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21 July 2023

Subject: St Ann's Hospital: Planning Condition 23
Our ref: L-21914-2.4.2-23-575-RJG

Dear Mr Allen,

I write further to your request to provide information to support the discharge of Condition 23 of Planning Permission HG|Y/2022/1833. Condition 23 States:

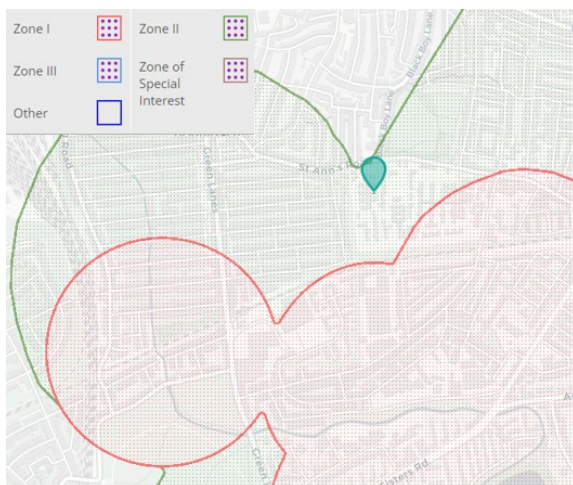
23 Source Protection Strategy

Development (other than demolition and site preparation works) within any Phase shall not commence until a Source Protection Strategy detailing how the developer intends to ensure the water abstraction source is not detrimentally affected by the proposed development both during and after its construction has been submitted to and approved by, the local planning authority in consultation with the water undertaker. The development shall thereafter be constructed in line with the recommendations of the strategy.

Reason: To ensure that the water resource is not detrimentally affected by the development.

There are no identified groundwater abstractions on site. However, the site is located within Zones 1 and 2 of a Groundwater Source Protection Zone (as illustrated by Figure 1 below).

Figure 1: Groundwater Source Protection Zones (from Groundsure).



The principal risk to controlled waters will be through the piling process to provide a suitable foundation for the proposed development. As a result, IDOM Merebrook Limited (IDOM) was commissioned by Hill Partnerships to undertake a Piling Works Risk Assessment.

The Design Engineer has determined that the foundation solution will comprise 450 mm diameter Continuous Flighted Auger piles to a depth of 25 metres below ground level.

This risk assessment has been prepared with reference to the Environment Agency document 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention', May 2001, referred hereafter as the 'EA Guidance'.

The EA Guidance identifies six priority pollution scenarios which should be considered when selecting the founding technique to be used and these are considered in this document:

1. Creation of the pathway by breach of aquitard or cap;
2. Creation of pathway to allow gas or vapour migration;
3. Direct contact with contaminated soils arising from pilings;
4. Degradation caused by contact between pile/foundation materials and contaminants;
5. Carriage of contaminated solids into aquifer;
6. Contamination of controlled waters by concrete, cement paste etc.

Background

The site is located at National Grid Reference 532589, 188605. It is located within the administrative boundary of the London Borough of Haringey and occupies a 7.2-hectare parcel, formerly part of the St Ann's Hospital complex. The buildings, the majority of which are no longer in active use, vary in styles from pre-war to refurbished post war buildings. Building heights across the site range from 2-3 storeys.

Vehicular and pedestrian access to the site is via St Ann's Road (N15 3TH).

The site comprises typically low-rise hospital buildings and related infrastructure. The site also includes soft landscaping (and a wooded area to the south) which incorporates trees with Tree Protection Orders (TPOs). A tank farm containing three above ground tanks (within a brick/concrete bund) was located in the south, it is understood that fuel lines run from the tank farm to the boiler room. An engineer's workshop was also located in the south. Two electricity substations were located towards the middle of the site.

The site was predominantly flat with a general slope from west to east and north to south.

The site is bound by St Ann's Road to the north with Chestnuts Park and residential properties beyond. To the east is a further parcel of St Ann's Hospital which is undergoing redevelopment and hospital buildings that are still in use. To the south is an overground railway line with residential housing and the Arena Design Centre beyond. To the west the site is bounded by Warwick Gardens with residential housing beyond.

Site History

The site was predominately farmland (with only a few buildings in the north) until the 1890s when a hospital was built on the site. The site has remained as a hospital with the addition of extensions and new buildings. Permanent buildings included an administrative block and water tower. A boiler house was added in 1907. A pond identified in the earliest available plan (1864) in the northwest of the site was later infilled (by the early 1900s). The above ground fuel storage tanks in the south of the site were installed in the 1960s. An electricity substation was noted by the 1970s and a second from the 1980s (both were noted towards the middle of the site).

Potential contaminative land uses within 250 m of the site have included: a burial ground (120 m to the east), laundry (100 m to the northeast), bedstead factory (120 m to the northeast), St Ann's Works – plastic moulding (beyond the site boundary to the west), electricity substation (beyond the site boundary to the west), furniture works (100 m to the south), garage (150 m to the east), petrol station (130 m to the east) and an industrial estate (to the south beyond the railway line). Infilled ponds were noted 167 and 248 m to the southeast.

Environmental Setting

The published geological map indicates that the site is underlain directly by London Clay (up to 150 m thick).

Seven boreholes were identified on site by BGS records all of which were advanced in November 1964. These are summarised as follows:

- i. TQ38NW555 (BH1): 0.15 m of topsoil over London Clay to the maximum depth drilled (18.29 m);
- ii. TQ38NW556 (BH2): 0.15 m of topsoil over London Clay to the maximum depth drilled (18.29 m);
- iii. TQ38NW557 (BH3): 0.15 m of topsoil over London Clay to the maximum depth drilled (9.15 m);
- iv. TQ38NW558 (BH4): 0.15 m of topsoil over London Clay to the maximum depth drilled (3.05 m);
- v. TQ38NW559 (BH5): 0.15 m of topsoil over London Clay to the maximum depth drilled (3.05 m);
- vi. TQ38NW561 (BH7): 0.3 m of topsoil over London Clay to the maximum depth drilled (3.35 m). The borehole was repositioned three times due to obstructions close to the surface; and
- vii. TQ38NW573 (BH20): 0.23 m of topsoil over London Clay to the maximum depth drilled (18.29 m).

The London Clay is classed by the Environment Agency as an Unproductive Stratum.

At the time of the desk study, five licenced potable groundwater abstractions were located within one kilometre. The site is within an Environment Agency defined Source Protection Zone (SPZ). The whole site is within a Zone II SPZ (Outer Protection Zone) and the extreme southeast of the site is also within a Zone I SPZ (Inner Protection Zone).

The nearest surface water feature is the New River, located approximately 500 m to the south of site.

The site is within flood Zone 1 as defined by the Environment Agency. This means it has a low probability of flooding from rivers and the sea.

Previous Site Investigations

A site investigation was produced by RSK in 2017. The report was reviewed by CAPITA in 2018.

The RSK investigation report was not available to IDOM, reference is made to the 2018 CAPITA report and the data summarised within it.

The RSK investigation comprised the following scope of works:

- i. 20 boreholes (eight boreholes to 25 m bgl and 12 boreholes to 15 m bgl);
- ii. 16 window sample boreholes to a maximum depth of 5 m bgl;
- iii. Three machine dug trial pits to a maximum depth of 3.0 m bgl;
- iv. Four hand pits to a maximum depth of 0.7 m bgl; and
- v. Six rounds of gas monitoring of the installed wells.

Thirty-two soil samples were recovered by RSK and submitted for analysis.

A screening exercise was undertaken by CAPITA whereby contaminant concentrations recorded in soils have been assessed against Suitable for Use Levels (S4ULs) published in 2015 by LQM/CIEH. These precautionary screening levels are designed to be representative of minimal risk to human health in a number of land use scenarios. S4ULs were selected for a residential land use where the possibility of consumption of homegrown produce exists and assuming a soil organic matter of 1 %. For lead the DEFRA Category 4 Screening Level was used.

Table 1: Summary of soil chemical exceedances

CONTAMINANT	No of Tests	SCREENING LEVEL (SL) (mg.kg ⁻¹)	No > SL*	Location/depth	Concentration (mg/kg)
HUMAN HEALTH RISK ASSESSMENT					
Asbestos in soil	15	Detected	3	BH8 (0.5 m)	Chrysotile loose fibres
				WS9 (0.5 m)	Chrysotile loose fibres
				WS16 (1.0 m)	Chrysotile & amosite loose fibres
Arsenic	25	37	1	WS18 (0.5 m)	75
Lead	25	200	5	BH1 (0.3 m)	265
				BH12 (0.4 m)	263
				BH15 (0.5 m)	215
				WS16 (2.5 m)	269
				WS18 (0.5 m)	350
Benzo(a)anthracene	18	7.2	2	BH4 (0.3 m)	17.8
				WS10 (0.1 m)	104
Chrysene	18	15	2	BH4 (0.3 m)	16.5
				WS10 (0.1 m)	91.8
Benzo(b)fluoranthene	18	2.6	3	BH4 (0.3 m)	16.9
				WS10 (0.1 m)	126
				WS18 (0.5 m)	3.69
Benzo(a)pyrene	18	2.2	3	BH4 (0.3 m)	16.1
				WS10 (0.1 m)	112
				WS18 (0.5 m)	2.92
Dibenzo(a,h)anthracene	18	0.24	3	BH4 (0.3 m)	1.46
				WS10 (0.1 m)	8.99
				WS18 (0.5 m)	0.4
Indeno(1,2,3-c,d)pyrene	18	27	1	WS10 (0.1 m)	61

The majority of exceedances were encountered in samples of made ground, but the lead exceedance at BH12 (0.4 m) was associated with the London Clay. Heavy metal exceedances appear to be scattered across the site while PAH exceedances were limited to the southern portion of the site.

It was also noted by IDOM that the phytotoxic criteria for zinc (300 mg/kg) was exceeded (491 mg/kg) at one location (BH6 at 0.5 m) within shallow made ground. It does not appear to have affected plant growth in the area.

Six rounds of gas monitoring were undertaken at five locations (WS2, WS4, WS16, WS17 and BH17). The monitoring locations included potential gassing areas – the infilled pond (WS2) and above ground tanks/boiler house (WS17 and BH17). The monitoring rounds were undertaken at barometric pressures ranging from 1001 to 1025mb. Flow was recorded in the range 0.0 to 0.6 l/hr. Over the six monitoring rounds methane (CH₄) was not detected, carbon dioxide (CO₂) was detected to a maximum of 3.1 % v/v with a corresponding depleted oxygen concentration of 19.0 % v/v.

Groundwater level data indicated that WS2, WS4, WS5 and WS16 were dry during each monitoring round (it

is not known how deep the wells were or the response zones). Groundwater/perched water was encountered at WS17 and BH17 (advanced in the south of the site, close to the tank farm), groundwater levels ranged from 1.08 to 1.75 m bgl.

Ground Investigation Scope of Works

An intrusive investigation was carried out by IDOM 21 March to 25 March 2022 and comprised the following scope of work:

- i. Five machine-dug trial holes (MTP1 to MTP5) to a depth of 3.0 m bgl (these were targeted in areas of previously identified contamination, in the vicinity of ducts and the tank farm/boiler house);
- ii. 17 hand-dug trial pits (MHP1 to MHP17) to a maximum depth of 1.3 m bgl (these were also targeted in areas of previously identified contamination, in the vicinity of ducts and the tank farm/boiler house); and
- iii. Six concrete cores (MC01 to MC06) to a maximum thickness of 0.3 m (targeted beneath the buildings to understand the potential for contamination in these areas).
- iv. Chemical testing for a wide variety of contaminants including the contaminants of concern; and
- v. Gas and groundwater monitoring at serviceable RSK boreholes.

Representative soil samples were taken from various depths and strata to assess the contaminative status of the site. Soil samples were submitted to an MCERTS/ UKAS accredited laboratory for chemical analysis of a suite of potential contaminants of concern.

Ground Conditions

The encountered geological ground conditions were consistent with those identified in previous site investigations. This consisted of made ground over the London Clay Formation.

A summary of the ground conditions encountered is presented in Table 2.

Table 2: Summary of Sub-surface Ground Conditions

STRATA	DEPTH TO TOP RANGE (m bgl)	THICKNESS RANGE (m)
Topsoil	0.0	0.2 – 0.4
Made Ground: Bituminous surfacing	0.0	0.15
Made Ground: Total	0.0 – 0.4	0.1 – 1.4
London Clay	0.1 – 1.4	2.0+

Topsoil

Topsoil generally comprised soft brown slightly sandy clay with rootlets.

Made Ground

Made ground was encountered at each investigation location and generally comprised sandy clay to gravelly sand/sandy gravel with inclusions of concrete, brick, flint, glass, clinker, ceramic fragments, ash mudstone and sandstone.

A fragment of asbestos cement (chrysotile) was observed at MTP05 (0.15 to 0.6 m bgl). Suspected asbestos containing material was encountered in the form of frequent fragments of cement sheeting (MTP01 from 0.3 m bgl) and a large felt/textile fragment (MTP02 at 0.4 to 1.0 m bgl). MTP01 was terminated at 0.4 m to prevent disturbance of asbestos within the pit.

A layer of ash and clinker was encountered at MTP03 (0.6 to 0.65 m bgl) and MHP03 (0.5 to 0.7 m bgl).

A strong hydrocarbon odour was reported at MTP04 within made ground.

London Clay Formation

London Clay generally comprised firm to stiff light brown silty sandy clay to greyish brown silty clay.

A pocket of groundwater/perched water was encountered at one location MTP04 (1.5 m bgl).

Environmental Assessment

Made Ground was noted to contain clinker and brick and is subject to widespread contamination by lead, arsenic, pH, PAH compounds and asbestos. PAH contamination was also encountered in samples of topsoil and a sample of natural clay was impacted by heavy metals (lead and arsenic).

Remediation will include clean soils in areas of soft landscaping and upgraded water pipes.

Proposed Development and Foundation Solution

The development comprises residential properties with associated private and communal soft landscaping, roads and footpaths. Based upon the ground conditions encountered the Design Engineer has therefore proposed to use Continuous Flight Auger (CFA) piles.

CFA piles are a bored system installed using a full height continuous auger. The auger has a hollow stem allowing concrete to be pumped to the toe of the pile as the auger is withdrawn. The CFA piles being used will be *circa* 450 mm in diameter and will be up to 25 m deep. The piles will be founded within the London Clay Formation. The final specification will be determined by a specialist piling contractor.

With reference to the EA Guidance six priority scenarios the following comment is offered:

1. Creation of pathway by breach of aquitard or cap

Contamination of the Made Ground has been identified. However, contamination is generally by metals, asbestos and polyaromatic hydrocarbons (PAH).

No superficial deposits were identified on site and the underlying geology is the London Clay Formation. The impermeable London Clay Formation in the vicinity of the site is in the region of 150 m thick and piles will not penetrate this stratum. As a result, the risk of a piles penetrating the London Clay to form a new pathway is considered to be negligible.

2. Creation of pathway to allow gas or vapour migration

No significant volatile contamination has been identified and the potential vapour risk is considered to be low.

Gas generation is low and a significant gassing regime was not reported. As a result, the risk from ground gas and vapours was considered to be low.

3. Direct contact with contaminated soils arising from piling

Some contamination of soils has been identified, including asbestos. However, the risk to construction workers can be mitigated by use of adequate personal protective equipment and good hygiene practices such as adequate washing and changing facilities. Operatives will not be allowed to eat, drink or smoke on site except in designated areas and will be required to wash all exposed skin at the end of each shift. Operatives are to be informed of the potential hazards at the site and will be required to report any observations of suspect material. Materials which are not going to be retained on site will be removed and disposed of in accordance with all relevant statutes.

4. Degradation caused by contact between pile/foundation materials and contaminants

Chemical analysis of soils from the site has been undertaken and the buried concrete class for the site has been designed accordingly to address the sulphate conditions and potential contaminants within mixed wastes. Therefore, no significant risk of concrete degradation in foundations arising from contamination is considered likely.

5. Carriage of contaminated solids into aquifer

Contamination of made ground has been identified. However, the downward movement of soils is restricted since the CFA pile is a replacement and not a displacement type pile. The cast in-situ concrete provides a tight bond to the pile shaft limiting the potential for vertical migration of contamination. This pollution scenario is not to be considered significant; furthermore, the piles will not penetrate the full thickness of the London Clay Formation.

6. Contamination of controlled waters by concrete, cement paste etc

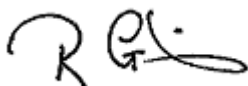
There is considered to be a low likelihood of this occurring. The CFA method does not require the pile bore to be supported with bentonite. The application of concrete will be closely controlled and there will be a very limited time period where contamination might occur prior to setting. Loss of pile concrete into the surrounding soil is considered to be minimal and the overall effect negligible furthermore, the piles will not penetrate the full thickness of the London Clay Formation. The contamination of the controlled waters by concrete, cement waste etc. is considered to be unlikely.

Conclusion

The proposed foundation solution will not penetrate the London Clay Formation and as a result, the potential risk to controlled waters is considered to be negligible.

I trust you find this information sufficient for your purposes. If you have any questions regarding the content of this risk assessment, please do not hesitate to contact me.

Yours sincerely.



Rob Glavin