

**Contaminated Land  
Assessment**

**Foxhill Brackley North**

## Contaminated Land Assessment

### Foxhill Brackley North

**Client:**

Manor Oak Homes Limited

Reference: 72152/R/002  
Status: Final for Local Authority  
Comments  
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## EXECUTIVE SUMMARY

### SCOPE

<b>Purpose of the report</b>	Contaminated land assessment of site.
<b>Future Site End-use</b>	Residential development with associated gardens, parking areas, landscaped areas and access roads.

### SITE INFORMATION

<b>Grid Reference</b>	459170, 238630	<b>Site Area (approx.)</b>	8.68 hectares
<b>Current Site Status</b>	Site comprises an open field which is heavily vegetated along its western boundary.		
<b>History</b>	The historical maps obtained indicate that the site consisted of an area of largely undeveloped agricultural field from 1883 until 1898. From 1898 a railway cutting is shown intercepting the site along its western boundary while the remainder of the site is shown to be occupied by allotments. The mapping indicates that the allotments disappeared in the 1950s. The railway is shown as 'dismantled' from 1972. From 1990 onwards the cutting is no longer present and has been infilled.		
<b>Published Geology</b>	Alluvium overlying Taynton Limestone and White Limestone Formations, Rutland Formation, Whitby Mudstone Formation and Horsehay Sand Formation.		
<b>Hydrogeology</b>	Principal, Secondary A and B and unproductive aquifers are present on site. The site is not located on a source protection zone.		
<b>Hydrology</b>	An unnamed tertiary river is present within the north west of the site while a culvert and drain are present 2m north and 9m east of the site boundary respectively.		
<b>Potential Contamination Sources</b>	On site sources includes the infilling of a former railway cutting with unknown waste material. Off site sources include a former landfill (infilled railway cutting), former saw mill, operational petrol station, industrial storage tanks and electrical sub stations.		

### GROUND CONDITIONS ENCOUNTERED

<b>Works Undertaken</b>	The ground investigation works comprised 10 machine excavated trial pits, 15 window sample holes and 2 open hole rotary boreholes. All exploratory holes were logged and representative soil and groundwater samples taken for chemical testing. A programme of gas and groundwater monitoring was also undertaken.
<b>Ground Conditions</b>	<p>The site has been divided in to two areas based upon previous uses of the site.</p> <p><u>Former Railway Cutting</u> The investigation works encountered made ground to a depth of 7.4m below ground level within the area of the former railway cutting.</p> <p><u>Rest of Site</u> Shallow topsoil overlying weathered residual soils which in turn grades into bedrock at various depths were encountered across the rest of the site.</p>
<b>Chemical Testing Results</b>	<p><u>Former Railway Cutting</u> One trial pit encountered slightly elevated concentrations of Benzo(a)Pyrene (1.6 mg/kg) at a depth of 0.3m bgl within the infilled railway cutting.</p> <p><u>Rest of Site</u> No elevated concentrations of the determinants tested in the soils have been encountered. In addition, no elevated concentrations of the determinants tested in the groundwater have been encountered.</p>

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**Gas Monitoring**

The gas monitoring undertaken has encountered elevated concentrations of carbon dioxide (maximum 6.1%) and depleted oxygen concentrations (minimum 12.2%) with zero flow rates (<0.1l/hr). No elevated concentrations of methane have been detected.

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## CONTAMINATED LAND ASSESSMENT

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**Assessment and  
Recommendations**Former Railway Cutting

Visual evidence of contamination was noted in the soil samples taken from this part of the site. None of the testing on recovered soil samples exceeded the generic screening value in respect to human health with the exception of an isolated hotspot of Benzo(a)pyrene encountered at a depth of 0.30m in one trial pit (TP1). No further work is warranted as this localised hotspot is within an area of landscaping.

Rest of Site

No visual evidence of contamination was noted in the soil samples taken from this part of the site. This was confirmed by the chemical testing undertaken on the soil samples as no elevated concentrations of the determinants tested were encountered. These results indicate that no further assessment or remedial works to the site is warranted.

Groundwater monitoring and testing indicates that no elevated concentrations of the determinants tested have been encountered and no further work is warranted with respect to groundwater contamination issues.

The ground gas monitoring indicates that no special precautions or measures are warranted during the construction of the buildings.

Soil testing is warranted to assess concrete specification for sulphate resistance during the foundation and geotechnical assessments.

Overall, the site has been assessed as a low risk in accordance with Contaminated Land Legislation. This report should be submitted to the Local Authority Planning Authority for their comments.

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## 1. BRIEF

The Nott Group have been instructed by Manor Oak Homes Limited to undertake a contaminated land assessment at an area of land referred to as 'Foxhill Brackley North', Brackley, Northamptonshire.

This report has been prepared for the exclusive use of the client for the purpose of assisting in evaluating the potential risks associated with contamination issues at the site and to provide recommendations for the proposed redevelopment of the site.

The information presented within this report is based on observations made on site, a review of available, geological and hydrogeological sources and site investigation information only.

The Nott Group has endeavoured to assess all information provided to them during this assessment, but makes no guarantees or warranties as to the accuracy or completeness of this information obtained and reviewed.

The scope of this report does not include an assessment of the presence of asbestos containing materials within the buildings at the site or the identification of Japanese Knotweed, or other invasive species, on site.

### 1.1 PROPOSED DEVELOPMENT

The proposed development comprises the construction of residential dwellings with associated gardens, parking areas, landscaped areas and access roads.

## 2. SITE DESCRIPTION AND RECONNAISSANCE

A description of the site and the surrounding area is summarised in Table 1. A site location plan is included in Appendix A.

**TABLE 1: SITE DESCRIPTION AND SURROUNDS**

Data	Information	
Address	Land located off Northampton Road, Brackley, Northamptonshire, nearest postcode NN13 5SZ	
Current Site Use and Description:	Site comprises an open field which is heavily vegetated along its western boundary	
National Grid Reference:	459170, 238630	
Site Area:	Approximately 8.68 hectares.	
Surrounding Land Use	North	Woodland and fields
	East	Operational petrol station and highway (Northampton Road and A43)
	South	Redundant saw mill
	West	Fields

### 2.1 SITE WALKOVER

A site walkover was undertaken by Mark Hiatt of the Nott Group on the 25<sup>th</sup> June 2012. The weather was warm and dry. During the walkover the following environmental concerns were noted:

- A former railway cutting was noted (infilled) which runs along the sites western boundary. A section of the infilled cutting was exposed at outcrop and visible infilled waste included cobbles of limestone, sandstone and concrete, metal drums, bricks and timber.

### 3. SITE HISTORY

Historical maps dating from 1883 have been obtained and reviewed. The relevant information is summarised in the following table. The historical maps obtained have been included in Appendix B.

**TABLE 2: HISTORICAL REVIEW OF SITE AND ADJACENT AREAS**

<b>Date</b>	<b>On Site Observations</b>	<b>Off Site Observations</b>
1883 - 1884	The site forms part of a series of fields. A small unnamed building is shown in the east of the site.	An unnamed highway is shown immediately east of the site. A number of quarries are shown approximately 700m east, 500m south west and west of the site respectively. An 'old sand pit' is also shown approximately 950m south of the site. The surrounding land use is predominantly agricultural.
1898 - 1900	The site is now shown to be intercepted along its western boundary by a large railway cutting referred to as the 'Great Central Railway'. The remainder of the site is now shown to comprise of 'allotments'.	The 'Great Central Railway' is now shown immediately north and south of the sites eastern boundary. The railway consists of a large continuous cutting running in a north south orientation. Allotments are now indicated immediately south of the site while an area of woodland is shown immediately to the north and north west of the site. The quarry approximately 500m south west of the site is now shown to have increased in size. The quarries approximately 700m east and 500m west and the 'old sand pit' are now absent.
1923 - 1925	No significant changes are shown on maps.	No significant changes are shown on maps.
1950	The site is no longer shown to comprise of 'allotments'.	No significant changes are shown on maps.
1957	No significant changes are shown on maps.	No significant changes are shown on maps.
1970	No significant changes are shown on maps.	No significant changes are shown on maps.
1972 - 1974	The railway cutting in the west of the site is now labelled as a 'dismantled railway'.	A saw mill is now shown directly south of the site and comprises of a series of buildings of various shapes and sizes. The quarry approximately 500m south west of the site is now absent
1983	The small building within the east of the site has decreased in size.	No significant changes are shown on maps.
1988 - 1989	No significant changes are shown on maps.	A large roundabout is now present east of the site.
1990	The railway cutting in the west of the site is no longer shown inferring it has been infilled.	The railway cutting immediately south of the site is now not shown inferring it has been infilled.
1994	No significant changes are shown on maps.	A petrol station is now shown immediately east of the site.
2004	No significant changes are shown on maps.	Extensive residential development has taken place approximately 50m south west of the site.
2012	The infilled former railway cutting is now shown be heavily vegetated.	No significant changes are shown on maps.



### 3.1 HISTORICAL SUMMARY

The historical maps obtained indicate that the site consisted of an area of largely undeveloped agricultural field from 1883 until 1898. From 1898 a railway cutting is shown intercepting the site along its western boundary while the remainder of the site is shown to be occupied by allotments. The mapping indicates that the allotments disappeared in the 1950s. The railway is shown as 'dismantled' from 1972. From 1990 onwards the cutting is no longer present and has been infilled.

## 4. GEOLOGY, HYDROLOGY AND HYDROGEOLOGY

### 4.1 GENERAL GEOLOGY AND GROUND CONDITIONS

The geology beneath the site has been established from the British Geological Survey (BGS) 1: 50,000 digital geological map of Great Britain. In addition, the hydrology and hydrogeology is summarised in the following tables.

**TABLE 3: SITE GEOLOGY, HYDROLOGY AND HYDROGEOLOGY**

<b>Data</b>	<b>Information</b>
<b>Solid Geology</b>	Taynton Limestone Formation (medium to coarse grained ooidal limestone with local calcareous sandstone beds). White Limestone Formation (limestones with occasional mudstone and clay beds). Rutland Formation (mudstone, siltstone and sandstone). Whitby Mudstone Formation (fossiliferous mudstones and siltstones) Horsehay Sand Formation (medium- to fine-grained sand, locally cemented into sandstone with thin mudstone and siltstone beds).
<b>Superficial Geology</b>	Alluvium (clay, silt, sand and gravel).
<b>Made Ground</b>	Associated with the infilling of a former railway cutting which runs along the sites western boundary.
<b>Closest Surface Waters</b>	An unnamed tertiary river is located in the far north west of the site; the river is channelled into an extended culvert 2m north of the site and runs along the sites northern boundary. A drain is also present 9m east of the site.
<b>Surface Water Abstractions within 1000m</b>	No surface water abstractions have been identified.
<b>Groundwater Vulnerability</b>	Alluvium: Secondary A Aquifer. Taynton Limestone Formation: Principal Aquifer. White Limestone Formation: Principal Aquifer. Rutland Formation: Secondary B Aquifer. Whitby Mudstone Formation: Unproductive Aquifer. Horsehay Sand Formation: Secondary A Aquifer.
<b>Groundwater Abstractions within 1000m</b>	No groundwater abstractions have been identified.
<b>Potable Water Abstractions within 1000m</b>	No potable water abstractions have been identified.
<b>Source Protection Zones (SPZs)</b>	The site is not located within a SPZ.

**TABLE 4: SUMMARY OF HYDROGEOLOGICAL PROPERTIES OF THE MAIN GEOLOGICAL STRATA**

<b>Strata</b>	<b>Hydrogeological Significance</b>	<b>Classification (Environment Agency)</b>
Taynton Limestone Formation White Limestone Formation	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale.	Principal Aquifer
Alluvium Horsehay Sand Formation	Aquifers where good water supplies are available or they support surface water.	Secondary A Aquifer
Rutland Formation	Lower permeability layers which may store/yield limited amounts of groundwater.	Secondary B Aquifer
Whitby Mudstone Formation	Rock layers with low permeability that have negligible significance for water supply or river base flow.	Unproductive Aquifer

#### **4.1 MINING AND EXTRACTION**

A review of the available information obtained indicates the following extraction, coal mining and associated activities:

- There are no historical mining areas within 1000m of the site boundary.
- There are no coal mining areas within 1000m of the site boundary.
- There are no non – coal mining areas within 1000m of the site boundary.
- There are no recorded non – coal mining cavities within the site boundary.
- There are no recorded natural cavities within 1000m of the site boundary.
- There is no recorded clay or tin mining areas within 1000m of the site boundary.
- There are no recorded brine or gypsum extraction areas within 1000m of the site boundary.

## 4.2 LANDFILLS AND WASTE SITES

A review of the available information obtained indicates the following landfill and other waste site activities:

- There are no recorded Environment Agency landfills within 1000m of the site boundary.
- There are no recorded operational landfill sites within 1000m of the site boundary.
- There are no recorded BGS/DoE non – operational landfill sites within 1500m of the site boundary.
- There are no recorded local authority landfill sites within 1500m of the site boundary.
- There are no operational or non operational waste treatment, transfer or disposal sites within 500m of the site boundary.

There are four recorded Environmental Agency (EA) historic landfill sites within 1500m of the site boundary as summarised in the below table.

**TABLE 5: RECORDS OF EA HISTORIC LANDFILL SITES**

Distance Direction	Grid Reference	Address	License Details	Details
0.0m - On site	458900, 238600	Railway cutting, Brackley, Northamptonshire	Waste license: Yes License issue: 29/12/77	Waste type: Inert
88m South	458900, 238300	Railway cutting adjoining Sawmills, Brackley, Northamptonshire	Waste license: Yes License issue: 28/03/85	Waste type: Inert
513m South	459400, 237900	Agnews Spinney, Brackley, Northamptonshire	Waste license: Yes License issue: 26/09/86	Waste type: Inert
919m North east	459900, 239400	A43, Radstone Turn, Whitfield	Waste license: Yes License issue: 04/09/92	Waste type: Inert

There are three recorded non-operational landfill sites within 1000m of the site boundary as summarised in the below table.

**TABLE 6: RECORDS OF NON - OPERATIONAL LANDFILL SITES**

Distance Direction	Grid Reference	Address	Details
55m West	458900, 238600	Railway cutting adjacent to Sawmills, Brackley, Northamptonshire	Waste Type: Non - Hazardous Waste description: Non - hazardous landfill Known restrictions: Only waste produced on site Category: Landfill - railway cutting
292m South	458900, 238300	Railway cutting adjacent to Sawmills, Brackley, Northamptonshire	Waste Type: Non - Hazardous Waste description: Non - hazardous landfill Known restrictions: Only waste produced on site Category: Landfill - railway cutting
474m South	459300, 238000	Agnews Spinney, Turweston Lane, Brackley, Northamptonshire	Waste Type: Inert Waste description: Inert Known restrictions: No known restrictions on waste source Category: Landfill

There is a single recorded Environment Agency (EA) licensed waste sites within 1500m of the site boundary as summarised in the below table.

**TABLE 7: RECORDS OF EA LICENSED WASTE SITES**

<b>Distance Direction</b>	<b>Grid Reference</b>	<b>Address</b>	<b>Details</b>
719m South	459111, 237765	Land/premises at Top Station Road, Top Station Road industrial estate, Brackley, Northants, NN13 7UG	Type: Clinical waste transfer station
773m South	459300, 237700	Top Station Road, Brackley, Northants, NN13 5QD	Type: Clinical waste transfer station

### 4.3 RADON

A radon report obtained from the British Geological Survey and Health Protection Agency indicates that the site is in a radon affected area, as between 1% and 3% of properties are above the action level, however no radon protective measures are deemed necessary.

## 5. REVIEW OF ENVIRONMENTAL DATABASES

Environmental information has been obtained from Groundsure. This information comprises data provided by the British Geological Survey, Environment Agency, Health Protection Agency and the Coal Authority and has been reviewed and summarised below. A full copy of this report has been enclosed in Appendix D.

### 5.1 INDUSTRIAL SITES HOLDING AUTHORISATIONS, PERMITS AND LICENSES

Information obtained from the Environment Agency and Local Authority indicates there are no records of Part A(1) and IPPC Authorised Activities within 500m of the site. No other licences and/or authorisations have been identified within 500m of the site.

### 5.2 DESIGNATED ENVIRONMENTALLY SENSITIVE SITES

There is a single recorded designated environmentally sensitive site within 500m of the site as summarised in the below table.

**TABLE 8: RECORDS OF DESIGNATED ENVIRONMENTALLY SENSITIVE SITES**

<b>Distance</b>	<b>Direction</b>	<b>Details</b>	<b>Name</b>
270m	North	Site of special scientific interest (SSSI)	Helmdon disused railway

### 5.3 ENVIRONMENT AGENCY RECORDED POLLUTION INCIDENTS

No recorded significant pollution incidents have been recorded with 250m of the site boundary.

### 5.1 SITES DETERMINED AS CONTAMINATED LAND UNDER PART2A

No designated contaminated sites have been identified within 500m of the site.

### 5.2 RECORDS OF POTENTIALLY CONTAMINATIVE INDUSTRIAL SITES

There are eight recorded potentially contaminative industrial sites within 250m of the site boundary as summarised in the below table.

**TABLE 9: RECORDS OF POTENTIALLY CONTAMINATIVE INDUSTRIAL SITES WITHIN 250M OF THE SITE**

Distance	Direction	Details
7.0m	SE	Petrol and fuel station
66m	NE	Electricity poles
97m	S	Industrial storage tank
167m	SE	Electricity poles
178m	S	Saw mill
189m	S	Industrial storage tank
216m	S	Electricity sub station
248m	SW	Electricity sub station

### 5.3 PETROL AND FUEL SITES

There is a single recorded petrol or fuel site within 500m of the site boundary as summarised in the below table.

**TABLE 10: RECORDS OF PETROL OR FUEL SITES**

Distance & Direction	NGR	Details
33m NE	459281, 238536	Company: BP Status: Open LPG: Yes

## 6. DEVELOPMENT OF CONCEPTUAL MODEL

### 6.1 CONTAMINATED LAND BACKGROUND INFORMATION

The Environmental Protection Act 1990 Part IIA, as amended, provides a statutory definition of contaminated land. To fall within this definition it is necessary that, as a result of the condition of the land, substances may be present in, on or under the land such that:

- (a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) Significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused.

Risk from contamination is assessed by consideration of possible linkages between contaminant sources and potential receptors via pathways which is usually termed a conceptual model.

### 6.2 POTENTIAL SOURCES

**TABLE 11: POTENTIAL CONTAMINATION SOURCES AT OR ADJACENT TO THE SUBJECT SITE**

Source	Location	Activity	Potential Contaminants
<b>On Site</b>			
Landfill	Along sites western boundary	Infilling of former railway cutting with unknown waste material	Metals, inorganic chemicals, hydrocarbons, asbestos, landfill gas and leachate generation and migration
<b>Off Site</b>			
Landfill	Directly south west of the site boundary	Infilling of former railway cutting with unknown waste material	Metals, inorganic chemicals, hydrocarbons, asbestos, landfill gas and leachate generation and migration
Former saw mill	Directly south of site boundary	Historical and present day mapping indicates a former saw directly south of the site boundary	Metals, inorganic chemicals, hydrocarbons and asbestos
Petrol station	Directly east of site boundary	Operational BP petrol station including LPG	Hydrocarbons
Tanks	97m and 189m south of site boundary	Industrial storage tanks containing unknown liquids	Hydrocarbons
Electrical sub stations	216m south and 248m south west of the site boundary	Operational electrical sub stations	Hydrocarbons, metals, inorganic chemicals and PCBs.

### 6.3 POTENTIAL RECEPTORS

Receptors that are required to be considered under Part IIA of the Environmental Protection Act 1990 are summarised in Appendix E, Tables E1 and E2.

The potential environmental receptors identified during this study are summarised in the following table.

**TABLE 12: POTENTIAL RECEPTORS IDENTIFIED FOR THE SITE AND SURROUNDING AREAS**

Category	Receptor	Location	Comments
<b>Humans</b>	Site end users	Whole site	Front and rear gardens proposed
	Construction workers		New construction proposed

Category	Receptor	Location	Comments
	Existing site users		Site unoccupied
Property (materials)	Site structures and buildings	whole site	Primarily foundations and services
Property (crops)	None identified		
Ecological systems	SSSI	270m north of site	
Controlled waters	Unnamed tertiary river	North west of site	
	Culvert	2m north of site	
	Drain	9m east of site	
	Principal Aquifer	Underlying site	

## 6.4 RISK ASSESSMENT

The risk of significant harm or pollution of controlled waters has been assessed qualitatively as low, medium or high using the criteria shown in Appendix D.

A risk estimation matrix for all pollutant linkages identified is shown below.

**TABLE 13: PRELIMINARY CONTAMINATION RISK ASSESSMENT**

Receptor	Sources	Risk	Justification
<b>Human Health</b>			
Existing site users	On site landfill (infilled railway cutting)	Low	Site is unoccupied.
	Off site sources including landfill (infilled railway cutting), former saw mill, operational petrol station, industrial storage tanks and electrical sub stations	Low	
Future site users	On site landfill (infilled railway cutting)	High	Further assessment of risks required and confirmation that it can be classed a lower risk.
	Off site sources including landfill (infilled railway cutting), former saw mill, operational petrol station, industrial storage tanks and electrical sub stations	High	Further assessment of risks required and confirmation that there is no contamination migration and/or ground gas generation and migration.
Construction workers	On site landfill (infilled railway cutting)	Medium	Risk assessment and appropriate PPE to be used by site staff.
	Off site sources including landfill (infilled railway cutting), former saw mill, operational petrol station, industrial storage tanks and electrical sub stations	Low - Medium	Use of appropriate risk assessment with PPE will reduce risk to low.
<b>Property</b>			
Site structures (concrete structures)	Concrete aggressive made ground	Low to Medium	Further work warranted to confirm low risk.
Potable water plastic pipes	Hydrocarbons	Medium to High	Further assessment of risks required and confirmation that it can be classed a lower risk.
<b>Controlled Waters</b>			
Principal, Secondary A and B aquifers	On site landfill (infilled railway cutting)	Medium to High	Further assessment of risks required and confirmation that it can be classed a

Receptor	Sources	Risk	Justification
			lower risk.
	Off site sources including landfill (infilled railway cutting), former saw mill, operational petrol station, industrial storage tanks and electrical sub stations	Medium to High	Further assessment of risks required and confirmation that it can be classed a lower risk
Unnamed tertiary river	On site landfill (infilled railway cutting)	Low to medium	Further work warranted to confirm low risk.
Unnamed tertiary river	Off site sources including landfill (infilled railway cutting), former saw mill, operational petrol station, industrial storage tanks and electrical sub stations	Low to medium	Further work warranted to confirm low risk.
Culvert	On site landfill (infilled railway cutting)	Low to medium	Further work warranted to confirm low risk.
Culvert	Off site sources including landfill (infilled railway cutting), former saw mill, operational petrol station, industrial storage tanks and electrical sub stations	Low to medium	Further work warranted to confirm low risk.
Drain	On site landfill (infilled railway cutting)	Low to medium	Further work warranted to confirm low risk.
Drain	Off site sources including landfill (infilled railway cutting), former saw mill, operational petrol station, industrial storage tanks and electrical sub stations	Low to medium	Further work warranted to confirm low risk.

## 6.5 FINDINGS OF CONCEPTUAL SITE MODEL

Based upon the development of the conceptual site model and the identification of medium to high risks a site investigation was undertaken with subsequent ground gas monitoring and chemical testing of both soil and water samples.



## 7. SITE WORKS UNDERTAKEN

### 7.1 DESIGN OF INVESTIGATION

The site investigation works were undertaken, where access was possible, to confirm the preliminary contamination risk assessment for the proposed development. This was based on the findings of the information review and the development of preliminary conceptual model. It is not possible to cover all areas of the site and contamination may exist in other areas of the site not covered by the sampling regime.

### 7.2 ON - SITE ACTIVITIES

The fieldworks were undertaken between 23<sup>rd</sup> July 2012 and 20<sup>th</sup> August 2012 and comprised the following:

- Fifteen window holes (WS1 - WS15) advanced to depths between 2.00m and 7.40m below ground level (bgl) with subsequent installation of six gas and groundwater monitoring wells.
- The gas monitoring wells were installed within the cutting and at approximately 10-15 metres away from the cutting in natural ground to assess potential lateral migration.
- Two open hole rotary boreholes (BHR1 and BH2R) advanced to depths of 12.00m and 15.00m bgl respectively with subsequent installation of groundwater monitoring wells.
- Excavation of ten machine dug trial pits (TP1 - TP10) to depths between 1.70m to 3.60m bgl.
- Gas and groundwater levels monitoring on six occasions.

During drilling and excavation representative soil samples were obtained from the exposed strata and sealed in 1 litre plastic tubs, glass brown jars and vials with airtight lids. The samples were then despatched in batches on a daily basis under a 'Chain of Custody' procedure to a NAMAS (UKAS) and MCERTS accredited laboratory, for subsequent chemical analysis.

During groundwater monitoring groundwater samples were retrieved from boreholes BHR1 and BHR2 and sealed within 1 litre plastic bottles, 1 litre brown glass bottles and glass vials. The samples were then despatched under a 'Chain of Custody' procedure to a NAMAS (UKAS) and MCERTS accredited laboratory, for subsequent chemical analysis.

Following boreholes installations soil gas monitoring over a period of two weeks was undertaken. As far as was reasonably practicable, the ground gas monitoring was undertaken when the barometric atmospheric pressure was falling. On each of the monitoring visits, the peak and steady concentration readings of methane, carbon dioxide, and oxygen were recorded at each installed monitoring standpipe, together with borehole gas flow readings and atmospheric pressure. This was undertaken using a Gas Data GFM430 gas analyser and gas flow data monitor. Groundwater levels were also measured on each visit.

## 8. GROUND CONDITIONS ENCOUNTERED

### 8.1 DESCRIPTION OF STRATA

For full details of the strata encountered during this ground investigation reference should be made to Engineer verified logs contained within Appendix F, however Tables 14 and 15 summarises the general ground conditions encountered within the infilled former railway cutting and the rest of the site.

**TABLE 14: DESCRIPTION OF STRATA - INFILLED RAILWAY CUTTING**

<b>Strata Encountered</b>	<b>General Description</b>	<b>Depth in meters below ground level (m bgl)</b>
Topsoil	Firm slightly sandy CLAY or slightly sandy slightly gravelly CLAY with occasional roots and rootlets	WS1: GL - 0.22m WS2: GL - 0.14m WS3: GL - 0.13m
Made Ground (infilled cutting only)	Soft to firm slightly sandy slightly gravelly to gravelly CLAY's. Gravel is fine to coarse angular to sub angular brick, ash, limestone, burnt shale, weathered siltstone, coarse grained sandstone, coal, mudstone and rare plastic	TP1: 2.24m - 3.40m WS1: 0.44m - 2.14m WS1: 2.39m - 2.69m WS1: 2.89m - 5.42m WS1: 6.54m - 7.40m WS2: 0.14m - 2.90m WS2: 4.00m - 5.13m WS2: 5.24m - 7.14m WS3: 0.13m - 2.72m WS3: 2.87m - 4.07m
Made Ground (infilled cutting only)	Silty sandy to very sandy GRAVEL's. Gravel is fine coarse angular to sub angular ash, wood fragments, limestone, clinker, ash, and brick	WS1: 0.22m - 0.44m WS1: 2.14m - 2.26m WS1: 2.69m - 2.89m WS1: 5.42m - 6.54m WS2: 2.90m - 4.00m WS2: 5.13m - 5.24m WS2: 7.14m - 7.30m WS3: 2.72m - 2.87m
Made Ground (infilled cutting only)	Very clayey coarse grained SAND	WS1: 2.26m - 2.39m
Made Ground (infilled cutting only)	Very clayey gravelly to very gravelly fine to coarse grained SAND's. Gravel is fine to coarse angular to sub rounded quartz, limestone, wood, burnt shale, ash, brick, weathered coarse grained sandstone and plastic	TP1: GL - 3.40m TP2: GL - 2.70m

**TABLE 15: DESCRIPTION OF STRATA - REST OF SITE**

<b>Strata Encountered</b>	<b>General Description</b>	<b>Depth in meters below ground level (m bgl)</b>
Topsoil	Firm slightly sandy CLAY or slightly sandy slightly gravelly CLAY with occasional roots and rootlets	All exploratory holes between depths of ground level to 0.80m.
Superficial Deposits	Firm slightly gravelly CLAY. Gravel is fine to medium rounded limestone	TP3: 0.10m - 0.30m
Weathered Bedrock	Stiff to very stiff slightly sandy to sandy CLAY's with occasional to frequent fine to coarse angular siltstone lithorelicts	WS3: 4.07m - 4.77m WS4: 3.35m - 4.34m WS4: 4.87m - 5.00m WS6: 0.34m - 1.64m WS7: 2.68m - 3.00m WS8: 1.84m - 2.51m WS9: 1.38m - 2.60m
Weathered Bedrock	Silty or very clayey fine to medium grained SAND's with frequent fine to coarse gravel size shell fragments and/or fine to coarse angular limestone lithorelicts	WS10: 4.00m - 4.61m WS12: 4.33m - 5.00m WS15: 0.26m - 2.00m TP4: 0.34m - 1.35m TP7: 0.30m - 1.20m TP7: 1.34m - 2.65m TP8: 0.38m - 2.55m TP10: 0.27m - 1.60m TP10: 2.05m - 2.30m
Weathered Bedrock	Firm to very stiff CLAY	WS3: 4.77m - 4.84m WS4: 3.00m - 3.35m TP6: 0.95m - 3.60m TP9: 1.48m - 3.40m TP10: 2.30m - 3.40m
Weathered Bedrock	Stiff to very stiff slightly sandy to sandy CLAY with occasional to frequent coarse angular limestone lithorelicts and fine to coarse gravel size shell fragments	WS3: 4.84m - 5.00m WS4: 0.26m - 2.11m WS5: 0.21m - 2.00m WS7: 0.26m - 2.68m WS10: 4.61m - 5.85m
Weathered Bedrock	Firm sandy CLAY with occasional medium gravel sized angular shell fragments and frequent angular coarse grained sandstone lithorelicts.	WS4: 2.11m - 3.00m
Weathered Bedrock	Stiff to very stiff CLAY/slightly sandy CLAY with rare to frequent fine to coarse angular mudstone lithorelicts	WS4: 4.34m - 4.87m WS5: 3.73m - 4.00m WS6: 3.82m - 4.00m

<b>Strata Encountered</b>	<b>General Description</b>	<b>Depth in meters below ground level (m bgl)</b>
		WS8: 0.35m - 1.84m WS8: 2.51m - 2.96m WS9: 0.24m - 1.38m
Weathered Bedrock	Firm to very stiff slightly sandy to sandy CLAY/slightly sandy to sandy CLAY with rare to frequent fine to coarse gravel size shell fragments	WS5: 2.00m - 3.73m WS6: 2.42m - 3.82m WS10: 0.46m - 4.00m WS11: 0.43m - 3.00m WS11: 3.81m - 3.92m WS12: 0.42m - 3.38m WS12: 3.52m - 4.00m WS12: 4.25m - 4.33m WS13: 0.25m - 1.25m WS14: 0.28m - 1.53m BHR1: GL - 0.80m BHR2: GL - 2.00m
Weathered Bedrock	Silty to very silty fine to coarse grained SAND/very clayey fine grained SAND	WS10: 5.85m - 6.00m WS11: 3.00m - 3.81m WS12: 4.00m - 4.25m WS13: 1.25m - 5.00m TP3: 0.40m - 1.65m TP4: 1.35m - 2.90m TP5: 0.28m - 1.28m TP6: 0.28m - 0.95m TP9: 0.32m - 1.48m BHR1: 3.00m - 3.80m
Weathered Bedrock	Very silty fine to coarse grained SAND with rare to frequent coarse angular fine to coarse grained sandstone lithorelicts	WS11: 3.92m - 6.00m WS14: 1.53m - 3.00m
Weathered Bedrock	Silty sandy GRAVEL. Gravel is coarse angular weathered limestone and shell fragments	WS12: 3.38m - 3.52m
Bedrock	Weak SANDSTONE	BHR1: 4.50m - 5.80m BHR1: 6.50m - 7.50m BHR1: 10.20m - 15.00m BHR2: 2.00m - 3.20m BH2R: 5.00m - 10.50m
Bedrock	Weathered LIMESTONE/Moderately strong to medium strong LIMESTONE	BHR1: 0.80m - 3.00m BHR1: 7.50m - 10.20m BHR2: 3.20m - 3.80m

Strata Encountered	General Description	Depth in meters below ground level (m bgl)
		TP3: 1.65m - 1.70m TP7: 1.20m - 1.34m TP8: 2.55m - 2.60m TP10: 1.60m - 2.05m
Bedrock	Weak MUDSTONE	BHR1: 5.80m - 6.50m BHR2: 3.80m - 4.20m BHR2: 10.50m - 12.00m WS8: 2.96m - 3.00m

## 8.2 FIELD OBSERVATIONS AND FIELD SCREENING

During the investigation, the recovered soils were inspected for visual and olfactory evidence of contamination. A summary of the field observations is presented in the following tables.

**TABLE 16: FIELD OBSERVATIONS - INFILLED FORMER RAILWAY CUTTING**

Exploratory Hole	Visual and Olfactory Evidence of Contamination
BHR1	None
BHR2	None
WS1	Ash, burnt shale, wood, coal and rare plastic were observed within the made ground between the following depths: 0.44m - 2.14m, 2.39m - 2.69m, 2.89m - 5.42m and 6.54m - 7.40m. Slight organic odour was noted between 2.89m - 5.42m
WS2	Ash, coal, wood, and burnt shale were observed within the made ground between the following depths: 0.14m - 5.13m and 5.24m and 7.30. Clinker was also observed within the made ground between 7.14m and 7.30m. Slight organic odour was noted between 3.00m - 4.00m and 5.24m - 7.14m
WS3	Clinker, slag, ash and coal were observed within the made ground between 0.13m - 2.72m and ash between 2.87m - 4.07m
TP1	Wood and burnt shale were observed between 0.60m - 1.24m and ash and wood between 2.24m - 3.40m with the made ground
TP2	Wood and plastic was observed within the made ground between 0.55m - 2.70m

**TABLE 17: FIELD OBSERVATIONS - REST OF SITE**

Exploratory Hole	Visual and Olfactory Evidence of Contamination
BHR1	None
BHR2	None
WS4	None
WS5	None
WS6	None
WS7	None
WS8	None
WS9	None
WS10	None
WS11	None
WS12	None
WS13	None
WS14	None
WS15	None
TP3	None
TP4	None
TP5	None
TP6	None
TP7	None
TP8	None

Exploratory Hole	Visual and Olfactory Evidence of Contamination
TP9	None
TP10	None

### 8.3 GROUNDWATER AND GAS MONITORING DATA

Six rounds of groundwater and gas monitoring data were undertaken between 2<sup>nd</sup> August and 14<sup>th</sup> September 2012. The data obtained is summarised in the following table.

**TABLE 18: GAS AND GROUNDWATER MONITORING DATA**

Well	Date	CH <sub>4</sub> (%)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	Atmospheric Pressure (mB)	Relative Pressure (mB)	Average Flow (l/hr)	Water Level (mbgl)
WS1	02/08/2012	0.0	20.5	0.0	996	0.0	0.0	Dry
WS1	10/08/2012	0.3	20.7	0.0	1014	0.0	0.0	5.40m
WS1	15/08/2012	0.0	16.9	1.4	990	0.0	0.0	5.40m
WS1	22/08/2012	0.0	18.4	1.3	1011	0.0	0.0	5.40m
WS1	30/08/2012	0.0	18.3	0.1	1004	0.0	0.0	5.42m
WS1	14/09/2012	0.0	17.1	0.0	1001	0.0	0.0	5.40m
WS2	02/08/2012	0.0	20.9	0.2	996	0.0	0.0	Dry
WS2	10/08/2012	0.0	12.2	3.3	1013	0.0	0.0	Dry
WS2	15/08/2012	0.0	20.3	0.2	990	0.0	0.0	6.75
WS2	22/08/2012	0.0	19.2	1.7	1011	0.0	0.0	Dry
WS2	30/08/2012	0.0	19.2	1.1	1004	0.0	0.0	Dry
WS2	14/09/2012	0.0	19.8	1.3	1001	0.0	0.0	6.96m
WS3	02/08/2012	0.0	18.9	4.8	996	0.0	0.0	Dry
WS3	10/08/2012	0.0	13.6	5.2	1012	0.0	0.0	Dry
WS3	15/08/2012	0.0	18.9	0.4	990	0.0	0.0	Dry
WS3	22/08/2012	0.0	19.3	1.9	1011	0.0	0.0	Dry
WS3	30/08/2012	0.0	18.4	4.3	1004	0.0	0.0	Dry
WS3	14/09/2012	0.0	19.8	2.3	1001	0.0	0.0	Dry
WS4	02/08/2012	0.0	20.3	0.2	997	0.0	0.0	Dry
WS4	10/08/2012	0.0	14.2	4.6	1014	0.0	0.0	4.91m
WS4	15/08/2012	0.0	19.7	1.6	991	0.0	0.0	Dry
WS4	22/08/2012	0.0	18.7	1.7	1011	0.0	0.0	Dry
WS4	30/08/2012	0.0	18.4	2.0	1004	0.0	0.0	4.89m

Well	Date	CH <sub>4</sub> (%)	O <sub>2</sub> (%)	CO <sub>2</sub> (%)	Atmospheric Pressure (mB)	Relative Pressure (mB)	Average Flow (l/hr)	Water Level (mbgl)
WS4	14/09/2012	0.0	17.8	2.3	1001	0.0	0.0	4.86
WS5	02/08/2012	0.0	12.9	6.1	997	0.0	0.0	Dry
WS5	10/08/2012	0.0	12.9	6.1	1014	0.0	0.0	Dry
WS5	15/08/2012	0.0	18.8	2.4	990	0.0	0.0	Dry
WS5	22/08/2012	0.0	18.3	2.0	1011	0.0	0.0	Dry
WS5	30/08/2012	0.0	17.3	0.4	1004	0.0	0.0	Dry
WS5	14/09/2012	0.0	17.9	2.6	1001	0.0	0.0	Dry
WS6	02/08/2012	0.0	18.4	2.4	997	0.0	0.0	2.96
WS6	10/08/2012	0.0	16.0	3.3	1014	0.0	0.0	3.23
WS6	15/08/2012	0.0	16.9	3.7	990	0.0	0.0	3.17
WS6	22/08/2012	0.0	17.2	3.6	1011	0.0	0.0	3.16
WS6	30/08/2012	0.0	18.4	3.1	1004	0.0	0.0	3.25
WS6	14/09/2012	0.0	17.9	2.6	1001	0.0	0.0	3.18

Readings are steady state concentrations within a 5 minute measurement period.

CH<sub>4</sub> – methane;

O<sub>2</sub> – oxygen;

CO<sub>2</sub> carbon dioxide;

mbgl – metres below ground level

mB – millibars

l/hr – litres per hour.

#### 8.4 CHEMICAL TESTING RESULTS - SOILS

A selection of soil samples were submitted for chemical analysis, the results of which are presented in Appendix G. The testing suite included metals, inorganic determinants, speciated petroleum hydrocarbons, polyaromatic hydrocarbons (PAHs), total petroleum hydrocarbons and asbestos as shown in the following table. All tests were undertaken by a UKAS accredited laboratory, under a 'Chain of Custody' procedure. All tests, where appropriate, were carried out in accordance with MCERTS accreditation.

Soil samples were selected for testing on the basis of the field observations recorded during the site works, location of proposed garden areas and ensure overall good geographic coverage across the site. A summary of the testing results is presented in the following table along with a comparison with screening values relevant to a future use of the site (residential with gardens).

**TABLE 19: CHEMICAL RESULTS SUMMARY – SOIL**

Substance		Screening Criteria		Number of Analyses	Reported Minimum Value	Reported Maximum Value	Statistical Mean	Number of Exceedences
Boron (H2O Soluble)	mg/kg	291	SGV / GAC (6% SOM)	11	<0.4	2.2	0.81	0
Arsenic	mg/kg	32	SGV / GAC (6% SOM)	15	<2	20	6.59	0
Cadmium	mg/kg	10	SGV / GAC (6% SOM)	15	<0.1	<0.1	0.1	0
Chromium (trivalent)	mg/kg	627	SGV / GAC (6% SOM)	15	<5	40	16.3	0
Copper	mg/kg	2330	SGV / GAC (6% SOM)	15	<5	23	9.95	0
Lead (using old SGV)	mg/kg	450	SGV / GAC (6% SOM)	15	<5	95	23.6	0
Mercury (elemental)	mg/kg	0.42	GAC (2.5% SOM)	15	<0.1	<0.1	0.1	0
Nickel	mg/kg	130	SGV / GAC (6% SOM)	15	<5	24	10.4	0
Selenium	mg/kg	350	SGV / GAC (6% SOM)	15	<0.2	0.39	0.21	0
Zinc	mg/kg	3750	SGV / GAC (6% SOM)	15	<10	230	41.2	0
Chromium (hexavalent)	mg/kg	4.3	SGV / GAC (6% SOM)	4	<0.5	<0.5	0.5	0
Vanadium	mg/kg	75	SGV / GAC (6% SOM)	11	<5	51	16.8	0
Beryllium	mg/kg	51	SGV / GAC (6% SOM)	11	<1	1.3	1.03	0
Barium	mg/kg	1300	EIC-Cl:aire	11	<10	71	25.9	0
Cyanide (free)	mg/kg	20	Dutch Intervention	4	<0.5	<0.5	0.5	0
Cyanide (Total)	mg/kg	3100	RBSL Resi	4	<0.5	<0.5	0.5	0
Phenols (Total)	mg/kg	290	GAC (2.5% SOM)	4	<0.3	<0.3	0.3	0
Acenaphthene	mg/kg	480	GAC (2.5% SOM)	4	<0.1	0.17	0.12	0
Acenaphthylene	mg/kg	400	GAC (2.5% SOM)	4	<0.1	0.31	0.15	0
Anthracene	mg/kg	4900	GAC (2.5% SOM)	4	<0.1	0.78	0.27	0
Benz(a)anthracene	mg/kg	4.7	GAC (2.5% SOM)	4	<0.1	1.5	0.53	0
Benzo(a)pyrene	mg/kg	0.94	GAC (2.5% SOM)	4	<0.1	<b>1.6</b>	0.53	<b>1 (TP1 @ 0.30m)</b>
Benzo(b)fluoranthene	mg/kg	6.5	GAC (2.5% SOM)	4	<0.1	1.3	0.44	0
Benzo(ghi)perylene	mg/kg	46	GAC (2.5% SOM)	4	<0.1	0.83	0.28	0
Benzo(k)fluoranthene	mg/kg	9.6	GAC (2.5% SOM)	4	<0.1	0.8	0.29	0
Chrysene	mg/kg	8	GAC (2.5% SOM)	4	<0.1	2	0.65	0
Dibenz(ah)anthracene	mg/kg	0.86	GAC (2.5% SOM)	4	<0.1	0.29	0.15	0
Fluoranthene	mg/kg	460	GAC (2.5% SOM)	4	<0.1	3.7	1.13	0
Fluorene	mg/kg	380	GAC (2.5% SOM)	4	<0.1	0.33	0.16	0
Indeno(123-cd)pyrene	mg/kg	3.9	GAC (2.5% SOM)	4	<0.1	0.8	0.28	0
Naphthalene	mg/kg	3.7	GAC (2.5% SOM)	4	<0.1	0.13	0.11	0
Phenanthrene	mg/kg	200	GAC (2.5% SOM)	4	<0.1	2.4	0.72	0
Pyrene	mg/kg	1000	GAC (2.5% SOM)	4	<0.1	3.3	1.11	0
Aliphatic EC 5-6	mg/kg	55	GAC (2.5% SOM)	4	<0.1	<0.1	0.1	0
Aliphatic EC >6-8	mg/kg	160	GAC (2.5% SOM)	4	<0.1	<0.1	0.1	0
Aliphatic EC >8-10	mg/kg	46	GAC (2.5% SOM)	4	<0.1	<0.1	0.1	0
Aliphatic EC >10-12	mg/kg	230	GAC (2.5% SOM)	4	<1	<1	1	0
Aliphatic EC >12-16	mg/kg	1700	GAC (2.5% SOM)	4	<1	<1	1	0
Aliphatic EC >16-35	mg/kg	6400	GAC (2.5% SOM)	4	<1	<1	1	0
Aliphatic EC >35-44	mg/kg	6400	GAC (2.5% SOM)	4	<1	<1	1	0
Aromatic EC 5-7	mg/kg	130	GAC (2.5% SOM)	4	<0.1	<0.1	0.1	0



Substance	Screening Criteria	Number of Analyses	Reported Minimum Value	Reported Maximum Value	Statistical Mean	Number of Exceedences
(benzene)						
Aromatic EC >7-8 (toluene) mg/kg	270 GAC (2.5% SOM)	4	<0.1	<0.1	0.1	0
Aromatic EC >8-10 mg/kg	65 GAC (2.5% SOM)	4	<0.1	<0.1	0.1	0
Aromatic EC >10-12 mg/kg	160 GAC (2.5% SOM)	4	<1	<1	1	0
Aromatic EC >12-16 mg/kg	310 GAC (2.5% SOM)	4	<1	<1	1	0
Aromatic EC >16-21 mg/kg	480 GAC (2.5% SOM)	4	<1	5.3	2.08	0
Aromatic EC >21-35 mg/kg	1100 GAC (2.5% SOM)	4	<1	8.6	2.9	0
Aromatic EC >35-44 mg/kg	1100 GAC (2.5% SOM)	4	<1	<1	1	0
Sulphate mg/kg	- -	4	0.02	0.22	0.11	-
pH	- -	4	8.5	10.3	9.03	-
Sulfate (2:1 water soluble) as SO4 mg/l	- -	4	10	660	308	-
PAHs total mg/kg	- -	4	<2	20	6.78	-
Petroleum Hydrocarbons mg/kg	- -	4	<10	14	11	-
Asbestos	Detection limit of 0.001%	4	No asbestos detected			-

Values presented in mg/kg, correct to two significant figures (unless greater level of accuracy is possible from analysis or published as a screening value). Bold values indicate where values have been exceeded their respective screening values.

The screening values comprise published Soil Guideline Values (SGVs) issued by the Environment Agency / DEFRA or, where SGVs have not yet been published, Generic Acceptance Criteria (GAC) published by Land Quality Management (LQM) or calculated by Nott Group.

Published SGVs and the CLEA UK software were withdrawn by DEFRA and the Environment Agency on 13<sup>th</sup> August 2008. New guidance has been published by the Environment Agency along with an updated version of the CLEA software (version 1.03, beta). The software has been released for comment and may be subject to amendment in the coming months. The EA will be issuing revised SGVs based on the new guidance but this is not anticipated until March 2009. Key guidance documents which will be needed in the generation of guideline values using the new software have not yet been published. In the interim Nott Group will continue to use published SGVs and GACs generated using CLEA UK to ensure a consistent approach in the assessment of chemical analysis results

#### 8.4.1 Infilled Former Railway Cutting

No widespread elevated concentrations of the determinants tested have been encountered within the infilled former railway cutting. However, one trial pit (TP1) has encountered slightly elevated concentrations of Benzo(a)Pyrene (1.6 mg/kg) at a depth of 0.30m below ground level. The former railway cutting will be used as a landscaping area and therefore no further investigations or further work is warranted or recommended.

#### 8.4.2 Rest of Site

The chemical testing undertaken indicates that no elevated concentrations of the determinants tested have been encountered. No further work or remedial works is warranted for residential development in this part of the site.

## 8.5 CHEMICAL TESTING RESULTS - WATER

Due to the identified medium to high risk from off-site sources, particularly the former saw mill site located to the south of the site, it was decided to install boreholes and undertake groundwater sampling and testing. The locations of these boreholes are along the boundary between the subject site and former saw mill site (Figure 2, Appendix A). The testing suite included metals, inorganic determinants, speciated aliphatic/aromatic hydrocarbons, polyaromatic hydrocarbons (PAHs), volatile organic compounds and semi-volatile organic compounds as shown in the following table. All tests were undertaken by a UKAS accredited laboratory, under a 'Chain of Custody' procedure. All tests, where appropriate, were carried out in accordance with MCERTS accreditation. The results of the testing are presented in Appendix G.

The groundwater samples were retrieved following the pumping of 3 well volumes of each respective borehole (BHR1 and BHR2) in order that a representative sample of the underlying aquifer groundwater was sampled and subsequently tested.

**TABLE 20: CHEMICAL RESULTS SUMMARY – WATER**

Contaminant	Unit	No of Samples	Minimum Value	Maximum Value	Screening Value	Locations where screening value is exceeded
<b>Metals</b>						
Arsenic	ug/l	2	<1.0	1.7	10 DWS	
Boron	ug/l	2	68	74	1000 DWS	
Cadmium	ug/l	2	<0.080	<0.080	5 DWS	
Chromium	ug/l	2	<1	24	50 DWS	
Copper	ug/l	2	1.2	1.8	2000 DWS	
Lead	ug/l	2	<1	<1	25 DWS	
Mercury	ug/l	2	<0.5	<0.5	1 DWS	
Nickel	ug/l	2	<1	1.5	20 DWS	
Selenium	ug/l	2	1.2	1.8	10 DWS	
Zinc	ug/l	2	3.7	11	5000 DWS	
<b>Inorganics</b>						
Total Cyanide	mg/l	2	<0.05	<0.05	50 DWS	
pH Value	pH Units	2	7.2	7.3		
Sulphate	mg/l	2	32	35	25,000 DWS	
Sulphide	mg/l	2	<0.050	<0.050	----	
<b>Aliphatic/aromatic Hydrocarbons</b>						
TPH aliphatic >C5-C6	ug/l	2	<0.1	<0.1	10 DWS	
TPH aliphatic >C6-C8	ug/l	2	<0.1	<0.1	10 DWS	
TPH aliphatic >C8-C10	ug/l	2	<0.1	<0.1	10 DWS	
TPH aliphatic >C10-C12	ug/l	2	<0.1	<0.1	10 DWS	
TPH aliphatic >C12-C16	ug/l	2	<0.1	<0.1	10 DWS	
TPH aliphatic >C16-C35	ug/l	2	<0.1	<0.1	10 DWS	
TPH aliphatic >C21-C35	ug/l	2	<0.1	<0.1	10 DWS	
TPH aliphatic >C35-C44	ug/l	2	<0.1	<0.1	10 DWS	
TPH aromatic >C6-C7	ug/l	2	<0.1	<0.1	10 DWS	
TPH aromatic >C7-C8	ug/l	2	<0.1	<0.1	10 DWS	
TPH aromatic >C8-C10	ug/l	2	<0.1	<0.1	10 DWS	
TPH aromatic >C10-C12	ug/l	2	<0.1	<0.1	10 DWS	
TPH aromatic >C12-C16	ug/l	2	<0.1	<0.1	10 DWS	
TPH aromatic >C16-C21	ug/l	2	<0.1	<0.1	10 DWS	
TPH aromatic C21-C35	ug/l	2	<0.1	<0.1	10 DWS	
TPH aromatic C35-C44	ug/l	2	<0.1	<0.1	10 DWS	
Total Petroleum Hydrocarbons	ug/l	2	<10	<10	10 DWS	
Total Aliphatic Hydrocarbons	ug/l	2	<5	<5	10 DWS	
Total Aromatic Hydrocarbons	ug/l	2	<5	<5	10 DWS	
Phenol	ug/l	2	<0.50	<0.50	0.5 DWS	
Phenols (Total)	ug/l	2	<0.03	0.05	0.5 DWS	
<b>Hydrocarbons - PAHs</b>						
Naphthalene	ug/l	2	<0.1	<0.1	10 EQS	
Acenaphthylene	ug/l	2	<0.1	<0.1	----	
Fluorene	ug/l	2	<0.1	<0.1	----	
Phenanthrene	ug/l	2	<0.1	<0.1	----	
Anthracene	ug/l	2	<0.1	<0.1	0.2 EQS	
Fluoranthene	ug/l	2	<0.1	<0.1	0.02 EQS	
Pyrene	ug/l	2	<0.1	<0.1	----	

Contaminant	Unit	No of Samples	Minimum Value	Maximum Value	Screening Value	Locations where screening value is exceeded
Benzo[a]anthracene	ug/l	2	<0.1	<0.1	----	
Chrysene	ug/l	2	<0.1	<0.1	0.2 DG	
Benzo[b]fluoranthene	ug/l	2	<0.1	<0.1	0.1 DWS	
Benzo[k]fluoranthene	ug/l	2	<0.1	<0.1	0.1 DWS	
Benzo[a]pyrene	ug/l	2	<0.1	<0.1	0.01 DWS	
Dibenzo[a,h]anthracene	ug/l	2	<0.1	<0.1	----	
Indeno[1,2,3-cd]pyrene	ug/l	2	<0.1	<0.1	0.1 DWS	
Benzo[g,h,i]perylene	ug/l	2	<0.1	<0.1	0.1 DWS	
Total (of 16) PAHs	ug/l	2	<2	<2	10 DWS	
<b>VOCs</b>						
Methyl tert-butylether	ug/l	2	<0.1	<0.1	9200 DG	
Dichlorodifluoromethane	ug/l	2	<0.1	<0.1	2000 EQS	
Chloromethane	ug/l	2	<0.1	<0.1	12 EQS	
Vinyl chloride	ug/l	2	<0.1	<0.1	0.5 DWS	
Bromomethane	ug/l	2	<20	<20	----	
Chloroethane	ug/l	2	<2.0	<2.0	----	
Trichlorofluoromethane	ug/l	2	<1.0	<1.0	----	
1,1-Dichloroethene	ug/l	2	<1.0	<1.0	----	
Dichloromethane	ug/l	2	ne	ne	----	
trans-1,2-Dichloroethene	ug/l	2	<1.0	<1.0	3 DWS	
1,1-Dichloroethane	ug/l	2	<1.0	<1.0	3 DWS	
cis-1,2-Dichloroethene	ug/l	2	<1.0	<1.0	20 DG	
Bromochloromethane	ug/l	2	<1.0	<1.0	----	
Trichloromethane	ug/l	2	<1.0	<1.0	12 EQS	
1,1,1-Trichloroethane	ug/l	2	<1.0	<1.0	100 EQS	
Tetrachloromethane	ug/l	2	<1.0	<1.0	3 DWS	
1,1-Dichloropropene	ug/l	2	<1.0	<1.0	----	
Benzene	ug/l	2	<1.0	<1.0	1 DWS	
1,2-Dichloroethane	ug/l	2	<2.0	<2.0	10 DG	
Trichloroethene	ug/l	2	<1.0	<1.0	12 DG	
1,2-Dichloropropane	ug/l	2	<1.0	<1.0	60 DG	
Dibromomethane	ug/l	2	<10	<10	----	
Bromodichloromethane	ug/l	2	<5.0	<5.0	----	
cis-1,3-Dichloropropene	ug/l	2	<10	<10	----	
Toluene	ug/l	2	<1.0	<1.0	50 EQS	
trans-1,3-Dichloropropene	ug/l	2	<10	<10	----	
1,1,2-Trichloroethane	ug/l	2	<10	<10	400 EQS	
Tetrachloroethene	ug/l	2	<1.0	<1.0	10 DWS	
1,3-Dichloropropane	ug/l	2	<2.0	<2.0	80 DG	
Dibromochloromethane	ug/l	2	<10	<10	----	
1,2-Dibromoethane	ug/l	2	<5.0	<5.0	----	
Chlorobenzene	ug/l	2	<1.0	<1.0	----	
1,1,1,2-Tetrachloroethane	ug/l	2	<2.0	<2.0	----	
Ethylbenzene	ug/l	2	<1.0	<1.0	20 EQS	
m- & p-Xylene	ug/l	2	<1.0	<1.0	30 EQS	
o-Xylene	ug/l	2	<1.0	<1.0	30 EQS	
Styrene	ug/l	2	<1.0	<1.0	50 EQS	
Tribromomethane	ug/l	2	<10	<10	----	
Isopropylbenzene	ug/l	2	<1.0	<1.0	----	
Bromobenzene	ug/l	2	<1.0	<1.0	----	
1,2,3-Trichloropropane	ug/l	2	<50	<50	----	
n-Propylbenzene	ug/l	2	<1.0	<1.0	----	
2-Chlorotoluene	ug/l	2	<1.0	<1.0	----	
1,2,4-Trimethylbenzene	ug/l	2	<1.0	<1.0	----	
4-Chlorotoluene	ug/l	2	<1.0	<1.0	----	
tert-Butylbenzene	ug/l	2	<1.0	<1.0	----	
1,3,5-Trimethylbenzene	ug/l	2	<1.0	<1.0	----	
sec-Butylbenzene	ug/l	2	<1.0	<1.0	----	
1,3-Dichlorobenzene	ug/l	2	<1.0	<1.0	----	
4-Isopropyltoluene	ug/l	2	<1.0	<1.0	----	
1,4-Dichlorobenzene	ug/l	2	<1.0	<1.0	20 EQS	
n-Butylbenzene	ug/l	2	<1.0	<1.0	----	
1,2-Dichlorobenzene	ug/l	2	<1.0	<1.0	20 EQS	
1,2-Dibromo-3-chloropropane	ug/l	2	<50	<50	----	
1,2,4-Trichlorobenzene	ug/l	2	<1.0	<1.0	0.4 EQS	
Hexachlorobutadiene	ug/l	2	<1.0	<1.0	0.1 EQS	
1,2,3-Trichlorobenzene	ug/l	2	<2.0	<2.0	----	

Contaminant	Unit	No of Samples	Minimum Value	Maximum Value	Screening Value	Locations where screening value is exceeded
<b>SVOCs</b>						
Acenaphthene	ug/l	2	<0.50	<0.50	0.1 DWS	
Acenaphthylene	ug/l	2	<0.50	<0.50	0.1 DWS	
Anthracene	ug/l	2	<0.50	<0.50	0.1 DWS	
Azobenzene	ug/l	2	<0.50	<0.50	----	
Benzo[a]anthracene	ug/l	2	<0.50	<0.50	0.1 DWS	
Benzo[a]pyrene	ug/l	2	<0.50	<0.50	0.01 DWS	
Benzo[b]fluoranthene	ug/l	2	<0.50	<0.50	0.1 DWS	
Benzo[g,h,i]perylene	ug/l	2	<0.50	<0.50	0.1 DWS	
Benzo[k]fluoranthene	ug/l	2	<0.50	<0.50	0.1 DWS	
bis(2-Chloroethoxy)methane	ug/l	2	<0.50	<0.50	----	
bis(2-Chloroethyl)ether	ug/l	2	<0.50	<0.50	----	
bis(2-Chloroisopropyl)ether	ug/l	2	<0.50	<0.50	----	
bis(2-Ethylhexyl)phthalate	ug/l	2	<0.50	<0.50	----	
Butylbenzylphthalate	ug/l	2	<0.50	<0.50	20 EQS	
Carbazole	ug/l	2	<0.50	<0.50	----	
Chrysene	ug/l	2	<0.50	<0.50	0.1 DWS	
Di-n-butylphthalate	ug/l	2	<0.50	<0.50	8 EQS	
Di-n-octylphthalate	ug/l	2	<0.50	<0.50	20 EQS	
Dibenzof[a,h]anthracene	ug/l	2	<0.50	<0.50	0.1 DWS	
Dibenzofuran	ug/l	2	<0.50	<0.50	----	
Diethylphthalate	ug/l	2	<0.50	<0.50	200 EQS	
Dimethylphthalate	ug/l	2	<0.50	<0.50	800 EQS	
Fluoranthene	ug/l	2	<0.50	<0.50	0.1 DWS	
Fluorene	ug/l	2	<0.50	<0.50	----	
Hexachlorobenzene	ug/l	2	<0.50	<0.50	0.03 EQS	
Hexachlorobutadiene	ug/l	2	<0.50	<0.50	0.1 EQS	
Hexachlorocyclopentadiene	ug/l	2	<0.50	<0.50	----	
Hexachloroethane	ug/l	2	<0.50	<0.50	----	
Indeno[1,2,3-cd]pyrene	ug/l	2	<0.50	<0.50	0.1 DWS	
Isophorone	ug/l	2	<0.50	<0.50	----	
N-Nitrosodi-n-propylamine	ug/l	2	<0.50	<0.50	----	
Naphthalene	ug/l	2	<0.50	<0.50	0.1 DWS	
Nitrobenzene	ug/l	2	<0.50	<0.50	----	
Pentachlorophenol	ug/l	2	<0.50	<0.50	2 EQS DWS	
Phenanthrene	ug/l	2	<0.50	<0.50	0.1 DWS	
Pyrene	ug/l	2	<0.50	<0.50	0.1 DWS	
1,2-Dichlorobenzene	ug/l	2	<0.50	<0.50	----	
1,2,4-Trichlorobenzene	ug/l	2	<0.50	<0.50	0.4 EQS	
1,3-Dichlorobenzene	ug/l	2	<0.50	<0.50	----	
1,4-Dichlorobenzene	ug/l	2	<0.50	<0.50	----	
2-Chloronaphthalene	ug/l	2	<0.50	<0.50	----	
2-Chlorophenol	ug/l	2	<0.50	<0.50	50 EQS	
2-Methyl-4,6-dinitrophenol	ug/l	2	<0.50	<0.50	----	
2-Methylnaphthalene	ug/l	2	<0.50	<0.50	----	
2-Methylphenol	ug/l	2	<0.50	<0.50	100 EQS	
2-Nitroaniline	ug/l	2	<0.50	<0.50	----	
2-Nitrophenol	ug/l	2	<0.50	<0.50	20 EQS	
2,4-Dichlorophenol	ug/l	2	<0.50	<0.50	20 EQS	
2,4-Dimethylphenol	ug/l	2	<0.50	<0.50	----	
2,4-Dinitrotoluene	ug/l	2	<0.50	<0.50	----	
2,4,5-Trichlorophenol	ug/l	2	<0.50	<0.50	10 DG	
2,4,6-Trichlorophenol	ug/l	2	<0.50	<0.50	10 DG	
2,6-Dinitrotoluene	ug/l	2	<0.50	<0.50	----	
3-Nitroaniline	ug/l	2	<0.50	<0.50	----	
4-Bromophenylphenylether	ug/l	2	<0.50	<0.50	----	
4-Chloro-3-methylphenol	ug/l	2	<0.50	<0.50	40 EQS	
4-Chloroaniline	ug/l	2	<0.50	<0.50	----	
4-Chlorophenylphenylether	ug/l	2	<0.50	<0.50	----	
4-Methylphenol	ug/l	2	<0.50	<0.50	100 EQS	
4-Nitroaniline	ug/l	2	<0.50	<0.50	----	
4-Nitrophenol	ug/l	2	<0.50	<0.50	----	

Screening values based upon EQS, UK Drinking Water Standards (DWS) or Dutch Guidance (DG) where available.

The chemical testing undertaken indicates that no elevated concentrations of the determinants tested have been encountered. Based upon this testing no further assessment or remedial works are warranted for groundwater.

## 8.6 GAS RISK ASSESSMENT

The gas monitoring undertaken has encountered elevated concentrations of carbon dioxide (maximum 6.1%) and depleted oxygen concentrations (minimum 12.2%) with zero measured flow rates (<0.1l/hr). A single slightly elevated concentration of methane was detected during a single monitoring visit within exploratory hole WS1 (located in railway cutting). This indicates a gas screening value (GSV) of <0.07 l/h. For carbon dioxide and methane this corresponds to a gas characteristic situation of 1 (very low risk) and no further works are warranted (CIRIA Report C655). Using the NHBC guidance, this correspondence to traffic light system of green and no special precautions in respect to protective measures are warranted. Further monitoring may be required to confirm this.

## 9. CONTAMINATED LAND ASSESSMENT

### 9.1 POTENTIALLY SIGNIFICANT POLLUTION LINKAGES

A revised conceptual model comprising the identification and assessment of potentially significant pollutant linkages has been undertaken.

### 9.2 POTENTIAL SOURCES

Potential contamination sources identified from the site investigation, chemical testing and monitoring have been summarised in the following table.

**TABLE 21: POTENTIAL CONTAMINATION SOURCES IDENTIFIED DURING SITE WORKS**

Source	Location	Comments
All determinants below adopted screening values with exception of localised hotspot	Infilled former railway cutting	No further work or assessment required as the localised hotspot is located within an area of proposed landscaping area.
All determinants below adopted screening values	Rest of Site	No further work or assessment required

No other potential sources of contamination in respect to human health were identified during the site works and chemical testing.

### 9.3 RISK ASSESSMENT

The risk of significant harm or pollution of controlled waters has been assessed qualitatively as **low, medium or high** using the criteria shown in Appendix E.

A risk estimation matrix for all pollutant linkages identified is shown in the following table.

**TABLE 22: REVISED CONTAMINATION ASSESSMENT BASED UPON RESULTS OF SITE WORK**

Receptor	Sources	Risk	Justification
<b>Human Health</b>			
Existing site users	No contamination sources identified during works with exception of localised hotspot within infilled railway cutting	Low	No further work warranted - site is unoccupied
Future site users	No contamination sources identified during works with exception of localised hotspot within infilled railway cutting	Low	No further work warranted as localised hotspot is located within a area of proposed landscaping rather than a residential garden area
Construction workers	No contamination sources identified during works with exception of localised hotspot within infilled railway cutting	Low	No further work warranted - appropriate use of PPE during construction works
Existing site users	Elevated CO <sub>2</sub> , depleted O <sub>2</sub> and slight CH <sub>4</sub> concentrations	Low	No further work warranted - site is unoccupied
Future site users	Elevated CO <sub>2</sub> , depleted O <sub>2</sub> and slight CH <sub>4</sub> concentrations	Low	Monitoring undertaken to date indicates low risk of gas migration. Further monitoring may be prudent. No precaution measures are warranted based on calculated gas screening value.

<b>Receptor</b>	<b>Sources</b>	<b>Risk</b>	<b>Justification</b>
Construction workers	Elevated CO <sub>2</sub> , depleted O <sub>2</sub> and slight CH <sub>4</sub> concentrations	Low	No further work warranted.
<b>Property</b>			
Site structures	Elevated CO <sub>2</sub> , depleted O <sub>2</sub> and slight CH <sub>4</sub> concentrations	Low	Monitoring undertaken to date indicates low risk of gas migration. Further monitoring may be prudent. No precaution measures are warranted based on calculated gas screening value.
Safety of water supply pipes	No hydrocarbon contamination identified during works	Low	No further work warranted.
<b>Controlled Waters</b>			
Unnamed tertiary river	None identified	Low	No further work warranted.
Culvert	None identified	Low	No further work warranted.
Drain	None identified	Low	No further work warranted.
Principal Aquifer	None identified	Low	No further work warranted.

## 10. PRELIMINARY FOUNDATION ASSESSMENT

### 10.1 FORMER RAILWAY CUTTING

It is not proposed to construct residential properties within the area of the former railway cutting.

Within the former cutting infilled made ground was encountered between depths of 4.07m and 7.40m below ground level. The infilled made ground does not constitute a reliable founding medium for any form of traditional foundation due to the deposits unknown compaction history and variable in-situ density, strength and material content, which in turn poses a risk of unpredictable and excessive total and/or differential settlements.

If residential development is to proceed within the former cutting area preliminary foundation options could include the following:

- A suitably designed semi-raft or ground beam foundation.
- Employment of ground improvement techniques.
- Piled foundations.

Unless ground improvement techniques are employed ground floor slabs should be fully suspended.

### 10.2 REST OF SITE

Within the area located outside the infilled railway cutting shallow topsoil overlying competent weathered residual soils was encountered. These weathered deposits graded into bedrock at depth.

Based on the information obtained, foundation design could proceed using strip footings, deepened using mass concrete trench fill if poor natural soils are encountered, or isolated pad bases bearing upon the competent weathered residual soils.

Providing that all the topsoil is removed from beneath the plan area of the proposed structure ground bearing slabs should be feasible.

### 10.3 REQUIREMENT FOR FURTHER GEOTECHNICAL GROUND INVESTIGATION WORKS

The above recommendations outlined are subject to further confirmatory geotechnical ground investigation works which should include, but not limited to, the following:

- Exploratory holes to include insitu testing in order to verify soils in situ density or shear strength.
- Geotechnical laboratory testing (to include for the assessment of the volume change potential of clay soils, assess the presence of desiccated clay soils and concrete classification tests).
- Soil testing for sulphate resistance concrete design.



## 11. CONCLUSIONS AND RECOMMENDATIONS

The Nott Group have been instructed by Manor Oak Homes to undertake a contaminated land assessment at an area of land referred to as 'Foxhills Brackley North', Brackley.

The Nott Group has undertaken a review of available site information provided and developed a conceptual model. Based on the conceptual model a ground investigation was designed and undertaken and included machine excavated trial pits, window sample holes and open hole rotary drilling. This was followed up by chemical testing on selected soil and groundwater samples as well as a programme of gas and groundwater monitoring.

Based on the findings of the ground investigation a conceptual model for the site in accordance with the current Contaminated Land Legislation has been developed with the following conclusions and recommendations.

### 11.1 CONTAMINATION ASSESSMENT

Historical mapping indicates the site consisted of an area of largely undeveloped agricultural land from 1883 until 1898. From 1898 a large railway cutting is shown to intercept the site along its western boundary while the remainder of the site is shown to be occupied by allotments. The allotments disappeared by 1950 to be replaced by fields. The railway is shown to be 'dismantled' from 1972 and from 1990 onwards the cutting is no longer present and has been infilled.

No industrial activity has been undertaken on the site (apart from infilled railway cutting) but a number of offsite (including a former saw mill and operational petrol station) sources of potential contamination have been identified.

Exploratory holes undertaken at the site generally did not encounter any visual evidence of contamination except for those located within the area of the former infilled railway cutting. None of the testing on recovered soil samples exceeded the generic screening value in respect to human health with the exception of an isolated hotspot of Benzo(a)Pyrene (1.6 mg/kg) encountered at a depth of 0.30m in one trial pit (TP1). This trial pit was excavated in the former cutting. No further work is warranted as this localised hotspot is within an area of proposed landscaping. All other soil testing indicates that no elevated concentrations were encountered and no further work or remediation is required.

The groundwater testing undertaken indicates that no elevated concentrations of the determinants tested have been encountered and no off-site source of contamination has impacted this site. No further work is warranted with respect to groundwater contamination issues.

The gas monitoring undertaken has encountered elevated concentrations of carbon dioxide (maximum 6.1%) and depleted oxygen concentrations (minimum 12.2%) with zero measured flow rates (<0.1l/hr). No elevated concentrations of methane have been detected. These elevated carbon dioxide levels and flow rates indicate that no special precautions are warranted during the construction of the buildings.

Overall, the site has been assessed as a low risk in accordance with Contaminated Land Legislation.

## GLOSSARY

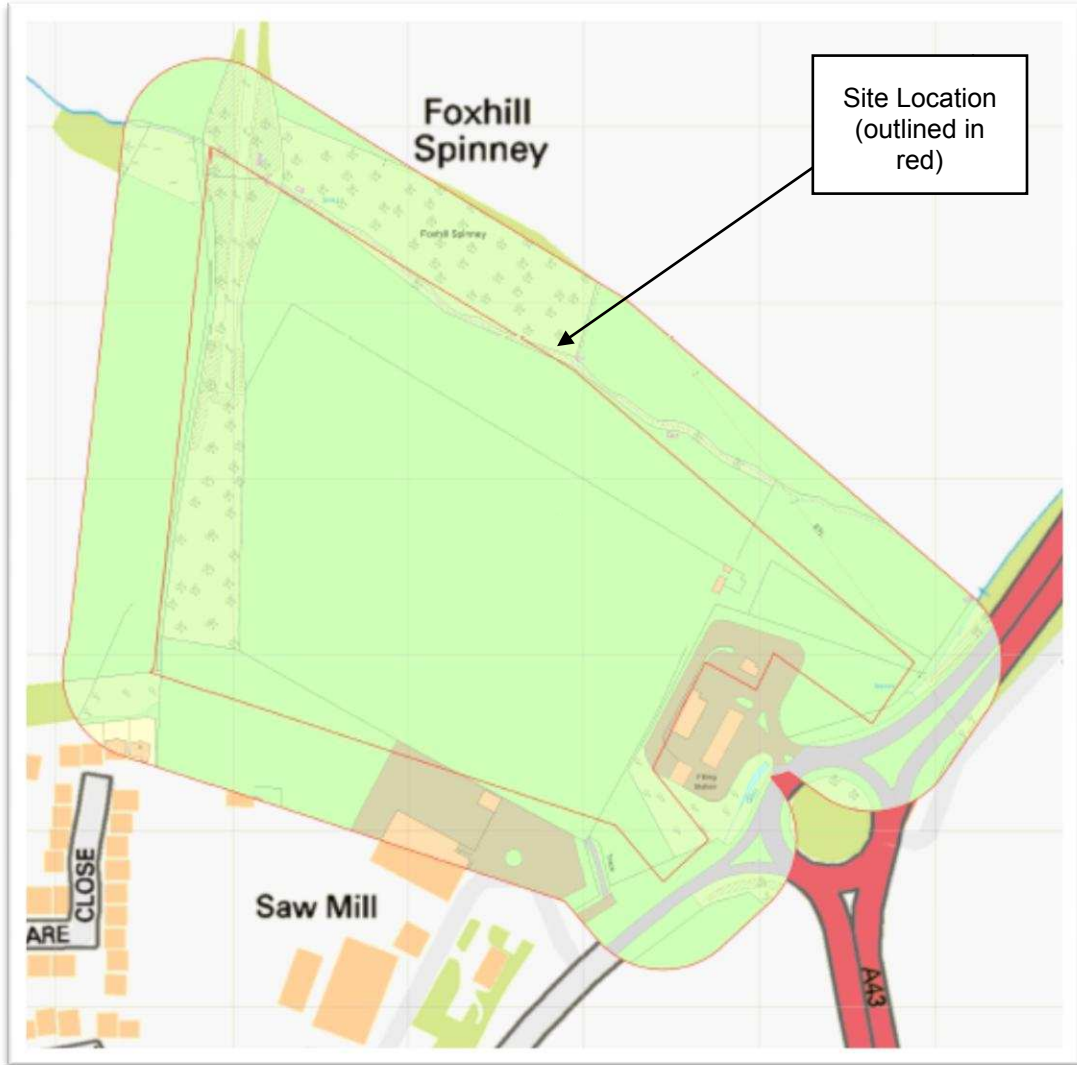
For the purpose of this report the following terms and definitions apply (see BS 10175:2001).

Accuracy	Level of agreement between true value and observed value.
Conceptual model	<p>Textual and or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the base of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process.</p> <p><b>Note 1:</b> The conceptual model is initially derived from the information obtained by the preliminary investigation. This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of the field investigation can provide additional data that can be used to further refine the conceptual model.</p>
Contamination	<p>Presence of a substance which is in, on or under land, and which has <u>the potential</u> to cause significant harm or to cause significant pollution of controlled water.</p> <p><b>Note 1:</b> There is no assumption in this definition that harm results from the presence of the contamination.</p> <p><b>Note 2:</b> Naturally enhanced concentrations of harmful substances can fall within this definition of contamination.</p> <p><b>Note 3:</b> Contamination may relate to soils, groundwater or ground gas.</p>
Controlled water	<p>Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three mile limit of territorial waters.</p> <p><b>Note 1:</b> See Section 104 of The Water Resources Act 1991.</p>
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case humans, including property.
Hazard	Inherently dangerous quality of a substance, procedure or event.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
Precision	Level of agreement within a series of measurements of a parameter.
Receptor	Persons, living organisms, ecological systems, controlled water, atmosphere, structures and utilities that could be adversely affected by the contaminant(s).
Risk	Probability of the occurrence of, and magnitude of the consequences of, an unwanted adverse effect on a receptor.
Risk assessment	Process of establishing, to the extent possible, the existence, nature and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
Soil	<p>Upper layer of the earth's crust composed of mineral parts, organic substance, water, air and living matter.</p> <p><b>Note 1:</b> In accordance with BS 10175:2001 the term soil has the meaning ascribed to it through general use in civil engineering and includes topsoil and subsoil; deposits such as clays, silt, sand, gravel, cobbles, boulders and organic deposits such as peat; and material of natural or human origin (e.g. fills and deposited wastes). The term embraces all components of soil, including mineral matter, organic matter, soil gas and moisture, and living organisms.</p>
Source	<p>Location from which contamination is, or was, derived.</p> <p><b>Note 1:</b> This could be the location of the highest soil or groundwater concentration of the contaminant(s).</p>
Uncertainty	Parameter, associated with the result of a measurement that characterizes the dispersion of the values that could reasonably be attributed to the measurement.

# Appendix A SITE PLAN AND EXPLORATORY HOLE LOCATION PLAN

## Site Location Plan

Not to scale



**Appendix B HISTORICAL MAPS**

## **Appendix C ENVIRONMENTAL DATABASES**

## Appendix D RISK RATING MATRIX

**Table 1: Risk rating for contaminated land qualitative risk assessment.**

Risk rating for contaminated land qualitative risk assessment.

Risk in this context is a combination of the pollution probability (or frequency) and the magnitude of the pollution.

Level of Scale and Seriousness (severity or magnitude)	Probability/Frequency		
	Most Likely	Reasonably Foreseeable	Unlikely
Severed pollution and high magnitude	High	High	Low
Moderately severe pollution and moderate magnitude	Medium	Medium	Low
Low severity of pollution and low magnitude	Low	Low	Low

## Appendix E ENVIRONMENTAL RECEPTORS

**Table E1: Pollution to controlled waters.**

<p>'Section 78A(9) of the EPA 1990 defines the pollution of controlled waters as: "the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter".' (A35)</p> <p>'Before determining that pollution of controlled water is being, or is likely to be, caused, the local authority should be satisfied that a substance is continuing to enter controlled waters or is likely to enter controlled waters. The local authority should regard something as being "likely" to be caused when the local authority judge it more likely than not to occur.' (A36)</p> <p>'Land should <b>not</b> be designated as contaminated land where:</p> <p>(a) a substance is already present in controlled waters;</p> <p>(b) entry into controlled waters of that substance from land has ceased; and</p> <p>(c) it is not likely that further entry will take place.' (A37)</p> <p>'Substances should be regarded as having entered controlled waters where:</p> <p>(a) they are dissolved or suspended in those waters; or</p> <p>if they are immiscible with water, they have direct contact with those waters on or beneath the surface of the water.' (A38)</p> <p>The term 'continuing to enter' should be taken to mean any entry additional to any which has already occurred. (A39)</p>
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Reproduced from DETR (2000) Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990 Circular 2/2000 and Scottish Executive Rural Affairs Department (2000) Circular 1/2000. Environmental Protection Act 1990: Part IIA – Contaminated Land.

**Table E2: Significant harm to various receptors.**

Type of receptor	Description of harm to that type of receptor that is to be regarded as significant harm
Human beings	<p>Death, disease, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.</p> <p>For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.</p> <p>In the Guidance, this description of significant harm is referred to as a 'human health effect'.</p>
<p>Any ecological system, or living organism forming part of such a system, within a location which is:</p> <ul style="list-style-type: none"> <li>• an area notified as an area of Special Scientific Interest under Section 28 of the Wildlife and Countryside Act 1981.</li> <li>• any land declared a National Nature Reserve under Section 35 of that Act</li> <li>• any area designated as a Marine Nature Reserve under Section 36 of that Act</li> <li>• an area of Special Protection of Birds, established under Section 3 of that Act</li> <li>• any European Site within the meaning of regulation 10 of the Conservation (Natural Habitats etc.) Regulations 1994 (i.e. Special Areas of Conservation and Special protection Areas)</li> <li>• any candidate Special Areas of Conservation or potential Special Protection Areas given equivalent protection</li> <li>• any habitat or site afforded policy protection</li> </ul>	<p>For any protected location:</p> <p>Harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location;</p> <p>or</p> <p>Harm which affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location.</p> <p>In addition, in the case of a protected location, which is a European Site (or a candidate Special Area of Conservation or a potential Special Protection Area), harm which is incompatible with the favourable conservation status of natural habitats at that location or species typically found there.</p> <p>In determining what constitutes such harm, the local authority should have regard to the advice of English nature and to the requirements of the Conservation (Natural Habitats etc Regulations 1994.</p>

Type of receptor	Description of harm to that type of receptor that is to be regarded as significant harm
<p>under paragraph 13 of Planning Policy Guidance Note 9 (PPG9) on nature conservation (i.e. candidate Special Areas of Conservation, potential Special protection Areas and listed Ramsar sites); or</p> <ul style="list-style-type: none"> <li>any nature reserve established under Section 21 of the National Parks and Access to the Countryside Act 1949.</li> </ul>	<p>In the Guidance this description of significant harm is referred to as an 'ecological system effect'.</p>
<p>Property in the form of:</p> <ul style="list-style-type: none"> <li>crops, including timber</li> <li>produce grown domestically, or on allotments, for consumption</li> <li>livestock</li> <li>other owned or domesticated animals; wild animals which are the subject of shooting or fishing rights.</li> </ul>	<p>For crops, a substantial diminution in yield or other substantial loss in their value, resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage.</p> <p>The local authority should regard a substantial loss in value as occurring only when a substantial proportion of the animals or crops are dead or otherwise no longer fit for their intended purpose. Food should be regarded as being no longer fit for purpose when it fails to comply with the provisions of the Food Safety Act 1990. Where a diminution in yield or loss in value is caused by a pollutant linkage, a 20% diminution or loss should be regarded as a benchmark for what constitutes a substantial diminution or loss.</p> <p>In the Guidance this description of significant harm is referred to as an 'animal or crop effect'.</p>
<p>Property in the form of buildings. For this purpose 'building' means any structure or erection and any part of a building, including any part below ground level, but does not include plant or machinery comprised in a building.</p>	<p>Structural failure, substantial damage or substantial interference with any right of occupation.</p> <p>For this purpose, the local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended.</p> <p>Additionally, in the case of a scheduled Ancient Monument, substantial damage should be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled in the Guidance this description of significant harm is referred to as a 'building effect'.</p>

Reproduced from DETR (2000) Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990. Circular 2/2000 and Scottish Executive Rural Affairs Department (2000) Circular 1/2000. Environmental Protection Act 1990: Part IIA – Contaminated Land.



## **Appendix F    EXPLORATORY HOLE LOGS**

## **Appendix G CHEMICAL TESTING RESULTS - SOIL & WATER**