# Desk Study Report

## Mearley Brook
## Clitheroe
## Lancashire

Client Beck Developments Limited

J11218

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GEA Geotechnical & Environmental Associates

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# EXECUTIVE SUMMARY

***This executive summary contains an overview of the key findings and conclusions. No reliance should be placed on any part of the executive summary until the whole of the report has been read. Other sections of the report may contain information that puts into context the findings that are summarised in the executive summary.***

## BRIEF

This report describes the findings of a desk study carried out by Geotechnical and Environmental Associates Limited (GEA), on behalf of Beck Developments Limited. The purpose of the work has been to determine the history of the site, to assess the potential for contamination, and to provide preliminary information on foundation options with regard to the proposed redevelopment for residential purposes.

## DESK STUDY FINDINGS

The earliest map studied, dated 1847, shows the site to have formed part of Primrose Lodge mill reservoir. The southwestern part of the site is shown to have been covered by woodland, whilst much of the the northeastern part formed the bank of Primrose Lodge reservoir and the remainder lay within the reservoir itself. The subsequent 1886 map shows terraced houses to have been built fronting on to Woone Lane along with a stone yard beyond the northern part of the site. The majority of the northeastern part of the site is shown within Primrose Lodge reservoir with the remainder of this being either allotments or gardens associated with the terraced houses. The southwestern part of the site is shown to have been woodland and open ground on the edge of the reservoir and does not appear to have changed significantly from this point up to the time of this investigation. The map dated 1912 shows a reduction of the area of the reservoir, possibly due to silting up, and the northeastern part of the site to have been allotment gardens and open ground with a small stream flowing into the reservoir from behind the houses. The 1932 map shows a tank to have been present close to the northern boundary of the site and two footbridges crossing Mearley Brook at the narrowed neck of the reservoir close to the northeastern boundary. On subsequent maps the footbridges are shown as a 'weir' and 'sluices'. The tank in the north of the site is not shown on maps later than 1956 but the area to the north of the tank is shown as 'works' on the large scale maps dated from 1964 to 1997, the most recent large scale map available. The maps also indicate that a number of short-lived small works were variously located near to Mearley Brook close to its entry into the lodge between 1884 and1995.

No significant changes to the site itself or its immediate surroundings were noted on subsequent maps from 1970 up to the time of the site walkover.

## CONTAMINATION RISK ASSESSMENT

The desk study has indicated the site to have had a potentially contaminative history. There is, therefore, assessed to be a MODERATE RISK of contamination at this site. It is recommended that an intrusive investigation is undertaken to quantitatively ascertain the risks posed by potentially contaminated soils and where necessary make recommendations for remedial measures.

## FOUNDATIONS

The site slopes fairly steeply from Woone Lane down to Mearley Brook and Primrose Lodge reservoir; it also contains many mature and semi-mature trees. Although the foundation loads are likely to be relatively light, the presence of the slope, potential for soft alluvial deposits to be present and the likely requirement to deepen foundations to bypass any soils that may be influenced by the presence of trees, may preclude the use of shallow spread foundations. It is therefore recommended that an allowance for piled foundations is made at this stage.

# 1.0 INTRODUCTION

Geotechnical and Environmental Associates Limited (GEA) have been commissioned by Beck Developments Limited, to carry out a desk study at Mearley Brook, Clitheroe.

## 1.1 Proposed Development

It is understood that consideration is being given to the redevelopment of the site for residential purposes. The proposed development is likely to include a range of two-storey to three-storey residential dwellings with associated infrastructure, gardens and landscaping.

This report is specific to the proposed development and the advice herein should be reviewed if the development proposals are amended.

## 1.2 Purpose of Work

The principal technical objectives of the work carried out were as follows:

- to determine the history of the site and surrounding area, particularly with respect to any previous or present potentially contaminative uses;
- to research the geology and hydrogeology of the site;
- to check records of data on groundwater, surface water and other publicly available environmental data;
- to use the information obtained in the above searches to carry out a qualitative risk assessment with respect to subsurface contamination; and
- to provide preliminary comments on foundation options and recommendations for appropriate ground investigation.

## 1.3 Scope of Work

In order to meet the above objectives, a desk study was carried out, comprising, in summary, the following activities:

- a review of readily available geological maps;
- a review of publicly available environmental data sourced from Envirocheck
- a review of historical Ordnance Survey (OS) maps supplied by Envirocheck;
- a walkover survey of the site; and
- provision of a report presenting and interpreting the above data, together with our advice and recommendations with respect to the proposed development.

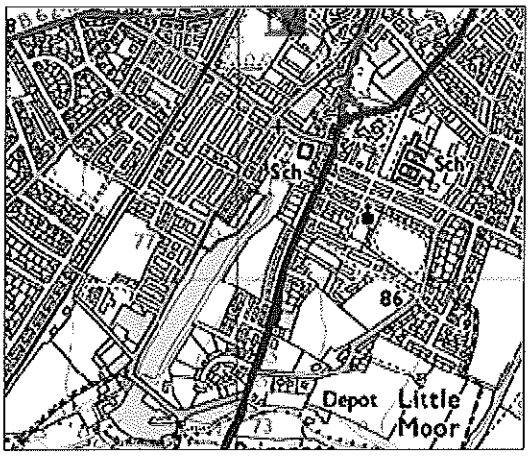
### 1.4 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the research carried out. The results of the research should be viewed in the context of the work that has been carried out and no liability can be accepted for matters outside the stated scope of the research. Any comments made on the basis of information obtained from third parties are given in good faith on the assumption that the information is accurate. No independent validation of third party information has been made by GEA.

## 2.0 THE SITE

### 2.1 Site Description

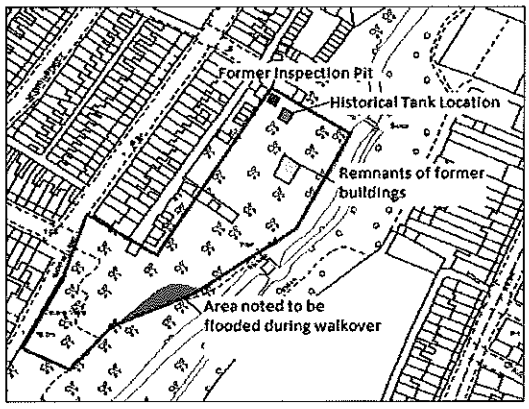
The site is located approximately 1.2 km southwest of Clitheroe town centre and fronts onto Woone Lane to the northwest. The site is bounded to the north by lock-up garages and various outbuildings that belong to houses that front onto Woone Lane. To the southeast, the site is bounded by Mearley Brook, which flows in a southwestly direction. The northeastern boundary is formed by woodland and dilapidated buildings which are noted on historic maps as works.




The remaining boundary to the southwest is open to woodland. The site is irregular in shape measuring 165 m southwest to northeast and 70 m northwest to southeast in maximum dimensions; it may additionally be located by National Grid Reference 373990, 441140 and is shown on the map extract above.

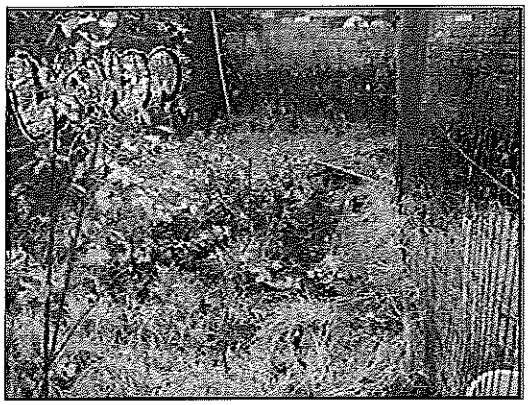
The site is in an overgrown and untidy state with fly tipped waste covering much of the surface. Part of the site to the rear of the houses that front onto Woone lane was, at the time of walkover, being used to keep poultry. The site slopes steeply down from Woone Lane towards Mearley Brook and the gradient reduces with increasing proximity to the brook.

It appears that the site was once accessed from Woone Lane as entrances for pedestrians and vehicles have been bricked up and 'Keep Out' and 'Deep Water' warning signs are displayed. Some remnants of former buildings were noted in the north of the site, including what appears to have been a vehicle inspection pit.




The fly tipped material noted at the site was generally observed to be demolition rubble; this rubble contained some fragments of corrugated cementious panels which may

contain asbestos.
The photograph opposite shows what appears to have been a vehicle inspection pit, which is filled with demolition rubble and water.



Part of the southeast of the site was flooded during the walkover survey.

The site contains numerous mature and semi-mature trees; the majority of these trees were noted to be ash.

## 2.2 Site History

The site history has been researched by reference to internet sources and historical Ordnance Survey (OS) maps obtained from the Envirocheck database.

The earliest map studied, dated 1847, shows the site to have formed part of Primrose Lodge mill reservoir. The southwestern part of the site is shown to have been covered by woodland, whilst much of the the northeastern part formed the bank of Primrose Lodge reservoir and the remainder lay within the reservoir itself. The subsequent 1886 map shows terraced houses to have been built fronting on to Woone Lane along with a stone yard beyond the northern part of the site. The majority of the northeastern part of the site is shown within Primrose Lodge reservoir with the remainder of this being either allotments or gardens associated with the terraced houses. The southwestern part of the site is shown to have been woodland and open ground on the edge of the reservoir and does not appear to have changed significantly from this point up to the time of this investigation. The map dated 1912 shows a reduction of the area of the reservoir, possibly due to silting up, and the northeastern part of the site to have been allotment gardens and open ground with a small stream flowing into the reservoir from behind the houses. The 1932 map shows a tank to have been present close to the northern boundary of the site and two footbridges crossing Mearley Brook at the narrowed neck of the reservoir close to the northeastern boundary. On subsequent maps the footbridges are shown as a 'weir' and 'sluices'. The tank, shown in the north of the site, is not shown on maps later than 1956 but the area to the north of the tank is shown as 'works' on the large scale maps dated from 1964 to 1997; the most recent large scale map available.. The maps also indicate that a number of short-lived small works were variously located near to Mearley Brook close to its entry into the lodge between 1884 and1995.

No significant changes to the site itself or its immediate surroundings were noted on subsequent maps from 1970 up to the time of the site walkover.

## 2.3 Other Information

A search of public registers and databases has been made via the Envirocheck database and relevant extracts from the search are appended. Full results of the search can be provided if required.

The desk study research indicates that there is a single historical landfill within 250 m of the site. It is located 228 m to the southwest of the site and the operator is listed as being the Stalwart Dying Company Limited and the waste listed as 'deposited waste including unknown material'. There are no other active or historical landfill sites, waste management, transfer or disposal sites located within 500 m of the site.

There are 16 recorded incidents of pollution to controlled waters within 500 m of the site. Of these 16 it is considered that seven may have directly impacted the site. These seven incidents were recorded upstream of the site and involved oils and chemicals entering Mearley Brook. Given the fact that part of the site is made up from silt accumulating from the Mearley Brook it is possible that the oils and chemicals from these pollution incidents may have accumulated in the soils forming the eastern part of the site.

The British Geological Survey, National Geoscience Information service indicates that the site falls within an area where 1% to 3% of homes are affected by radon emissions and that no radon protective measures will not be necessary. The current Health Protection Agency Indicative Atlas of Radon in England and Wales 2007 however indicates that the site lies within an area where 10% to 30% of homes are above the action level for radon emissions and therefore radon protection measures may be necessary. Confirmation should be sought from the local authority to ascertain any requirement for radon protection measures to be installed in the proposed dwellings.

The site is not listed as being within a nitrate vulnerable zone or any other area of sensitive land use.

# 3.0 GROUND CONDITIONS

## 3.1 Soil Conditions

The Geological Survey map of the area indicates the site is underlain by Glacial Till and Alluvium overlying the Clitheroe Limestone Formation and Hodder Mudstone Formation.

## 3.2 Groundwater Conditions

The Clitheroe Limestone Formation and Hodder Mudstone Formation are classified by the Environment Agency as a Secondary 'A' aquifers, which refers to permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. The Glacial Till is designated as unproductive strata, rather than its former classification as a non-aquifer.

There are four water abstraction licences within 500 m of the site. The nearest such licensed abstraction is located 32 m northeast of the site, and along with the other abstractions , relates to the abstraction of surface water from Mearley Brook. The site is not located within a Groundwater Source Protection Zone as defined by the Environment Agency.

The nearest surface water feature is Mearley Brook, located directly east of the site, which flows to the southwest towards Primrose Lodge and then a confluence with the Pendleton Brook, which in turn flows to the west towards a confluence with the River Ribble. Local groundwater flow is likely to be generally in a southwesterly direction towards the adjacent Mearley Brook and Primrose Lodge.

The Environment Agency Flood Map indicates that the northeastern portion of the site is in an area that is at risk from extreme flooding from rivers without defences (Zone 2) and flooding from rivers without defences (Zone 3).

# 4.0 RISK ASSESSMENT

Consideration is being given to the redevelopment of the site for residential purposes. The proposed development is thought likely to include a range of two-story and three-storey residential dwellings with associated infrastructure, gardens and landscaping.

## 4.1 Environmental Risks

Part IIA of the Environmental Protection Act 1990, which was inserted into that Act by Section 57 of the Environment Act 1995, provides the main regulatory regime for the identification and remediation of contaminated land. As part of the new regime local authorities are required to carry out inspections of their area to identify sites that may be contaminated. The determination of contaminated sites is based on a "suitable for use" approach which involves managing the risks posed by contaminated land by making risk-based decisions. This risk assessment is carried out on the basis of establishing one or more "pollution linkages"; a pollution linkage requires a source of contamination, a sensitive target or receptor that is at risk from the contamination and a pathway by which the contamination can travel from the source to the target.

Current guidance to Local Planning Authorities (LPAs)[1] also indicates the need for a risk assessment and requires that where development is proposed on land that may be affected by contamination, a risk assessment should be carried out for consideration by the LPA before the planning application is determined. Where unacceptable risks are identified proposals need to be made to address these risks as part of the development process. The guidance recognises the benefits of a phased approach and the desk study is the first phase in the process of investigating and identifying contamination to assist in the determination of a planning application.

### 4.1.1 Source

The findings of the desk study have indicated that contamination may be present due to potentially contaminative past land use. A former tank has been identified by the historical map search; the walkover revealed a number of dilapidated buildings and what appeared to be a vehicle inspection pit.

Fly tipped material including what appeared to be asbestos containing material was also noted during the walkover.

The environmental search revealed a number of pollution incidents to the adjacent Mearley Brook which may be have affected the site as well as a single historical landfill located 228 m to the northeast and possiby within influencing distance of the site. There is potential for elevated carbon dioxide concentrations to exist in the organic rich silt beneath the site.

### 4.1.2 Receptor

The proposed redevelopment of the site for residential purposes will result in the end users representing relatively high sensitivity receptors. The cohesive soils beneath the site are classified as an unproductive stratum; however given the site's proximity to Mearley Brook it is considered that groundwater also represents a sensitive receptor.

1 Planning Policy Statement 23 (2004) *Planning and Pollution Control* HMSO

### 4.1.3 Pathway

End users of the site may be exposed to any potential near surface contamination in gardens and landscaped areas through direct soil and dust inhalation, consumption of homegrown produce, consumption of soil adhering to homegrown produce and skin contact with soils and dust.
The majority of site is likely to be directly underlain by Alluvium which is designated a Secondary 'A' Aquifer, over the Clitheroe Limestone Formation and Hodder Mudstone Formation which are also designated a Secondary 'A' Aquifers. Given the environmental setting of this site it is unlikely that potential near surface contamination will impact the aquifer and will instead migrate to the adjacent Mearley Brook via surface water run off or leaching. Buried services may be exposed to any contaminants present within the soil through direct contact and site workers will come into contact with the soils during construction works.

### 4.1.4 Preliminary Risk Appraisal

In accordance with the guidelines provided by CIRIA[2], the following table summarises possible pollution linkages for the site.

| SOURCE | RECEPTOR | PATHWAY | PROBABILITY | CONSEQUENCE |
|---|---|---|---|---|
| Potential contamination within near surface soils | End users | Ingestion of contaminated soil or dust, through skin contact or inhalation | Likely | Medium |
| | | Ingestion of contaminated soil through vegetable uptake | Unlikely | Mild |
| | Groundwater | Percolation and leaching of surface run-off | Likely | Medium |
| | | Infiltration of contaminated perched groundwater to Aquifer | Unlikely | Medium |
| | Site workers | Ingestion of contaminated soil or dust, through skin contact or inhalation | Low likelihood | Minor |
| | Buried services | Direct contact | Low likelihood | Mild |
| | Adjacent sites | Surface water flow or drain runs | Unlikely | Mild |
| Asbestos containing materials | End Users | Inhalation of fibres | Low likelihood | Medium |
| | Site Workers | Inhalation of fibres | Low likelihood | Medium |
| Ground gas from nearby historical landfill | End Users | Migration through faults, or granular layers within the underlying soil | Unlikely | Medium |
| Carbon dioxide from organic rich soils at site | End Users | Migration through granular layers in to buildings | Low likelihood | Medium |

This method of risk evaluation involves classification of the magnitude of the potential consequence (severity) and probability (likelihood) of the risk. The method by which these factors are classified is detailed in the Appendix. On the basis of the consequence and probability the site can be attributed a level of risk, ranging from very low to very high and the procedure for making this assessment is shown in the Appendix, together with a description of each level of assessed risk and the actions that may be required to mitigate the risk.

2 Rudland, DJ, Lancefield, RM and Mayell, PN (2001) *Contaminated land risk assessment. A guide to good practice. CIRIA C552*

On this basis of the above it is considered that there is a MODERATE RISK of there being a significant contaminant linkage at this site which would result in any requirement for any remediation work. It is recommended that an intrusive investigation is undertaken to quantitatively ascertain the risks posed by potentially contaminated soils and where necessary make recommendations for remedial measures.

### 4.2 UXO Preliminary Risk Assessment

This assessment has been carried out in accordance with the guidelines provided by CIRIA[3], which state that the likelihood of encountering and detonating unexploded ordnance (UXO) below a site should be assessed along with establishing the consequences that may arise. The first phase comprises a preliminary risk assessment, which should be undertaken at an early stage of the development planning. If such an assessment identifies a high level of risk then a detailed risk assessment should be carried out by a UXO specialist, which will identify an appropriate course of action with regard to risk mitigation.

The site is not located an area of known World War II bombing, it is not near military sites or other sites that would have been specifically targeted by German bombing raids. On this basis there is considered to be a LOW risk to the site from unexploded ordnance.

A UXO detailed risk assessment is not considered to be required although the information detailed in this assessment should be retained and reviewed should any intrusive investigation be proposed.

### 4.3 Development Issues

The site slopes fairly steeply from Woone Lane down to Mearley Brook and Primrose Lodge; it also contains many mature and semi-mature trees. Although the foundation loads are likely to be relatively light, the presence of the slope, potential for soft alluvial deposits to be present and the likely requirement to deepen foundations to bypass any soils that may be influenced by the presence of trees, may preclude the use of shallow spread foundations. An intrusive investigation to provide parameters for foundation design and assess slope stability as well as to quantify the risks posed by potential soil contamination and if necessary provide remedial recommendations is considered necessary.

The Environment Agency flood map indicates that the northeast portion of the site may be within a flood risk zone and as such a detailed flood risk assessment is likely to be required.

## 5.0 CONCLUSIONS

On the basis of the findings of the research carried out there is considered to be a MODERATE risk of there being a significant contamination linkage at this site and it is anticipated that remedial works may be required. It is therefore recommended that an intrusive investigation to determine the level of risk posed by potential contamination should be undertaken as well as to assist in waste disposal classification.

3 Stone, K, Murray, A, Cooke, S and Foran, J (2009) *Unexploded Ordnance (UXO). A guide for the construction industry.* CIRIA C681

Information gained from the desk study regarding the ground conditions at this site has indicated that due to the presence of sloping ground, trees and soft alluvium, shallow spread foundations may not be a suitable foundation solution and it is recommended that an allowance for piled foundations is made at this stage. Similarly, it is thought unlikely that soakaway drainage will be effective and it would be prudent to allow for surface waters to be directed into the main drainage system.

A ground investigation is required to confirm the ground conditions in order to provide design recommendations for the proposed development.