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REMEDIAL STRATEGY AND VERIFICATION PLAN

FOR

**PROPOSED DEVELOPMENT AT
222 ARCHWAY ROAD,
HIGHGATE,
LONDON,
N6 5AX**

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Report Title: Remedial Strategy & Verification Plan for 222 Archway Road, Highgate, London, N6 5AX (Application 2)

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1 INTRODUCTION

1.1 Terms of Reference

- 1.1.1 Papa Architects ("The Client"), has commissioned Jomas Associates Ltd ('Jomas') to produce a remedial strategy prior to the development of 222 Archway Road, Highgate, London, N6 5AX.

1.2 Proposed Development

- 1.2.1 The proposed development is to convert the existing ground floor and lower ground floor from offices to residential use. The proposed development contains a private garden at lower ground floor level.

1.3 Previous Reports

- 1.3.1 The previous reports that have been utilised by Jomas for the purposes of this document comprise:
- Desk Study/Preliminary Risk Assessment Report for 222 Archway Road, Highgate, London, N6 5AX, P3562J2287, July 2021, Jomas Associates Ltd.
 - Geo-environmental Assessment Ground Investigation Report for 222 Archway Road, Highgate, London, N6 5AX, P3562J2287/HAH, 5th July 2023, Jomas Associates Ltd.

1.4 Background

- 1.4.1 Planning permission has been granted on appeal by The Planning Inspectorate under reference: APP/Y5420/W/22/3294965.

- 1.4.2 The following conditions related to contaminated land were attached to the permission:

1) The development hereby approved shall not commence until an intrusive assessment of the risks posed by any contamination, carried out in accordance with British Standard BS 10175: Investigation of potentially contaminated sites - Code of Practice and the Environment Agency's Model Procedures for the Management of Land Contamination (CLR 11) (or equivalent British Standard and Model Procedures if replaced), has been submitted to and approved in writing by the Local Planning Authority. If any contamination is found, a report specifying the measures to be taken, including the timescale, to remediate the site to render it suitable for the approved development shall be submitted to and approved in writing by the Local Planning Authority. The site shall be remediated in accordance with the approved measures and timescale and a verification report shall be submitted to and approved in writing by the Local Planning Authority.

- 1.4.3 The purpose of this report is to provide the required report specifying the remedial measures required to bring the site into a condition suitable for the proposed use.

1.5 Objectives

- 1.5.1 The primary objectives of this document are as follows:
- To provide information on the site setting; identify ground conditions and potential environmental risks associated with the development.
 - To provide an assessment of various options for remediation.

- To set out the remediation strategy that will provide a site that is suitable for the intended use and addresses any identified unacceptable risks.
- To provide relevant information to address planning conditions relating to contaminated land. A separate verification report will be required following the implementation of the remediation strategy.

1.5.2 The primary remediation objective is the mitigation of the risks associated with arsenic and lead impacted soils. A bulk sample of asbestos containing material was also identified on site and confirmed to contain chrysotile and amosite asbestos.

1.5.3 This document provides an assessment of potential remedial strategies and describes the methodology for the proposed remedial action.

1.5.4 The remediation strategy and associated remediation criteria have been developed with reference to previous works carried out at the site. The remediation criteria used to develop the proposed remediation strategy will be used for the proposed verification works.

1.5.5 The Principal Contractor will be responsible for implementing the appropriate methodology and site management procedures to achieve the required outcome and comply with these principles.

1.5.6 The works will be undertaken by experienced personnel and will be managed in accordance with the Contractor's Construction Environmental Management Plan. Detailed construction method statements will be prepared for the impacted soil removal works. Jomas will be employed as Environmental Specialist, to supervise the works and undertake soil sampling and analysis as part of the validation process.

1.5.7 This document should be read in conjunction with the above reports.

1.6 Limitations

1.6.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use of Papa Architects, in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

1.6.2 This report provides an overview of conclusions drawn from previous investigations, some of which has been conducted by others. Third party information used is assumed to be correct, and Jomas has not validated any of the data provided. Jomas is unable to guarantee the accuracy of the information provided by others.

2 LAND CONTAMINATION OVERVIEW

2.1 Desk Study Findings

2.1.1 A desk study was produced for the site (Jomas, July 2021), and issued separately. A brief overview of the findings is presented below;

- A review of the earliest available historical maps (1864) indicated that the site was undeveloped and devoid of any features at that time. By the map dated 1894, the site was shown to be occupied by a residential-style terraced building in the west, with an external area presumed to be an associated garden in the east. The site appears to remain unchanged through to the most recent map (2021) and was at the time of writing used at ground and lower ground floor level as offices.
- From the earliest map (1854), the site vicinity was primarily undeveloped with ponds, a brick field and clay pits noted within 200m of the site. By 1870, a branch of the Great Northern Railway was present roughly 120m north-east of the site. The site vicinity was noted to have undergone dense residential-style development by 1894. A few industrial buildings are noted in the site vicinity through to the 1960s, following which no significant changes were noted through to the most recent map (2021).
- Information provided by the British Geological Survey indicates that the site is directly underlain by solid deposits of the Claygate Member.
- There are no artificial deposits within the site area.
- The solid deposits directly underlying the site are identified as a Secondary A Aquifer.
- A review of the Enviro+Geosight Report indicates that there are no source protection zones within 500m of the site.
- There are no groundwater, surface water or potable water abstractions reported within 2km of the site.
- There are no Environment Agency Zone 2 or Zone 3 floodplains reported within 50m of the site.
- It was recommended that an intrusive investigation be undertaken to assess the extent of Made Ground soils present at the site, and to conduct chemical testing to assess the suitability of the soils in the proposed soft landscaped area for residential end-use.

2.2 Intrusive Investigation

2.2.1 The ground investigation was undertaken on 13th June 2023, and consisted of the following:

- 4 No. hand-held window sampling boreholes (WS1-WS4), drilled up to 3.50m below ground level (bgl), with associated sampling;
- Laboratory analysis for chemical purposes.

2.2.2 The results of the ground investigation revealed a ground profile comprising a thickness of Made Ground (up to 1.00mbgl depth), overlying orange brown mottled grey clay (considered to represent the Claygate Member/London Clay Formation), encountered to the base of the boreholes (up to 3.50mbgl).

2.2.3 Groundwater was not encountered in any of the exploratory holes.

2.3 Soil Gas Risk Assessment

- 2.3.1 No significant potential source of ground gas was identified during the desk study and therefore no further ground gas assessment was considered necessary.

2.4 Controlled Waters Risk Assessment

- 2.4.1 The site is underlain by solid deposits of the Claygate Member, a Secondary A Aquifer. The London Clay Formation is a parent unit of the Claygate Member.
- 2.4.2 There were no source protection zones identified within 500m of the site, and no groundwater, surface water or potable water abstractions reported within 2km of the site. As a result, the sensitivity of controlled waters was considered low.
- 2.4.3 No significantly elevated concentrations of potentially mobile contaminants were reported within soil samples analysed.

2.5 Human Health Risk Assessment

- 2.5.1 Following a review of the Site Investigation reports, the following factors are noted:
- The proposed development is to convert the existing ground floor and lower ground floor from offices to residential use. The proposed development contains a private garden at lower ground floor level.
 - Following generic risk assessments, elevated concentrations of arsenic and lead were reported in soils in excess of generic assessment criteria for the protection of human health within a residential with home grown produce end-use scenario.
 - WS4 was moved from where initially positioned due to potential asbestos containing material (ACM) being encountered in the shallow sub-surface. A new location was undertaken approximately 0.5m away. A bulk sample of the suspected ACM was obtained and identified. Other than this sample, no asbestos containing materials (ACM) or fibres were reported in samples analysed in the laboratory.
 - Health and Safety measures will be required for the protection of construction workers.

2.6 Impact to Neighbouring Properties and Buried Services

- 2.6.1 Screening of levels of determinands potentially affecting water pipes identified exceedances relating to 1No. band of hydrocarbons, therefore upgraded pipework may be required.
- 2.6.2 Requirements for potable water supply pipework should be confirmed with the relevant utility provider at an early stage of the project life cycle.

2.7 Conceptual Site Model (CSM)

- 2.7.1 A review of potential sources Identified During Desk Study, is presented below, with an updated CSM in Table 2.1.

SECTION 2

LAND CONTAMINATION OVERVIEW

Table 2.1: Plausible Pollutants Linkages Summary (Pre-Remediation, as updated for Remediation Strategy)

Source	Pathway	Receptor	Relevant Pollutant Linkage?	Comment
- Potential for contaminated ground associated with industrial use – off site (S1) - Published goods, 14m north-west - Garage, 96m north-west (1962 – 1996) - Laundry and associated tank, ~120m north - Potential ground gas generation from infilled land – off site (S2) - Pond, ~50m north Brick field, 70m south-east (1879) - Unspecified pit, 133m north-west (1879)	- Ingestion and dermal contact with contaminated soil (P1) - Inhalation or contact with potentially contaminated dust and vapours (P2) - Permeation of water pipes and attack on concrete foundations by aggressive soil conditions (P6) - Accumulation and migration of soil gases (P5) - Leaching through permeable soils, migration within the vadose zone (i.e., unsaturated soil above the water table) and/or lateral migration within surface water, as a result of cracked hardstanding or via service pipe/corridors and surface water runoff. (P3) - Horizontal and vertical migration of contaminants within groundwater (P4)	- Construction workers (R1) - Maintenance workers (R2) - Neighbouring site users (R3) - Future site users (R4) - Building foundations and on site buried services (water mains, electricity and sewer) (R5) - Neighbouring site users (R3) - Building foundations and on site buried services (water mains, electricity and sewer) (R5) - Controlled waters (R6) - Secondary A aquifer, on site	✓	Remedial measures considered necessary. The findings of the ground investigation report should be included in the construction health and safety file, with adequate measures put in place for the protection of construction and maintenance workers. No significant source identified in the Desk Study, and no source identified during the GI. No formal gas protection considered necessary. No significant risk to controlled waters receptors identified. Contact should be made with relevant utility providers to confirm if upgraded materials are required.

3 REMEDIAL OPTIONS APPRAISAL

3.1.1 Soil Screening

- A possible remedial option would be to undertake soil screening, comprising excavation of impacted soils, screening within the site to remove likely contaminative materials, and re-deposition of materials on site. Such an operation may include a variety of screening methodologies, including soil washing etc.
- Any visual asbestos materials may be removed by hand, with extensive dust control measures required during the soil screening operations for the protection of site workers and nearby residents. Asbestos fibres in soil, however, not be visible for removal.
- However, it is not practical to screen soil for arsenic or lead.

3.1.2 Excavation and disposal

- Made Ground displaying elevated concentrations of contaminants may be excavated for disposal off site. From a review of chemical testing data, excavations to a depth of the order of 1.0mbgl minimum would be required, with the importation of a respective thickness of certified clean material to restore site level.
- The costs and vehicle movements required for such an operation may render the costs associated with this method prohibitive.

3.1.3 Encapsulation

- In order to sever the identified pathways to the most sensitive receptors (human health), encapsulation of impacted materials below building footprints or areas of hard surfacing may be undertaken. This would have the effect of removing the potential pathways of direct contact and inhalation.
- In areas of soft landscaping, impacted soils can be encapsulated beneath a minimum 600mm thickness of clean imported sub/topsoil placed over a geotextile membrane or marker layer.

3.1.4 Dust control measures will be required during the undertaking of all the remedial options identified above for the protection of site workers.

3.1.5 When issues of cost effectiveness, requirements for vehicle movements etc. are taken into account, it is recommended that encapsulation of impacted soils is adopted as the preferred remedial methodology.

3.1.6 The requirements for the remedial methodology are presented within Section 4 of this report.

4 PROPOSED REMEDIATION STRATEGY

4.1 Introduction

4.1.1 The proposed remediation scheme serves to address the potential unacceptable risks identified in the context of the proposed redevelopment of the site.

4.1.2 The remedial measures comprise:

- The encapsulation of impacted soils below areas of building footprint or hardstanding.
- A watching brief following demolition and during enabling works.
- Within areas of soft landscaping, a cover layer comprising a minimum 600mm thickness of clean subsoil/topsoil over a geotextile membrane/marker layer will be utilised.
- Where Made Ground is removed and the base of the Made Ground is encountered at shallower depth than the depth of the proposed clean cover, the depth of clean cover can be limited to the thickness of Made Ground removed, or thickness required for finished levels.
- Validation testing will be undertaken upon soils imported to site to confirm their suitability for use as a clean capping layer.

4.2 Remediation Strategy

Impacted Soils Encapsulation

4.2.1 Following removal of hardstanding etc, any visible asbestos materials are to be removed by a specialist contractor by a hand picking operation, and double bagged for disposal. Dust control measures will also be required. This may comprise the damping down of excavations. It is noted that asbestos fibres will not be visible to the naked eye.

4.2.2 Where buildings or hardstanding are proposed, no formal remedial works are considered necessary, beyond the hand picking discussed above, and the construction of the building/hardstanding, as this should provide an appropriate barrier to impacted soils. External hardstanding within private areas should be of a construction that discourages possible removal by future occupiers.

4.2.3 Within areas of soft landscaping, soils will be encapsulated below a cover layer of imported clean subsoil/topsoil. This should comprise a minimum 600mm of soil within soft landscaping areas, laid over a geotextile membrane/marker layer.

4.2.4 Where topsoil and sub-soil is imported to the site, the soil should be chemically suitable for use. All imported soil should conform to the following chemical specification:

Table 4.1: Topsoil Requirements

Determinand	Unit	Screening Criteria	
Arsenic	mg/kg	S4UL	37
Boron	mg/kg	S4UL	290
Cadmium	mg/kg	S4UL	11
Chromium	mg/kg	S4UL	910
Lead	mg/kg	C4SL	200
Mercury	mg/kg	S4UL	40
Nickel	mg/kg	BS3882	110

Determinand	Unit	Screening Criteria	
Selenium	mg/kg	S4UL	250
Copper	mg/kg	BS3882	200
Zinc	mg/kg	BS3882	300
Total Cyanide	mg/kg	CLEA v1.06	33
Asbestos	%	S4UL	None Detected
pH	-	S4UL	5-9
Naphthalene	mg/kg	S4UL	2.3
Acenaphthylene	mg/kg	S4UL	170
Acenaphthene	mg/kg	S4UL	210
Fluorene	mg/kg	S4UL	170
Phenanthrene	mg/kg	S4UL	95
Anthracene	mg/kg	S4UL	2400
Fluoranthene	mg/kg	S4UL	280
Pyrene	mg/kg	S4UL	620
Benzo(a)anthracene	mg/kg	S4UL	7.2
Chrysene	mg/kg	S4UL	15
Benzo(b)fluoranthene	mg/kg	S4UL	2.6
Benzo(k)fluoranthene	mg/kg	S4UL	77
Benzo(a)pyrene	mg/kg	S4UL	2.2
Indeno(123-cd)pyrene	mg/kg	S4UL	27
Dibenzo(ah)anthracene	mg/kg	S4UL	0.24
Benzo(ghi)perylene	mg/kg	S4UL	320
TPH C ₅ -C ₆	mg/kg	S4UL	42
TPH C ₆ -C ₈	mg/kg	S4UL	100
TPH C ₈ -C ₁₀	mg/kg	S4UL	27
TPH C ₁₀ -C ₁₂	mg/kg	S4UL	74
TPH C ₁₂ -C ₁₆	mg/kg	S4UL	140
TPH C ₁₆ -C ₂₁	mg/kg	S4UL	260
TPH C ₂₁ -C ₃₅	mg/kg	S4UL	1100

4.3 Health and Safety / PPE

- 4.3.1 Excavations will have suitable barriers and access points, with pedestrian routes clearly marked. Appropriate safety signage and instructions will be clearly visible, with accesses to be kept clear of debris, materials and cables.
- 4.3.2 Operatives will be briefed on sharps protection in order to ensure safety. Clean/dirty rooms will be provided for operatives working within contaminated areas.
- 4.3.3 Standard PPE will be required at all times, namely:
- Hard hat
 - Safety spectacles
 - Hi-viz waistcoat or jacket
 - Gloves

- Boots or shoes with steel toe and midsole protection

4.3.4 Other items may be required as per detailed in the specific method statement, such as:

- Harness
- Dust protection
- Ear protection
- Other specialist equipment

4.3.5 A method statement will be produced by the chosen contractor.

4.4 Unexpected Contamination

4.4.1 To accord with best practice if, during the construction of the development, contamination and/or materials not previously identified are found to be present at the site, then no further development (unless otherwise agreed in writing with the Local Planning Authority) shall be carried out until Jomas' (or qualified environmental engineer) has been informed, and a suitable strategy implemented to the approval of the engineer and/or the Local Planning Authority.

4.4.2 Examples of such materials include:

- Buried drums, tanks, pipework or containers
- Soil or water with colour or odour
- Non-natural materials and wastes
- Other evidence of contamination, for example iridescent sheens (like oil or diesel) on soil or water.

4.5 Operational Standards – Summary

4.5.1 As a minimum, the following standards shall be employed during the full course of this remediation site works:

- All materials subject to excavation and disposal must be tracked throughout and evidence generated to provide an auditable trail.
- Any excavated soils will be stockpiled/stored in a designated area on site, with plastic sheeting placed at ground surface to prevent cross-contamination. The contractor shall be responsible for the removal of spoil from the site.
- Personal protective equipment shall be employed by all site remediation and ground worker personnel in accordance with site specific risk assessments. These are to be completed by all contractors following consideration of the potentially hazardous properties of contaminants within the site.
- A copy of this remediation statement together with all previous geo-environmental assessment reports shall be retained on site for reference during the full course of remediation activities.

5 VERIFICATION PLAN

5.1 Proposals for Validation & Verification

Cover Layer

5.1.1 A qualified environmental engineer shall undertake the following tasks to monitor the remedial activities described in this statement.

- Following importation of subsoil/topsoil to site, representative samples will be obtained for laboratory testing. It is anticipated that 1No sample will be taken per 50m³ of soil imported, with a minimum of 3No samples.
- The thickness of the clean cover layer and the presence of a geotextile/marker layer will be verified by a series of hand dug pits in areas of soft landscaping, with accompanying photographs.
- These samples shall be sent directly to an MCERTS and UKAS accredited laboratory for testing.
- The results will be screened against the criteria given previously within Table 4., which comprise current published Environment Agency residential end-use soil guideline values (SGVs) or where unavailable, LQM or S4UL generic assessment criteria – safe for use levels for human health risk assessment. If these values become out of date, reference shall be made to replacement industry approved values.

5.2 Remediation Verification/Completion Report

5.2.1 The Remediation Completion Report shall include the following information:

- Summary of all works undertaken.
- Photographic log of the works.
- A full chemical soil analysis results schedule.
- Full details of any further contamination reported during construction works.
- Disposal documentation for any spoil or asbestos materials spoil.

5.3 Reporting

5.3.1 All activities will be documented (including photographs) to show compliance with the Remediation Strategy. This documentation will be kept on site at all times during the works and updated daily as part of a field record as the works progress, which would be available for regulatory inspection at any time. All documentation would be included in a final verification report to be presented to the Local Authority.

6 REFERENCES

- A possible approach for generating site specific assessment criteria for polycyclic aromatic hydrocarbons (draft internal HPA briefing note)
- CIEH & CL:AIRE (2008) *Guidance on comparing soil contamination data with a critical concentration*. London: Chartered Institute of Environmental Health (CIEH) and CL:AIRE
- Environment Agency (2020); Land Contamination Risk Management (LCRM). <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>
- Environment Agency, NHBC & CIEH (2008) *Guidance for the safe development of housing on land affected by contamination*. R & D Publication 66. London: Environment Agency
- Environment Agency Technical Report P45 "Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environment Quality Standard Development
- LQM/CIEH S4ULs. LQM, 2014
- National Planning Policy Framework. Department for Communities and Local Government, March 2012

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