PHASE II ENVIRONMENTAL ASSESSMENT

Priory Garage,
232 Priory Road,
Liverpool
L4 2SL

For

Topflight Trading Limited

February 2016

16/0533

Geo^2 Remediation Limited

11, The Mending Rooms, Sunny Bank Mills, Town Street, Farsley, Leeds, LS28 5UJ
Tel 0113 257 5397

Topflight Trading Limited

Phase II Environmental Assessment

Priory Garage,
232 Priory Road,
Liverpool,
L4 2SL

February 2016

Report ref no. 16/0533

Contents

1.0 Introduction

2.0 Site Reconnaissance
- 2.1 Site Location and Topography
- 2.2 Surfacing and Drainage
- 2.3 Fuel Storage Infrastructure
- 2.4 Stock Reconciliation Records

3.0 Desk Study
- 3.1 Site Geology
- 3.2 Site Hydrogeology
- 3.3 Site Hydrology
- 3.4 Waste
- 3.5 Other Receptors

4.0 Site History

5.0 Hazard Identification
- 5.1 Contaminant Source
- 5.2 Receptors or Points of Exposure
- 5.3 Contamination Pathways
- 5.4 Initial Contaminant Linkages

6.0 Site Investigation
- 6.1 Soils Investigation

7.0 Laboratory Analysis
- 7.1 Analysis Rationale
- 7.2 Soils Analysis

8.0 Risk Estimation
- 8.1 Discussion of Investigation Findings
- 8.2 Qualitative Risk Assessment

9.0 Conclusions
10.0 Limitations
11.0 References

Appendices

Appendix A Figures
Appendix B Desk Study Data
Appendix C Soil bore logs
Appendix D Laboratory Certification
Appendix E Risk Assessment Criteria
Appendix F Watching Brief Method Statement

Topflight Trading Limited

Phase II Environmental Assessment

Priory Garage,
232 Priory Road,
Liverpool,
L4 2SL

February 2016

Report ref no. 16/0533

1.0 Introduction

Geo^2 Remediation Limited (Geo^2) were commissioned by Topflight Trading Limited to conduct an Environmental Site Assessment of the Priory Garage site, 232 Priory Road, Liverpool, L4 2SL. The site is located at grid reference SJ 36580 93480. The study was undertaken prior to purchase of the property for redevelopment as a commercial use.

The site investigation, consisting of a soil bore construction programme, was conducted in order to establish the presence and extent of sub-surface contaminants, if any, resulting from the past and current landuse at the site and in the surrounding area, prior to potential redevelopment for continuing commercial use.

The site investigation was conducted on the 26th January 2016, in accordance with Geo^2 Remediation Ltd Method Statement SMS SI 0533. The findings of the investigation are presented in this report.

2.0 Site Reconnaissance

At the time of investigation, the site comprised a Petrol Filling Station (PFS) with associated shop/maintenance garage and jetwash bays, along with a further three individual maintenance garage buildings and a row of domestic style garages. The maintenance garages are all currently in use for a range of activities, including an MOT garage, body shop, valet and tyre garage.

The site is noted to lie within a predominantly residential area, although the site itself is surrounded by Stanley Park to the west, and beyond Priory Road, to the south. To the north is a cemetery and to the east is a large electrical substation.

The site can be accessed from two egress/ingress points on Priory Road to the south.

No assessment has been made for asbestos in the buildings, however given the construction and likely age of the building, it is considered possible that asbestos panels are present.

2.1 Site Location and Topography

The site is situated in a high-density residential area of Anfield, approximately 2km north-east of Liverpool.

The surrounding landuses are summarised in Table 1.

Direction	Landuse
North	Cemetery.
East	Electrical Substation with transformers.
West	Parkland.
South	Priory Road, parkland beyond.

Table 1. Landuses in the Surrounding Area

The nearest residential properties appear to be located 100m from the site's eastern boundary.

The site has a slight slope to the north east, away from Priory Road. Surrounding land slopes slightly to the north and east.

2.2 Surfacing and Drainage

Site drainage is limited, with box gullies running across the ingress and egress along with the jet washes, which were noted to be blocked. As a result, these gullies could not be fully traced, but partial traces indicate that they, along with other site drainage, drain to the site interceptor, located in the northern corner of the site.

The forecourt area and jetwash bays are surfaced in concrete slabs, which were found to be in a fair condition. The remainder of the site is surfaced in a mix of concrete and tarmac, which was in a poor condition.

A full service plan including a drainage survey is provided in Appendix A.

2.3 Fuel Storage Infrastructure

There were five Underground Storage Tanks (USTs) identified during the investigation, in two tank farms, located to the north west and south east of the forecourt. Anecdotal evidence suggests that these are not currently in use, as the site is changing fuel supplier, and as a result, the site has not sold fuel for a number of months. All tanks are currently fed by direct fill points.

Anecdotal evidence suggests that all tanks were tested and relined approximately 10 years ago, and tank tests are planned prior to the future redevelopment. It is understood that the site will also be moving to offset fill points during the redevelopment.

Tank details are summarised below in Table 2.

Tank No.	Size	Grade
1	26,190	Diesel
2	26,190	Unleaded
3	34,500	Diesel
4	17,460	Unleaded
5	17,460	Diesel

Table 2. Tank Size Details

2.4 Stock Reconciliation Records

No up to date stock reconciliation records for the on-site tanks were available for view by Geo^2; as the site has not sold fuel for a number of months.

3.0 Desk Study

3.1 Site Geology

The site geology is understood to comprise superficial deposits of Devensian Till, comprising clay, sand and sandy gravels. BGS records for nearby boreholes indicate that boulder clays are present across the site. This is underlain by the Chester Pebble Beds Formation, of gravelly Sandstones.

Envirocheck records indicate very low to no hazard of ground stability issues for the site. The site lies outside of a coal mining affected area.

The Envirocheck report indicates that the site does not lie within a radon affected area, as less than 1% of properties are above the Action Level. As such no basic radon protection measures are necessary in the construction of new homes or extensions.

3.2 Site Hydrogeology

Groundwater mapping indicates the superficial deposits are classified as an unproductive stratum. Bedrock layers are classified as a Principal aquifer. The groundwater is listed as being of high vulnerability. These are layers of rock deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply, and/or river base flow on a strategic scale.

According to the Envirocheck Database there is a single groundwater abstraction within 1,000m of the site, this is located 686m to the northwest, and is used to supply top-up water to Stanley Park.

3.3 Site Hydrology

Envirocheck records show Stanley Park Lake to be the closest surface water feature, which is located 411m to the northwest. The Leeds Liverpool Canal is located approximately 2.2km to the west and the River Mersey approximately 2.4km to the west. The River Mersey is considered likely to be the nearest surface water receptor to the site.

There are no surface water abstractions recorded within 1,000m of the site.

The Envirocheck report does not identify any waste water discharges within 1,000m of the site.

3.4 Waste

Envirocheck records no current or historical landfill sites within 1,000m of the site. A historical waste transfer facility was located 735m to the south of the site, the licence for which was surrendered in the year 2000.

3.5 Other Receptors

The site lies within a Nitrate Vulnerable Zone.

4.0 Site History

The site history was investigated through historical maps to search for potentially contaminative land uses during the life of the property and in its immediate surroundings. The pertinent findings of the historical map review are listed below in Table 3.

Date	Onsite	Offsite
1851	Site is a portion of a field.	Priory Lane is located in its current position, southeast of the site. Residential properties are present adjacent to the north and south.
1893	-	A mortuary chapel is present 200m to the north. Stanley Park has been developed to the west.
1908-10	-	A crematorium replaces residential property to the north.
1927-28	Current boundaries are established and the site is listed as a tennis court.	Further residential development to the north and south. Significant residential development occurs 170m to the south and 150m to the east. A tramway is shown 150m to the south, running east / west. Land to the east of the site is shown as allotments.
1949	The site is redeveloped into blocks of domestic sized garages. These are present along the northern, eastern and western boundaries and with two back-to-back blocks of seven garages in the centre of the site.	A school is developed immediately to the south of the site. The allotment to the north is now listed as part of Anfield Cemetery, which has expanded from the north.
1975	The site is listed as a garage with one of the two blocks of garages in the centre of the redeveloped into a shop in the current position of today's shop building. A canopy is shown in its current location.	-
2010	-	The school to the south has been demolished to slab level.

Table 3. Summary of Site History

The maps indicate that the site was developed as a petrol filling station (PFS) by the mid-1970s but prior to that there were a number of apparent domestic sized garages. It is unclear from site plans at what point the second block of garages in the centre of the site was converted into a Tyre garage that is currently at the site; it is either when the HGV pump island was installed or when the garages along the north eastern boundary became an MOT garage.

There are no potentially contaminative activities sufficiently close to the site to be considered a plausible hazard, with the exception of Anfield Cemetery, which may act as source of ground gases or the adjacent substation, although this is considered too recent to pose a risk.

5.0 Hazard Identification

UK legislation and guidance on assessing potentially contaminated land recommends the use of a risk assessment process based on a review of source/pathway/receptor relationships for various environmental media. The first stage of any risk assessment is to identify, using the desk study data and site information, the presence and extent of any hazard at the site, theoretical or demonstrable.

A key component of the overall risk assessment process is identification of "significant contamination linkages" between contaminants and receptors. This can be accomplished through development of a site-specific conceptual model in which the potential contaminants, pathways and receptors identified on-site are described.

Each element can be defined as follows:

- **Contaminant source:** A substance either on or under the land and which has the potential to cause harm or pollution to human or environmental receptors.
- **Pathway:** A route or means by which a receptor can be exposed to or affected by a source.
- **Receptor:** A living organism or an ecological system or, controlled water, or property including buildings, crops and livestock.

The presence of all three of the above elements identifies a contamination linkage and a potentially unacceptable risk. To ensure that any risk present to, or, from the site can be appropriately managed each of these contamination linkages will be targeted by the investigation.

5.1 Contaminant Source

The desk study identified use of the site as Petrol Filling Station (PFS) and potentially a maintenance garage to be the main potential contaminant sources at the site. Contamination may have occurred through leaks and spills from the fuel storage and distribution infrastructure and site drainage during the operational life of the site. Additionally, use of areas of the site for vehicle maintenance activities would be associated with releases of poorly stored chemicals and waste oils which may also pose risks to identified receptors.

Use of the neighbouring land as a cemetery since circa 1949 may also act as a contaminant source through off-gassing during decay. This will only occur under certain circumstances; if the burial site is waterlogged or has a shallow water table (which may slow down degradation through anaerobic processes and aid gas production), and if recent burials (less than 12 years, time for complete degradation to occur) have occurred. Groundwater contamination may occur as a result of leaching of embalming fluids and liquids which may affect the groundwater chemistry. None of these scenarios is considered likely to be significant or to pose a potential risk to the site and as such these will not be considered further.

No other activities on or offsite nearby are considered likely to act as a contaminant source.

5.2 Receptors or Point of Exposure

Potential receptors both on and offsite that could be affected by contamination hazards at the site are listed below:

- **Surface waters**

The nearest identified surface water body is likely to be the River Mersey, located 2.4km to the west of the site. Other identified water bodies are unlikely to be in connectivity with the groundwater.

- **Groundwater as a resource**

The bedrock is listed as a Principal aquifer with an abstraction point located 686m to the northwest.

- **Current site users**

This will include exposure to current and future staff on the site. The current hardcover use of the site will effectively sever many pathways, however in the event of a future change of use this may have to be taken into consideration.

- **Neighbouring site users**

Potential future neighbouring site users may be a receptor, located on the former school site, immediately to the south.

- **Construction workers**

Any construction workers involved in works in impacted areas may become directly exposed to contaminants. Any potential harm may easily be mitigated to this receptor through the use of appropriate Personal Protective Equipment (PPE). This represents an easy and low cost solution to any such hazard and as such it is not considered necessary to consider construction workers any further in this assessment.

5.3 Contamination Pathways

Potential pathways by which any identified contamination may manifest itself in the environment are as follows:

- **Groundwater migration**

  Records suggest that the underlying geology has the potential to provide a pathway for vertical migration, should the low permeability drift deposits be penetrated, and provide a potential threat to the water body within the bedrock.

- **Accumulation of volatile vapours and tainting of potable water**

  Volatile compounds may generate potentially harmful vapours which may accumulate within buildings onsite or offsite.

  Shallow contamination may migrate along, or within, water pipes or ducting, potentially providing a preferential pathway and permitting tainting of buried water pipes. Exposure to contaminated material may lead to tainting of potable water supplies.

- **Direct contact, inhalation and ingestion**

  This may occur during redevelopment works at the site or in the event of a future change of landuse. This pathway is not considered to be currently active due to the predominantly hardcover landuse of the site but may become active during any redevelopment or in future landscaped or garden areas.

5.4 Initial Contaminant Linkages

All contamination linkages arising as a result of the interconnection of the contaminant source, contamination pathways and potential receptors detailed above are summarised in Table 4, below. These contamination linkages are used to design the site investigation, guiding the type of investigation, location of soil bores and boreholes and the required sample analysis.

Linkage No.	Source	Pathway	Receptor
1	Potential releases and historical identified impact, leaks and spills associated with historical use of the site as a PFS and maintenance garage.	Leaching to, or, groundwater migration within the aquifer.	Surface waters such as the River Mersey.
2			The Principal Aquifer as a resource.
3		Exposure to harmful vapours and tainting of water supply.	Current and future site users, principally within buildings onsite.
4			Future neighbouring site users, principally within enclosed spaces.
5		Direct contact, inhalation and ingestion.	Site users.

Table 4. Identified Contamination Linkages

6.0 Site Investigation

In order to provide an assessment of each of the identified contamination linkages an intrusive investigation was specified to endeavour to obtain further information regarding the geology of the site and the quality of the soils and groundwater.

6.1 Soils Investigation

Nine soil bores (SB's 1-9) were constructed to depths of up to 1.6m below ground level at locations indicated on the figures presented in Appendix A.

The soil bores, constructed using percussive window sampling, were undertaken to the 'rock head', As a result of this drilling technique, relatively undisturbed shallow soil samples were able to be obtained for field analysis and for logging of ground conditions.

No groundwater was encountered during the site investigation.

Field analysis comprised the examination of each of the samples for visual and olfactory indications of contamination. Headspace analysis was also conducted for volatile hydrocarbons using a photo-ionisation detector (PID).

Ground conditions encountered across the site comprised tarmac and concrete hardstanding over a thin band of made ground, comprising an ashy, clayey sand and gravel fill overlying weathered, clayey sands. The top of the sandstone bedrock was encountered at depths of 0.9mbgl to 1.60mbgl.

Visual and olfactory indications of hydrocarbon contamination were encountered in shallow soils in SB7, near the forecourt (0.4-0.8mbgl). The logs, which are presented in Appendix C, detail the ground conditions and the sampling depths together with the visual and olfactory indications of contamination.

Table 5, overleaf, shows the locations of each soil bore and borehole along with justification of why the location was investigated.

Soilbore No.	Location	Justification
SB1	Rear of domestic style garages.	Assess area for potential shallow impact from garages. Explore potential for offsite migration.
SB2	Rear of maintenance garages and near to interceptor.	Assess area for potential historical impact in the garage area and potential impacts surrounding interceptor and drainage.
SB3	North of pumps 11/12, between maintenance garage buildings.	Investigate shallow soils around pump island and garages for localised impact.
SB4	Western boundary, near UST's and maintenance garage.	Assess for contamination localised around UST's and maintenance garage.
SB5	Jetwash bay, near vents.	Investigate for impact associated with vents or jet washes.
SB6	Adjacent to forecourt and USTs.	Investigate for impact associated with USTs and forecourt.
SB7	Roadside of forecourt and near to USTs.	Assess potential for contamination on the forecourt and offsite migration.
SB8	South of second tank farm.	Investigate for potential impact around tank farm, and for offsite migration.
SB9	Between maintenance garage and domestic style garages.	Investigate potential shallow impact around maintenance garage or domestic style garages.

Table 5. Soil bore and borehole location rationale

7.0 Laboratory Analysis

7.1 Analysis Rationale

Eight soil samples were selected for laboratory analysis following field screening, via visual and olfactory methods and using a Photo-Ionisation Detector (PID). The soil samples were collected from depths of 0.3m to 1.3m below ground level (mbgl).

Samples were analysed for contaminants associated with use of the site as a petrol filling station and maintenance garage, as specified in *Guidance for the Safe Development of Housing on Land Affected by Contamination* (EA / NHBC, 2008). Justification for sample location is shown below in Table 7.

Sample No.	Depth	Justification	Suite of Analysis
SB1	0.8m	Assess for shallow historical impact. Provide site coverage. PID readings indicate possible impact at this depth. 'Clean' soils encountered beneath this depth.	Hydrocarbons (TPH-CWG), Volatile and semi-volatile organic compounds (VOC + SVOC suites), BTEX, MTBE.
SB3	0.3m	Assess potential for shallow impact in near pumps 11/12.	Heavy Metals (CLEA suite), Hydrocarbons (TPH-CWG), BTEX, MTBE, Asbestos, TOC.
SB4	0.3m	Assess shallow soil conditions near to maintenance garage and UST's.	Hydrocarbons (TPH-CWG), BTEX, MTBE, Asbestos, Heavy Metals (CLEA suite).
SB5	0.8m	Assess potential for shallow impact around jetwash and vents.	Hydrocarbons (TPH-CWG), BTEX, MTBE, Total Organic Carbon.
SB6	0.3m	Assess potential for horizontal and vertical migration from the forecourt and UST's.	Hydrocarbons (TPH-CWG), BTEX, MTBE, Asbestos.
SB7	0.8m	Explore potential identified hydrocarbon impact. Investigate potential for offsite migration from forecourt.	Hydrocarbons (TPH-CWG), Volatile and semi-volatile organic compounds (VOC + SVOC suites), BTEX, MTBE.
SB8	1.3m	Assess potential for horizontal or offsite migration from UST's.	Hydrocarbons (TPH-CWG), BTEX, MTBE, TOC.
SB9	0.3m	Assess potential for shallow impact from maintenance garage or domestic style garages.	Hydrocarbons (TPH-CWG), BTEX, MTBE, Heavy Metals (CLEA suite), Asbestos.

Table 7. Sample selection strategy

7.2 Soil Analysis

The analysis, conducted by a Gas Chromatography / Flame Ionisation Detector (GC/FID) and Gas Chromatography / Mass Spectrometry (GC / MS) comprised fractionation and speciation of hydrocarbons including analysis for benzene, toluene, ethylbenzene and xylenes (BTEX) and MTBE compounds. Selected samples were analysed for heavy metals by IRIS emission spectroscopy and volatile and semi volatile components (including PAHs), by GC/MS) and asbestos.

The analytical results were analysed for contaminants associated with use of the site as a PFS and potential maintenance garage. The results of soil analysis were compared using the following UK guidance:

- EA SGV Values;
- Suitable for Use Levels (S4ULs) or LQM/CIEH's Category 4 Screening Levels (C4SLs); or
- EIC Soil Generic Assessment Criteria for Human Health (2010).

The results of laboratory analysis are presented below and overleaf in Tables 8, 9, 10 and 11 and documented in Appendix C.

Contaminant	SB1	SB3	SB4	SB5	SB6	SB7	SB8	SB9
Depth	**0.8m**	**0.3m**	**0.3m**	**0.8m**	**0.3m**	**0.8m**	**1.3m**	**0.3m**
	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Benzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Ethylbenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
m- & p- Xylenes	<1.0	<1.0	<1.0	<1.0	<1.0	15	<1.0	1.4
o-Xylenes	<1.0	<1.0	<1.0	<1.0	<1.0	6.7	<1.0	<1.0
MTBE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Aliphatic	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
Aliphatic C5-C6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic >C6-C8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic >C8-C10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic >C10-C12	22	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic >C12-C16	88	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic >C16-C21	150	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic >C21-C35	430	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic >C35-C44	280	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatics	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
Aromatic C5-C7	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic >C7-C8	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic >C8-C10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic >C10-C12	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic >C12-C16	1,000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	16
Aromatic >C16-C21	3,500	22	18	11	38	3.1	1.6	82
Aromatic >C21-C35	8,500	27	22	15	80	< 1.0	< 1.0	120
Aromatic >C35-C44	390	< 1.0	< 1.0	< 1.0	4.8	< 1.0	< 1.0	9.1
TPH	14,000	49	40	27	120	< 10	< 10	230

Table 8. Results of laboratory analysis for hydrocarbons in soils

Elevated concentrations of hydrocarbons were encountered in the sample from SB1, with the banding of the observed impact in this sample being indicative of a diesel or heavy oil range

impact. All other concentrations of contaminants are considered to be at low to background concentrations. None of these concentrations of contaminants are considered to present a potential risk to human health in a commercial setting, as all fall below generic screening criteria, as derived by the Environment Agency (SGV), LQM/ CIEH (S4ULs) and EIC.

The results of the heavy metal analysis from three soil shallow samples are shown below in Table 9. All concentrations fall below the generic screening criteria to be protective of human health in a commercial setting.

Sample No.	Depth (m)	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn	ACM
SB3	0.3	6.7	0.14	14	20	<0.1	14	140	<0.2	350	ND
SB4	0.3	16	0.2	19	36	<0.1	23	98	<0.2	78	ND
SB9	0.3	23	0.32	14	98	0.3	30	140	<0.2	210	ND
SB6	0.3	-	-	-	-	-	-	-	-	-	ND
Background		15-25	<1.8	120-180	-	-	15-30	150	-	-	-

Table 9. Results of heavy metal and asbestos analysis in soils in mg/kg

An asbestos screen of selected samples indicated no trace of asbestos fibres in four samples of made ground, SB3, SB4, SB6 and SB9 from near surface soils across the site.

Tables 10 and 11, overleaf, summarise the results of semi volatile and volatile organic contaminants analysis of the soil samples obtained.

Contaminant (mg/kg)	SB1 0.8m	SB7 0.8m	Contaminant (mg/kg)	SB1 0.8m	SB7 0.8m
SVOC			**Phthalates**		
2,4,5-Trichlorophenol	< 0.50	< 0.50	Bis (2-ethylhexyl)phthalate	<0.5	<0.5
2,4,6-Trichlorophenol	< 0.50	<0.50	Butyl benzylphthalate	<0.5	<0.5
2,4-Dichlorophenol	<0.50	<0.50	Di-n-butylphthalate	<0.5	<0.5
2,4-Dimethylphenol	<0.50	< 0.50	Di-n-octylphthalate	<0.5	<0.5
2,4-Dinitrophenol	< 0.50	< 0.50	Diethyl phthalate	<0.5	<0.5
2-Chlorophenol	< 0.50	< 0.50	Dimethyl phthalate	<0.5	<0.5
2-methyl phenol	< 0.50	< 0.50			
2-methyl-4,6-dinitrophenol	< 0.50	< 0.50	**Other Semi-Volatiles**		
2-Nitrophenol	< 0.50	< 0.50	1,2,3-Trichlorobenzene	<0.5	<0.5
4-Methylphenol	< 0.50	< 0.50	1,2,4-Trichlorobenzene	<0.5	<0.5
4-Chloro-3-methylphenol	< 0.50	< 0.50	1,2-Dibromo-3-chloropropane	<0.5	<0.5
4-Nitrophenol	< 0.50	< 0.50	1,2-Dichlorobenzene	<0.5	<0.5
Pentachlorophenol	< 0.50	< 0.50	1,3-Dichlorobenzene	<0.5	<0.5
Phenol	< 0.50	< 0.50	1,4-Dichlorobenzene	<0.5	<0.5
N-Nitrosodi-n-propylamine	< 0.50	< 0.50	2,4-Dinitrotoluene	<0.5	<0.5
			2,6-Dinitrotoluene	<0.5	<0.5
PAH			2-Nitroaniline	<0.5	<0.5
2-Chloronaphthalene	< 0.50	< 0.50	3-Nitroaniline	<0.5	<0.5
2-Methylnaphthalene	23	< 0.50	4-Bromophenyl phenylether	<0.5	<0.5
Acenaphthene	91	< 0.50	4-Chloroaniline	<0.5	<0.5
Acenaphthylene	< 0.50	< 0.50	4-Chlorophenyl phenylether	<0.5	<0.5
Anthracene	120	< 0.50	4-Nitroaniline	<0.5	<0.5
Benzo(a)Anthracene	200	< 0.50	Bis (2-chloroethoxy) methane	<0.5	<0.5
Benzo(a)Pyrene	200	< 0.50	Bis (2-chloroethyl) ether	<0.5	<0.5
Benzo(b/k) Fluoranthene	340	< 0.50	Bis (2-chloroisopropyl) ether	<0.5	<0.5
Benzo(ghi)Perylene	140	< 0.50	Carbazole	35	<0.50
Chrysene	190	< 0.50	Dibenzofuran	45	<0.50
Dibenzo(ah) Anthracene	50	< 0.50	Hexachlorobenzene	<0.5	<0.5
Fluoranthene	420	< 0.50	Hexachlorobutadiene	<0.5	<0.5
Fluorene	68	< 0.50	Hexachlorocyclo pentadiene	<0.5	<0.5
Indeno(123-cd)Pyrene	120	< 0.50	Hexachloroethane	<0.5	<0.5
Naphthalene	26	< 0.50	Isophorone	<0.5	<0.5
Phenanthrene	390	< 0.50	Nitrobenzene	<0.5	<0.5
Pyrene	400	< 0.50	N-butylbenzene	<0.5	<0.5

Table 10. Summary of SVOC Analysis

Analysis of the samples indicated elevated concentrations of SVOC compounds in the sample from SB1 (0.8m). However, a comparison of concentrations present with a PAH double ratio plot (included in Appendix D), indicate that these concentrations are associated with the presence of coal fragments in the ashy made ground rather than being from a fuel source.

Contaminant (µg/kg)	SB1 0.8m	SB7 0.8m	Contaminant (µg/kg)	SB1 0.8m	SB7 0.8m
Volatile Organic Compounds			**Volatile Organic Compounds**		
1,1,1,2-Tetrachloroethane	<2	<2	Chloroethane	<2	<2
1,1,1-Trichloroethane	<1	<1	Chloromethane	<1	<1
1,1,2-Trichloroethane	<10	<10	Cis-1,2-Dichloroethene	<1	<1
1,1-Dichloroethane	<1	<1	Cis-1,3-Dichloropropene	<10	<10
1,1-Dichloroethene	<1	<1	Dibromochloromethane	<10	<10
1,1-Dichloropropene	<1	<1	Dibromomethane	<10	<10
1,2,3-Trichloropropane	<50	<50	Dichlorodifluoromethane	<1	<1
1,2,3-Trichlorobenzene	<1	<1	Dichloromethane	ne	ne
1,2,4-Trichlorobenzene	<1	<1	Hexachlorobenzene	<1	<1
1,2,4-Trimethylbenzene	<1	<1	Isopropyl benzene	<1	<1
1,2-Dibromo-3-chloropropane	<1	<1	n-Butylbenzene	<1.0	<1.0
1,2-Dibromoethane	<5	<5	n-Propylbenzene	<1.0	<1.0
1,2-Dichlorobenzene	<1	<1	Sec-Butylbenzene	<1.0	<1.0
1,2-Dichloroethane	<1	<1	Styrene	<10	<10
1,2-Dichloropropane	<1	<1	Tert-Butylbenzene	<1	<1
1,3,5-Trimethylbenzene	<1	<1	Trans-1,2-Dichloroethene	<10	<10
1,3-Dichlorobenzene	<1	<1	Trans-1,3-Dichloropropene	<1	<1
1,3-Dichloropropane	<2	<2	Tetrachloroethene	<1	<1
1,4-Dichlorobenzene	<1	<1	Tetrachloromethane	<1	<1
2-Chlorotoluene	<1	<1	Trichloroethane	<1	<1
4-Chlorotoluene	<1	<1	Tribromomethane	<10	<10
4-Isopropyltoluene	<1	<1	Trichloromethane	<1	<1
Bromobenzene	<20	<20	Trichloromethene	<1	<1
Bromochloromethane	<1	<1	Trichlorofluoromethane	<1	<1
Bromodichloromethane	<5	<5	Vinyl Chloride	<1	<1
Bromomethane	<20	<20			
Chlorobenzene	<1	<1			

Table 11. Summary of VOC Analysis

Analysis of the samples indicated no concentrations of VOC compounds above laboratory detection limits in SB1 (0.8m) and SB7 (0.8m). As such there are no exceedances of available generic assessment criteria (i.e. SGV, LQM / CIEH and/or EIC screening criteria) for soils to be protective of human health (assuming a commercial industrial end use of the site and a SOM of 1%).

8.0 Risk Estimation

8.1 Discussion of Investigation Findings

Sampling of shallow soils did not encounter any evidence of significant contamination associated with use of the site as a petrol filling station and maintenance garage. It was not possible to extend soil bores to below the likely base of the UST's, due to the presence of shallow sandstone bedrock at depths of approximately 1.5mbgl beneath the site.

As the site is not currently distributing fuel, no up to date stock reconciliation records were available for review, and as such, no comment can be made on the integrity of the fuel storage and distribution infrastructure. It is understood that the UST's have been relined in the past ten years, and that a full tank and line test is to be undertaken prior to the proposed redevelopment. Should this test indicate that the integrity of the fuel storage and distribution infrastructure is sound, it is not considered likely that an ongoing source is present at the site, however, it should be noted that presence of deeper historical impacts cannot be ruled out.

8.2 Qualitative Risk Assessment

Each of the identified plausible contamination linkages in the preliminary conceptual site model is reviewed based upon the findings of the site investigation which allows a greater understanding of the ground conditions at the site, site observations, soil and groundwater quality and chemical analysis. This review, discussed for each contamination linkage, allows a qualitative risk assessment to be undertaken.

A qualitative risk assessment is undertaken in line with guidance provided in *Guidance for the Safe Development of Housing on Land Affected by Contamination* (EA / NHBC, 2008). The purpose of this assessment is to determine the relative significance of the identified contamination linkages by assessing the probability of an impact occurring and by assessing the perceived severity of an impact to a receptor.

Those linkages considered of low risk or less on the basis of the additional site data will not be considered any further in this assessment. Linkages considered to be more significant are identified as presenting the possibility of significant harm (PoSH), which may present a potentially unacceptable risk to the identified receptor. In these instances further works may be considered necessary.