PHASE 3: REMEDIAL STRATEGY
POND LANE FARM,
7A GREEN BALK LANE,
LITTLE LEPTON,
HUDDERSFIELD,
HD8 0LN

For Mr A. Steers

Your Environment
Head Office, Chilgrove Business Centre, Chilgrove Park Road, Chilgrove, Nr Chichester, PO18 9HU
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Report Number: YE8009 Date: April 2019

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For and on behalf of *Your*Environment				

Issue	Date	Description	Prepared	Reviewed	Approved
00	25.04.2019	Final Report	MG	DS	CH

Executive Summary

This document presents a Phase 3: Remedial Strategy for the proposed redevelopment works at Pond Lane Farm, 7A Green Balk Lane, Little Lepton, Huddersfield, HD8 0LN. It summarises details of the Phase 1: Desktop Study and Risk Assessment Report, Phase 2: Site Investigation and addresses the consequent requirement for a Phase 3: Remedial Strategy.

The purpose of this report is to satisfy a particular planning condition which has been attached to the redevelopment of the site by Kirklees Council under application reference 2018/62/92691, namely condition 9.

This report has been prepared subsequent to [redacted]estigation, issued by YE (Report reference: YE7444 dated: September 2[redacted]mpleted subsequent to a previously published Phase 1: Desktop Study &[redacted]Report for the site (Report Reference: YE7208, dated: June 2019). These should be read in conjunction with this report.

We understand current plans for the redevelopment of the site include:

- Demolition of an existing bungalow; and
- Construction of detached dwelling with integral garage.

Salient details from earlier reports produced in connection with the site have been included within this Remedial Strategy. The purpose of this document is to outline the activities that will be required to mitigate plausible pollutant linkages on site.

The strategy includes the following:

- Mitigation of risks to human health including future occupiers & site visitors, site workers and the general public;
- A watching brief and discovery strategy for control of unforeseen contamination;
- Mitigation of risks to Controlled Waters;
- Mitigation of risks to Building Materials;
- Mitigation of risks to Plants and Wildlife in areas of soft landscaping areas; and
- Verification reporting.

This report must be forwarded to the Environmental Health Department / Contaminated Land Officer of Kirklees Council for their comments and approval prior to the commencement of any groundworks and/or remedial works.

1.0 Introduction

*Your*Environment (YE) was instructed by Mr A. Steers (Quote No: Q8009, Dated: January 6th 2020) to provide details of a Remedial Strategy to be formulated in connection with the proposed redevelopment works at Pond Lane Farm, 7A Green Balk Lane, Little Lepton, Huddersfield, HD8 0LN.

The purpose of this report is to satisfy a particular planning condition which has been attached to the redevelopment of the site by Kirklees Council under application reference 2018/62/92691, namely condition 9.

We understand current plans for the redevelopment of the site include:

- Demolition of an existing bungalow; and
- Construction of detached dwelling with integral garage.

This report has been prepared subsequent to a Phase 2: Site Investigation, issued by YE (Report reference: YE7444 dated: September 2019). The SI was completed subsequent to a previously published Phase 1: Desktop Study & Risk Assessment Report for the site (Report Reference: YE7208, dated: June 2019). These should be read in conjunction with this report.

The Phase 2: Site Investigation Report established ground conditions and provided quantified data relating to contamination on site, such that any environmental issues pertaining to the redevelopment proposals can be addressed and/or mitigated appropriately.

Salient details from this earlier report produced in connection with the site have been summarised within this Remedial Strategy. The purpose of this document is to outline the remediation activities that will be required to mitigate plausible pollutant linkages on site.

All previous reports available for the site should be reviewed in their entirety in conjunction with this document.

2.0 Proposed Development

We understand current plans for the redevelopment of the site include:

- Demolition of an existing bungalow; and
- Construction of detached dwelling with integral garage.

The proposed redevelopment plans for the site can be reviewed within **Appendix A.**

3.0 Site Investigation Conditions

The following presents a summary of the site's ground conditions and environmental settings based upon data available from the Site Investigation (SI) completed by YE at the site directly. The locations of exploratory positions were selected relative to the historic land use and current proposed redevelopment plans for the site whilst providing as broad a coverage of the site as feasibly as possible.

A plan showing the exploratory hole locations is provided for review in **Appendix B.**

For full details of the SI completed by YE, the following report should be reviewed in its entirety:

- Phase 2: Site Investigation, Report reference: YE7444 dated: September 2019.

3.1 Geology

The relevant British Geological Survey (BGS) online mapping information indicates that there are no superficial ground deposits underlying the study site. The bedrock geology is composed of the Pennine Lower Coal Measures Formation strata (sandstone). The site is directly underlain by a sandstone member within this formation, underlain by mudstone/siltstone/sandstone and a number of coal seams.

From the SI completed by YE at the site the ground conditions identified in the exploratory holes completed were as follows:

Topsoil – Encountered in all exploratory holes to a maximum depth of 0.80mbgl and consisted of grass overlying a dark brown gravelly SILT. Gravel is fine to medium, angular to sub-rounded of mixed lithology, sandstone and clinker.

Pennine Lower Coal Measures Formation strata (sandstone) – Natural soils were encountered within all exploratory holes at subsurface depths of 0.60-0.80mbgl to the maximum excavated depth of 2.45mbgl. The stratum generally comprised of a light brown slightly clayey sandy GRAVEL. Gravel is fine to coarse, angular of sandstone (weathered sandstone).

The windowless sampler borehole logs can be reviewed within **Appendix C.**

3.2 Hydrogeology and Hydrology

The Environment Agency designate aquifers in accordance with the Water Framework Directive. These designations reflect not only the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetlands ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey.

As a result of the bedrock geology on site, the aquifer is designated as being a Secondary (A) Aquifer. These are defined as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

Groundwater was not encountered during the site works completed. However, it was encountered within all of the boreholes during the three monitoring rounds. The following table presents the levels recorded in each installation and round of monitoring.

Exploratory Hole	MON1 Standing Level (mbgl)	MON2 Standing Level (mbgl)	MON3 Standing Level (mbgl)
WS01	1.71	1.71	1.72
WS02	1.92	1.95	1.96
WS03	1.96	1.98	2.01

Table 1: Groundwater level recorded in installs

It should be noted that groundwater levels are dependent upon seasonal variations and can change after periods of prolonged rainfall or drought.

3.3 Site Investigation Contamination Findings

3.3.1 Risks to Human Health

With the exception of the limited depth of Made Ground identified, no visual and/or olfactory evidence of potential contamination was noted within any soils encountered during the SI works undertaken.

Overall, there were five exceedances identified in the form of arsenic (GAC of 37mg/kg) within WS01 at 0.40mbgl (39mg./kg) and WS03 at 0.15mbgl (62mg/kg), 0.50mbgl (37mg/kg) and 2.00mbgl (47mg/kg) and lead (GAC of 200mg/kg) within WS03 at a depth of 0.15mbgl (335mg/kg).

Therefore, it would be reasonable to conclude that there is a possible risk to human health receptors.

Reference should be made to the Phase 2: Site Investigation report for derivations of the GACs and for analysis of other determinands where GAC values were not exceeded. The site investigation laboratory certificates can be viewed in **Appendix D**.

Due to the identified exceedances within the proposed garden areas, there is requirement for remediation to address risk to human health on site.

3.3.2 Risks to Plants and Wildlife

A negligible risk has been attributed given the concentrations of phytotoxic contaminants below elevated concentrations often below the limit of detection returned.

3.3.3 Risks to Site Workers

Due to the presence of elevated concentrations of determinants precautions should be taken to minimise exposure of site workers during ground works through the implementation of site safety procedures and the use of suitable personal protective equipment (PPE). Such precautions should include, but not be limited to:

- Personal hygiene, washing and changing procedures;
- Availability of site welfare;
- Provision of PPE appropriate to the task; and
- Safety briefings and tool box talks.

All site works will be undertaken in accordance with the guidelines prepared by the Health and Safety Executive (1991) and all work will be carried out in accordance with the Principal Contractor's Health and Safety Plan.

3.3.4 Risks to Controlled Waters

Groundwater was encountered during the site works and all of the monitoring rounds, however, given the well depths and due to the small amount of water encountered, which is believed to be condensation at the base of the well, it was not possible to collect samples during the monitoring rounds. Based on the site's setting and having reviewed the general area, we would consider the groundwater regime is of relatively low importance, as potable resource for this site. In addition, given the low leachability of the exceedances identified within the soil samples, the risk is further reduced.

It may be feasible to conclude that there has been minimal impact, if any, to the groundwater regime underlying the site.

3.3.5 Risks to Buried Services

The concentrations and types of contaminants identified are not considered to represent a risk to buried water pipes, however the requirements of the water company serving the property should be ascertained in this regard.

3.3.6 Risks to Proposed Structures

Based on the maximum calculated GSV of 0.0112l/hr, the site was below the threshold given by CIRIA C665 for Situation B and is characterised as 'Green'. Based on this data, the indication is that there is a negligible gas regime identified. As a consequence, gas protection measures are not considered necessary to be incorporated into the proposed development.

4.0 Updated Conceptual Site Model and Risk Assessment

The following Conceptual Site Model (CSM) is presented in accordance with t[redacted]te investigation works. The model examines the remaining plausible pollutant linkages that may exist at the site in accordance with Con[redacted]port (CLR) 11 and the DEFRA and CLR 6 site prioritisation and categorisation risk rating system. This is in relation to the proposed end use being classified as 'residential with homegrown produce'. The following linkages have been identified:

Contaminant Source	Pathways	Receptor	Potential Severity	Probability of Risk	Level of Risk	Justification
On Site: Made Ground soils on site containing Hydrocarbons (TPH, PAH) Heavy metals, phenols, BTEX, MTBE.	Ingestion, dermal contact, inhalation of dusts/vapours	Future end users and site visitors	Medium	Likely	Moderate ●	A moderate risk has been assessed given the exceedances of lead and arsenic. Contact is likely between future residential occupiers/visitors and contaminants in the shallow soil in garden/permeable driveway areas of the site, soil/dust tracked back into the house and from ingestion of homegrown produce.
		Construction Workers	Medium	Likely	Moderate ●	Construction workers are likely to come into direct contact with soils during groundworks. Safe working practices should be implemented and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from contact with soils and shallow/perched groundwater.
	Leaching through soils and migration via groundwater or soil pore moisture	Controlled Waters	Mild	Low Likelihood	Low ●	A low risk is assessed despite the lack of water samples analysed given that the groundwater encountered was believed to be condensation within the boreholes. Moreover, the site is underlain by a Secondary (A) Aquifer within the bedrock underlying the site. In addition, the likelihood of migration through groundwater is low due to groundwater lowering by mine workings. There are no current or potable groundwater abstractions within 1300m of the site and no surface water bodies close to the site.
	Permeation of plastic water pipes	Construction materials, future end users and site visitors	Medium	Likely	Low/ Moderate ●●	There were no exceedances for hydrocarbons, however exceedances of lead and arsenic were encountered. Provision of water supply pipes and connectors formed from proprietary "barrier pipe" materials (eg polyethylene-aluminium-polyethylene) may be required by the water supply company.
On site: Phytotoxic Contamination.	Uptake	Plant and Wildlife	Mild	Low Likelihood	Low ●	A low risk has been assessed given the returned laboratory results which indicates there to be no significant concentrations of phytotoxic contamination.
On Site: Asbestos at/near ground surface in made ground soils.	Inhalation of fibres in airborne dust	Future end users and site visitors	High	Low Likelihood	Low ●	Although screening has revealed no asbestos to be present within the samples analysed from exploratory holes undertaken, it cannot be guaranteed that asbestos is not present within the soils across the site.
		Construction Workers	High	Low Likelihood	Low ●	Asbestos fibres have not been identified in the samples returned from laboratory analysis. However, Safe working practices should be

						implemented and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from asbestos in soils.
On Site: Ground Gases (CH4, CO2) from on site Made Ground.	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures.	High	Low Likelihood	Low ●	A low risk is assessed based on the calculated GSV of 0.0112l/hr, the site was below the threshold given by CIRIA C665 for Situation B and is characterised as 'Green'. Therefore, no gas protection measures are considered necessary.
Off Site: Limited off site development.	Leaching through soils and migration via groundwater or soil pore moisture	Future end users and site visitors	Mild	Unlikely	Low/ Moderate ●●	A low to moderate risk is assessed given that the groundwater encountered was believed to be condensation within the boreholes and given the low leachability of the exceedances encountered within the soils.
	Inhalation of vapours	Future end users and site visitors	Medium	Low Likelihood	Low ●	A low risk is assessed based on the lack of volatile compounds detected and the results of the ground gas monitoring.
Off Site: Ground Gases (CH4, CO2, H2S) from off site Made Ground.	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures.	High	Low Likelihood	Low ●	A low risk is assessed due to the returned gas monitoring results which indicated that there is no gas regime at the site.

Table 2: Updated Conceptual Site Model and Risk Assessment

5.0 Remediation Strategy

The aim of the proposed remedial works is to reduce and/or remove unacceptable risks to the identified on site receptors. The adopted remedial measures to be introduced are intended to minimise and/or break the aforementioned pollutant linkages as identified within the CSM.

A pragmatic approach has been adopted with regard to the necessary remedial works to be undertaken at the site. The outlined remedial measures have been based upon the previous investigative works completed and the propos[redacted]ch the planning consent issued by Kirklees Council has been ba[redacted]

Should a material change to these plans be ma[redacted]ore sensitive site end use be proposed, the recommendations made in t[redacted]y no longer be appropriate and a revision would therefore be required.

5.1 Mitigation of Risks to Future Occupiers & Site Visitors

The contaminants that have been identified from the site investigation works completed are considered to be typical of Made Ground in developed urban areas, and the concentrations represent relatively widespread contamination.

The majority of the site will be covered by building footprint and hard standing in the form of the stone flag patio in the back-garden area. This will provide a sufficient degree of isolation of contaminants from future occupiers and visitors.

However, the arsenic exceedance within WS01 at 0.40mbgl is within an area of proposed permeable driveway, we would recommend that soils are removed in the permeable driveway area of the site to a depth of 600mm, a geotextile layer is installed at a depth of 600mm across the entire proposed permeable driveway area followed by 600mm of clean imported material. The removal of this shallow subsoil from across the permeable driveway area would be sufficient to mitigate the risks posed by the contamination encountered during the site investigation.

The proposed layout of the site, showing the distribution of hard and soft substrates within the external areas, is provided in **Appendix A.**

5.2 Mitigation of Risk to Site Workers

Due to the elevated levels of lead and arsenic compounds, precautions should be taken to minimise exposure of site workers during ground works through the implementation of site safety procedures and the use of suitable personal protective equipment (PPE). Such precautions should include, but not be limited to:

- Personal hygiene, washing and changing procedures;
- Availability of site welfare;
- Provision of PPE appropriate to the task; and
- Safety briefings and tool box talks.

All site works will be undertaken in accordance with the guidelines prepared by the Health and Safety Executive (1991) and all work will be carried out in accordance with the Principal Contractor's Health and Safety Plan.

5.3 Mitigation of Risks to General Public / Off Site Receptors

During the redevelopment precautions should be taken to minimise exposure of the general public to potentially harmful substances with specific reference to earthworks involving the disturbance of contaminated soil which has the potential to expose construction workers and any nearby residents. Mitigation measures to mitigate risks to the general public should include, but not be limited to:

- Restricting off site nuisances, such as dust emissions by covering waste haulage vehicles and monitoring site boundary conditions;
- Preventing surface water run-off, tracki[redacted]e development demise;
- Dust suppression techniques (if required[redacted]

5.4 Mitigation of Risks to Controlled Waters

No remedial measures are proposed.

5.5 Mitigation of Risks to Plants and Wildlife

Refer to Section 5.1.

5.6 Mitigation of Risks to Building Materials

5.6.1 Buried services

Given that new services may be installed as part of the redevelopment of the site, the company responsible for the local water supply should be contacted to determine their specification for the type of pipework which should be used on this site. This may include barrier pipework. Further information can be found within the Water Regulations Advisory Scheme. *Information and Guidance Notes for the Selection of Materials for Water Supply to be laid in Contaminated Land.*

5.6.2 Gas Protection Measures

Ground gas risks were not identified during the previous assessment and investigation phases and ground gas mitigation measures are not deemed necessary for this development.

5.7 Watching Brief and Discovery Strategy

A watching brief should be maintained by the Main Contractor at all times during the groundworks stage. Should any unforeseen contamination, such as oils or soils/groundwater with an unusual colour or odour, be encountered during groundworks then the following procedure should be implemented:

- Work to cease in that area to prevent exposure to ground workers and potential contaminants being spread around;
- Notify a Geo-Environmental Consultant, to attend site and sample material;
- Notify the Environmental Health Department / Contaminated Land Officer(s) of the local planning authority.

If the nature and extent of the contamination is unmanageable under the procedure set out above, then a suitable management, mitigation or remediation procedure will be agreed with the CLO. However, this is considered unlikely at this particular site.

5.8 Materials Management

5.8.1 Off-site disposal

It is possible that the surplus soils that will be generated during groundworks will require disposal off site. The Contractor will be responsible for the appropriate segregation, classification and disposal of material.

All material intended for off site disposal should be transported and disposed in accordance with the Environmental Protection (Duty of Care) Regulations, 1991 and the Landfill (England and Wales) Regulations.

Based on the analytical data from the Phase 2 [redacted] that the soils will be eligible for disposal at a non-hazardous landfill [redacted]s that will be excavated as part of the proposed development will on[redacted] inert disposal, if "inert" thresholds are not exceeded in Waste Acceptan[redacted]) test results.

Copies of the soil logs, general contamination test results and available WAC results should be provided to a licensed landfill facility to agree upon a suitable end point for disposal of site arisings.

Waste legislation stipulates that hazardous and non-hazardous waste should be pre-treated prior to disposal. Pre-treatment can be undertaken either at the site of origin or may be carried out at a licensed off-site facility and can include selective excavation and segregation of soils conducted on site.

Excavated soils should be appropriately stored with preventative measures against infiltration/leaching and/or nuisance odours to protect the environment and human health during temporary storage on site. Ideally, site arisings would be loaded directly to waste haulage vehicles for immediate transfer off-site to a suitably licensed facility.

All waste handling procedures should be documented by the Main Contractor with appropriate Duty of Care records maintained and held on site.

5.8.2 Reduction of Waste to Landfill

There are other material management options that can be considered in order to minimise the volumes of material received at landfill. Providing the appropriate protocols are followed these options can include:

- Disposal of non-hazardous material to a soil hospital/recycling facility, where the soil can be disposed and subject to treatment for a particular end use and does not incur landfill tax;
- Recycling of materials such as metals, concrete and tarmac;
- Re-use of site won demolition concrete/hardcore for use as pile mats and/or sub-base materials in accordance with the WRAP Protocol; and/or
- Re-use of soils on/off-site (where there is a specified need for them and they do not pose a human health/environmental risk) in accordance with the CL:AIRE Definition of Waste Industry Code of Practice.

Should reuse of this material be pursued it will required to be laboratory tested for a basic range of contamination parameters to include heavy metals, speciated Total Petroleum Hydrocarbons (TPH CWG Aromatic/aliphatic split) and speciated Polycyclic Aromatic Hydrocarbons (PAH, including the more carcinogenic benzo(a)pyrene (BaP) and volatile naphthalene), MTBE, BTEX, cyanide, phenols, soil organic matter (SOM) content and an

asbestos screen. A laboratory able to carry out UKAS and MCERTS accredited tests for these determinands should be used.

The results from laboratory testing shall be compared against standards, such as, against revised LQM/CIEH S4UL criteria[1] where available. These GAC have been designed for use under planning, using Health Criteria Values based on minimal risk, and updated exposure parameters. The S4UL are intended to replace the previous LQM/CIEH GAC. Or alternatively criteria such as, Soil Guideline Values (SGVs) and LQM 'CIEH' Generic Assessment Criteria for the most stringent land use classification appropriate to the proposed end use, namely; 'residential with homegrown produce'.

5.8.3 Imported Fill material

Acceptance criteria for imported topsoil with [redacted]erials identified above are provided in **Appendix E.**

5.9 Constraints

In the event of any changes proposed by the developer in the design scope and specification for the installation of any of the mitigation measures as outlined within this document, YE should be contacted to determine whether these amendments will lead to any increased risk to the receptors identified within the CSM.

Notification of these changes will be supplied to Kirklees Council by YE, allowing for them to review and provide comments, prior to proceeding with the installation of any changes to design measures and specification.

It will be the responsibility of The Client to inform YE of any changes in the design scope and specifications.

5.10 Verification Reporting

5.10.1 Inspection, Sampling and Measurement

The following requirements for inspection, sampling and measurement, are identified:

- A photographic record will be provided showing construction of the soil cover system and overlying cover soil layers;
- Confirmation of thickness of cover soil layers by hand excavation of inspection pits in each garden area;
- Sampling of topsoil from each of the inspection pits and testing to confirm compliance with the requirements in Appendix E.
- Duty of care records for disposal of waste material including the landfill site(s) or disposal facility where the material has been disposed and a copy of the Contractor's current waste carrier's licence (to be provided by Contractor);
- Records and test certificates relating to the management and disposal or unforeseen contaminants.

5.10.2 Verification Reporting

The verification Report will include, but not be limited to, the following:

[1] Nathanail et al. (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, 2015. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3495

- Site visit records and photographic records from the watching brief;
- Site visit records and photos from visits completed by a Geo-Environmental Consultant from YE;
- Validation records of installation of various proposed capping layers;
- Duty of care records for disposal of waste material including the landfill site(s) or disposal facility where the material has been disposed and a copy of the Contractor's current waste carrier's licence (to be provided by Contractor);
- Records and test certificates relating to the management and disposal or unforeseen contaminants;
- Details of source and chemical test results for imported materials;
- Thickness of cover system measurement



6.0 Statutory Consultee

This report must be forwarded to the Local Planning Authority in order to obtain their comments and approval and discharge of planning conditions prior to the commencement of any groundworks and/or remedial works.

7.0 Limitations

This report has been prepared by YE with all reasonable skill, care and diligence. The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources.

The opinions given in this report have been dictated by the finite data on which are they based and are relevant only to the purpose for which the report was commissioned.

Information reviewed should not be considered exhaustive and has accepted in good faith as providing true and representative data with respect to site conditions. Should additional information become available which may influence the opinion expressed in this report, YE reserves the right to review such information and, if warranted, to alter the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed.

The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted industry practices at this time and as such is not a guarantee that the study site is free of hazardous conditions.

This report has been prepared solely for the use of the named client, and may not be relied upon by other parties without written consent from YE. YE disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.