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REMEDIATION STRATEGY
AND
VERIFICATION PLAN

FOR

PROPOSED DEVELOPMENT AT

138-140 HIGHGATE ROAD, HIGHGATE, LONDON, NW5 1PB

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1 INTRODUCTION

1.1 Terms of Reference

1.1.1 Design Ventures Highgate Ltd ("The Client"), has commissioned Jomas Associates Ltd ('Jomas') to produce a remedial strategy prior to the development of 138-140 Highgate Road, Highgate, London NW5 1PB.

1.2 Background

1.2.1 Development permission is being granted by the London Borough of Camden with a number of conditions relating to various requirements.

1.2.2 Planning Condition 15 of application ref 2018/1528/P, relates to land contamination matters.

1.2.3 Condition 15 states:

1.2.4 At least 28 days before the development hereby permitted commences a written detailed scheme of assessment consisting of site reconnaissance, conceptual model, risk assessment and proposed schedule of investigation must be submitted to the planning authority. The scheme of assessment must be sufficient to assess the scale and nature of potential contamination risks on the site and shall include details of the number of sample points, the sampling methodology and the type and quantity of analyses proposed. The scheme of assessment must be approved by the LPA and the documentation submitted must comply with the standards of the Environment Agency's Model Procedures for the Management of Contamination (CLR11).

1.2.5 No specific requirement has been identified for provision of a remediation strategy. However, due to the reported site conditions remedial measures are considered necessary.

1.3 Objectives

1.3.1 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 anticipated planning conditions relating to contaminated land. A separate verification report will be required following the implementation of the remediation strategy.

1.3.2 The primary remediation objective is the mitigation of the risks associated with below ground fuel storage tanks and associated infrastructure and hydrocarbon impacted ground that may be present.

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

1.3.4 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.

1.3.5 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.

1.3.6 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.

1.4 Previous Reports

The previous reports that have been utilised by Jomas for the purposes of this document comprise:

- Phase I Desk Study on 138-140 Highgate Road, Highgate, London NW5 1PB for IDM Land Ltd, 13859/DS Rev 1.02, February 2014, Soils Limited.
- Desk Study and Basement Impact Assessment Report for 138-140 Highgate Road, Highgate, London NW5 1PB, P1323J1303, February 2018, Jomas Associates Ltd.
- Ground Investigation, Basement Impact Assessment Report & GMA for 138-140 Highgate Road, Highgate, London NW5 1PB, P1323J1303/SL, Final v4.3, December 2018, Jomas Associates Ltd.

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

1.5 Limitations

1.5.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use of Design Ventures Highgate Ltd, 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.

1.5.2 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 SITE SETTING & REDEVELOPMENT PROPOSALS

2.1 Site Information

2.1.1 The site currently comprises a fuel filling station and MOT test centre.

2.2 Proposed Development

2.2.1 It is understood that the proposed development will involve the demolition of the existing buildings and construction of a new four-storey residential development. The new development is understood to include a lower ground floor (half of which is basement due to slope of ground) and a full single-storey basement below. An area of communal soft landscaping is anticipated facing Highgate Road. Private gardens are envisioned; however, these are to be placed above the proposed basement slab. Proposed basement and ground floor plans are presented in Figure 3 and Figure 4 in Appendix 2.

3 CONTAMINATION OVERVIEW

3.1 Desk Study Findings

3.1.1 A desk study was produced for the site (by others), and issued separately. A brief overview of the findings is presented below;

- A Desk Study report has been produced for the site and issued separately (Jomas – March 2018). A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information.
- Earliest historical maps (1872) indicate that the site consists of an undeveloped agricultural field. Few major changes occur to the site until 1936 when an industrial-style unit was constructed in the northwest of the site. By 1952 the industrial-style unit on site was identified as a garage which was demolished by 1970. By 1974 another garage was constructed in the northeast of the site. The canopy above the forecourt also appears to have been constructed at this time. The site appears to have remained in this configuration until the present-day.
- The surrounding area has been utilised predominantly for residential use with limited industrial uses including railway, garages, various works and an oil processing plant.
- The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation. No artificial deposits are reported within the site.
- A review of the EnviroInsight 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 500m of the site.
- There are 2No. surface water features within 250m of the site, the nearest identified 182m east.
- There is a culvert 271m south-west of the site identified as a detailed river network.

3.2 Intrusive Investigation

3.2.1 The ground investigation was undertaken on 12th & 13th February 2018, and consisted of the following:

- 7No. window sampling boreholes, drilled up to 5.45m below ground level (bgl), with associated in situ testing and sampling;
- 2No. cable percussive boreholes, drilled up to 24.95mbgl, with associated in situ testing and sampling;
- Laboratory analysis for chemical and geotechnical purposes;

- 4No. return visits to monitor ground gas concentrations and groundwater levels have been completed.

3.2.2 The results of the ground investigation revealed a ground profile comprising Made Ground up to 1.20mbgl overlying London Clay Formation to the base of the boreholes up to 24.95mbgl. The base of this deposit was not proven.

3.2.3 Groundwater was not encountered during drilling of any of the exploratory holes, though water was noted to seep into WS2 at 1.1mbgl and WS4 at 4.5mbgl.

3.2.4 During return monitoring groundwater was reported at depths of between 1.64m and 4.66m bgl within WS2, WS3, WS4 and WS5. No water was reported within WS1 or BH1 during any monitoring visit. Such variance suggests the water may be surface water ingress as opposed to groundwater.

3.3 Soil Gas Risk Assessment

3.3.1 Calculating the Gas Screening Value using worst case results indicates Characteristic Situation 1. However, concentrations of methane are raised at the site, with corresponding depleted oxygen, meaning raising the site to CS2 is to be considered.

3.3.2 It is noted that the elevated levels were only recorded in a single well (WS5) in close proximity to the underground tank locations, with product also reported within the installation. The other wells on site reported significantly reduced gas readings. It is possible that following remediation of the site, including the removal of the underground tanks and associated contaminated soils and free product, future monitoring may be able to reduce the level of gas protection required. Given the levels of potentially volatile contaminants identified within soil, a vapour resistant membrane may be required within the proposed structures.

3.4 Controlled Waters Risk Assessment

3.4.1 During return monitoring groundwater was reported at depths of between 1.64m and 4.66m bgl within WS2, WS3, WS4 and WS5. No water was reported within WS1 or BH1 during any monitoring visit.

3.4.2 Groundwater analysis has reported no concentrations of contaminants above the laboratory detection limit. Due to several installations reported as ‘dry’ and the underlying geology (London Clay Formation - unproductive strata) it is considered that the water encountered represents surface water ingress as opposed to groundwater.

3.4.3 “Free product” was reported to be floating on the surface of the water within WS2 and WS5. The source of this product is likely to be water migrating though the contaminated Made Ground. Any product encountered during the tank removal works will also have to be removed. Due to the underlying London Clay Formation, identified as unproductive strata, the product and contaminants within soil are unlikely to migrate to impact off-site controlled waters receptors.

3.5 Human Health Risk Assessment

3.5.1 Following a review of the Site Investigation reports, the following factors are noted:

- It is understood that the proposed development will involve the demolition of the existing building and construction of a new three-storey residential development. The new development will include a lower ground floor (half of which is basement due to slope of ground) and a full single-storey basement below. Private gardens are envisioned; however, these are to be placed above the proposed basement slab.

- Following generic risk assessments, elevated concentrations of lead, naphthalene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenzo(ah)anthracene and C21-C35 aromatic hydrocarbons were detected in soils in excess of generic assessment criteria for the protection of human health within a 'residential with plant uptake' end-use scenario.

- Asbestos in the form of chrysotile and amosite - loose fibres were detected in 3No. samples analysed in the laboratory. These were quantified to <0.001%, less than the 0.1% fibre content where arisings are considered hazardous for the purpose of disposal. There is no safe concentration of asbestos for the protection of human health, and measures will be required for the protection of end users and construction workers.

- Health and Safety measures will be required for the protection of construction workers.

3.6 Impact to Neighbouring Properties and Buried Services

3.6.1 Upgraded potable water supply pipe materials are likely to be required for proposed development, which should be confirmed with the relevant service provider at the earliest opportunity.

3.7 London Fire and Emergency Planning Authority Data

3.7.1 Jomas contacted the LFEPA to obtain information they may hold regarding the storage of fuel on site. The information provided indicated the presence of 4No fuel tanks, summarised as follows:

- 1No dual compartment petrol/diesel tank up to 17793 litres in capacity. This is reported to be a double skin steel tank that has been in use since 1998.

- 1No dual compartment petrol tank up to 17793 litres in capacity. This is reported to be a double skin steel tank that has been in use since 1998.

- 1No dual compartment diesel/kerosene tank up to 13638 litres in capacity. This is reported to be a single skin steel tank that has been in use since 1959.

3.7.2 The response included the following statements on the status of current and previous tanks:

3.7.3 *"According to our records, this petrol station was first licensed in 1959 and the site has been occupied by A S F Garages Ltd since1969.*

3.7.4 *The petrol station is currently licensed for the sale of petroleum spirits. The details of the tanks located on site are indicated on page 3 of this report.*

3.7.5 *I enclose a copy of the Licensed Drawing for this site (Drawing Number 1843/97/010A) dated 12 October 1996, indicating the location of the tank farm. The current set of tanks designated T1-T4 directly replaced 4 previous tanks of the same size dating back to 1969.*

3.7.6 *A second plan is enclosed (1436/CS140/21) dated 20 July 1972 which shows the positions of the 2 tanks in the table above, installed in 1959 and currently being used for kerosene/diesel storage (in addition to the 4 replaced tanks)."*

3.7.7 The locations of these features are shown on the plans included in Appendix 1 Figures 1 and 2 and were used in the design of the above summarised exploratory hole plan.

3.8 Conceptual Site Model

Table 3.1: Plausible Pollutants Linkages Summary (Pre Remediation)

Potential Source (from desk study)	Pathway	Receptor	Relevant Pollutant Linkage?	Comment
• Potential for hydrocarbon contaminated ground associated with previous site use as fuel station/garage – on site (S1) • Potential for Made Ground associated with previous development operations – on site (S2) • Potential buried tanks associated with former use as a fuel station/garage – on site (S3) • Current and previous industrial use – off site (S4) • Potential asbestos containing materials within existing buildings – on site (S5) • Potential asbestos impacted soils from demolition of previous buildings – on site (S6) • Potential ground gas generation associated with hydrocarbon impacted soils from historic use as fuel station - on site (S7)	• 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)	• 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)	✓	Removal and disposal of tanks and impacted soils. Encapsulation of impacted soils.
	• Accumulation and migration of soil gases (P5)		✓	Gas Protection measures are required. However, additional monitoring undertaken post-remediation may reduce this or prove otherwise.
	• 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)	• Neighbouring site users (R3) • Building foundations and on site buried services (water mains, electricity and sewer) (R5) • Controlled Waters (Culvert) (R6)	✓	All free product should be removed form site. Contact should be made with relevant utility providers to confirm if upgraded materials are required. It should be noted that remediation may negate the requirement for this.

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;

- Removal of tanks and associated infrastructure;
- Removal of impacted and non-impacted soils as part of the basement excavation and beyond.
- Removal of free phase product and any impacted perched waters discovered using pump and disposal method;
- A watching brief following demolition and during enabling works for grossly impacted soils or water;
- Potential CS2 soil gas mitigation measures may be required; assessment may be required after removal of tanks and impacted soils to negate their necessity;
- Proposed gardens will be constructed on the basement slab, therefore soils within these areas will not be in direct contact with underlying soils and there will be no pathway between potentially contaminated soils and end users. No further remedial measures will be required within private gardens beyond the importation of suitable topsoil for planting and landscaping purposes.
- Within areas of communal soft landscaping, which overlie existing Made Ground, a cover layer comprising a minimum 300mm thickness of certified clean topsoil laid over a geotextile membrane will be utilised if soft landscaping is externally managed, to be increased to 450mm if not externally managed;
- Validation testing will be undertaken upon the remedial excavations, basement excavation and on soils imported to site. This will confirm that all impacted soils have been removed and to confirm the suitability of imported soils for use as a clean capping layer.

4.2 Remediation Strategy

<u>Removal of Tanks and Infrastructure, Impacted Soil Excavation and Disposal</u>

4.2.1 It is understood that the majority of the site is to be excavated to form the basement of the proposed structure. The proposed basement floor level is to be between 5mbgl to 8mbgl. Thus, construction of the basement will necessitate the removal of below ground fuel tanks and associated infrastructure, as well as surrounding soils.

4.2.2 It should be noted that the construction of the basement does not fully cover the site and that further excavation will be required to remove all of the tanks.

4.2.3 It is recommended that the tanks are exposed, emptied and cleaned prior to commencement of the basement excavation. Once the tanks have been emptied, they can be removed from the ground and stored on site for disposal off-site at an appropriately licensed facility. No evidence of grossly impacted soils has been identified to date; however, should such soils be discovered these should be stockpiled separately from "clean" soils for separate disposal at an appropriate facility. Any stockpiled soils should be placed on polythene sheeting that is sufficient to prevent cross-contamination by direct contact or leaching.

4.2.4 Following removal of the tanks, associated infrastructure and grossly impacted soils, the remaining basement excavations may be undertaken. The basement excavation, and excavations beyond in order to remove the tanks, are expected to remove any residual contaminated soils, which will be "chased out". On completion of the excavation, validation samples will be obtained from the base and side(s) of the excavation.

4.2.5 Visual and olfactory evidence from the excavation limits will also be recorded, along with screening with the use of a photo-ionisation detector (PID). Samples will be obtained at a minimum frequency of one sample per 25m^2, and the locations of all samples obtained will be justified within subsequent verification reports based on the presence of visual/olfactory evidence of contamination within the excavation.

4.2.6 Samples will be scheduled for an extended hydrocarbon suite of contaminants and the laboratory test results will be subject to analysis against the generic screening criteria used for the preliminary assessment within the Ground Investigation Report. In the event of failure, the excavation at the failing elevation will be progressed if possible. This process will be repeated until a 'passing' result is achieved or the excavation may no longer be practically extended. Soil testing will be limited to above the water table.

4.2.7 Excavations will be backfilled with either site-derived or imported materials that are chemically suitable for use with respect to the requirements in Table 4.1. As per Section 5.1, backfill samples will be tested at a rate of 1 sample per 250m^3 of material, with a minimum of three samples tested.

<u>Removal of Visually Evident Free Phase Product and Perched Water</u>

4.2.8 Free product was reported floating on the perched water table during the ground investigation and will be require removal. If encountered during the remedial excavations, this will be pumped into a suitable container before off site disposal.

<u>Impacted Soils Encapsulation</u>

4.2.9 In the areas of site where the basement footprint is not proposed, any remaining soils should be encapsulated beneath permanent hard-cover or clean cover layer.

4.2.10 Following removal of existing 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.

4.2.11 Within any areas of communal soft landscaping at ground level, soils will be encapsulated below a cover layer of imported clean subsoil/topsoil. This should comprise a minimum 300mm thickness of soil laid over a geotextile membrane if this is to be externally managed. If external management is not in place then this layer should be increased to 450mm in thickness.

4.2.12 It is assumed that the proposed gardens will be constructed on the basement slab planters and that soils within these areas will not be in direct contact with underlying soils. Therefore, no further remedial measures will be required within private gardens beyond the importation of suitable topsoil for planting and landscaping purposes.

4.2.13 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
Selenium	mg/kg	S4UL	250
Copper	mg/kg	BS3882	200
Zinc	mg/kg	BS3882	300
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

Determinand	Unit	Screening Criteria	
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

Ground Gas Mitigation Measures

4.2.14 The methodology set out in BS 8485 (2015) has been used for determining the required gas protection measures. For a Type A development on a CS2 sites the gas protection measures must provide a minimum of 3.5 points.

4.2.15 This can be achieved in a number of ways, within BS 8485 it is recommended that a range of protection measures are utilised with a minimum of two separate methods chosen from the three groupings (Structural, Ventilation and Barrier).

4.2.16 It is considered that combinations selected from the following are likely to provide the most suitable option in the context of the proposed development:

Table 4.2: Recommended Gas Protection Measures

Protection Measures	BS 8485 Score
Structural	
Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations	**1.5**
Ventilation	
Pressure relief pathway	**0.5**
Or	
Passive sub floor dispersal layer of:	
• Very good performance:	**2.5**
• Good performance:	**1.5**
Barrier	
Gas resistant membrane meeting all of the following criteria:	**2**

Protection Measures	BS 8485 Score
• sufficiently impervious to the gases with a methane gas transmission rate <40.0 ml/day/m^2/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); • sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); • sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc); • capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • verified in accordance with CIRIA C735	
MINIMUM REQUIRED TOTAL	**3.5**

4.2.1 To achieve a score of 1.5, the suspended slab should be well reinforced to control cracking and have minimal penetrations of the slab. Any necessary penetrations should be cast in.

4.2.2 Alternatively, additional gas monitoring and assessment could be carried out after the tanks and impacted soils have been excavated and removed from site to determine whether specific gas protection measures are still necessary above the current tanking that is likely to be required for the basements.

4.3 Health and Safety / PPE

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.

Operatives will be briefed on sharps protection in order to ensure safety. Clean/dirty rooms will be provided for operatives working within contaminated areas

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

Other items may be required as per detailed in the specific method statement;

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

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

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

5.1.2 A watching brief will be maintained throughout the tank removal/basement excavation process. If gross contamination is observed within soils or groundwater then a revision to this strategy may be required.

5.1.3 On completion of the basement excavation and remedial excavations, validation samples will be obtained from the void(s) and scheduled for testing at an accredited laboratory. Validation samples will be obtained from the exposed faces and base of the excavation. Visual and olfactory evidence from the excavation limits will also be recorded, along with screening by photo-ionisation detector (PID), in order to determine whether additional samples are required. Samples will be obtained at a minimum frequency of one sample per 25m^2, and the locations of all samples obtained will be justified within subsequent verification report based on the presence of visual/olfactory evidence of contamination within the excavation.

5.1.4 Validation samples will be scheduled for suite of laboratory testing to comprise TPHCWG, BTEX compounds, speciated PAHs and VOCs. Validation samples will be tested at a minimum rate of 1 sample per 50m^2 of exposed face/base of excavation.

5.1.5 Should validation samples fail risk assessment, further excavation and re-sampling of new faces will be undertaken where feasible within the constraints posed by the site. Soils failing risk assessment will be removed offsite for disposal or treatment at an appropriately licensed facility.

5.1.6 At the completion of the installation of the soil encapsulation cover layer at “ground level”, the depth of imported material and the presence of the marker layer will be verified, with samples of the imported material obtained for validation testing.

5.1.7 Following importation of any material to site, representative samples will be obtained prior to laying. It is anticipated that 1No sample will be taken per 100m^3 of soil imported.

5.1.8 These samples shall be sent directly to an MCERTS and UKAS accredited laboratory for testing.

5.1.9 The results will be screened against the criteria given previously within Table 4.1.

5.1.10 The installation of gas protection measures requires independent verification in line with CIRIA C735.

5.2 Remediation Verification/Completion Report

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.
- Verification of ground gas and vapour protection measures.

5.3 Reporting

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
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- Environment Agency, NHBC & CIEH (2008) *Guidance for the safe development of housing on land affected by contamination*. R & D Publication 66. London: Environment Agency
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- LQM/CIEH S4ULs. LQM, 2014
- National Planning Policy Framework. Department for Communities and Local Government, March 2012
- Phase I Desk Study on 138-140 Highgate Road, Highgate, London NW5 1PB for IDM Land Ltd, 13859/DS Rev 1.02, February 2014, Soils Limited.

APPENDIX 1: HISTORICAL FUEL TANK PLANS

Figure 1: Topography Plan with Tank Features

TANK SCHEDULE		
TANK	CAPACITY	DEPTH(M)
1	17,793 LITRES	1.07d
2	17,793 LITRES	1.07d
3	17,793 LITRES	1.06d
4	17,793 LITRES	1.05d

NOTES

JOB No. : P1323J1303
SURVEY DATE : 05/12/2018
SURVEYED : AR

DISUSED SERVICES NOT SURVEYED. INTERNAL AREAS NOT SURVEYED. FEATURES MISSING FROM TOPO: POOR GPR IMAGES & SIGNALS DUE TO REINFORCED CONCRETE, PARKED VEHICLES ACROSS WHOLE SITE & CAUSED INFERENCE WITH SIGNALS. SW DRAINAGE SYSTEM FULLY FLOODED & UTS.

DISCLAIMER

ELECTRO-MAGNETIC TECHNIQUES AND/OR GROUND PENETRATING RADAR HAVE BEEN USED IN THE LOCATION OF UNDERGROUND SERVICES. THE RESULTS ARE NOT INFALLIBLE AND TRIAL EXCAVATIONS SHOULD BE CARRIED OUT TO CONFIRM SERVICE IDENTIFICATION, POSITIONS AND PARTICULARLY DEPTHS WHERE THESE ARE CRITICAL. ALTHOUGH ALL REASONABLE EFFORT HAS BEEN MADE IN SEARCHING AVAILABLE RECORD DRAWINGS, THE COMPLETENESS OF THE UNDERGROUND SERVICES SHOWN ON THIS PLAN CANNOT BE GUARANTEED. IT IS ALSO DIFFICULT TO DIFFERENTIATE BETWEEN LIVE AND DEAD SERVICES. SUCH AS ALL SERVICES SHOULD BE TREATED AS LIVE.

WHERE SERVICES ARE NON-METALLIC, POSITIONS MAYBE TAKEN FROM RECORDS, TRENCH SCARS AND SURFACE DETAIL. WHERE QUOTED, DEPTHS ESTIMATIONS ARE GENERALLY TO THE CENTRE OF THE SERVICE. DEPTHS TO GRAVITY SEWERS AND DRAINS ARE GENERALLY TO INVERT LEVELS UNLESS STATED OTHERWISE.

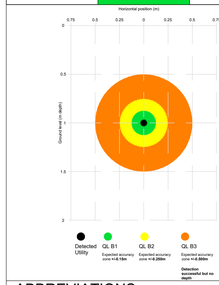
PIPE SIZES WHICH CANNOT BE OBTAINED BY VISUAL SURVEY ARE TAKEN FROM RECORD DRAWINGS OR MARKER PLATES WHERE AVAILABLE.

WHERE GROUND PENETRATING RADAR HAS BEEN USED IT WILL PRIMARILY HAVE BEEN TO IDENTIFY UNDERGROUND UTILITIES. IF POSSIBLE WE WILL ALSO IDENTIFY UNDERGROUND STRUCTURES, TANKS ETC, BUT CANNOT GUARANTEE TO HAVE LOCATED ALL SUCH ITEMS.

THE USE OF RADAR CAN BE LIMITED BOTH BY SURFACE CONDITIONS AND ALSO BY SOIL TYPE. DEPTH ESTIMATES WOULD NOT NORMALLY BE PROVIDED FOR SERVICES LOCATED WITH GPR.

PAS 128 : 2014

SURVEY CATEGORY	QUALITY LEVEL	CRITERIA USED IN THE DETERMINATION OF QUALITY LEVEL
TYPE B - DETECTION	QL-B4	A UTILITY SEGMENT WHICH IS SUSPECTED TO EXIST BUT HAS NOT BEEN DETECTED AND THEREFORE PLOTTED AS AN ASSUMED ROUTE **(NO DETECTION POSSIBLE)**
	QL-B3	POSITION OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES **(EML OR GPR DETECTION WITH LIMITED CONFIDENCE IN DEPTH)**
	QL-B2	POSITION AND DEPTH OF THE UTILITY DETECTED BY ONE OF THE GEOPHYSICAL TECHNIQUES **(EML OR GPR DETECTION WITH CONFIDENCE IN DEPTH)**
	QL-B1	POSITION AND DEPTH OF THE UTILITY DETECTED BY MULTIPLE GEOPHYSICAL TECHNIQUES. **(EML + GPR DETECTION)**



ABBREVIATIONS

AR	ASSUMED ROUTE	PE	POLYETHYLENE
BD	BACKDROP	PR	PIPE RISER
BL	BLOCKED	PVC	POLYVINYL CHLORIDE
BTIC	BT INSPECTION CHAMBER	RE	RODDING EYE
CI	CAST IRON	RWP	RAIN WATER PIPE
CL	COVER LEVEL	ST	STOP TAP
CP	CABLE PIT	SV	STOP VALVE
CR	CABLE RISER	SVP	SOIL VENT PIPE
EM	EARTH MAT	TFR	TAKEN FROM RECORDS
EP	ELECTRICITY POLE	TL	TRAFFIC LIGHT
EOT	END OF TRACE	TP	TELEGRAPH POLE
FE	FENCE EARTH POINT	UTL	UNABLE TO LOCATE
FH	FIRE HYDRANT	UTR	UNABLE TO RAISE
GV	GAS VALVE	UTS	UNABLE TO SURVEY
GY	GULLY	UTT	UNABLE TO TRACE
IC	INSPECTION CHAMBER	VP	VENT PIPE
IL	INVERT LEVEL	VR	VAPOUR RECOVERY
LP	LAMP POST	WL	WATER LEVEL
MH	MANHOLE	WM	WATER METER
NPV	NO PIPES VISIBLE	WO	WASHOUT VALVE
OSA	OUTSIDE SURVEY AREA	WWP	WASTE WATER PIPE

LEGEND

	BOREHOLE (BH)
	BOREHOLE PROPOSED
	LOCATION
BT	BT
TV	CABLE TV CATV
CCTV	CLOSED CIRCUIT TV
COM	COMMS
E	EARTH
ED	EMPTY DUCT
FO	FIBRE OPTICS
G	GAUGE LINES
TS	TRAFFIC SIGNALS
	ELECTRIC
F	FUEL LINES
O	OFFSET FILL
V	VENT
	FUEL PIPE
	GAS
	WATER
OIL	OIL
CA	COMPRESSED AIR
R	RADAR TRACE
U	UNKNOWN TRACE
	DRAINAGE FOUL
	DRAINAGE SURFACE
	OUTFALL
	RISING MAIN
	END OF TRACE
	SURVEYED AREA

Amendments

Rev	Date		By	Chkd

JOMAS
Jomas Associates Ltd.
1 Furzeground Way
Lakeside House
Stockley Park
UB11 1BD
Tel. 0843 2892187

Client

Project
138-140 HIGHGATE ROAD, LONDON NW5 1PB

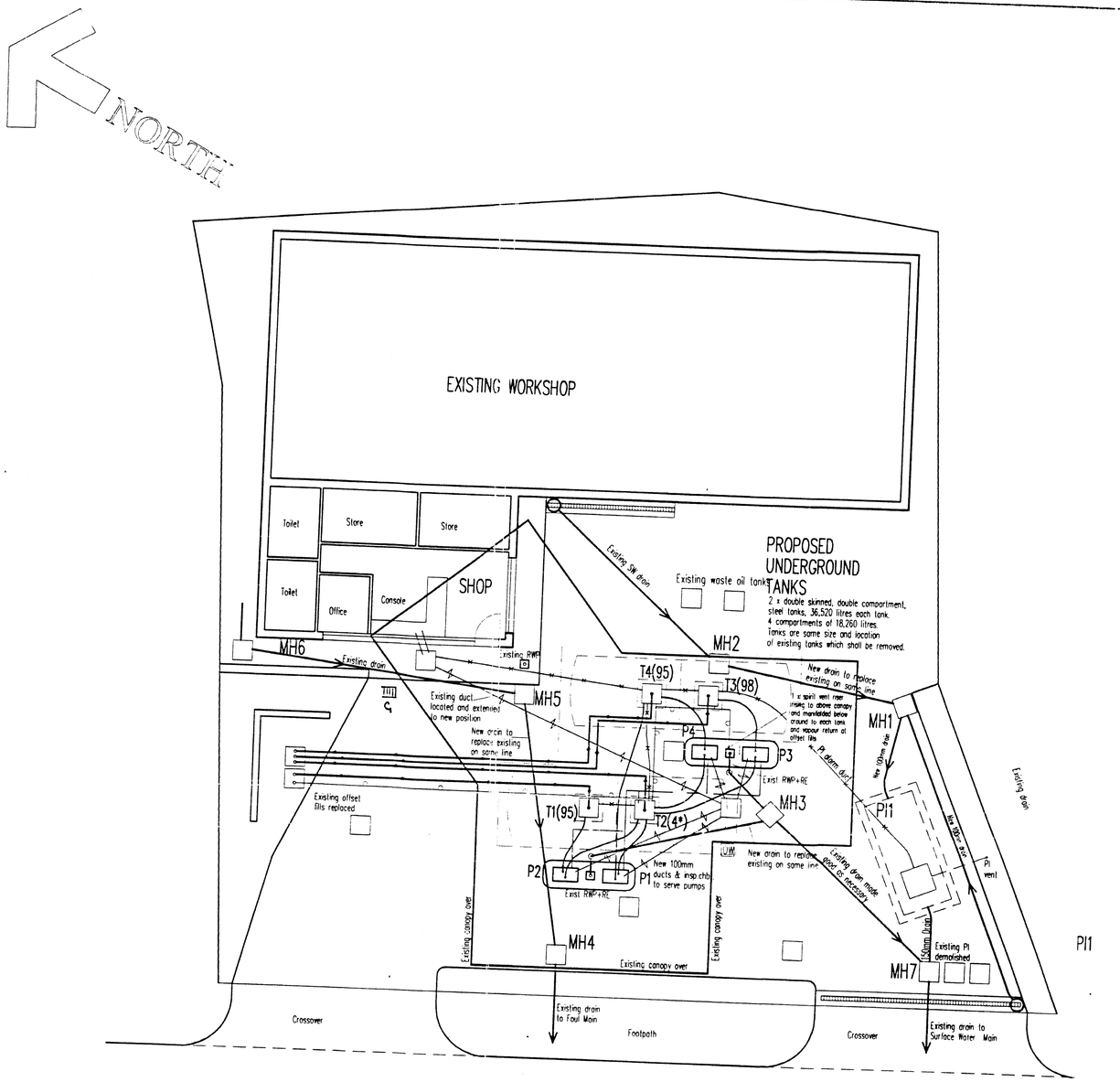
Drawing
Utility Survey

Dwg no G18574	Checked	Surveyor: AR

Date: 08/02/2019	Scale: 1/200 @ A1	
Job No. P1323J1303		Rev. B

Grid	Contours	Level Datum

Figure 2: Tank Farm Plan



DRAINAGE LEGEND

- FW drains. 1:40 min fall or 1:80 min fall for FW drains draining precourt only
- 100 & 150 mm SW drain 1:80 min fall
- 75 mm Interceptor Vents
- Existing drainage channels, gratings and gullies

Inspection chambers shall be either plastic to BS 7158 or precast concrete ring chambers.

Drainage shall be "Hepsleve" salt glazed stoneware with Polypropylene joints

All abandoned drainage shall be sealed to the satisfaction of the Local Authority and utilised existing drains shall be tested for soundness.

All assumed drainage runs and levels shall be checked and confirmed before works commence

DRAINAGE MANHOLE SCHEDULE

MH1	SW	New Manhole built in position of existing Manhole
MH2	SW	New Manhole built in position of existing Manhole
MH3	SW	Existing Manhole
MH4	FW	Existing Manhole
MH5	FW	Existing Manhole
MH6	FW	Existing Manhole
MH7	FW	Existing Manhole
P11	SW	Conder Separator Pea Shingle Surround Type

Superceptor P11 shall be fitted with a Pentold or similar shut-off valve

Inspection Chambers shall be either 600 x 600 plastic to BS 758 or, where more than 1m deep, shall be 1100 dia concrete ring chambers.

SERVICE DUCT LEGEND

- Electric ducts 100 and 150mm
- Tank Gauge Duct 100mm

Existing ducts shall be extended or redirected as necessary to maintain all existing Electrical, Water, Telephone and other services as affected by the works

PROPOSED NEW TANKS

Double skinned steel construction

Tank No	Capacity Litres	95% Capacity Litres	Grade	Pump No	Pump type
T1	18,260	TBA	ULP 95	P 2	Highline 2
T2	18,260	TBA	4*	P 1, 2, and 4	Highline 2
T3	18,260	TBA	ULP 98	P 3	Highline 2
T4	18,260	TBA	ULP 95	P 1 and 4	Highline 2

PIPEWORK LEGEND

- 100mm Offset Fills UPP pipes
- 63mm Suction pipes, flexible lined UPP
- 90mm Stage 1 Tank vent pipes, rigid UPP lined Manifolded underground using Emco Wheaton vent T valves
- 63mm Stage 2 Vapour return pipes, rigid UPP, lined installed for future use
- OW — Tank Observation Well
- Tank gauge duct 100mm

LONDON FIRE AND CIVIL DEFENCE AUTHORITY
FIRE SAFETY-PETROLEUM LICENCE No. _____
THIS IS TO CERTIFY THAT THIS PLAN WAS
APPROVED/APPROVED AS AMENDED ON 17.12.96
SIGNED _____ PETROLEUM INSPECTOR

AMENDMENT No. 1

A / LM / 17 Oct 97 / New Petrol Superceptor added. Drains and ducts amended.

REVISIONS

TITLE
PROPOSED TANK INSTALLATION
AND ASSOCIATED WORKS

SITE
PARLIAMENT HILL
SERVICE STATION
138/140 HIGHGATE ROAD
LONDON NW5

ESSO PETROLEUM CO. LTD
MAILPOINT 22
ESSO HOUSE 2/F/18
ERMYN WAY
LEATHERHEAD
SURREY
KT22 8UX

SCALE 1/100 | DATE 12 Oct 96 | DRAWN LM

DRAWING NUMBER 1843/97/010 Planacourt 9930 Castle 2405/2018 | REV A

DO NOT SCALE DRAWING Planacourt Limited

APPENDIX 2: FIGURES

Figure 3: Proposed Basement Plan

DO NOT SCALE FROM THIS DRAWING
The contractor shall check and verify all dimensions on site and report any descrepancies in writting to the architect before proceeding with work.

FOR ELECTRONIC DATA USE
Electronic data/drawings are issued as "read only" and should not be interrogated for measurement. All dimensions and levels should be read only from those values stated in text, on the drawing.

AREA MEASUREMENT
The areas are approximate and can only be verified by a detailed dimensional survey of the completed building. Any decisions to be made on the basis of these predictions whether as to project viability, pre-letting, lease agreements or the like should include due allowance for the increases and decreases inherent in the design development and building processes. Figures relate to the likely areas of the building at the current state of the design and using Gross External Area (GEA), Gross Internal Area (GIA) and Net Internal Area (NIA) method of measurement from the Code of Measuring Practice, 5th edition (RICS code of practice). All areas are subject to Town Planning and Conservation Area Consent, and detailed Rights to Light analysis.

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
GA_000 Top floor	33	32.8	32.8	32.8	32.8	32.5
GA_B01 Middle Floor	41.9	42.9	43.2	43.4	43.6	39.3
GA_B02 Basement	46.3	47.5	48.6	49.1	49.3	43.4
Total	121.2	123.2	124.6	125.3	125.7	115.2
Garden Room	12.4	12.8	12.8	12.8	12.8	16.1
Total (with Garden Room)	133.6	136	137.4	138.1	138.5	131.3

KEY

- 350 MM SHEET PILE FOUNDATIONS
- 225 MM REIN FORCED CONCRETE
- TIMBER (MAPLE)
- BRICK
- BLACK METAL CLADDING

REVISION	DATE	COMMENT

PROJECT:
138 - 140 HIGHGATE ROAD
LONDON, NW5 1PB

CLIENT:
DESIGN VENTURES HIGHGATE LTD

DRAWING:
BASEMENT PLAN

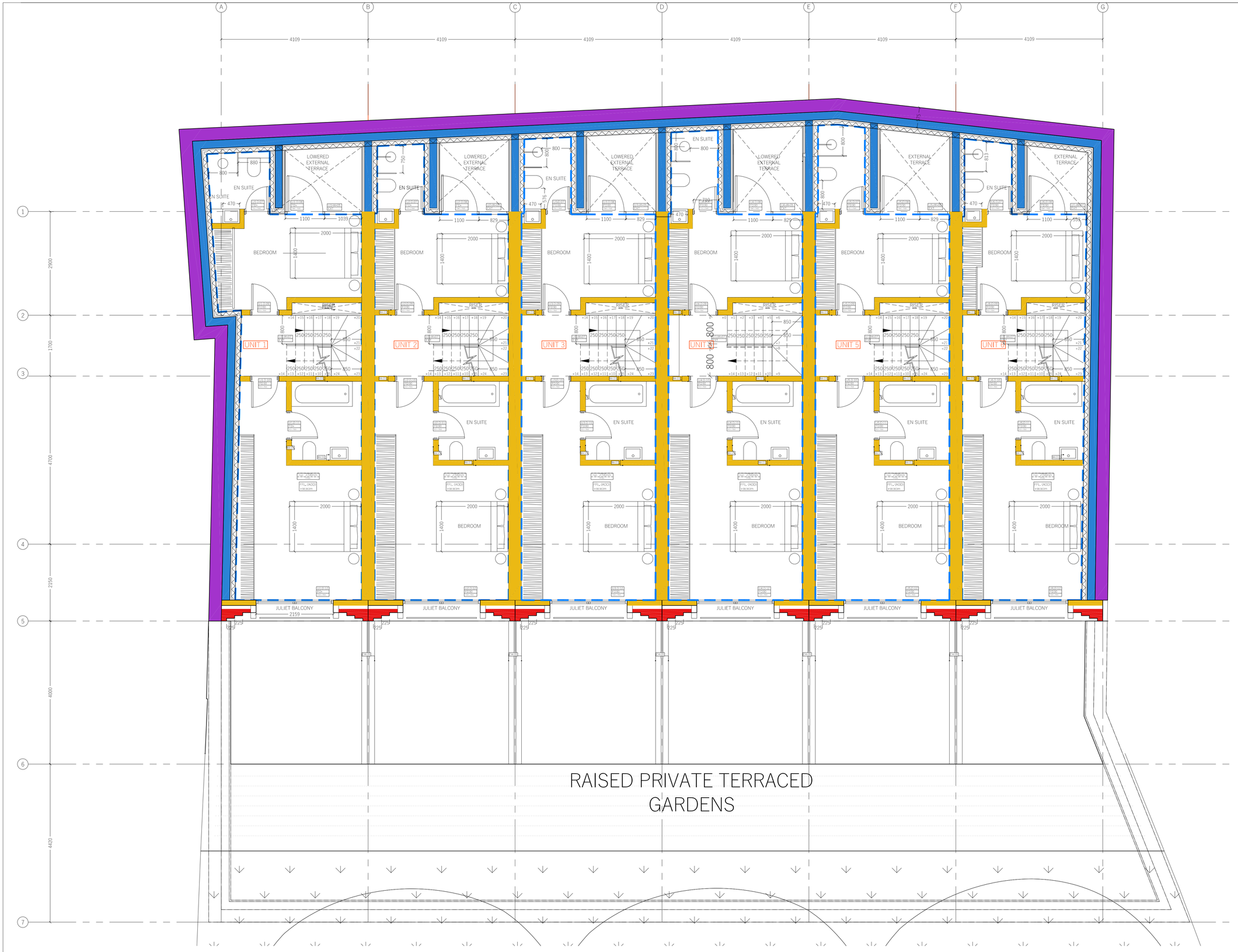
SCALE BAR:
0,5m 2,5m 5,0m

DATE:	SCALE:	DRAWN:	CHECK:
13.06.2019	1:50	DW	DG

REASON FOR ISSUE: TENDER
NORTH:
DRAWING NO: 0067_GA_B02
REV: -

THE D*HAUS COMPANY LIMITED
UNIT 13, OLD DAIRY COURT
17 CROUCH HILL
LONDON N4 4AP
thedhaus.com

Figure 4: Proposed GF Plan



01
LOWER GROUND FLOOR PLAN
1:50

DO NOT SCALE FROM THIS DRAWING
The contractor shall check and verify all dimensions on site and report any descrepancies in writting to the architect before proceeding with work.

FOR ELECTRONIC DATA USE
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AREA MEASUREMENT
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	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
GA_000 Top floor	33	32.8	32.8	32.8	32.8	32.5
GA_B01 Middle Floor	41.9	42.9	43.2	43.4	43.6	39.3
GA_B02 Basement	46.3	47.5	48.6	49.1	49.3	43.4
Total	121.2	123.2	124.6	125.3	125.7	115.2
Garden Room	12.4	12.8	12.8	12.8	12.8	16.1
Total (with Garden Room)	133.6	136	137.4	138.1	138.5	131.3

KEY
- 350 MM SHEET PILE FOUNDATIONS
- 225 MM REIN FORCED CONCRETE
- TIMBER (MAPLE)
- BRICK
- BLACK METAL CLADDING

REVISION	DATE	COMMENT

PROJECT:
138 - 140 HIGHGATE ROAD
LONDON, NW5 1PB

CLIENT:
DESIGN VENTURES HIGHGATE LTD

DRAWING:
LOWER GROUND FLOOR PLAN

SCALE BAR:
0,0m 2,5m 5,0m

DATE:	SCALE:	DRAWN:	CHECK:
31.05.2019	1:50	DW	DG

REASON FOR ISSUE: TENDER
NORTH:
DRAWING NO: 0067_GA_B01
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