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GROUND INVESTIGATION REPORT

ELM VILLAGE

OFF ROSSENDALE WAY

CAMDEN

LONDON NW1

Report Reference C11779

On behalf of:

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WYNNE WILLIAMS ASSOCIATES LIMITED

REPORT ON A GROUND INVESTIGATION
AT
ELM VILLAGE
OFF ROSSENDALE WAY
CAMDEN
LONDON NW1

Report Reference No. C11779 **November 2009**

INTRODUCTION

The client, Wynne Williams Associates Limited, has instructed Ground Engineering, to carry out an intrusive ground investigation comprising five hand excavated pits located in Elm Village, London NW1. This report summarises the findings of the ground investigation and laboratory testing on recovered samples and provides an assessment of any ground contamination encountered.

LOCATION, TOPOGRAPHY AND GEOLOGY OF THE SITE

The areas of investigation were located off Rossendale Way, close to the Grand Union Canal, within the Elm Village Estate in Camden, London NW1 at approximate National Grid Reference TQ 295 840, as shown in Figure 1.

The five exploratory holes were distributed within three areas; the western canal site, eastern canal site and Berhholt Mews site. Within the western canal site, one position was at the same level as the Grand Union Canal tow-path at the foot of a set of steps and one was within a raised planter within a terraced area located up the same set of steps. Within the eastern canal site two positions were adjacent ground anchors on sloping ground above a retaining wall facing the Grand Union Canal. The fifth location was situated within a raised planter adjacent Bergholt Mews about 40m to the north-east of the canal

The canal lies at an elevation of approximately 45mOD and there is 5m difference in level up to Bergholt Mews which lies at about 50mOD.

The 1:50,000 scale geological map for the area, Sheet 256 'North London ', shows the plots to be underlain by the solid geology of the London Clay Formation.

SITE WORK

The site work was undertaken on 19 August 2009 and comprised five hand excavated trial pits which were set out by the Engineer and whose locations are given in Figure 2. Trial pits TP1 and TP2 were located within raised planters whilst TP3 and TP4 were positioned against mass concrete ground anchors which are understood to tie back the retaining wall facing the tow-path of the Grand Union Canal to the south-east. Trial pit TP5 was located at the foot of a retaining wall further to the south-west along the canal tow path.

Service plans were supplied by the client to establish the location of likely utilities beneath the site prior to the commencement of the ground investigation.

Prior to boring and excavation, service plans were consulted and a service scan was made using a Cable Avoidance Tool (CAT), at each position.

Trial pits TP1 to TP4 were hand excavated to a depth of 1.00m or 1.20m and disturbed soil samples were recovered at regular intervals through out the progression of the hole. Trial pit TP1 was abandoned at 1.00m on a concrete obstruction presumed to be the base of the planter. Trial pit TP5 was abandoned in concrete at a depth of 0.30m.

The trial pit records are presented in Appendix 1 and give the descriptions and depths of the various strata encountered, details of all samples taken and the groundwater conditions observed during and on completion of excavation.

Ground Surface Levels

Ground surface levels, relative to Ordnance Datum, at each exploratory hole location have been interpolated from site survey plans provided by the client.

LABORATORY TESTING

The samples were inspected in the laboratory and assessments of the soil characteristics have been taken into account during preparation of the exploratory hole records. The soils have been described in accordance with BS5930:1999.

Laboratory Geotechnical Testing

Samples recovered from the exploratory holes were tested in accordance with the recommendations of British Standard BS1377:1990 'Methods of Tests for Soils for Civil Engineering Purposes'. The results of testing are presented as Laboratory Summary Sheets in Appendix 2.

CBR Testing

California Bearing Ratio (CBR) tests were performed on two selected samples that had been recompacted with a 2.5kg rammer.

The test consisted of jacking into the soil a cylindrical plunger with a cross sectional area of 1935mm^2. A force of 50N was applied initially to seat the plunger on the soil surface and then the plunger was made to penetrate the soil at a uniform rate of 1mm/min. Readings of force were taken at intervals of penetration of 0.25mm to a penetration not exceeding 7.5mm. The CBR value is the ratio of the force required to achieve 2.5mm or 5mm penetration to standard forces expressed as a percentage.

The results of testing are presented on the laboratory test results summary sheet to the rear of this report.

Topsoil Analysis

Topsoil analysis was carried out on two samples in accordance with BS3882. The analysis measured the pH, organic matter content, electrical conductivity, particle size distribution and the concentrations of nitrogen, phosphorus, potassium and magnesium. The results are provided in Appendix 3.

Laboratory Chemical Testing

Four samples were tested for a suite of tests which encompassed a wide range of potential contaminants outlined by CLR 8 which is included within the CLEA series of contaminated land reports, by the Department for Environment, Food and Rural Affairs, DEFRA, and the Environment Agency, EA. This suite of tests is considered sufficient to screen for most commonly occurring potential contaminants.

The sample was submitted to a UKAS Accredited Laboratory who carried out analyses for potential contaminants and the results are provided in Appendix 3.

Tests for inorganic compounds included the following suite of potential contaminants. Total arsenic, total cadmium, total chromium, hexavalent chromium, total lead, total mercury, total selenium, water soluble boron, total copper, total nickel, total zinc, total cyanides, free cyanides, soluble sulphate, sulphides and pH-value.

Tests for organic compounds included the determination of phenols, polyaromatic hydrocarbons (PAH), including benzo[a]pyrene.

GROUND CONDITIONS

Trial pits TP1 to TP4 encountered made ground to at least 1.00m, or 1.20m, thickness and the anticipated underlying solid geology of the London Clay was not reached.

Trial pit TP5 was abandoned on a concrete obstruction at a depth of 0.30m.

Due to the spatial distribution the findings of the trial pits are discussed individually below.

Trial Pit TP1 (Bergholt Mews)

Trial pit TP1 was located within a raised planting area adjacent Bergholt Mews.

The made ground comprised dark brown, locally black, very gravelly, clayey, silty sand which contained gravel of angular brick, concrete and flint.

This was underlain at a depth of 0.40m by stiff friable gravelly, slightly sandy clay/silt fill where the gravel fraction comprised angular brick, flint and rounded quartz. This trial pit was abandoned on a concrete obstruction, presumed to be the base of the planter at depth of 1.00m.

Trial Pit TP2 (Western Area)

Trial pit TP2 was located within a raised planting area within a terraced area above the canal-tow path.

The made ground comprised a 0.20m thick surface layer of stiff, friable, dark brown, slightly sandy, gravelly organic clay with dead roots. The gravel fraction comprised angular glass, concrete and flint. This layer was underlain by brown gravelly, silty, fine sand where the gravel fraction comprised angular concrete, flint and rounded quartz.

This pit was completed within this made ground at a depth of 1.00m.

Trial Pits TP3 and TP4 (Eastern Area)

Trial pits TP3 and TP4 were positioned against mass concrete ground anchors which are understood to tie back the retaining wall facing the tow-path of the Grand Union Canal to the south-east. The made ground in these pits comprised brown gravelly and very gravelly, locally clayey, silty sand which was present to at least the depth of the pits which were completed at 1.20m. The gravel fraction comprised angular brick, concrete, flint, chalk, pottery and rounded quartz. Rounded cobbles of chalk and concrete were encountered within this made ground.

Trial Pit TP5 (Western Area)

Trial pit TP5 was located at the foot of a set of steps leading down on to the canal tow-path and was excavated against the retaining wall. This pit encountered a 0.40m thick surface layer of concrete over lean mix concrete to 0.10m. Below the lean mix a concrete slab was encountered which was present across the full 1m width of the steps. Continued breaking of the concrete penetrated a further 0.20m and the pit was abandoned at a depth of 0.30m within the concrete.

Groundwater

No ground water was encountered during the excavation of the pits which were dry on completion at depths of between 0.30m and 1.20m.

Observations

No visual or olfactory evidence of hydrocarbon pollution was noted within the soil encountered during this investigation.

COMMENTS ON THE CBR TEST RESULTS

Results of laboratory CBR testing are provided in Appendix 2.

Laboratory CBR tests on a sample of brown gravelly clayey silty fine sand recovered from TP3 (0.20m to 0.50m) indicated values of between 17% and 18%.

Laboratory CBR tests on a sample of brown very gravelly silty sand recovered from TP4 (0.20m to 0.50m) indicated values of between 30% and 31%.

For the purpose of design a value in the order of 17% could be used for the sand fill. However the silty nature of the made ground means that it could be frost susceptible, which would require a minimum construction thickness of at least 450mm.

The formation should always be proof rolled and carefully inspected ensuring that any topsoil and soft or loose spots are removed and replaced with properly compacted clean granular material if inferior CBR values are to be avoided.

It is recommended that the pavement designer ensures that there are no underlying less competent layers since these could detrimentally affect the future pavement performance.

COMMENTS ON THE TOPSOIL ANALYSIS

The results of the topsoil analysis are presented in Appendix 3 and it is recommended that the advice of a suitably qualified horticulturalist be sought regarding the suitability of this as a growing medium.

COMMENTS ON THE CHEMICAL TEST RESULTS

The results of the laboratory chemical testing from the investigation have been compared to CLEA Soil Screening Values (SSV) which have been used as screening tools for use in the assessment of land affected by contamination.

CLEA Soil Screening Values based on CLEA model v1.04 (SSV)

Atkins Limited have derived ATRISKsoil SSVs based on the 2009 guidance (SC050021/SR3 (the CLEA Report) and SC050021/SR2 (the TOX report)) for residential with plant uptake, residential without plant uptake and park land uses. They have based these on the default assumptions provided in the CLEA report which, it is understood, will be used in development of future Soil Guideline Values by Defra and the Environment Agency. Atkins SSVs for 6% soil organic matter (SOM) have been derived using CLEA model v1.04. These are provided under licence to Ground Engineering Limited and respective toxicology reports and technical details on the derivation of the SSVs can be provided on request.

Soil Assessment

The following standard land uses form the basis of the assessment in relation to soils:

- Residential usage with home grown produce.
- Residential without home grown produce.
- Parks defined as open grassed areas in close proximity to residential housing or offices.

The intended purpose of the SSV is as "intervention values" in the regulatory framework for assessment of human health risks in relation to land use. These values are not binding standards, but are intended to inform judgements about the need for action to ensure that a new use of land does not pose any unacceptable risks to the health of the intended users.

In summary Tables 1 and 2 compare the test results with the SSVs in relation to the specified usage. The number of test results, which exceed these values, are also provided.

Table 1: Trial Pits TP1 & TP2 (Raised Planters) -Comparison of Chemical Test Results for Near Surface Soils with SSV

Determinand	Number of Samples	Min Value mg/kg	Max Value mg/kg	Number of Samples Exceeding SSV for			Measured 95th Percentile mg/kg	Soil Screening Criteria SSV 6% SOM			
				Residential with Home Grown Produce	Residential without Home Grown Produce	Parks		Assessment Method	Residential with Home Grown Produce mg/kg	Residential without Home Grown Produce mg/kg	Parks mg/kg
Arsenic	2	13	13	0	0	0	-	SSV	32	32	39
Cadmium	2	0.92	4.2	0	0	0	-	SSV	8	30	72
Chromium	2	33	36	2	0	0	-	SSV	14	38	184
Chromium (hexavalent)	2	<5	<5	0	0	0	-	SSV	14	38	184
Lead	2	110	510	1	1	0	-	SSV	322	444	555
Mercury	2	0.45	0.46	0	0	0	-	SSV	11	14	20
Selenium	2	0.34	0.97	0	0	0	-	SSV	350	595	696
Nickel	2	21	33	0	0	0	-	SSV	130	130	130
Phenols	2	<0.3	<0.3	0	0	0	-	SSV	1930	33,500	46,300
Benzo[a]pyrene	2	<0.1	<1.1	0	0	0	-	SSV	2.4	2.4	3.4
Boron	2	1.6	4.0	0	0	0	-	*	*	*	*
Copper	2	53	55	0	0	0	-	SSV	4020	8370	12,200
Zinc	2	140	160	0	0	0	-	SSV	17,200	46,800	54,800
Free Cyanide	2	<0.5	<0.5	0	0	0	-	SSV	34	34	34
Sulphide	2	2.9	8.3	0	0	0	-	*	*	*	*

Table 2: Trial Pits TP3 & TP4 (Eastern Area) -Comparison of Chemical Test Results for Near Surface Soils with SSV

Determinand	Number of Samples	Min Value mg/kg	Max Value mg/kg	Number of Samples Exceeding SSV for			Measured 95th Percentile mg/kg	Soil Screening Criteria SSV 6% SOM			
				Residential with Home Grown Produce	Residential without Home Grown Produce	Parks		Assessment Method	Residential with Home Grown Produce mg/kg	Residential without Home Grown Produce mg/kg	Parks mg/kg
Arsenic	2	17	19	0	0	0	-	SSV	32	32	39
Cadmium	2	0.28	1.5	0	0	0	-	SSV	8	30	72
Chromium	2	34	38	2	0	0	-	SSV	14	38	184
Chromium (hexavalent)	2	<0.5	<0.5	0	0	0	-	SSV	14	38	184
Lead	2	110	120	0	0	0	-	SSV	322	444	555
Mercury	2	0.39	0.52	0	0	0	-	SSV	11	14	20
Selenium	2	<0.2	<0.2	0	0	0	-	SSV	350	595	696
Nickel	2	26	33	0	0	0	-	SSV	130	130	130
Phenols	2	<0.3	<0.3	0	0	0	-	SSV	1930	33,500	46,300
Benzo[a]pyrene	2	0.68	0.77	0	0	0	-	SSV	2.4	2.4	3.4
Boron	2	0.7	1.1	0	0	0	-	*	*	*	*
Copper	2	40	40	0	0	0	-	SSV	4020	8370	12,200
Zinc	2	92	120	0	0	0	-	SSV	17,200	46,800	54,800
Free Cyanide	2	<0.5	<0.5	0	0	0	-	SSV	34	34	34
Sulphide	2	2.9	5.9	0	0	0	-	*	*	*	*

Trial Pits TP1 and TP2 (Raised Planters)

With the exception of total chromium (TP1 and TP2) and lead (TP1) none of the determinands exceeded the soil screening values for residential usages.

Measured total chromium concentrations were 33mg/kg and 39mg/kg and the samples exceeded the chromium residential with home grown produce SSV of 14mg/kg and residential without home grown produce SSV of 38mg/kg. The toxicity of chromium depends upon its oxidation state, which generally comprises trivalent and hexavalent forms. Trivalent compounds are stable and most naturally occurring chromium is in the trivalent (chromic) state. Hexavalent chromium (chromate) rarely occurs naturally and the presence in soil is most likely to be from pollution. Hexavalent chromium is significantly more toxic than the trivalent form, and consequently the SSV assumes that all the chromium is present in the hexavalent form. The hexavalent chromium test results for the two samples analysed were all less than 0.5mg/kg a concentration below the SSV of 14mg/kg and therefore the measured chromium concentrations would not be considered to present a significant risk to residential with home grown produce usage.

None of the determinand concentrations exceeded the soil screening criteria for parks usage.

Trial Pits TP3 and TP4 (Eastern Area)

With the exception of total chromium, in TP3 and TP4, none of the determinands exceeded the soil screening values for residential usages.

Measured total chromium concentrations were 34mg/kg and 38mg/kg and the samples exceeded the chromium residential with home grown produce SSV of 14mg/kg. The hexavalent chromium test results for the two samples analysed were all less than 0.5mg/kg a concentration below the SSV of 14mg/kg and therefore the measured chromium concentrations would not be considered to present a significant risk to residential with home grown produce usage.

None of the determinand concentrations exceeded the soil screening criteria for parks usage.

Hydrocarbon Pollution in Soil

No visual or olfactory evidence of hydrocarbon fuel impacted soils were identified within the trial pits.

COMMENTS ON GROUND CONTAMINATION

Anticipated exposure scenarios relating to the site and future development works including remedial options as applicable are discussed as follows.

This investigation may not have revealed the full extent of contamination on the site and appropriate professional advice should be sought if subsequent site works reveal materials that may appear to be contaminated. Additional ground investigation works would be necessary in order to prove the thickness of the made ground beneath the site.

Contaminated Soil in Raised Planters - Trial Pits TP1 and TP2

The tested made ground comprised dark brown, locally black very gravelly clayey silty sand and stiff, friable, dark brown, slightly sandy, gravelly organic clay with dead roots. The gravel fraction included angular glass, brick, concrete and flint.

With the exception of total chromium (TP1 and TP2) and total lead (TP1) none of the determinands exceeded the soil screening values for residential with home grown produce usage. The hexavalent chromium test results for the two samples analysed were all less than 0.5mg/kg a concentration below the SSV of 14mg/kg and therefore the measured chromium concentrations would not be considered to present a significant risk to residential with home grown produce usage.

None of the determinand concentrations exceeded the soil screening criteria for parks usage.

Contaminated Soil in Eastern Area - Trial Pits TP3 and TP4

The tested made ground comprised brown, gravelly or very gravelly silty sand. The gravel fraction included brick, concrete, flint, pottery and quartz.

With the exception of total chromium none of the determinands exceeded the soil screening values for residential with home grown produce usage. The hexavalent chromium test

results for the two samples analysed were all less than 0.5mg/kg a concentration below the SSV of 14mg/kg and therefore the measured chromium concentrations would not be considered to present a significant risk to residential with home grown produce usage.

None of the determinand concentrations exceeded the soil screening criteria for parks usage.

Human Health - Construction Workers

No special precautions would be required during the development of the site by workers who may come into contact with the soil during groundworks, providing standard precautions are adopted which should generally include the procedures given by the Health and Safety Executive (The Blue Book).

For the protection of these workers during groundworks the following is recommended:

a) Limit repeated or prolonged skin contact with soils by wearing gloves with sleeves rolled down.

b) Washing facilities should be made available to groundworkers, so as to minimise the potential for inadvertent ingestion of soil.

c) If any soils are revealed which are different to those encountered by this ground investigation, the advice of a specialist should be sought in view of classifying the material and ascertaining its risk to groundworkers.

Human Health - Users of the Planters TP1 and TP2

Taking into account the test results no scheme of remediation would be considered necessary for grass or flower/shrub covered parks usage in either of the planters. However it is understood that the proposed scheme may include the growing of vegetables for consumption by the public. On the basis of the lead concentration encountered in TP1 the made ground would be considered unsuitable for use as a vegetable growing medium. Consequently it is recommended

that if vegetables are to be grown further analysis of the upper 0.60m thickness of made ground, within both planters, should be carried out, together with analysis of all imported soil/topsoil, to verify that the soil is suitable for use.

Human Health - Users of the Eastern Area around TP3 and TP4

The test results provide no evidence for soil contamination being present with concentrations which would be considered unsuitable for use, therefore no scheme of remediation would be considered necessary within this area.

Building Materials - Buried Concrete

The sulphate analyses of the soil sample gave a results in Design Sulphate Class DS-1 and DS-2 of the BRE Special Digest 1, Table C2 (2005) presented in Appendix 4. The pH results recorded were alkaline with pH values of 5.6 and 7.5.

Off-site Disposal of Soil Arisings

Excavated material and excess spoil should always be classified prior to removal from site as required by 'Duty of Care' (Environmental Protection Act, 1990) legislation. This means that material has to be given a proper description and waste classification prior to removal.

The site plan, exploratory hole records and certificates of chemical analysis should be sent to the Environmental Agency or a suitably licensed waste disposal contractor for classification of the material prior to disposal off-site during the development works.

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