

A large, light green, semi-transparent watermark of the word "TERRAMECH" is oriented diagonally across the page, from the bottom left towards the top right.

**PHASE 2 ENVIRONMENTAL
INVESTIGATION**

NO 3888/16

AT

**THE POND HOUSE (PUBLIC HOUSE)
738 OXFORD ROAD, READING
BERKSHIRE. RG30 1EH**

FOR

PROPOSED HOUSING DEVELOPMENT

CONTENTS

1	INTRODUCTION	1
2	SITE DETAILS	2
3	PHASE 2 INVESTIGATION.....	3
4	GEOTECHNICAL RECOMMENDATIONS	6
5	CONTAMINATION RISK ASSESSMENT (QUANTITATIVE)	7
6	RECOMMENDATIONS	12
7	NOTES.....	12

FIGURES

1. SITE LOCATION
- 2-3. SITE PHOTOGRAPHS

APPENDICES

- A. EXPLORATORY HOLE LOCATION PLAN AND LOGS
- B. CONTAMINATION ANALYSIS
- C. CONTAMINATION ASSESSMENT CRITERIA

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1 INTRODUCTION

- 1.1 This investigation was commissioned by the developers, RJD London Mayfair, in order to provide a ground contamination assessment for the proposed development area.
- 1.2 The Contamination Assessments have been carried out with reference to CLR 11 (Model Procedures for the Management of Land Contamination), as well as Environment Agency Guidance for the Safe Development of Housing on Land Affected by Contamination (R&D Publication 66-2008) and BS 10175 (Code of Practice for the Investigation of Potentially Contaminated Sites). This phased approach is set out below.

Phase 2

- 1.3 Because plausible contamination linkages were identified at phase 1, a generic quantitative risk assessment was carried out by physical investigation. Measured contaminant concentrations were assessed with respect to generic (rather than site specific) guideline values. These comparisons were then used to review each of the linkages made in the conceptual model thus revising the model. This allowed any unacceptable risks to be defined and also the need for further assessment, physical investigations, or remedial works.

2 SITE DETAILS

Site Location

This site is located approximately 2.50km west of Reading town centre and 460m south east of Norcot. The site centre is located at grid reference 468998E 173968N and post code reference RG30 1EH.

Brief Description

- 2.1 The area under consideration is approximately 0.078ha and is rectangular in shape.
- 2.2 At the time of the investigation the site was used as a car parking area for the Pond House (public house), covered in hardstanding and fenced off. Access was from the driveway adjacent to the Pond House along with a large gated access from Pangbourne Street however this had been boarded off and locked at the time of the investigation.

Published Geology

- 2.3 The British Geological Survey Map, data provided by British Geological Survey ©NERC shows the site to be underlain by Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated), a sedimentary bedrock composed of chalk formed approximately 71 to 89 million years ago. These chalk formations are likely to be overlain by Taplow Gravel Formation a superficial deposit composed of sand and gravel formed up to 2 million years ago.

3 PHASE 2 INVESTIGATION

- 3.1 The site work was carried out on 2nd November 2016, and the environmental laboratory tests completed on 15th November 2016.

Scope of Works

Tracked Window Sampling rig

- 3.2 Small diameter boreholes were drilled using a small rubber tracked 'Window Sampling' rig. The drilling rig percussively drives sampling tubes into the ground which are then withdrawn by the rig. Further depth is achieved by driving another tube down from the base of the hole left by the first. This process is repeated until the desired depth, or an obstruction, is met. The soil samples are retained inside the sampler tubes by a removable thin plastic liner. The rig therefore produces a continuous core from ground level to depth. The name window sample is a historic term referring to long sections, or windows, cut out of the sampler tube to allow recovery of the samples.

Ground Conditions

- 3.3 The exploratory hole location plan along with the logs are presented in the appendix A of this report however, a summary of the strata encountered within the holes is summarised below:

Stratum Description	Depth to Top (m bgl)	Depth to Base (m bgl)	Thickness (m)
Made Ground – (Encountered in all exploratory holes) Tarmac Medium dense brown red sandy angular fine to coarse GRAVEL of brick and concrete with cobbles of brick. Concrete (WS1). Loose to medium dense brown silty gravelly fine to coarse SAND. Gravel is angular to sub-rounded fine to coarse of flint and brick	0.00	0.30-1.00	0.30-1.00
Taplow Gravel Formation – (Encountered in all exploratory holes) Medium dense brown mottled grey and white very sandy angular to rounded fine to coarse GRAVEL of flint. Sand is fine to coarse. Medium dense brown gravelly fine to coarse SAND. Gravel is angular fine to coarse of flint.	0.30-1.00	2.70-5.00 (Unproven)	1.70-4.70 (Unproven)
Seaford & Newhaven Chalk Formation – (Encountered in WS1, WS2 & WS4) Structureless CHALK: White gravelly SILT. Gravel is angular to sub-angular fine to coarse of flint and chalk. (Class Dm)	2.70-5.00 (Unproven)	5.00 (Unproven)	0.20-2.30 (Unproven)

Groundwater

- 3.4 Groundwater was encountered in all of the exploratory holes from a depth range of 2.90m to 4.00m below ground level.
- 3.5 There may be significant fluctuation in this observed groundwater level. Seasonal variations, weather induced variations and variations caused by nearby abstractions or discharges could cause rapid and significant changes in the effective groundwater level. We suggest that it would be prudent to carry out a test excavation immediately prior to construction to ensure the levels have not changed.

Samples for Geotechnical Analysis

3.6 Although the client had not requested for any geotechnical testing samples were taken that represented the varying strata at the site. These samples are currently on hold should testing be required at a later date, as agreed upon with the client. It should be noted that these samples if tested will not have any reliable moisture content test results due to the time delay in. The laboratory tests that would be able to be carried out on the selection of samples are as follows:

- Particle size analysis
- Liquid and plastic limit
- Sulfate and pH value

Samples for Contamination Analysis

3.7 Samples were taken from within the overlying Made Ground as well as the natural ground in each of the four exploratory holes.

3.8 The samples were recovered for contamination analysis in accordance with BS10175 (2011). The samples were placed in laboratory supplied containers including amber glass jars with hydrocarbon resistant seals and plastic waterproof pots.

3.9 The samples were then placed in plastic cool boxes with frozen ice packs to be transported to a fridge at our laboratory for storage overnight before being couriered to an MCERTS accredited laboratory for analysis.

3.10 The assessment parameters and criteria are discussed in separate sections.

4 GEOTECHNICAL RECOMMENDATIONS

Soil Strength

- 4.1 SPT 'N' values show a steady increase in strength with depth until the chalk formation was encountered at which point the 'N' values dropped as you would expect. At a level of 1.0m to 1.5m an 'N' value of range of 7 to 31 was recorded. Using the relationship set out by Terzaghi and Peck between SPT 'N' values and allowable bearing pressure we can see that in the absence of groundwater a capacity range of 75kN/m² to 300+kN/m² would be applicable.
- 4.2 At a level of 2.0m to 2.5m an 'N' value of range of 14 kN/m² to 35 kN/m² was recorded. Using the relationship set out by Terzaghi and Peck between SPT 'N' values and allowable bearing pressure we can see that in the absence of groundwater a capacity range of 150kN/m² to 300+kN/m² would be applicable.
- 4.3 In the absence of any plate bearing tests on the site and given the uncertain changeover depth from unstructured to structured chalk we would suggest that the bearing value used for design is limited to 225kN/m².

Solution Features

- 4.4 Whilst it is thought that there would be a low risk of a solution feature being present onsite. However, given the bedrock geology change from the Seaford Chalk Formation & Newhaven Chalk Formation to the Lambeth Group less than 100m southwest of the site there is generally a high risk associated with this. Therefore it may be prudent to obtain site specific data to determine the actual solution feature risk to this site.

5 CONTAMINATION RISK ASSESSMENT (QUANTITATIVE)

Soil Contaminants of Concern

- 5.1 A full environmental assessment comprising a desk study and follow on physical investigations have not been carried out by Terramech at this site. Targeted recovery of soil samples, with respect to identified potential contamination sources, was not possible.
- 5.2 However, samples were recovered from the proposed new garden area and from the material likely to be excavated for the foundations of the development based in plans provided to Terramech Investigations Ltd by the client. Two samples were selected, one from the Made Ground and the other from the top of the natural material Taplow Gravel Formation. These were tested for a basic suite of metal contaminants along with a Waste Acceptance Criteria (WAC) test with the measured contaminant concentrations compared to Environment Agency Soil Guideline Values (ref SC050021) or values from the Chartered Institute of Environmental Health and Land Quality Management Ltd report on generic guideline values (2nd Edition 2009).

Soils Assessment Criteria

- 5.3 For the assessment of the risk posed to human health the measured soil concentrations for particular contaminants are compared to acceptable limits set out in two main guidance reports. Both give values derived using the Environment Agency CLEA model.
- 5.4 Our assessments are based on a hierarchy of CLEA model derived values where the Environment Agency Soils Guideline Values (SGVs - 2008) and Suitable For Use Values (S4UL - 2015) from the Chartered Institute of Environmental Health are most preferred,

followed by values derived by Terramech using the CLEA model. These guideline values are appended.

Exposure Scenario

5.5 The generic exposure scenario for residential land use, where occupants are expected to grow and consume fruits and vegetables on the site, has been selected for the assessment of soil contamination concentrations.

5.6 The generic guideline values are appended.

Assessment of the Measured Concentrations in Soil

5.7 The measured concentrations of contaminants in the samples recovered from this site were compared with the assessment criteria described above as follows. The laboratory result sheets are appended.

Metal Compounds

5.8 Analysis showed that concentrations of metals detected in the samples were generally seen to be within the sample from Made Ground and were low with all but one of the measured concentrations being below the respective guideline values.

5.9 The only value that was above the guideline value was that of the lead value within the Made Ground at 352mg/kg., which is 4.3 times higher than the accepted guideline value of 82mg/kg.

Lead

- 5.10 Although the guideline levels for Lead are unclear at this time. The Environment Agency withdrew the Soil Guideline Value (SGV) for Lead (450mg/kg) and the TOX report on which it was based in 2004. This was when new SGVs were determined using a new incarnation of the CLEA model and published (ref SC050021), Lead was not included.
- 5.11 Reports on Generic Assessment Criteria from the Chartered Institute of Environmental Health (CIEH), first, second and third editions all use the CLEA model to determine guideline values for a number of metals but omit any guidance on Lead.
- 5.12 DEFRA have recently produced new guideline values (C4SL) for a number of contaminants in their SP1010 report. Although this report has not been widely accepted, it does give an HCV based guideline for Lead determined using the CLEA model and the Environment Agency SR2 and SR3 reports (residential with plant uptake guideline is 82mg/kg). Our own use of the CLEA model (v1.06) also gave a guideline value of 82mg/kg for Lead in a residential garden.
- 5.13 A higher guideline value was also calculated by DEFRA for children (191mg/kg). This reflects the nature of Lead as a toxin in humans. Adults suffer blood pressure changes and kidney damage. children below specific ages do not suffer these affects but are subject to neurological development problems and are therefore not as vulnerable to Lead in the environment as Adults.
- 5.14 Given the limited testing carried out to date the single sample cannot be dismissed as an isolated fragment and so we would recommend further testing is carried out within the made ground to determine the extent of the lead contamination. Examples of the forms of lead are given below, which could be identified with further testing, targeting the gardens of the proposed development.

- 5.15 Solid Lead forms an insoluble oxide coating when weathered, or when ingested by humans. This tends to protect the Lead from further weathering and dissolution. Analysis of soil with occasional Lead fragments then shows sporadic very high Lead concentrations, with very low concentrations in the immediately surrounding soils.
- 5.16 Soluble Lead from a car battery for example (Lead Sulphide) would leave a more distributed plume of contamination which would be detected in more samples.

Waste Classification

- 5.17 Assessment of soils destined for landfills takes two stages. The first is basic site characterisation, the second stage is compliance testing to assess the leachability or solubility of any contaminants that are present at elevated concentrations as well as to assess organic matter which will generate gases when the materials are buried.
- 5.18 Waste Acceptance Criteria (WAC) compliance testing involves a series of leachate or solubility tests for metalloid compounds and total concentrations of hydrocarbon based compounds as well as organic matter content. The purpose of these tests is to assess the risk posed by the material when placed in a landfill. These risks range from the leaching of soluble contaminants out of the material and into groundwater or water courses, to the risk posed by matter which could decay and generate gases such as Methane, Hydrogen Sulphide or Carbon Dioxide.
- 5.19 The leachate and total concentrations were then compared to values set out in BS EN 12457-3.
- 5.20 Two samples were recovered from the area where excavations are proposed and submitted for waste acceptance analysis.

- 5.21 Waste Acceptance Criteria (WAC) testing was carried out on a sample of the Made Ground and the underlying natural subsoil which reflects the type of material that will be removed as foundation arisings.
- 5.22 The analysis showed that the total concentrations of hydrocarbons, concentrations of 17 individual Poly-cyclic Aromatic Hydrocarbons (The family of 16 compounds discussed above with the addition of Coronene) and concentrations of PCB oils as well as volatile aromatics were within the limits for inert waste.
- 5.23 Concentrations of organic matter and organic carbon (which can be measure of the final gas generation of the material when placed in the ground again) were also within the limits for inert waste.
- 5.24 The leachate tests considered a number of metalloid compounds and their ability to dissolve and migrate away. All of the results were within the limits for inert waste.

Summary

- 5.25 The results showed that there were concentrations of the CLEA metals within the Made Ground were present however the only contaminants to exceed its guideline value for a residential garden with plant uptake was Lead.
- 5.26 Waste Acceptance Criteria tests showed that the mixed materials from the main excavation area should be classified as uncontaminated inert soil.

6 RECOMMENDATIONS

- 6.1 Given the high lead value recorded within the made ground in WS2, which located in the proposed garden area of the development we would recommend that further testing is carried out in this area to determine whether it's an isolated solid fragment or a soluble plume within the ground that would require remediation works.
- 6.2 We would also recommend that given the potential of a high risk of a solution feature being in close proximity to the site that the site-specific Mining and Ground Stability datasheets and maps are acquired. This will provide a basic risk assessment for the potential of natural cavities or mining hazards at the site.

7 NOTES

- 7.1 The investigation report and the opinion expressed therein are based on the ground conditions encountered during the site work and on the results of tests made in the field and laboratory. However, there may be special conditions prevailing at the site which have not been disclosed by the investigations and which have not been taken into account in this report.
- 7.2 In the unlikely event that unexpected areas of contaminated soil are noted during the development, such as a localised farmers waste pit or an area impacted by fuel or hydraulic oil, then the Local Authority and Terramech should be informed as soon as possible to assess the situation.
- 7.3 Groundwater levels can vary significantly from those observed during this investigation and the range of potential variation has not been defined by ongoing monitoring via installed observation wells.

7.4 The conclusions in this report represent our professional opinion, these conclusions have been drawn up with the greatest care to ensure that all apparent issues were addressed properly in accordance with applicable UK guidance and accepted practice.

Written by:

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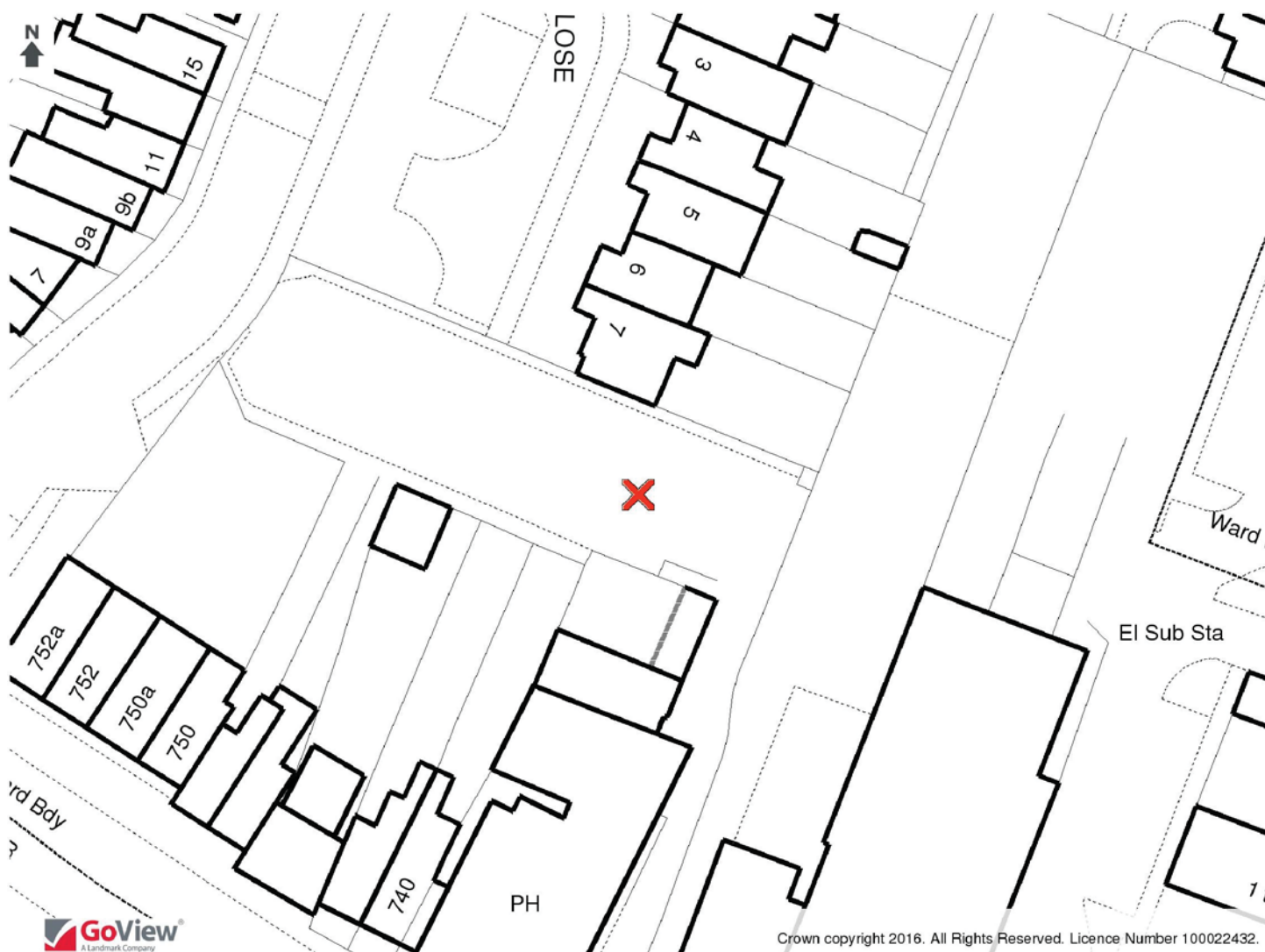
T.N. Leigh BSc (Hons) FGS
For and on Behalf of
Terramech Investigations Ltd

Checked by:

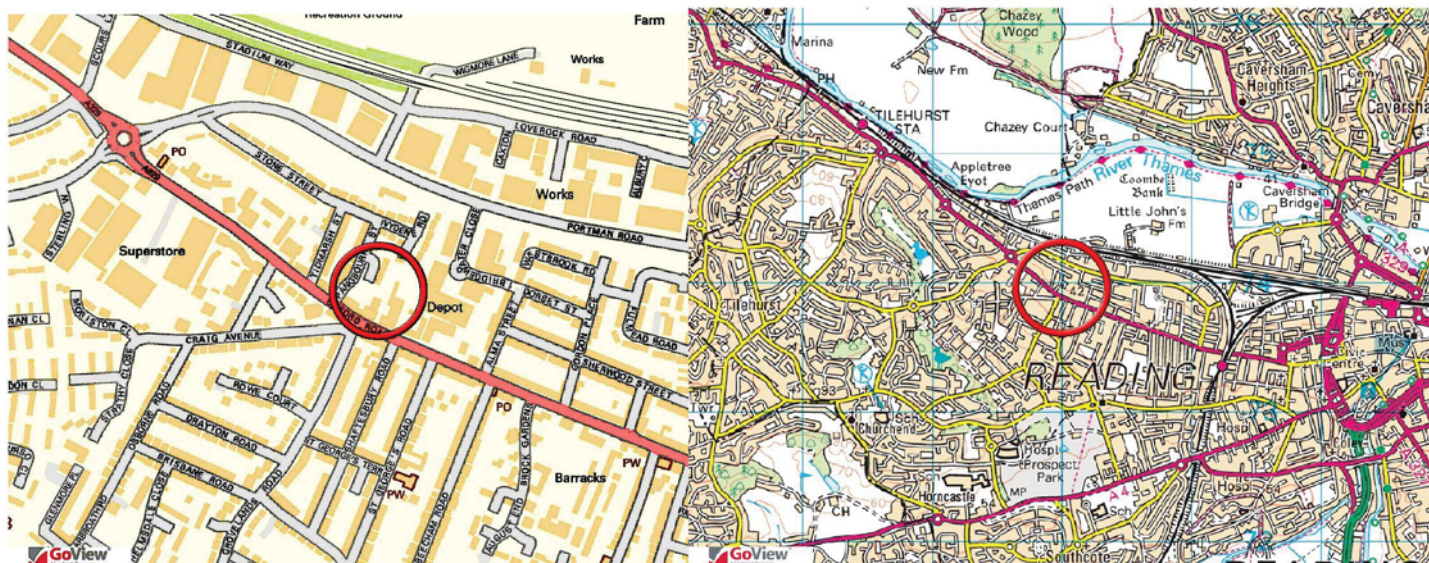
A handwritten signature in black ink, appearing to read 'N. L. Barker'.

N. L. BARKER
For and on Behalf of
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FIGURES
Site Location Plan
&
Site Photographs**



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Page 2	JOB 3888	SITE PHOTOS
DATE: 16.11.16	THE POND HOUSE, 738 OXFORD ROAD, READING. RG30 1EH	

Photograph 1 – View looking northwest towards fenced access adjacent to Pangbourne Street.



Photograph 2 – View looking southeast towards site access adjacent to the Pond House.



Page 3	JOB 3888	SITE PHOTOS
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Photograph 3 – View looking at large oak tree in the southeast corner the site.

