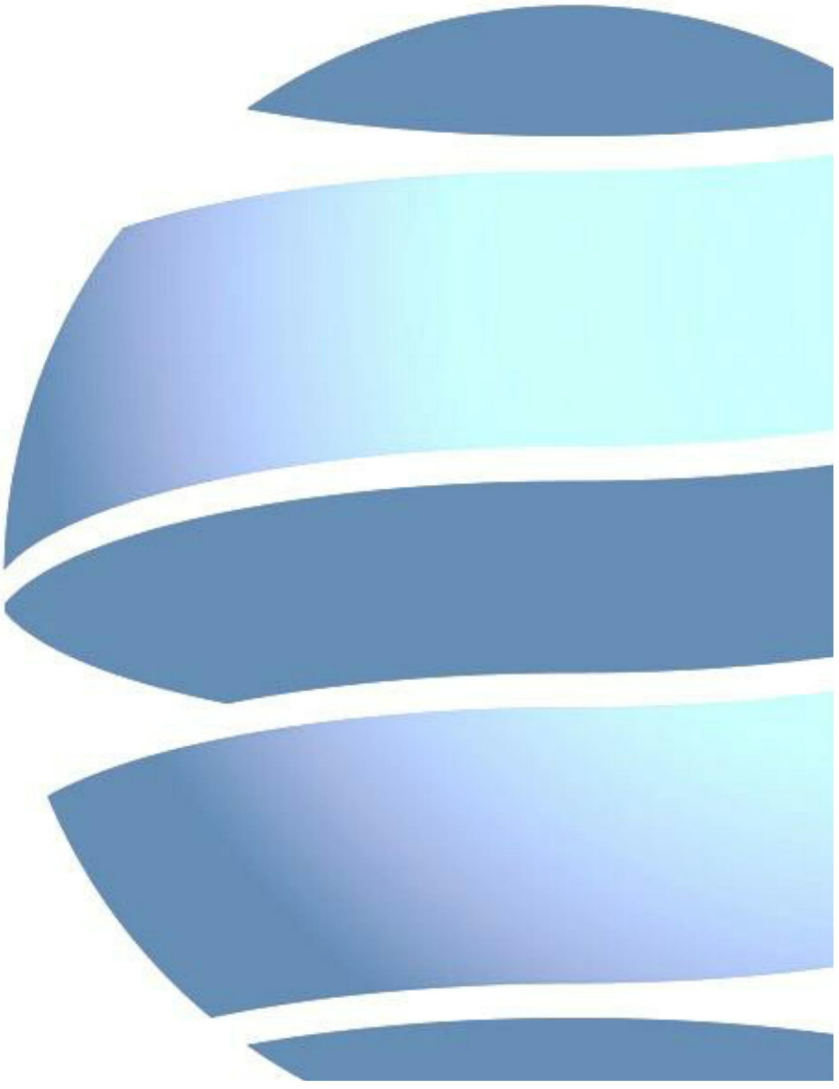
Geo-Environmental

REMEDIAL STRATEGY & VERIFICATION PLAN
for the site at
MIDLAND CRESCENT
279 FINCHLEY ROAD
LONDON NW3 6LT
on behalf of
ANTHONY GREEN & SPENCER



Report:	**REMEDIAL STRATEGY & VERIFICATION PLAN**
Site:	**MIDLAND CRESCENT, 279 FINCHLEY ROAD, LONDON NW3 6LT**
Client:	**ANTHONY GREEN & SPENCER**
Date:	**FEBRUARY 2018**
Reference:	**GE16421 – RSVPv1JK180202**
Version:	**1.0**
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Environmental Consultants | Geotechnical Engineers | Site Investigation

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1.0 INTRODUCTION

1.1 General

Geo-Environmental Services Limited was appointed by Anthony Green & Spencer to formulate a remedial strategy and verification plan for the proposed development works at the site known as Midland Crescent, 279 Finchley Road, London NW3 6LT (National Grid coordinates at centre: 526140, 184880) (see Figure 1).

1.2 Development Proposals

It was understood that the development works would comprise the construction of a six storey (two lower ground floor levels) mixed-use building with associated utilities and soft landscaping.

1.3 Objectives

Investigation of the site by Geo-Environmental Services Limited identified the presence of potential hazards and through a risk assessment process a series of pollutant linkages were identified which require action to mitigate or otherwise reduce the risk. This Remedial Strategy and Verification Plan sets out the proposed remedial works to be undertaken on the subject site to support its development for a mixed use residential/commercial end use.

2.0 BACKGROUND

A Desk Study and Ground Investigation Report was prepared by Geo-Environmental Services Limited in January 2018. For details, reference should be made to the individual report (ref: GE16421 – GIRv2JK180123).

The investigation broadly comprised ten window sampler boreholes located across the site, with associated laboratory analysis and return ground gas monitoring.

Elevated concentrations of lead and benzo(a)pyrene were identified within the Made Ground and was considered to indicate soil contamination across the site. As such, a risk to proposed end users and water supply pipes was considered likely.

2.1 Former Site Use

Historic mapping has shown the site comprised part of Finchley Road station from the beginning of the mapping period (1871). The station buildings on site were shown to have been redeveloped a number of times, with the buildings located on the road-front at Finchley Road being used as commercial units from 1954. The buildings in the centre of the site were no longer mapped in 1984-1986 with only the building used as commercial units on Finchley Road remaining. The commercial units were no longer shown after the 2006 mapping extract.

The surrounding land comprised primarily open space with railway tracks located immediately to the south and 170m north and north-west of the site and gradually became developed for residential use to the north, east, south and west with associated facilities and services (schools, hospitals, churches, sports grounds) with commercial and industrial uses (electronic lighting station, coal depots, cocoa factory, chemical works site, nursery and waste transfer sites) also occupying much of the surrounding land.

3.0 REMEDIAL WORKS

3.1 Protection of End Users

Due to the presence of marginally elevated concentrations of lead and benzo(a)pyrene within the Made Ground soils encountered on site, it was recommended that a cover system be constructed for all soft landscaping.

Given the depth, and physical and chemical quality of the Made Ground encountered on site, it was considered likely that barrier pipe would be required on site. It was recommended that the results be forwarded to the appropriate water supply company for confirmation of the potable water supply pipe material.

3.1.1 Cover System

In view of the chemically and physically unsuitable nature of the near surface soils encountered across the site, there are two economically viable remedial approaches that could be utilised at the site, although their sole or combined implementation would be based on developer preference and the final development proposals.

It should be noted that soft landscaping on raised podiums or 'green roofs' that are not in contact with the affected soils on site would not require specific remedial works. However, soils imported in to these areas would require certification.

Raised Planters

Raised planters could be utilised where there are limited soft landscaped areas proposed on site. Concrete or brick built troughs filled with certifiably 'clean' Topsoil and sub-soil would effectively sever any source-pathway-receptor as the soils within the raised planters would not be in contact with the underlying affected soils.

Cover System

Where more extensive areas of soft landscaping are proposed or where raised planters are unsuitable a cover system would be more suited. The cover system should incorporate an overall cover system thickness of 500mm. The cover system should comprise 500mm of certifiably 'clean' Topsoil and subsoil.

Certification for both sub-soil and Topsoil should include laboratory analysis for determinands known to pose a threat to human health (e.g. heavy metals, poly-aromatic hydrocarbons [PAHs] and total petroleum hydrocarbons [TPH]). The Topsoil portion of the cover system should be placed at a thickness in accordance with NHBC Standards and Local Authority requirements.

In areas encapsulated by the buildings footprints or areas of permanent hardstanding no remedial measures for soils are considered necessary.

Although the phytotoxicity assessment identified exceedances of the phytotoxicity threshold for zinc at several locations, the proposed remedial works to protect human health would effectively negate the need for further specific remedial measures to protect future planting from phytotoxic effects. However, localised deepening of the cover system will be necessary within tree pits for any proposed trees.

3.1.2 Water Supply Pipes

Buried plastics laid in contact with contaminated soils may be susceptible to attack by aggressive chemicals; therefore, potable water supplies may potentially become contaminated or tainted.

The results of the chemical analysis indicated that there were marginal exceedances of Semi-Volatile Organic Compounds (SVOC) and Mineral Oil within the Made Ground soils when compared against the thresholds stated within Table 3.1 of UK Water Industry Research's (UKWIR) report reference 10/WM/03/21 (re-issued 2010). As such, barrier pipe is recommended.

As a matter of good practice, and to maximise the protection to utilities, it is recommended that clean, gap-graded granular backfill is used in service runs and that marker tapes are used for all buried services.

3.2 Imported Materials

It was recommended that physically and chemically suitable Topsoil/subsoil be incorporated into all soft landscaped areas in accordance with the remedial strategy.

Chemical certification of the imported Topsoil and subsoil should be submitted prior to importing materials onto site to confirm their suitability for use.

Samples of the imported Topsoil/subsoil should also be collected from in situ locations and submitted for laboratory analysis by the Environmental Consultant. Laboratory testing would include analysis of determinands known to pose a risk to human health (see list of determinands in Tables 1 and 2 appended).

In addition to the above, the physical quality of imported soils should be verified by visual inspection. The presence of brick, concrete, timber, metal, glass, etc. would render the materials sub-standard (regardless of the results of chemical analysis) and would not be considered fit for the proposed end use.

In addition, all Topsoil materials should generally conform to Multipurpose grade as specified under BS3882:2015, or will otherwise be rejected.

3.3 Inspection

Cover system

Regular site inspections should be made by the Environmental Consultant to ensure that appropriate management of contaminated soil is carried out during excavation works. Upon completion of this phase of the remediation, the Environmental Consultant shall be instructed to visit the site and inspect the cover systems to verify their installation.

Potable Water Supply Pipes

The Environmental Consultant should be contacted to make regular inspections of the barrier pipe in situ to verify its installation.

3.4 Timetable of Remedial Works

Once this document has been approved by the Local Authority (LA), the remedial works should be undertaken in accordance with Anthony Green & Spencer's construction timetable for the site. A copy of the timetable should be forwarded to the LA. In addition, the Environmental Consultant should be

given suitable notice of the dates of the individual remedial works so they can be appropriately inspected and validated.

4.0 WASTE

In accordance with CL:AIRE Code of Practice (2011) materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded by the holder'.

The Code of Practice therefore allows soils to be reused on site where the following criteria are met:

- Pollution of the environment and harm to human health is prevented in reusing the excavated materials;
- The material are suitable for use (without any further processing);
- There is certainty of use; and
- The quantity that is absolutely necessary (and no more) is used.

In order to comply with the Code of Practice, a material management plan that confirms the above criteria are met has to be prepared. The material management plan must be reviewed by a 'Qualified Person' who then issues a declaration to the Environment Agency. Geo-Environmental can provide this service should it be required.

Where materials do not meet the required criteria, it may be possible to treat them under an environmental permit so that they may be re-used on site.

4.0.1 Reuse of Waste

Where material is discarded as waste, it may still be possible to re-use the waste on site under a standard rules environmental permit or a U1 waste exemption. However, strict limits on the volumes that can be reused apply in these cases.

4.0.2 Disposal to Landfill

Under current legislation, where wastes are to be disposed of to landfill they may, depending on their classification, require pre-treatment. Pre-treatment shall comprise a chemical, physical (including sorting), thermal or biological process. The pre-treatment is required to change the characteristics of the waste, reduce its volume, reduce its hazardous nature, and facilitate its handling and enhance its recovery.

4.1 Waste Classification

The following information is provided for preliminary guidance purposes, as different facilities or operators may have differing acceptance criteria and Waste Acceptance Criteria (WAC) analysis may be required to confirm the exact classification.

In the first instance the chemical test results have been screened using CatWasteSoil. The results confirmed that the soils tested did not have any hazardous properties that would deem them to be hazardous waste.

Based on the results of the chemical analysis undertaken, the Made Ground soils encountered on site are likely to be classified as 'inert'.

However, it is recommended that confirmation of this assessment be sought from the appropriate landfill facility to confirm the waste classification.

Natural 'uncontaminated' soil arisings such as those of the London Clay Formation are likely to be classified as 'inert' for waste disposal purposes. Confirmation of this assessment should also be

sought from the receiving landfill facility.

4.2 Storage and/or Removal of Waste Materials

Materials excavated as part of the remedial works (cover system construction) should be removed immediately from site to an appropriate facility. Where immediate removal is not possible, these materials may be stockpiled on site prior to removal at the earliest possible time. Stockpiled soils should be placed on plastic sheeting (1200 gauge damp proof membrane) and covered with plastic sheeting, weighed down at regular locations. Waste Transfer tickets should be retained and forwarded to the Environmental Consultant to form part of the verification report for the site.

In the event of dry spells, or where the exposed surface becomes dry, it is recommended that the surface of the site is regularly dampened down to prevent the release of soil dust which could migrate off-site and thereby mitigate both off-site exposure and nuisance for neighbours.

Excess natural arisings may be placed beneath roadways etc. subject to geotechnical constraints to reduce the volume of materials disposed of to landfill. Where re-use of soils is proposed on site, validation samples will be required to confirm suitability.

5.0 DISCOVERY STRATEGY

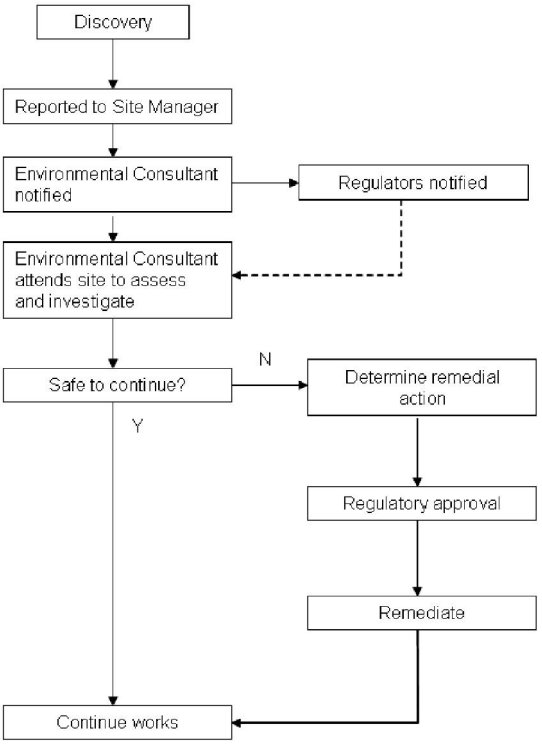
Whilst the site has been the subject of numerous phases of investigation and assessment, it remains possible that accidental or previously unexpected soil conditions may be encountered during the process of site clearance and construction.

Examples may include oily pockets within the soil, pockets of cement boarding or fibrous materials within the soil, black ashy materials, soils exhibiting strong odours, brightly coloured materials, and former structures or brickwork.

Should previously undiscovered contamination be encountered during the demolition/construction of the new buildings the following course of action should be adhered to:

- Works in the area of the suspected contamination should cease immediately. The ground workers should report any suspected contamination immediately to the Client's site supervisor. The supervisor should contact the Environmental Consultant, who should visit the site to assess the extent of the 'contamination'.
- The Environmental Consultant shall make records of their inspection, and pass details of these to the Local Authority.
- Where the conditions revealed differ from those previously anticipated, the Environmental Consultant shall take samples as deemed appropriate to be dispatched for appropriate chemical testing.
- Depending on the results of the testing either: 1) no further work will be required; 2) a further detailed risk assessment will be required; and/or 3) localised specific remedial measures will be necessary. Appraisal criteria will vary depending on the nature of the assessment.
- The results of any such testing will be sent to the Regulatory Authority for consultation. If further remediation is required, the Regulatory Authority will be informed of the date and time of the proposed works.
- Any further remediation will be undertaken in accordance with a method statement submitted to the Local Authority for approval. The works shall be supervised by the Environmental Consultant who shall provide a Validation Report for the Local Authorities purposes.

The process is summarised overleaf:



A copy of this strategy should be lodged on site, and provisions made to ensure that all workers are made aware of their responsibility to observe, report, and act on any potentially suspicious or contaminated materials they may encounter.

6.0 VERIFICATION

On completion of the development a verification report(s) will be prepared for the remedial works undertaken. The report(s) will be submitted to the Client and Local Authority for formal approval.

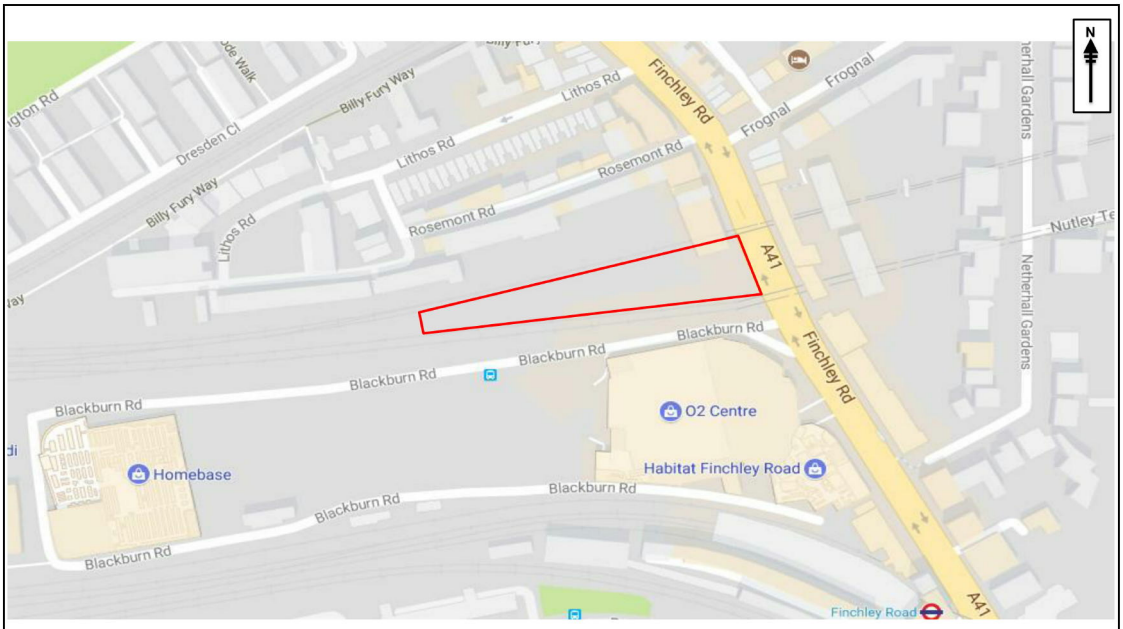
The Verification Report(s) will refer to the works as set out within this Remedial Strategy and include relevant site based information such as records from site inspections, photographs of specific remedial or waste handling measures, material datasheets, QA certification (where relevant) and an audit trail for imported sub-soil and Topsoil, including source, provenance, analytical results, placement location and thickness.

The remedial works will be inspected and validated by the Environmental Consultant (Geo-Environmental).

Reference	Principal requirements	Design or construction related	Site visit required by qualified geo-environmental engineer?	Supporting documentation
1.0 General principles	The site remediation requirements are as follows: • Implementation of a cover system within areas of soft landscaping. • Protection of underground potable water supply pipes from contact with residual contaminants in the near surface soils on site. Amendments will be made to accord with any differing conditions encountered during the progress of the construction works.	Design & Construction	**YES** • As detailed below.	Details of construction programme to be provided by client/contractor.
2.0 Compliance with legislation	The construction and remediation activities on the site will be undertaken in accordance with all current health and safety and environmental legislation.	Construction	-	-
3.0 Health and Safety requirements	This verification plan does not specifically cover health and safety requirements. This will be addressed in the Contractor's Health and Safety Plan.	Design & Construction	-	-

4.0 Cover System	It should be noted that raised planters, soft landscaping on raised podiums or 'green roofs' that are not in contact with the affected soils on site will not require specific remedial works. However, soils imported in to these areas will require certification. The cover system should incorporate an overall cover system thickness of 500mm. The cover system should comprise 500mm of certifiably 'clean' Topsoil and subsoil. Chemical certification of the imported Topsoil and subsoil should be submitted prior to importing materials onto site to confirm their suitability for use. Samples of the imported Topsoil/subsoil should also be collected from in situ locations and submitted for laboratory analysis by the Environmental Consultant.	Design & Construction	**YES** • To validate the depths of implemented cover systems. • To visually inspect the physical quality of the imported in situ Topsoil. • Take samples of imported soils from in situ locations for chemical analysis.	Laboratory certificates to be supplied by Client prior to importation. Topsoil 'import' tickets to be retained and supplied for inclusion in verification report. Site visit reports including photographs and laboratory reports.
5.0 New Services	Potable water supply pipes on site require protection. Barrier pipe should be installed. The installation of these pipes will require validation including in situ photographic evidence.	Design & Construction	**YES** • To validate that the recommended pipework has been installed.	Barrier pipe specification sheet to be supplied by Client prior to installation. Site visit reports including photographs.
6.0 Unexpected Contamination	A watching brief is to be put in place on site. Should unexpected areas of contamination be encountered during construction works a qualified geo-environmental engineer is to be informed to conduct a site visit, take additional samples and assess the risk. The Local Authority should also be notified. For full details, reference should be made to the Section 5 (Discovery Strategy) of the Remedial Strategy.	Construction	**YES** *Only in the event of unexpected contamination.* • To assess the extent of any unexpected contamination.	*In the event of unexpected contamination:* Site visit reports including photographs. Chemical test results. Revised risk assessment.

FIGURES



Project:	Midland Crescent			**Title:**	Site Location Plan			**Revision:** v1
Address:	Finchley Road, London, NW3 6LT			**Date:**	04-12-17			
Grid Ref:	526180, 184890.	**Scale:**	Not to scale	**Drawn:**	JK	**Figure:**	1	Geo-Environmental
Client:	Stadium Capital Holdings Ltd			**Ref:**	GE16421			

APPENDICES

TABLE 1: CHEMICAL QUALITY THRESHOLDS FOR IMPORTED FILL
(SOFT LANDSCAPING – Private Gardens with Home-Grown Produce [C4SL & GAC])

Determinand	Threshold Value (mg/kg)	Standard
Arsenic	37	(DEFRA) C4SL
Benzo(a)pyrene	5	(DEFRA) C4SL
Beryllium	51	(Environment Agency) GAC
Boron	290	(Environment Agency) GAC
Cadmium	26	(DEFRA) C4SL
Chromium III	630	(Environment Agency) GAC
Copper	2300	(Environment Agency) GAC
Hexavalent Chromium	21	(DEFRA) C4SL
Lead	200	(DEFRA) C4SL
Mercury (inorganic)	170	(Environment Agency) GAC
Nickel	130	(Environment Agency) GAC
Phenols	420	(Environment Agency) GAC
Selenium	350	(Environment Agency) GAC
Total Petroleum Hydrocarbons	110*	(Environment Agency) GAC
Vanadium	74	(Environment Agency) GAC
Zinc	3700	(Environment Agency) GAC

* This is the lowest threshold for specific hydrocarbon bands (excluding benzene) within soils for use within areas of private gardens. This aside, the imported soils should not display any organoleptic evidence of hydrocarbon contamination.

The above thresholds were calculated for sandy soils with a soil organic matter (SOM) content of 6%.

TABLE 2: CHEMICAL QUALITY THRESHOLDS FOR IMPORTED FILL
(SOFT LANDSCAPING – Private Gardens without Home-Grown Produce [C4SL & GAC])

Determinand	Threshold Value (mg/kg)	Standard
Arsenic	40	(DEFRA) C4SL
Benzo(a)pyrene	5.3	(DEFRA) C4SL
Beryllium	51	(Environment Agency) GAC
Boron	1000	(Environment Agency) GAC
Cadmium	149	(DEFRA) C4SL
Chromium III	630	(Environment Agency) GAC
Copper	6200	(Environment Agency) GAC
Hexavalent Chromium	21	(DEFRA) C4SL
Lead	310	(DEFRA) C4SL
Mercury (inorganic)	240	(Environment Agency) GAC
Nickel	130	(Environment Agency) GAC
Phenols	520	(Environment Agency) GAC
Selenium	600	(Environment Agency) GAC
Total Petroleum Hydrocarbons	110*	(Environment Agency) GAC
Vanadium	190	(Environment Agency) GAC
Zinc	40000	(Environment Agency) GAC

* This is the lowest threshold for specific hydrocarbon bands (excluding benzene) within soils for use within areas of private gardens. This aside, the imported soils should not display any organoleptic evidence of hydrocarbon contamination.

The above thresholds were calculated for sandy soils with a soil organic matter (SOM) content of 6%.