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# REMEDIATION METHOD STATEMENT

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58 Renfrew Street  
Glasgow  
G2 3BW



Client: ES Renfield Limited

14 August 2018

J18065



# Document control

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*This report is intended as a Ground Investigation Report (GIR) as defined in BS EN1997-2, unless specifically noted otherwise. The report is not a Geotechnical Design Report (GDR) as defined in EN1997-2 and recommendations made within this report are for guidance only.*

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## 1.0 INTRODUCTION

Consideration is being given to the construction of a 13-storey to 15-storey hotel and a 16-storey block of student accommodation, along with two areas of soft landscaped amenity space. The site has previously been subject to a desk study and ground investigation by GEA (Report Ref J18065, dated 30 May 2018). The previous work identified fragments of asbestos within the shallow made ground and, at a single location, elevated TPH, PAH and phenol concentrations were measured.

This report forms a Remedial Method Statement and should be read in conjunction with the previous reports.

### 1.1 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the investigations carried out. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil, gas or groundwater samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

## 2.0 THE SITE

The site is located in Glasgow city centre, approximately 450 m northwest of Queen Street railway station. The site is irregular in shape measuring 85 m north to south by 95 m east to west in maximum dimension and is bounded by Renfrew Street to the south, from which it is accessed, and

by Renfield Street to the east; the northern boundary of the site is formed by an office building occupied by Tesco Bank. The western boundary is irregular in shape and formed by the Citizen M hotel in the southwestern corner and the Theatre Royal in the northwestern corner. A service yard is located between these two buildings and forms part of the site, but is not going to be developed as part of the proposed scheme.

The area immediately adjacent to the northern site boundary is surfaced with concrete and is at a level of 30.1 m OD. From this area the site slopes steeply up a grassed bank to a level of 30.9 m OD and then slopes gently down to the south to the level of the entrance from Renfrew Street at 28.3 m OD.

The site occupies an area of 0.44 Ha and its centre may additionally be located by National Grid Reference 258930, 665920.

## 3.0 EXPLORATORY WORK

A series of seven boreholes was drilled, to a maximum depth of 30.2 m. Three of the boreholes were advanced using rotary coring techniques and the remaining four by open-drive sampling. Standard penetration tests (SPTs) were carried out at regular intervals in the boreholes and disturbed and undisturbed samples were recovered for subsequent laboratory examination and testing.

Combined gas and groundwater monitoring standpipes were installed in three of the boreholes, to depths of between 3.0 m and 4.0 m, and a single groundwater monitoring standpipe was installed into one of the boreholes.

In addition a series of five trial trenches were mechanically excavated to a maximum depth of 4.0 m with the aim of physically exposing the edge of the sandstone face.

#### 4.0 GROUND CONDITIONS

The investigation has indicated that the site is generally underlain by a significant thickness of made ground associated with the former quarry, which extended to a depth of about 12 m. However, in the northeastern part of the site the made ground was found to extend to a depth of only around 2.0 m and was directly underlain by moderately strong sandstone, which extended to the maximum depth investigated of 19.2 m. Below the remainder of the site made ground comprised soft, firm and stiff gravelly clay with gravel sized fragments of brick, sandstone and occasionally concrete and metal. Beneath the made ground, sandstone was encountered at about 12 m and proved to the maximum depth investigated, of roughly 30 m.

Groundwater was encountered as occasional seepages in the made ground but a general water table is apparently present at a depth of about 13 m. The contamination testing has revealed generally low contaminant concentrations all of which were below the adopted human health screening values for a commercial end use.

Borehole No 6 has however revealed contaminants that, whilst below the human health screening values, require additional consideration. The sample from 0.9 m is described as containing microscopic fragments of asbestos sheeting board and the sample from a small pocket of limited thickness at a depth of 2.8 m contained material with a strong coal tar odour. The testing has confirmed the coal tar compounds including highly elevated PAH, TPH and phenol. The material represented by the testing could pose an odour nuisance and the phenol concentration is

sufficiently high to pose a risk to groundwater quality if it were to leach through the soil to the aquifer, as well as posing an odour nuisance to end users

#### 5.0 GROUND MODEL

On the basis of the intrusive investigation, the ground conditions at this site can be characterised as follows:

the site is located over a backfilled former quarry from which sandstone of the Upper Limestone Formation was extracted. The backfill comprises made ground that extends to depths of between 11.8 m and 12.6 m within the quarry and between 1.65 m and 2.70 m outside the quarry;

- the made ground generally comprises sandy gavel, cobbles and boulders of sandstone, brick and concrete with much reinforcement to around 2.0 m and sandy clay with fragments of brick, concrete and sandstone beneath that;
- the Upper Limestone Formation generally comprises very pale brown and pale grey moderately weak to moderately strong sandstone;
- groundwater is present at around 8 m to 9 m depth with a perched body of groundwater at around 3.0 m in the northwest of the site; and
- the made ground contains elevated concentrations of the TPH, PAH and phenols at a single location as well as microscopic and identifiable fragments of asbestos containing material, but generally concentrations are within acceptable limits for the proposed redevelopment.

## 6.0 CONCEPTUAL MODEL

The table below sets out the risk pathways that could potentially be present following the commercial development of the site. This conceptual model is based upon the findings of the ground model developed in the light of the investigation findings and highlights areas where remedial work should be considered.

SOURCE	RECEPTOR	PATHWAY	COMMENT
Localised TPH and PAH and phenol concentrations  Asbestos	End users	Direct contact, accidental ingestion or inhalation of soil or soil derived dust	No direct contact due to footprint of the buildings and surrounds. Areas of soft landscaping will be incorporate imported certified clean sub-soil and topsoil as a planting medium.
	Vegetation	Uptake via soil through roots in landscaped areas	
	Groundwater	Percolation and leaching of surface run-off in areas of soft landscaping	Following removal of the source no residual risks will remain.
	Adjacent sites	Mobilisation of contaminants to underlying aquifer via leaching	
	Ground workers and future site workers	Ingestion of contaminated soil or dust, through skin contact or inhalation although in acute dose the risk posed by the concentrations present is considered to be small	Skin contact with the soil should be minimized through the use of PPE and washing facilities will be provided
	Buried services	Direct contact with soil	Contamination will be isolated from buried services through the use of oversized, clean backfilled trenches or through the use of barrier pipe

## 7.0 RISK ASSESSMENT

The chemical analyses highlighted the presence of PAH and TPH concentrations within the made ground in a single location, Borehole No 6, which, whilst not posing an unacceptable human health risk could pose a risk of affecting groundwater quality and potentially nuisance odours. The material is indicative of coal tar and was identified at a depth of 2.80 m. Microscopic evidence of asbestos was identified within a single sample, also from Borehole No 6, at a depth of 0.9 m and larger fragments of suspected asbestos were identified within Trial Trench No 5. Fibres of asbestos will pose a risk through inhalation of airborne fibres.

### 7.1 Human Health Risk Assessment

Given the presence of the identified contaminants within the made ground it is recommended that the coal tar contamination should be removed from site through targeted excavation and that any identifiable fragments of asbestos containing material hand-picked during the reprofiling of the site or the excavation of the made ground to remove obstructions and reinforcement in advance of piling.

Two amenity areas are proposed for the site and certified clean subsoil and topsoil will be imported into these areas of soft landscaping. As well as supporting the growth of plants, such material will also break any plausible linkage between the contamination in the soil and the end users.

### 7.2 Site Workers

Site workers should be made aware of the contamination and a programme of working should be identified to protect workers handling any soil and to minimise dust generation. To this end, the site should be damped down during dry periods. The method of site working should be

in accordance with guidelines set out by HSE and CIRIA and the requirements of the Local Authority Environmental Health Officer.

### 7.3 Services

Consideration may need to be given to the protection of buried plastic services if they are to be laid within the made ground in the vicinity of the coal tar contamination. Details of the proposed protection measures for buried plastic services will in any case need to be approved by the EHO and the relevant service authority prior to the adoption of any scheme. It is probable that barrier pipe would be required or that additional testing will need to be carried out to satisfy the Water Authority.

### 7.4 Groundwater

Following the removal of the source the risk to groundwater through leaching and migration will also have been removed but in any case the site is not considered to be posing a significant risk to groundwater.

## 8.0 REMEDIAL OBJECTIVES

Based on the above risk assessment the following remedial objectives have been established for this development;

- break the potential chronic human exposure pathways to the contaminated soil in areas which are not to be covered by hard structures and pavements;
- prevent the ingress of volatile contamination into the proposed buildings;
- protect ground workers who will be exposed to the soil; and

- provide buried water pipes with protection to minimise the potential for permeation or degradation by contaminants and to minimise the potential exposure of future maintenance personnel.

## 9.0 REMEDIAL PROPOSALS

The site investigation and risk assessment have identified potential risks to end users of the site and as such remedial measures will be implemented to ensure the safe development of the site. To address the remedial objectives the remedial measures will include;

- the removal of the coal tar contamination in the vicinity of Borehole No 6;
- the removal of identifiable fragments of asbestos during site preparation; and
- the installation of a soil cap of 'clean' soil in landscaped areas to prevent end users coming in to contact with potential contaminated soil through direct contact. This capping will also minimise the potential for dust generation from the existing made ground;

The details of these remedial measures are set out below:

### 9.1 Coal Tar Contamination

The odorous and stained soil identified in Borehole No 6 at 2.8 m will be excavated and the resultant excavation backfilled with clean material to remove the risk of vapour ingress into the proposed buildings and any potential for groundwater impaction.

### 9.2 Hydrocarbon Contamination

In areas proposed for amenity soft landscaping the made ground will be removed to a depth of 0.60 m and a capping layer comprising a layer of topsoil and subsoil with a geotextile at the base will be installed over the made ground. The capping layer will prevent direct contact with the potentially contaminated soils below the site and will eliminate the potential for the generation of soil derived dust that could potentially contain unacceptable contaminant concentrations.

### 9.3 Asbestos Removal

The made ground will be excavated and screened. During this process fragments of asbestos will be removed, bagged and placed in a secure skip for disposal to a facility licensed to take such waste.

### 9.4 Services

Barrier pipe will be used and installed within oversized trenches backfilled within clean material. This will protect water supply pipes from degradation and the permeation of organic compounds and protect future utility workers from any potential contaminants.

### 9.5 Site Workers

Site workers will be made aware of the potential for contamination in the soils and a programme of working will be identified to protect workers handling any soil. The method of site working will be in accordance with guidelines set out by HSE and CIRIA. Washing facilities will be provided and site workers will be encouraged to wash prior to eating and to use appropriate PPE when on site to minimise skin contact with the soil.

## 10.0 VALIDATION OF REMEDIAL MEASURES

This section sets out how the remedial measures will be validated.

### 10.1 Landscaped Areas

#### Importation of soil for capping layer

Prior to the importation of any topsoil or subsoil for use within the proposed capping layer, certification will be provided and approved by GEA. The suitability of the material will be assessed against the GEA Screening Values which are either CLEA Soil Guideline Value where available, the Defra C4SLs or are a Generic Guideline Value calculated using the CLEA UK Version 1.07 software for residential with gardens use, a copy of which is enclosed.

#### Installation of capping layer

All landscaped areas will include a minimum 0.6m thick layer of 'clean' subsoil and topsoil to support plant growth. This growth medium will comprise a layer of topsoil over subsoil placed above a geotextile separation layer.

Photographs of the capping installation will be taken by the contractor along with records of the levels before and after installation, and these will be included in the validation report.

#### Frequency of analysis

Confirmatory soil samples will be taken at a rate of one sample per 200m<sup>3</sup> of certified material and a minimum of three samples per source.

#### Documentation

The validation report will include waste transfer documents for all exported and imported material, photographs of the excavations and capping layer, details of the certified imported soil and the results of the

validation testing together with the pre and post levels to confirm the thickness of the imported clean cover layer.

### 10.2 Coal Tar Contamination

GEA will supervise the excavation of the coal tar impacted soils to determine its extent and will scan the excavation using a photo-ionisation detector (PID) to confirm the successful removal of the source of volatile contamination. Samples will be taken from the sides and base of the excavation will be subject to confirmatory laboratory testing.

### 10.3 Services

The technical specification along with photographs of the installation taken by the contractor will be included in the validation report.

### 10.4 Site Workers

Site work will be carried out in accordance with guidelines set out by HSE and CIRIA and all appropriate PPE will be worn. Where any odorous, discoloured, fibrous or suspicious material is identified during construction, work in that area will cease until GEA return to site to investigate, assess and make necessary recommendations.

## 11.0 VALIDATION

On completion of the remedial works a report will be prepared documenting the satisfactory undertaking of the remediation proposals, together with an assessment of the suitability of the soils remaining beneath the site in respect of the proposed development. The report will include written and photographic records of the site inspections carried out, together with the results of the validation analyses and will present







GEA

Widbury Barn  
Widbury Hill  
Ware  
Herts SG12 7QE**Generic Risk-Based Soil  
Screening Values****Site** 58 Renfrew Street, Glasgow**Job Number**  
J18065**Client** ES Renfield Limited**Sheet**  
1 / 1**Engineer** Ian Black Consulting**Proposed End Use** **Commercial****Soil pH** **8****Soil Organic Matter content %** **6.0**

Contaminant	Screening Value mg/kg	Data Source
<b>Metals</b>		
Arsenic	640	C4SL
Cadmium	410	C4SL
Chromium (III)	30400	LQM/CIEH
Chromium (VI)	49	C4SL
Copper	71,700	LQM/CIEH
Lead	2330	C4SL
Elemental Mercury	170	SGV
Inorganic Mercury	3600	SGV
Nickel	1350	LQM/CIEH
Selenium	13000	SGV
Zinc	665,000	LQM/CIEH
<b>Hydrocarbons</b>		
Benzene	98	C4SL
Toluene	4400	SGV
Ethyl Benzene	48000	SGV
Xylene	2600	SGV
Aliphatic C5-C6	13000	LQM/CIEH
Aliphatic C6-C8	42000	LQM/CIEH
Aliphatic C8-C10	12000	LQM/CIEH
Aliphatic C10-C12	49000	LQM/CIEH
Aliphatic C12-C16	91000	LQM/CIEH
Aliphatic C16-C35	1,800,000	LQM/CIEH
Aromatic C6-C7	See Benzene	LQM/CIEH
Aromatic C7-C8	See Toluene	LQM/CIEH
Aromatic C8-C10	18000	LQM/CIEH
Aromatic C10-C12	34500	LQM/CIEH
Aromatic C12-C16	37800	LQM/CIEH
Aromatic C16-C21	28000	LQM/CIEH
Aromatic C21-C35	28000	LQM/CIEH
PRO (C <sub>5</sub> -C <sub>10</sub> )	89498	Calc
DRO (C <sub>12</sub> -C <sub>28</sub> )	1,956,800	Calc
Lube Oil (C <sub>28</sub> -C <sub>44</sub> )	1,828,000	Calc
<b>TPH</b>	<b>1000</b>	Trigger for speciated testing

Contaminant	Screening Value mg/kg	Data Source
<b>Anions</b>		
Soluble Sulphate	500 mg/l	Structures
Sulphide	50	Structures
Chloride	400	Structures
<b>Others</b>		
Organic Carbon (%)	10	Methanogenic potential
Total Cyanide	12000	WRAS
Total Mono Phenols	3200	SGV
<b>PAH</b>		
Naphthalene	1,100.00	C4SL exp & LQM/CIEH
Acenaphthylene	100,000	LQM/CIEH
Acenaphthene	100,000	LQM/CIEH
Fluorene	71,000	LQM/CIEH
Phenanthrene	22,000	LQM/CIEH
Anthracene	540,000	LQM/CIEH
Fluoranthene	23,000	LQM/CIEH
Pyrene	54,000	LQM/CIEH
Benzo(a) Anthracene	97.0	C4SL exp & LQM/CIEH
Chrysene	140	C4SL exp & LQM/CIEH
Benzo(b) Fluoranthene	100.0	C4SL exp & LQM/CIEH
Benzo(k) Fluoranthene	140.0	C4SL exp & LQM/CIEH
Benzo(a) pyrene	76.00	C4SL
Indeno(1 2 3 cd) Pyrene	62.0	C4SL exp & LQM/CIEH
Dibenzo(a h) Anthracene	13.00	C4SL exp & LQM/CIEH
Benzo (g h i) Perylene	660	C4SL exp & LQM/CIEH
<b>Screening value for PAH</b>	<b>1,085.7</b>	<b>B(a)P / 0.15</b>
<b>Chlorinated Solvents</b>		
1,1,1 trichloroethane (TCA)	2490	LQM/CIEH
tetrachloroethane (PCA)	620	LQM/CIEH
tetrachloroethene (PCE)	283	LQM/CIEH
trichloroethene (TCE)	28.8	LQM/CIEH
1,2-dichloroethane (DCA)	1.8	LQM/CIEH
vinyl chloride (Chloroethene)	0.203	LQM/CIEH
tetrachloromethane (Carbon tetra	15	LQM/CIEH
trichloromethane (Chloroform)	345	LQM/CIEH

**Notes**

Concentrations measured below the above values may be considered to represent 'uncontaminated conditions' which pose 'LOW' risk to human health. Concentrations measured in excess of these values indicate a potential risk which require further, site specific risk assessment.

SGV - Soil Guideline Value, derived from the CLEA model and published by Environment Agency 2009

LQM/CIEH - Generic Assessment Criteria for Human Health Risk Assessment 2nd edition (2009) derived using CLEA 1.04 model 2009

C4SL - Defra Category 4 Screening value based on Low Level of Toxicological Risk

C4SL exp & LQM/CIEH calculated using C4SL revisions to exposure assessment but LQM/CIEH health criteria values

Calc - sum of nearest available carbon range specified including BTEX for PRO fraction

B(a)P / 0.15 - GEA experience indicates that Benzo(a) pyrene (one of the most common and most carcinogenic of the PAHs) rarely exceeds 15% of the total PAH concentration, hence this Total PAH threshold is regarded as being conservative