will be to consider the following assessment techniques.

17.1 Soil Assessment

Considering the site area, we would suggest that the most appropriate way forward would be to undertake a series of window sampler boreholes across the site to provide targeted sampling and additionally, general and spatial sampling of the subsoil to provide the necessary coverage of the site conditions.

Soil sampling will be completed recovering samples in appropriate containers for analysis by the analytical chemist. All sampling will be sent directly to the chemist in cool boxes to retain the integrity of the soil sample. Appropriate GQRA or DQRA assessments will be completed and reported in an Environmental Report as and when this is available and where appropriate.

Table 19 Soils Assessment - Targeted Sampling

<u>Feature</u>	<u>Method Of Investigation</u>
Infilled Ponds (risk migrating onto the site area) E 1m	Window Sampler Boreholes / Hand Auger Boreholes / Trial Pits

Table 20 Soils Assessment – Spatial Sampling

<u>Feature</u>	<u>Method Of Investigation</u>
Made ground	Window Sampler Boreholes / Hand Auger Boreholes / Trial Pits

17.2 Groundwater Assessment

As part of the justification for groundwater risk assessments or limitations of any groundwater assessments required, the following should be considered:-

- Soil contamination has a potential to be in place and as such, risk to groundwater is possible;
- BGS Records show the underlying geology as Lowestoft Formation over Claygate Member
- These strata are recorded as Secondary Aquifers and may contain volumes of groundwater which may be abstracted locally for agricultural and within the wider area, potable water supplies;
- The nearest abstraction well is located 638 meters to the south west of the site which is recorded as a Private Water Supply (Pisciculture)
- The nearest surface water feature is recorded as 66 meters to the east of the site which is recorded as a pond.
- The site does not lie within a Source Protection Zone.

Human Health Risk

- There is a low risk for the made ground within and surrounding the site to have impacted on the groundwater and therefore may impact on human health through vapours or through drinking water purposes.

Method of Groundwater Assessment

In order to gain an understanding of the groundwater system and the level of risk in place, we can confirm that the following works should be completed:-

- The Geology within the site should be confirmed;
- The depth of the Geology within the site should be assessed and if ground water is encountered some assessment of the risk to ground should be carried out;
 - Considering the size and nature of the site, the groundwater elevation may be perched at locations and as such, strikes may be local to lenses or pockets of more permeable ground in order to provide surface water run off.
 - Standpipes should be installed across the site, in order to orientate the groundwater table to identify groundwater flow direction. Three to four standpipes should be installed for groundwater assessment such that orientation of the groundwater table can be undertaken;
 - We would recommend that the installation of the boreholes at the site should be completed in order determine the groundwater elevation. The groundwater / standpipes should then be left in order to allow groundwater to reach equilibrium concentration which represents the groundwater condition at the site. The boreholes should be left for a minimum period of one week in order to allow the groundwater to reach equilibrium at which time, sampling of the groundwater can be completed and retained in appropriate containers. The sample should then be sent to the analytical chemist for assessment in appropriate transport conditions;
 - It is possible that groundwater assessments may require extending the standpipes through any superficial deposits suggested by the Envirocheck report.
 - In light of the size and nature of the site should ground water risk be recorded within the site area each borehole should be sampled and tested for the range of pollutants as identified within this report. The potential risks should be initially assessed against the UK Drinking Water standard as a Tier 1 assessment Criteria with possible further assessments required where heavy contamination or risk deemed in place;
 - The assessment of groundwater will also be used to consider the risks to surface water features and whether the site may impact on surface water features which are recorded some to the south of the site;
 - Risk assessment A & B, to classify the extent of pollutants to be identified within the groundwater sample.

17.3 Land Gas Assessment

Considering the potential for Land Gas risks due to the potential made ground and infilled ponds, Land Gas risk assessments must be completed. These will include the potential for contamination migration from on and off site sources which may be present in concentrations where risk is recorded.

Land gas monitoring should be specifically targeting the following land uses.

Table 21 Land Gas Assessment - Response Zone

Feature	Targeted Response Zone	Location to Target	Gas risk
Made ground	Made Ground	Site Wide	Land Gases - CO ₂ , CH ₄ .
Infilled Ponds E 1m W 20m S 100m	Made Ground	East of the site area (nearest feature)	Land Gases - CO ₂ , CH ₄ .
Potentially Infilled Land N 113m S 134m			

Considering the above, we would suggest that soil testing is undertaken to assess the infilled ground its depth and type, and a standpipe should be installed within the site with response zones placed within the upper made ground solely, and the following assessments completed as follows :-

- Install standpipes to allow vapour and Land Gas risk to be considered from the upper made ground.
- Assess vapour risk over a minimum of six monitoring rounds to comply with CIRIA C665 to consider risks to buildings, CLR 11 and R & D Publication 66;
- Monitoring should be completed over falling or low atmospheric pressures or in periods where ground conditions are frozen to provide the worst case scenario for the site, although, the site is laid to hard cover which will restrict natural ventilation of any gases.
- Reporting of land gas and vapour risk/ can be completed assessing soils in situ using a Photo Ionisation Detector for Volatile Organic Compounds, (which include BTEX). Flow rates should also be noted for reporting purposes.

17.4 Vapour Risk Assessment

Considering the potential for vapour risk to be in place from various source as noted below, the following risk are in place.

Table 22 Vapour Risk Assessment - Response Zone

Feature	Targeted Response Zone	Location to Target	Vapour risk
Made ground & Infilled Ground	Made Ground	Site wide	TPH's Naphthalene

Considering the above, we would suggest that soil testing is undertaken to assess whether contamination that may promote a vapour risk is in place within the site area and the groundwater.

17.5 Working Brief

It should be noted that this investigation is undertaken in order to identify the extent of contamination as a result of historic and ongoing use. Should any areas of the site be encountered within the development that appear potentially contaminated through visual or olfactory assessment outside that discussed within this report, consultation with ourselves should be undertaken in order to identify the risk associated with the material.

Table 23 Overview of Works

Receptor	Scope of Investigation Works Required			Proposed Method of Assessment	Proposed Site Works to Complete
	Soils	Assessment of : Vapour and Gas	Ground and Surface Water		
Human Health	✓	✓	✓	Window Sampling - Soil sampling - Install standpipe - Groundwater sampling*	Recover samples of the made ground; Assessment of the underlying natural soils to consider contamination; Leachate testing on elevated samples; Vapour Risk Assessment; Analysis of soil samples for GQRA Assessment; Reporting
Surface Water	✓	✓	✓	Window Sampling - Soil sampling - Install standpipe - Groundwater sampling*	Recover samples of the made ground; Assessment of the underlying natural soils to consider contamination; Leachate testing on elevated samples; Vapour Risk Assessment; Analysis of soil samples for GQRA Assessment; Reporting
Ground Water	✓	✓	✓		
Services & Building	✓	✓#	X	Window Sampling - Soil sampling	Recover samples of the made ground; Vapour Risk Assessment; Groundwater Assessment; Analysis of soil samples for GQRA Assessment. Reporting
Geotechnical Assessment	✓	N/A	X	Window Sampling	Recover samples of the natural soils for laboratory testing; Assessment of shallow soils for conventional foundation; Consider deeper or piled foundations; Reporting.

NB * Initial assessments of the site should be undertaken using Leachate Testing and water sampling if required.
Complete soils testing to assess if vaporous contamination is in place within the site area.

APPENDIX ONE

CONCEPTUAL MODEL

Land at Orchard Way, Chigwell Row. IG7 6EE

Site Specific Source-Pathway-Receptor - Proposed Site Use

Key

Purple = Possible pathways
Green = Possible receptors
Red = Possible sources

Potential Pathways

Human Heath

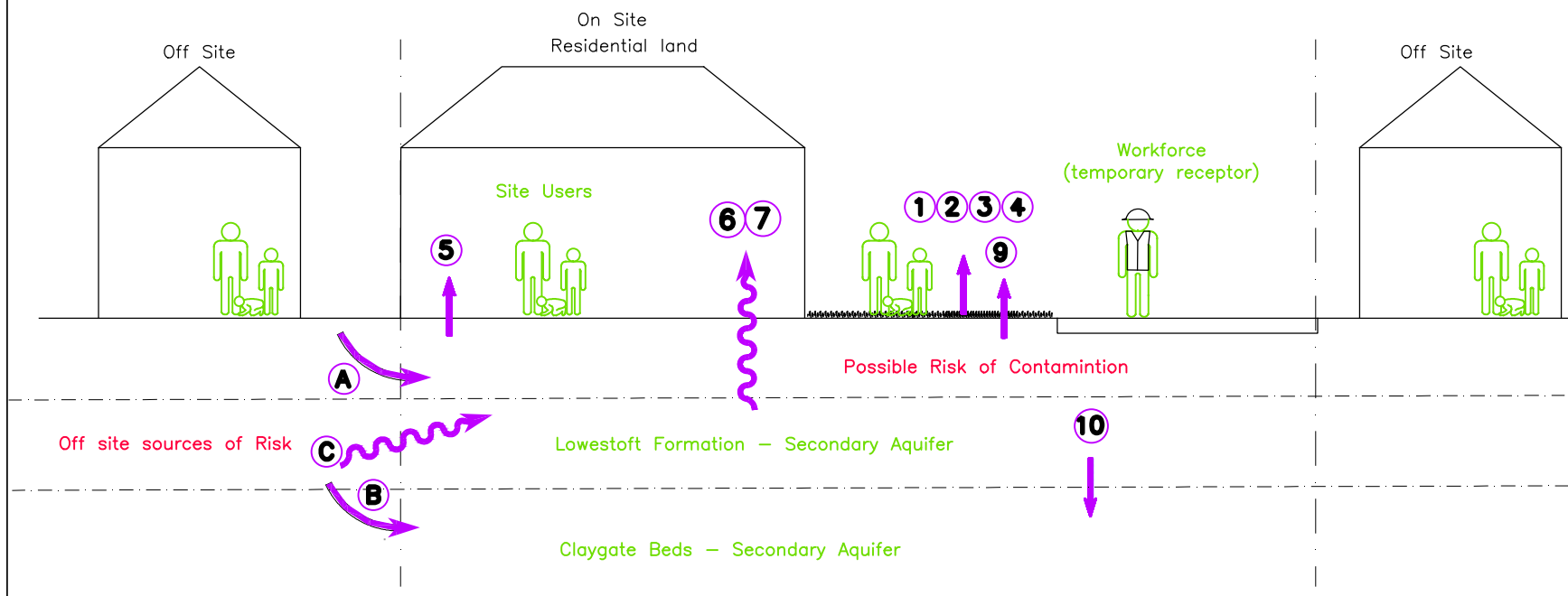
- ① Direct contact with contaminants in soil/dust or water
- ② Inhalation of contaminants through soil/dust/particles
- ③ Dermal Contact
- ④ Ingestion of home grown produce
- ⑤ Ingestion of contaminated water through water main pipework
- ⑥ Inhalation of Land Gas and Vapours
- ⑦ Inhalation of Vapours from Groundwater
- ⑧ Migration to off site Adjoining Land Owners

Flora

- ⑨ Plant Uptake & Direct Contact with soil
- ⑩ Leaching, lateral migration of shallow groundwater to a target receptor

Off Site Sources

- A Migration of contamination to the site area
- B Migration of land gases/ Vapours to the site area
- C Migration of contaminated groundwater to the site area



Sketch No: DTS/15249/01/01

APPENDIX TWO

SITE PLANS

HERTS & ESSEX SITE INVESTIGATIONS

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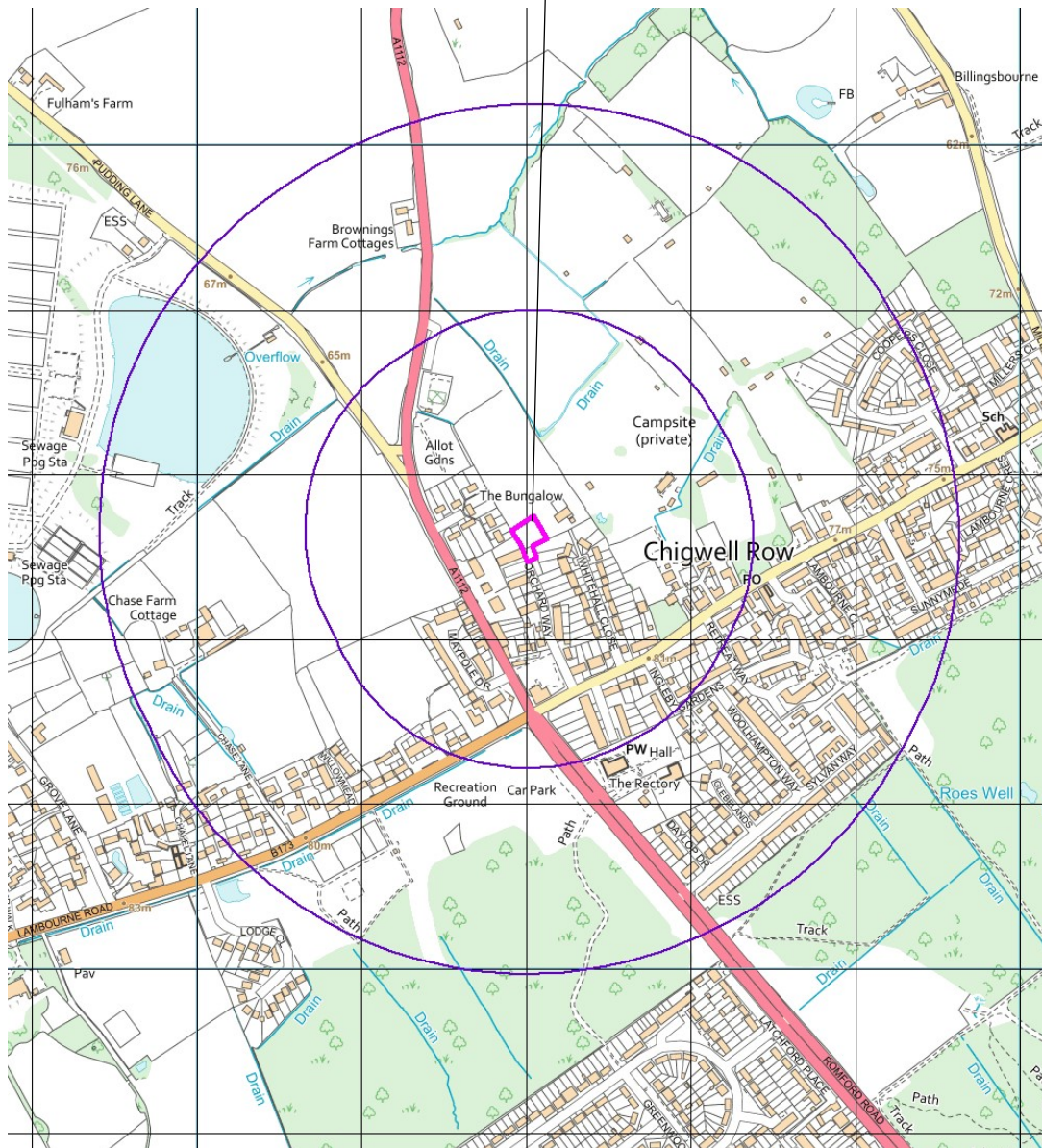
Appendix No. 2
Sheet No. 1
Job No. 15249
Date Feb 2019

Land at Orchard Way, Chigwell Row. IG7 6EE

Location Plan



The Site



Not To Scale
Sketch No: DTS/15249/02/01

HERTS & ESSEX SITE INVESTIGATIONS

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Appendix No. 2
Sheet No. 2
Job No. 15249
Date Feb 2019

Land at Orchard Way, Chigwell Row. IG7 6EE

Existing Site Plan



Not To Scale
Sketch No: DTS/15249/02/02