

PHASE 2 GEOENVIRONMENTAL REPORT
at
SITE OF PROPOSED RESIDENTIAL DEVELOPMENT
EVERTON ROAD
LIVERPOOL



13-B-10198

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1. INTRODUCTION AND OBJECTIVES

This report has been prepared at the request of Seddon Construction Ltd, at the site of a proposed new residential development on land to the north east of Everton Road, Liverpool. At the time of writing, former housing and a public house on site have been demolished, and consideration is being given to the construction of new social housing units with associated drainage and infrastructure.

The site's geographic and geological setting, together with its history and potential for environmental contamination has been described in the Phase 1 Preliminary Risk Assessment Report prepared by this practice and dated 21st August 2013.

The objective of the report was ultimately to support a proposed Planning Application as follows:

- obtain information, from accessible sources, about the soil and groundwater conditions within the area of the site.
- to determine the possible ground related geotechnical and contamination hazards within the site boundaries that may affect the proposed development.
- to provide preliminary development recommendations.
- to provide advice on further works required for the cost effective reduction of risks to the development and procedures likely to satisfy regulators.

The site comprises an irregular shaped plot of land at the junction of Everton Road and Spencer Street, Liverpool. Cresswell Street also forms the southern boundary. The National Grid Reference for the approximate centre of the site is 335900,391260. The former development on site consisted of a public house at the junction of Spencer Street and Everton Road, together with terraced housing fronting onto Everton Road and Cresswell Street. Also, the northern part of the site (accessed from Spencer Street) previously had a workshop building. The site is approximately level, and has a surface finish of unmanaged vegetation (grass and trees). The site is also crossed by a gravel path. There are no watercourses on site, and no major trees, other than the small trees & bushes.

The report indicated that the site had been developed in the past, and the previous developments included a public house, terraced housing, and also a workshop (handicraft centre) at the northern end of the site. By 1979, the terraced housing fronting onto Everton Road and Cresswell Street had been demolished, and the site appeared to have been landscaped at this time. The public house remained until very recently.

The report indicated that possible sources of contamination were present, relating to activities within the handicraft centre, which may have been used for light manufacture on site. This could have led to contamination possibly from hydrocarbons and metals. Also, contamination was considered possible from any made ground within backfilled cellars to the former public house and terraced housing.

The report also indicated that the possibility of asbestos within any made ground may be present.

The report stated that the wider area was unlikely to have suffered from major levels of contamination, as the principal development within 250m or thereabouts, appears to have been largely residential since earliest recorded times.

The report recommended that a future intrusive Phase 2 intrusive site investigation should be undertaken. Specifically, a sampling and trial pit investigation was recommended to confirm ground conditions, and a further recommendation was made that soil samples should be taken and tested for chemical analysis so that a more detailed risk assessment to human health be determined. The report Appendices contained a full set of historical mapping and site specific environmental data.

2 STATUTORY CONSULTATIONS

To date, no statutory consultations have been undertaken with the Local Authority. However, the recommendations of the Phase 1 Preliminary Risk Assessment have been brought forward into the Phase 2 investigation and are considered to be prudent.

These include the following activities:

- 4 boreholes and 4 hand dug trial pits.
- Conversion of 3 of the boreholes for ground gas monitoring.
- Soil sampling, involving the collection of a total of 8 soil samples to be analysed for the following potential contaminants:
 - heavy metals
 - sulphate & Ph
 - asbestos screening
 - speciated PAH (USEPA16)
 - carbon banded TPH

3 SITE INVESTIGATION

The site investigation was undertaken in February 2014. The site works were undertaken by Mini Soil Surveys (Bolton) Ltd, acting under our direct control and supervision.

Soil sampling was undertaken on site by this practice, and placed in standard sealed contamination test jars. The samples were delivered to SAL at Old Trafford, Manchester, for testing.

The investigation comprised 4 boreholes and 4 trial pits and the Location Plan is included in Appendix B.

Boreholes were typically sunk to a maximum depth of 4.0m.

Boreholes show a similar soil profile. However, Borehole 1 (at the north end of the site) encountered sandstone bedrock at very shallow depth.

Boreholes 2, 3, and 4 indicated made ground to a maximum depth of 2.8m, overlying weathered sandstone and sandstone bedrock.

Boreholes 2, 3 & 4 were sunk within the former public house and terraced housing, and these properties are believed to have contained cellars.

All boreholes were found to be dry.

On completion, it was intended that all 4 boreholes should be converted for gas monitoring. However, the very shallow borehole (Borehole 1) was deemed to be insufficiently deep for ground gas conversion and, accordingly, this was limited to Boreholes 2, 3, and 4.

4 TRIAL PITS

A total of 4 trial pits were excavated by hand.

Trial Pits A & B indicated turf and made ground (comprising ash, cinder, brick, and occasional cobbles) to depths of 300mm and 700mm. At these depths, weathered sandstone was encountered.

In Trial Pits C & D, made ground was encountered down to a typical depth of 1m. Weathered sandstone was encountered in Trial Pit D.

Standing water was not encountered in the trial pits.

5 GEOCHEMICAL RISK ASSESSMENT

Former site usage suggested a potentially low to moderate risk of contamination on site, and significant levels of inground contamination were not anticipated.

Within the Phase 1 PRA, a Conceptual Site Model is presented, identifying possible potential sources of contamination, possible release mechanisms, potential pathways, and varying risks. Reference should be made to this table.

6 CHEMICAL TESTING AND APPRAISAL

Chemical testing has been carried out on 8 soil samples, typically from depths of 0.3 – 0.8m, collected within the boreholes and trial pits.

Soil testing was carried out for the following forms of contamination:

- heavy metals
- pH & sulphate
- carbon banded TPH
- speciated PAH (USEPA16)
- asbestos screening

A summary of the results is included in the table below:

6.1 SOIL TESTING

CONTAMINANT	CONCENTRATION (mg/kg)		TARGET (see notes below)	COMMENTS & RISK
	min	max		
METALS				
Arsenic	5	10	32	LOW
Boron (water soluble)	<1	<1	290	LOW
Cadmium	<1	<1	10	LOW
Chromium	8	17	130	LOW
Chromium VI	<1	<1	4.3	LOW
Copper	14	4600	2330	ELEVATED IN BH 2
Cyanide (total)	<1	<1		LOW
Cyanide (free)	<1	<1		LOW

Lead	80	1700	450	ELEVATED IN BH'S 2 & 4 & TPC
Mercury	<1	1	11	LOW
Nickel	5	13	130	LOW
Phenols (mono)	<1	<1		LOW
Selenium	<3	<3	350	LOW
Sulphide	<10	<10		LOW
Sulphur (free)	<500	<500		LOW
Thiocyanate	<10	<10		LOW
Zinc	60	460	3750	LOW
POLYAROMATIC HYDROCARBONS				
Napthalene	0.01	0.28	1.5	LOW
Acenaphthylene	<0.01	0.05	170	LOW
Acenaphthene	0.01	0.95	210	LOW
Fluorene	0.01	0.49	160	LOW
Phenanthrene	0.09	2.4	92	LOW
Anthracene	0.04	0.58	2300	LOW
Fluoranthene	0.26	1.8	260	LOW
Pyrene	0.13	2.2	560	LOW
Benzo(a)Anthracene	0.07	1.2	3.1	LOW
Chrysene	0.07	1.1	6.0	LOW
Benzo(b/k)Fluoranthene	0.12	1.5	56	LOW
Benzo(a)Pyrene	0.06	0.92	0.83	SLIGHTLY ELEVATED IN TPA
Indeno(123-cd)Pyrene	0.05	0.51	3.2	LOW
Dibenzo(ah)Anthracene	0.07	0.14	0.76	LOW
Benzo(ghi)Perylene	0.04	0.41	44	LOW
PAH(total)	1.5	8.2		LOW
TOTAL PETROLEUM HYDROCARBONS				
TPH (C8-C10)	<1	<1	1.09	LOW

TPH (C10-C12)	<1	<1	69	LOW
TPH (C12-C16)	<1	3	140	LOW
TPH (C16-C21)	<1	20	250	LOW
TPH (C21-C35)	2	61	890	LOW
pH & Sulphate				
pH	7.6	8.6		
ASBESTOS TESTING				
None detected within the 8 soil samples				

Notes

Values above are based upon Soil Guideline Values published by DEFRA & the Environment Agency. Where these have not been published, SGV's are based upon Generic Assessment Criteria for Human Health Assessment by Land Quality Management (LQM) & Chartered Institute of Environmental Health (2nd Edition)

Comments

Metals

An elevated level of copper was encountered in Borehole 2 and elevated levels of lead were encountered in Boreholes 2 & 4, and also Trial Pit C. No other elevated levels of metals were encountered.

PAH

A single slightly elevated level of Benzo(a)Pyrene was encountered in Trial Pit A.

TPH

No elevated levels of TPH were encountered.

7 GROUND GAS MONITORING

Three boreholes have been converted for ground gas monitoring to establish a ground gas monitoring regime. Monitoring will be carried out to test for the presence of methane and carbon dioxide gases. This is presently ongoing, and the results, when available, will be assessed against the risk criteria in Ciria Report 665.

8 SOIL STRENGTH TESTING

The Following insitu and laboratory tests were carried out in order to provide the required data for estimated safe bearing capacities of the various strata:

- insitu Standard Penetration Tests (SPT's)

MADE GROUND

This material is regarded as unsuitable for use as a foundation bearing strata.

SANDSTONE BEDROCK

Sandstone bedrock is known to be present at shallow depths within the immediate area, and is not overlain by drift geology.

SPT results could not be taken on the sandstone bedrock due to refusal.

9 REVISED ENVIRONMENTAL RISK ASSESSMENT

The table indicated hereunder sets out a revised Risk Assessment in respect of ground gases and soil contamination.

RISK ASSESSMENT TABLE

<u>HAZARD</u>	<u>RECEPTOR</u>	<u>PATHWAY</u>	<u>RISK WITHOUT MITIGATION</u>	<u>MITIGATING MEASURES</u>	<u>RISK WITH MITIGATION</u>
*Ground Gases	Future residents	Vapour migration	TBD	#Gas barrier & vented floor voids	Low
Soil Contamination	Future residents	Dermal contact, ingestion and inhalation of contaminated soil and dust	Moderate	Clean soil capping layer	Low
Soil Contamination	Vegetation	Uptake of contaminants via plant growth	Moderate	Clean soil capping layer	Low
Soil contamination	Ground Water	Migration to aquifer	Low	None	Low
Soil contamination	Construction workers	Dermal contact	Low	PPE	Low

*Note – Ground gas monitoring presently ongoing

10 GEOTECHNICAL CONCLUSIONS & RECOMMENDATIONS

It is our opinion that the proposed properties at the northern end of the site (fronting Spencer Street) can be constructed on shallow concrete strip foundations, bearing directly onto shallow sandstone bedrock.

Elsewhere, to the properties fronting Everton Rod and Spencer Street, there is approximately 2.0m - 2.5m of made ground consisting of backfill into the former cellars.

Foundation options could involve the removal of the backfill, and construction of concrete strip foundations on the sandstone bedrock just below former cellar level. Alternatively, a pier and beam type foundation arrangement could be constructed, with concrete piers supporting reinforced concrete ground beams. The piers would bear onto sandstone bedrock, and could be constructed using manhole rings filled with concrete.

We consider that the sandstone bedrock has a minimum safe bearing capacity of 500kN/m².

11 ENVIRONMENTAL CONSIDERATIONS & RECOMMENDATIONS

The proposal is to build low rise residential housing with private gardens that could be used for vegetable growth.

Extensive sampling and contamination testing has been undertaken. This revealed relatively low levels of contamination, though some elevated levels of copper and lead, together with a slightly elevated level of B(a)P have been identified in the investigation.

Accordingly, we are of the opinion that the measured levels of contamination, whilst posing a threat to public health if unmitigated, are not so great that the soils require removal. We consider that contaminated soils may safely remain in place, below structures and hardstandings of the development. Accordingly, we consider that a default remediation strategy can be adopted to gardens and unsurfaced/soft landscaped areas where prolonged human contact with soil is possible, or where vegetable growth could take place. Effectively, this would comprise a remediation exercise to ensure that the average contamination levels in the upper 600mm of material lie below the relevant soil guideline value.

We would recommend that if any material is brought to site to significantly alter levels or to provide finishes to soft landscaped areas, then the suitability of this material should be confirmed by testing, to ensure it is fit for purpose.

It must be appreciated that localised levels of contamination may be discovered that exceed those identified, and appropriate action/treatment may be required.

Therefore, as part of the development work on site, a careful inspection of all excavations should be undertaken, and any materials which may be suspected to contain higher or differing levels of contamination beyond those identified should be subject to further relevant testing and appraisal.

Disposal of any contaminated soil from the site may attract a premium. However, reference should be made to relevant disposal operators & authorities regarding this issue.

Consultations are also likely to be required in due course with United Utilities regarding a suitable form of water supply pipeline.

Based on the fact that there are no surface water features on or close to the site boundary, and the presence of sandstone bedrock, we consider that there is little to no risk of the proposed development causing a threat to controlled waters. This view should, however, be confirmed with the Local Authority and the Environment Agency.

Monitoring of ground gases for the presence of methane, carbon dioxide and oxygen is ongoing. The final results and ground gas exclusion measures (if required) will be drawn up in due course.

Should a gas membrane be required, installation should be verified by an appropriate third party specialist, with documentary evidence (diary entries, photographic evidence etc) recorded by the main contractor.

SIGNED

C.R. CARLEY
CARLEY DAINES & PARTNERS

A P P E N D I X A

L O C A T I O N P L A N S

APPENDIX B

BOREHOLE LOGS

APPENDIX C

TRIAL PIT LOGS

A P P E N D I X D

CHEMICAL TEST RESULTS

A P P E N D I X E

GROUND GAS MONITORING