4 December 2018

Your ref:
Our ref: J114212C/JS/VAL01

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Mr Callum Sanderson
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Dear Callum

RE: KINGSGATE PRIMARY LOWER SCHOOL, 1 LIDDELL ROAD, LONDON NW6 2DJ

We attended site on Tuesday 6 November 2018 to validate the remedial works carried out with regard to ground contamination at the above site, which has been redeveloped through the demolition of the former commercial units and the construction of a primary school in the northern part.

This letter details the work, which has been carried out to discharge planning conditions relating to contamination.

1.0 INTRODUCTION

The site has been the subject of a number of previous ground investigations and environmental assessments, as follows:

- November 2014: Desk Study and Ground Investigation Report. GEA (ref J14212 Issue 2);
- September 2015: Letter Report Re additional soil testing and gas monitoring. GEA (ref J14212A/AI/01); and
- December 2016: Remediation Proposals Report. GEA (ref J14212B Issue 1); and

The previous desk study and ground investigation report should be referred to for information regarding the site layout, location and history, although pertinent information is also provided below.

1.1 Limitations

The conclusions and recommendations made in this letter are limited to those that can be made on the basis of the investigation. 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 Geotechnical and Environmental Associates (GEA).

2.0 CONCEPTUAL MODEL

The conceptual model established by the investigation has been used to formulate an assessment of the potential for contaminants within the ground to cause harm to sensitive receptors. This risk assessment was carried out on the basis of a source-pathway-receptor model for each of the contaminants of concern; this approach has been adopted for the interpretation of the ground conditions at this site and is set out below.

The site has been redeveloped by the construction of a two-storey primary school which includes areas of soft landscaping. The ground investigation indicated the site to be underlain by a significant thickness of made ground over London Clay. The London Clay is classified as an Unproductive stratum and as such there is no shallow sensitive aquifer beneath the site.

2.1 Contaminants of Concern

During the previous investigations elevated levels of arsenic, lead, total PAH including benzo(a)pyrene, TPH and total organic carbon were measured within the made ground. As such it was considered that these contaminants could pose a potentially unacceptable risk to human health although it is not considered likely to be in a soluble or volatile form and as such does not pose a risk to groundwater or adjacent sites or a vapour risk. Traces of carbon dioxide were measured during gas monitoring and low risk of soil gas was concluded.

2.2 Potential Pollutant Linkages

Targets that could potentially be affected by the contaminants of concern and the pathways by which exposure could occur were identified as:

1. End users exposed to contamination through ingestion and inhalation of soil or dust, by skin contact.

2. Plant uptake in landscaped areas.

3. Site workers exposed to contamination through ingestion of soil, dust or vegetation, skin contact or inhalation.

4. Exposure of buried plastic services to PAH and TPH contaminated soils.

5. Inhalation of hazardous soil gas within the building

On this basis, the following remedial objectives have been identified:

- protect end users and plants in landscaped areas by removing the direct contact pathway;

- provide gas impermeable membrane beneath the building to block the gas migration pathway;

- protect site workers by breaking the direct contact pathway; and

- protect buried services by using resilient materials.

3.0 REMEDIATION

In order to address the risks outlined above, remediation has been undertaken by a combination of severance of the linkages between contamination and receptors, and through safe working practices being followed as required under Health and Safety Executive (HSE) and Construction Design and Management (CDM) regulations.

3.1 Protection of End Users and Landscaped Areas

In order to protect end users and plants in new landscaped areas it was recommended that a layer of imported soil up to 600 mm in thickness was provided above the made ground to provide a suitable growing medium and to prevent end users from coming into direct contact with the soil.

The thickness and condition of the soil was verified by GEA on 6th November 2018. A series of samples was obtained from locations across the site and five samples were tested for a range of contaminants. The results were compared to the previously adopted generic guidelines values, also included in the appendix, and revealed all contaminant concentrations to be below the guideline values. A record of the soil description and thickness is detailed below.

TP ref	Depth to base (m)	Sample (m)	Description
1	0.40	0.2	Topsoil (dark brown silty sand with gravel, rootlets and wood)
	0.45		Made ground (brown silty sand with brick, gravel and metal)
2	0.26	0.1	Topsoil (dark brown clayey sandy silt with gravel rootlets and wood. White membrane at base)
3	0.22		Topsoil (brown silty sand with rootlets and occasional gravel)
	0.25		Made ground (pea gravel)
4	0.26	0.1	Topsoil (dark brown silty sand with flint gravel, rare charcoal, rootlets and white membrane at base)
5	0.50	0.3	Topsoil (dark brown silty sand with gravel, rootlets and wood)
	0.55		Made ground (pea gravel)
6	0.40	0.1	Topsoil (dark brown clayey sandy silt with gravel, rootlets and wood)
	0.42		Made ground (pea gravel over concrete)
7	0.40		Topsoil (dark brown clayey sandy silt with gravel, rootlets and wood)
	0.42		Made ground (lean concrete)
	0.60		Made ground (dark brown silty sand with gravel and wood)
	0.62		Made ground (concrete)

3.2 Soil Gas

The gas monitoring indicated the need for the ventilation of confined spaces within the new building, a well-constructed floor slab with low permeability gas membrane and minimum penetration of the ground slab by services. The RIW Sheetseal GR membrane was selected which comprised a 1.5 mm thick cross orientated polyethylene with aluminium laminate. The membrane installation was certified by UK Membranes Limited. A copy of the membrane specification and installation certificate in enclosed.

3.3 Protection of Site Workers

A programme of working was put in place to protect workers handling soil during ground works, including making them aware of the potential contamination. Workers were protected through the use of suitable personal protective equipment (PPE). A discovery strategy was also established in order to have a procedure for dealing with any suspicious soil discovered during the course of the groundwork. It is understood that no unexpected contamination was encountered during the groundworks.

3.4 Protection of Buried Services

Barrier pipe has been used for the water supply to the site and across the site where necessary; a drawing is provided detailing the pipe specification.

4.0 CONCLUSIONS

In addition to the potential risks posed to construction personnel during ground works, which have been mitigated through the use of good working practice and appropriate PPE, the conceptual model set out in Section 2.2 highlighted the following potential risks at this site:

- ❒ end users and plants exposed to contamination through direct contact with the soil and dusting of the soil in the areas of soft landscaping;
- ❒ exposure to harmful gases; and
- ❒ deterioration of plastic pipes and potential tainting of the water supply.

These risks have been mitigated by the provision of a capping of clean imported soil, which has been confirmed to be suitable for use by testing of the in-situ imported material, the installation of a gas impermeable membrane which has been certified by an external specialist and the provision of barrier pipe for the water supply.

On the basis of the observations made to date, it is considered that the site has been suitably remediated in accordance with the recommendations made within our previous reports and will be acceptable for the proposed use.

We trust that this information is sufficient for you to discharge the planning conditions but if you require further clarification, please do not hesitate to contact us.

Yours sincerely
GEOTECHNICAL & ENVIRONMENTAL ASSOCIATES

Juliet Fuller

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