Our ref: JR:le:H13004

Southdale Limited
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30th July 2013

For the attention of Stephen Parker (by email)

Dear Stephen

QUEEN’S MILL, BURNLEY – SHALLOW COAL MINING INVESTIGATION REPORT

We are pleased to present our report on the investigation of potential shallow coal mining recently undertaken at the above site.

Introduction

Following completion of a desk top study by REC Consultants (ref. 44699p1r0) and ground investigation by Patrick Parsons Ltd (PPL) (ref. jr:le:N13004), PPL were commissioned by Southdale Limited (SL) to undertake a supplementary ground investigation to address the potential for shallow coal mining at the site of the former Queen’s Mill, Burnley, which is proposed for residential development, as shown on OMI Architects Proposed Site Layout Drawing no. L1010C included as Appendix A.

Aim

The aim of the investigation was to assess whether the site is affected by past shallow coal mining. This involved drilling boreholes to provide information on the presence, depth and nature of the underlying coal seam, which is expected to be the ‘Low Bottom’ seam.

A Coal Mining Risk Assessment has been prepared by PPL (Report ref. N13004/MRA, January 2013), which should be read in conjunction with this report.
Limitations

This report is based on and limited to an assessment of the information obtained during works undertaken here and has been prepared for the sole use of SL and their agents only. PPL cannot take responsibility for variations in ground conditions between exploratory holes. This report should not be relied upon by any third party without the written permission of PPL.

The intrusive investigation was undertaken during the demolition of the mill, with consequently, some restrictions on access to the overall site.

Site Location and Description

The site is located in the district of Burnley Lane, approximately 1.5km north of Burnley town centre and immediately east of the Leeds and Liverpool Canal and the East Lancashire railway line. Residential development is present along all boundaries with the exception of the land beyond the northern boundary, which is derelict.

The site is rectangular and generally level, lying at approximately 131.0m AOD. However, the site falls slightly from approximately 132.0m AOD in the east to approximately 130.0m AOD in the west. At the time of the investigation the mill building was undergoing demolition.

Geological and Mining Setting

A comprehensive assessment of the site’s geological setting and potential risk posed to the site with regards to past shallow coal mining is presented in the PPL Coal Mining Risk Assessment. The salient points are summarised below:

- The Low Bottom coal seam potentially underlies the site at approximately 25 to 30m depth;
- Thickness of superficial drift deposits, predominantly cohesive glacial till, are anticipated to be between 20 and 25m;
- The Low Bottom coal seam may have been removed by erosion;
- The Low Bottom coal seam is recorded at 0.8 to 1.1m thick;
- British Geological Survey (BGS) information records the conjectured subcrop of the Low Bottom coal seam as being beneath the site;
- The Coal Authority (CA) coal mining risk plan specific to Burnley identifies the site as being in an area subject to probable past shallow coal mining, but not in an area where shallow coal mining has been recorded;
- There is no evidence of any past mine entries (shafts or adits) within the locality or information to suggest that nearby historic collieries exploited the Low Bottom coal.

Rationale for the Intrusive Investigation

The Coal Mining Risk Assessment concluded that the presence of possible unrecorded shallow coal workings in the Low Bottom coal seam beneath the site is unlikely. However, in order to fully address this risk, a drilling investigation was proposed to obtain information on the underlying geology. Determination of the presence, thickness and nature of the coal seam beneath the site would enable an assessment of the coal seam’s potential affect on surface stability.
Fieldwork

The fieldwork was undertaken on the 25th and 26th July 2013 and comprised the drilling of 3 rotary open boreholes (R1 to R3) to depths of between 33 and 39m bgl to allow logging of the soils and solid strata through examination of flush returns and rate of penetration of the drill bit. Observations of groundwater were also made.

Drilling was progressed initially using air flush and changing to air mist with depth. The boreholes were cased within the majority of the superficial deposits. In accordance with CA conditions, the borehole head was monitored for gases during its advancement. The borehole locations were positioned to give a maximum site coverage, given the restrictions posed by the ongoing demolition activities.

The boreholes were positioned to avoid known services and pre-scanned using a cable avoidance tool (CAT) as a precautionary measure. A plan showing the exploratory hole locations is presented as Drawing no. N13004-702 in Appendix A.

Ground Conditions

The ground encountered during the intrusive investigation is summarised below.

Hardstandings and Made Ground

Coated macadam hardstandings were present at the surface at R1. Beneath these, and at existing ground level at locations R2 and R3, made ground comprising either ash and brick fill, concrete and brick demolition materials or reworked clay fill were proved to depths of between 0.2 and 1m.

Natural Strata (cohesive glacial deposits)

Sandy gravelly clays with bands of laminated clay were encountered within all exploratory holes and proved to depths of between 26 and 32m, thickest in the south of the site at location R1.

Natural Strata (granular glacial deposits)

Below 25.5m, R1 proved bands of sand and gravel within the clay at thicknesses of between 1.5 and 2m.

Coal Measures Strata

Rockhead was proved at between 26 and 32m, deepening southwards across the site. The strata comprised weathered mudstone at rockhead becoming more competent with depth. Siltstone was present towards the base of the exploratory holes.

Coal Seams

Coal was proved within R2 and R3, located within the centre and northern parts of the site respectively, and in both instances it was found to be intact. It was present at between 27.7 and 29m depth and at thicknesses of between 800mm and 900mm. No coal was encountered in R1.
and it is assumed that the seam has either been removed through erosion or that the subcrop of the seam lies to the north, towards boreholes R2 and R3.

**Groundwater**

Perched groundwater was present in all exploratory holes within the glacial clays at depths of between 4 and 9m.

Copies of the exploratory hole records are presented in Appendix B.

**Gas Monitoring**

During the drilling, monitoring of methane, carbon monoxide, hydrogen sulphide and oxygen was undertaken at the borehole head. No significant concentrations were recorded with Lower Explosive Limit (LEL) concentrations of methane measured between 0 and 1%, carbon monoxide at between 0 and 12ppm, hydrogen sulphide at 0ppm and slightly depressed oxygen concentrations of between 15.9 and 17% v/v.

**Conclusions**

**Shallow Mining**

A total of 3 rotary open holes have been drilled across the site with an intact coal seam proved in 2 locations in the centre and northern parts of the site. The coal is considered to be the Low Bottom seam. The coal is between 800 and 900mm thick and present at depths of 27.7 and 29m, approximately 1 to 2m below rockhead. No evidence of past exploitation of this coal seam, either by soft or voided strata or loss of flush, was noted during the drilling. The remaining location did not prove the coal seam and as stated above it is likely that this has been removed by erosion, or that it subcrops further to the north.

From available records and the results of the drilling investigation, there is not considered to be a risk from past shallow mining beneath the site that would warrant ground treatment or precautions being taken in houses and infrastructure.

**Gas**

Monitoring of gases during drilling did not record the presence of any significant concentrations of gases considered as potentially presenting a risk to development. As previously recommended, the site is considered to fall within Characteristic Situation 1 (CIRIA C665) or classed as ‘Green’ in accordance with the NHBC traffic light system. The risk is assessed as being NEGLIGIBLE to LOW and, subject to regulatory approval, no precautions associated with ground gas are considered warranted.
If you have any queries or require further information, please do not hesitate to contact us.

Yours faithfully
For: PATRICK PARSONS LIMITED

Jonny Roberts
Senior Geoenvironmental Engineer

Encl - Appendices
APPENDIX A

Drawings
APPENDIX B

Exploratory Hole Records