

**Petrol Coedpoeth, High Street,
Coedpoeth**

SUBADRA

Environmental - Geotechnical - Laboratory - Foundations

13 Triangle Business Park, Stoke Mandeville, HP22 5BL

Tel: 01296 739400 Email: consultants@subadra.com

ADDITIONAL SITE INVESTIGATION COMPLETION REPORT



Report Prepared By:

James Skinner

Report Reviewed By:

James Edley

Client: The Co-Operative Group Ltd

Subadra Consulting Ltd. Registered in
England No. 4586038
Registered Office 13 Triangle Business
Park, Stoke Mandeville, HP22 5BL

Report

CP17129 CL 004

Date

March 2019

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1 Introduction

1.1 The Purpose of This Assessment

The site is located on High Street, Coedpoeth and comprises a petrol filling station with a small convenience store. The Cooperative Group Ltd (The Coop) propose to redevelop the existing filling station site and neighbouring residential property for continued use as a petrol station with a larger Coop convenience store.

We completed an environmental investigation at the site during February 2017 that did not identify any significant hydrocarbon impact of underlying soils and/or groundwater. We concluded that the site was suitable for continued commercial use.

Conditional planning permission for the proposed redevelopment has been granted by Wrexham County Borough Council (Planning application ref. P/2018/0463). Condition 9 of the planning permission was requested by the Coal Authority and required additional intrusive site investigation to assess deeper ground conditions and establish 'potential risks posed the development by past coal mining activity'.

In order to address the requirements of Condition 9, we have now completed additional site investigation work under a Coal Authority 'Permit to Enter or Disturb Coal Authority Mining Interests' (Permit Ref. 17185). This report is designed to form the required completion statement and to set out any remedial works or mitigation measures that we consider necessary.

All the activities comprising this assessment were carried out in accordance with the procedures set out in our Quality Manual. Your attention is drawn to the Notice to Interested Parties included as Attachment One.

1.2 The Scope of This Assessment

Our assessment of the site was carried out in the following parts:

- A review of previous investigation report(s);
- An additional intrusive site investigation comprising two boreholes drilled to 20m depths using water flush rotary coring techniques. Logging of soil cores and the collection of soil samples;
- Provision of this report, which details the results of our assessment and conclusions, and makes recommendations for further works (if necessary).

1.3 Previous Reports Relating to the Site

As part of our environmental assessment we have reviewed the reports listed in the following table.

Our Ref.	Report Title	Prepared By	Prepared on Behalf of	Date of Issue	Report Reference
Ref.1	Environmental Assessment Report	Subadra Consulting Ltd	The Cooperative Group Ltd	March 2017	CP17129 CL 001
Ref.2	Coal Mining Risk Assessment			August 2018	CP17129 CL 003

Our summary review of these documents is provided in Table Two overleaf and we have used information from these documents, where relevant, in other sections of this report.

Table One: Previous Environmental Reports Relating to the Site

Client: The Co-Operative Group Ltd	Additional Site Investigation Completion Report	Report	CP17129 CL 004
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Our Ref.	Summary of Results and Conclusions of Previous Works
Ref.1	This report details the findings of an environmental site assessment we completed for the site during February 2017. This comprises a desk based review of the sites environmental sensitivity and history and then an intrusive investigation comprising the construction of five boreholes to a maximum depth of 7.2m, analysis of soil and groundwater samples and completion of a Generic Quantitative Risk Assessment. Our environmental assessment concluded: ➤ The site is located in an area of low to moderate environmental sensitivity with respect to underlying groundwater and nearby surface water receptors. The underlying geology comprises Glacial Till (Unproductive Strata) overlying Lower Pennine Coal Measures unit (Secondary A Aquifer). There is River Clywedog ~230m to the south west. There are residential properties to the immediate south, east and west. ➤ The site has been used as a petrol station and/or garage since at least the early 1960s and possibly from as early as the 1930s. We understand that the site was last redeveloped during 1988, although the current tanks may pre-date this development. ➤ We proved the underlying geology to comprise a variable layer of Made Ground material to a maximum depth of 1.3m, generally overlying a thin layer of stiff grey brown mottled clay with frequent fine gravel that we interpreted to comprise Glacial Till. Underlying the Till we encountered more friable clay or highly weathered grey brown mudstone with occasional coal fragments or thin coal layers, encountered at various depths, that we interpreted as units of the Lower Pennine Coal Measures. This was proved to a maximum depth of 7.2m. ➤ We encountered groundwater in three of our boreholes at variable depths, ranging between 1.8m and 4.0m. Two boreholes were dry on completion. Resting groundwater levels were recorded between 2.7m and 5.9m depths. We consider the groundwater we encountered to comprise water perched within more sandy or gravelly horizons in the underlying clay and there is no continuous groundwater table under the site at shallow depths. ➤ We identified low concentrations of petrol range hydrocarbons in shallow Made Ground and underlying shallow soils in BH3. No detectable hydrocarbons were identified in deeper soil samples from BH3, however. Low concentrations of waste oil range hydrocarbons were identified in a single soil sample from BH4. Elevated concentrations of lead were identified in samples of shallow Made Ground. We have not detected asbestos fibres in any of the shallow soil (predominantly Made Ground) samples that were screened. ➤ Concentrations of hydrocarbons, consistent with waste oil and possibly weathered diesel, were identified in the groundwater sample collected from BH4. No detectable hydrocarbons were identified in the other groundwater samples obtained (BH5 and MW1). ➤ The results of our Generic Quantitative Risk Assessment indicated that the concentrations of hydrocarbons identified in underlying soils and groundwater did not pose a potential long-term risk to future commercial site users and no active migration pathway from the site, to environmental receptors, was identified. We therefore considered the site to be suitable for commercial use.
Ref.2	This report comprises a Coal Mining Risk Assessment, comprising a desk-based review of all available information on the coal mining issues which are relevant to the site. This was designed to assess potential risks posed to the redevelopment.
Continued overleaf:	

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Our Ref.	Summary of Results and Conclusions of Previous Works
Ref.2	We reviewed a Non-Residential Coal Mining Report for the site, sourced from The Coal Authority (Ref. 51001373122001). The Coal Authority does not consider the site to be in a surface area at risk from underground past or present mining activity, however the property is in an area where coal could be at or close to the surface. This coal may have been worked at some time in the past. The site does not lie within a defined 'development high risk area' and there are no historical mine shafts within 20m of the site boundary. There have not been any claims made to the Coal Authority relating to mining related ground subsidence. We reviewed historical maps for the site location and borehole archives held by the British Geological Survey (BGS). There are a number of mining shafts located to the north, north west and south of the site. The closest of these is located ~150m to the north. The BGS archive does not hold any detailed logs for these shafts. The available evidence indicated that the shallowest coal seam is likely to be between 9m and 13m depth. There is no evidence of this coal seam having ever been worked, however the Coal Authority have noted that their records are not comprehensive. The shallowest coal seam is shown overlain by layers of clay, sandstone and mudstone. The deepest borehole drilled on the site (Ref.1) extended to 7.2m and confirmed the shallow geology to comprise stiff clay to 4.0m overlying mudstone to the base of the borehole. The site has been a garage/filling station since 1964, and possibly since 1938. The surrounding area has been extensively developed with residential housing since at least 1964. We are not aware of any subsidence having taken place at or near the site. Based on the depth to the shallowest coal seam, the nature of the overlying soil/rock (clay / weathered mudstone recorded to at least 7.2m under the site) and the site's history, we considered the risk of unrecorded former mine workings affecting the proposed development to be negligible.

Table Two: Review of Previous Environmental Works at the Site

1.4 Proposed Development Plans

Proposed Developments	The proposed redevelopment scheme comprises the demolition of a neighbouring residential property and then reconfiguration of the existing forecourt. A new, larger, convenience store will be constructed in the location of the former residential property and the petroleum infrastructure replaced. A site plan showing the proposed development plan is provided overleaf.
Planning Applications	Planning permission for the redevelopment has been granted by Wrexham County Borough Council (Planning application ref. P/2018/0463). Condition 9 requires the completion of an intrusive site investigation to assess ground conditions on the site and establish risks posed to the development by past coal mining activity. This report is designed to assist with the discharge of Condition 9.
Notes	We understand that our previous environmental assessment report (Ref. 1) has been submitted in support of other planning conditions relating to potential contamination issues at the site (Condition 7).

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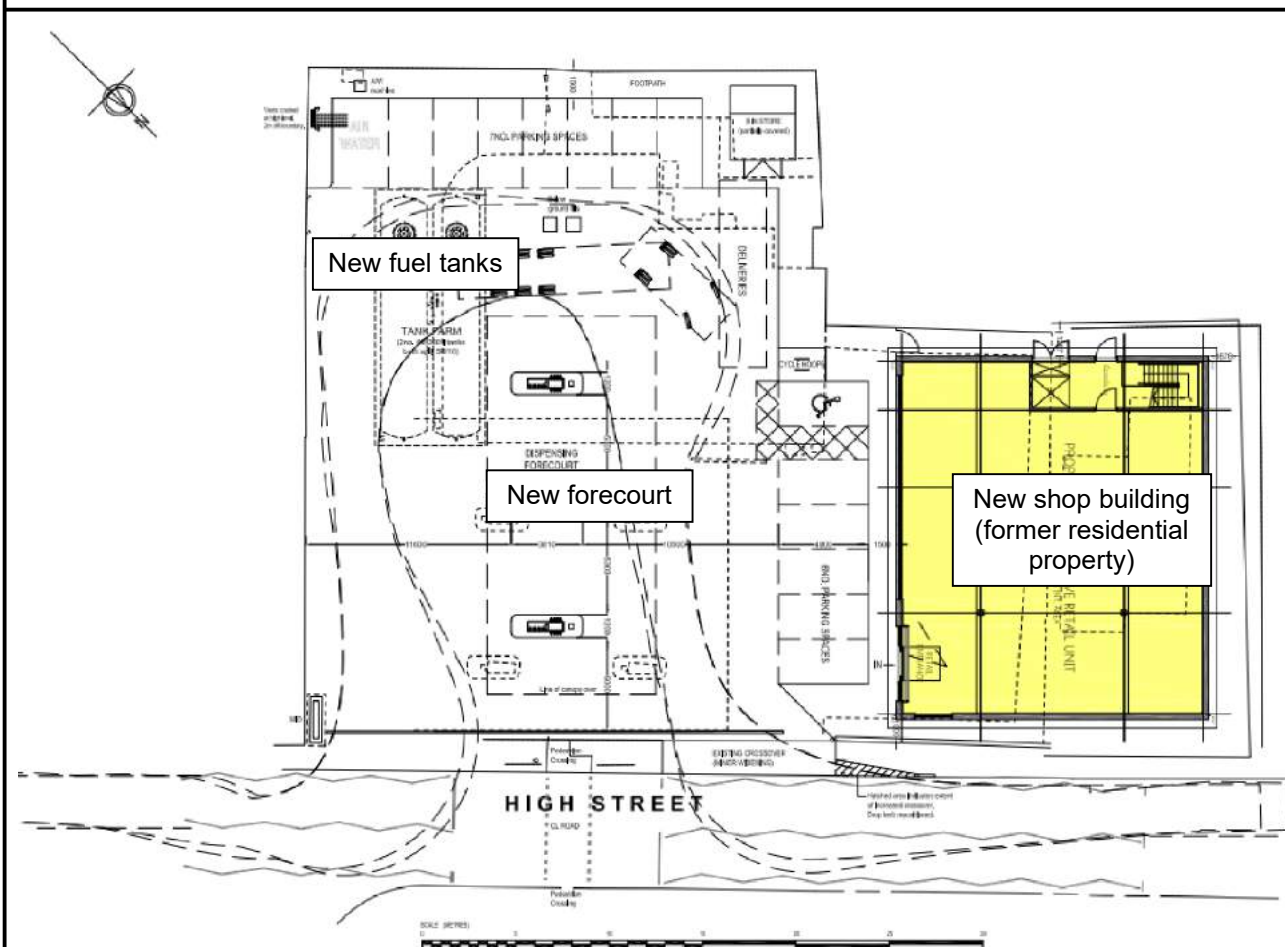


Table Three: Proposed Development Plans

2 Summary of Desk Study Information

2.1 Site Description, Location and Setting

Site Description	The site comprises a Texaco branded retail petrol filling station with a combined petrol and diesel forecourt covered with an overhead canopy, jet wash and Co-op branded shop.		
Grid Reference	328080, 351440	Location	The site is located in Coedpoeth, off High Street (A525) and ~5km to the west of Wrexham.
Elevation	~235m AOD		
Size (approx)	~0.13 Ha		

Table Four: Site Location and Setting

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Figure One: Site Location Map

Direction	Details
North	High Street (A525) forms the northern boundary of the site, with residential properties beyond (~15m).
East	Residential properties with gardens along High Street to the east of the site (~10m).
South	Terraced residential properties with gardens to the immediate south (~20m). Further residential properties beyond, and then a cemetery (~100m).
West	Residential properties to the immediate west (~10m) and further to the west. Industrial unit ~150m west and then woodland.

Table Five: Surrounding Land Use

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Figure Two: Aerial Photograph Showing Site and Surrounding Area

2.2 Geology, Hydrogeology and Hydrology

	Geological Unit	Description	Estimated Thickness	Data Source
Drift Geology	Glacial Till	[Shown present along the north and western edge of the site only] Generally stiff slightly sandy clay with poorly sorted gravels.	~5m (if present)	British Geological Survey (BGS)
Solid Geology	Pennine Lower Coal Measures / Pennine Middle Coal Measures (Undifferentiated)	Comprises interbedded layers of mudstone and siltstone, with sandstone and occasional coal seams and some ironstones.	>50m	
Existing Investigation Data	Our 2017 site investigation proved the underlying geology at the site to comprise Made Ground to ~1m depth, overlying layer of gravelly clay (Glacial Till) encountered to up to 3.9m depths and then clay / weathered mudstone to at least 7.2m depths.			Ref. 1

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Existing Investigation Data	The BGS holds records for a borehole located ~ 100m north of the site (BGS Ref. SJ25SE974). Geology is described as 'drift geology' to ~24m depths, overlying coal to 30m depth and then layers of shale and ironstone to a depth of ~39m.	BGS
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Table Six: Regional Geology

	Geological Unit	Environment Agency Aquifer Classification	Data Source
Drift Geology	Glacial Till	Unproductive Strata	Natural Resources Wales
Solid Geology	Pennine Lower Coal Measures	Secondary Aquifer (Class A)	
Existing Investigation Data	We encountered limited perched groundwater in three of our boreholes, with two remaining dry. Resting groundwater levels were recorded between 2.7m and 5.9m depths.		Ref.1

Table Seven: Regional Hydrogeology

3 Investigation Results

3.1 Details of Our Investigation

Activity		Description of Works
Service Clearance	Public utility drawings	We have obtained and reviewed public utility drawings from the relevant service providers. This provides information regarding major services that supply the site and neighbouring properties.
	Underground Utilities Survey	As part of our 2017 site investigation, we carried out a survey using radio detection methods of utilities buried underneath the petrol station part of the site. The results of our survey are included in Attachment Two.
	On-site	Prior to drilling all boreholes locations underwent a final service check using a Cable Avoidance Tool (CAT) scanner.
Drilling	Our site investigation was completed between the 11 th and 15 th March 2019. We investigated underlying ground conditions by constructing two boreholes at the site to 20m depths using our Comacchio Geo205 (dynamic sampling / rotary rock coring) drill rig. Borehole locations were reviewed and approved by the Coal Authority in advance of our works and we were granted a 'Permit to Enter or Disturb Coal Authority Mining Interests' (Permit ref. 17185). A site plan showing borehole locations is included, along with our borehole logs, as Attachment Two.	
Screening for Hazardous Ground Gases	During the drilling works we completed continual monitoring for hazardous ground gases at the drill rig using a GA5000 series landfill gas monitor, designed to record concentrations of methane, carbon dioxide, carbon monoxide, hydrogen sulphide and oxygen.	

Table Eight: Drilling and Sampling Methodologies

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3.2 Borehole Locations

We selected two borehole locations at either end of the site in order to assess underlying deep geology under the site location. BH101 was designed to assess ground conditions at in the vicinity of the petroleum installation (existing tanks / proposed tank locations). BH102 was selected to assess ground conditions under the proposed new shop building.

A site plan showing the location of the two boreholes is shown below.

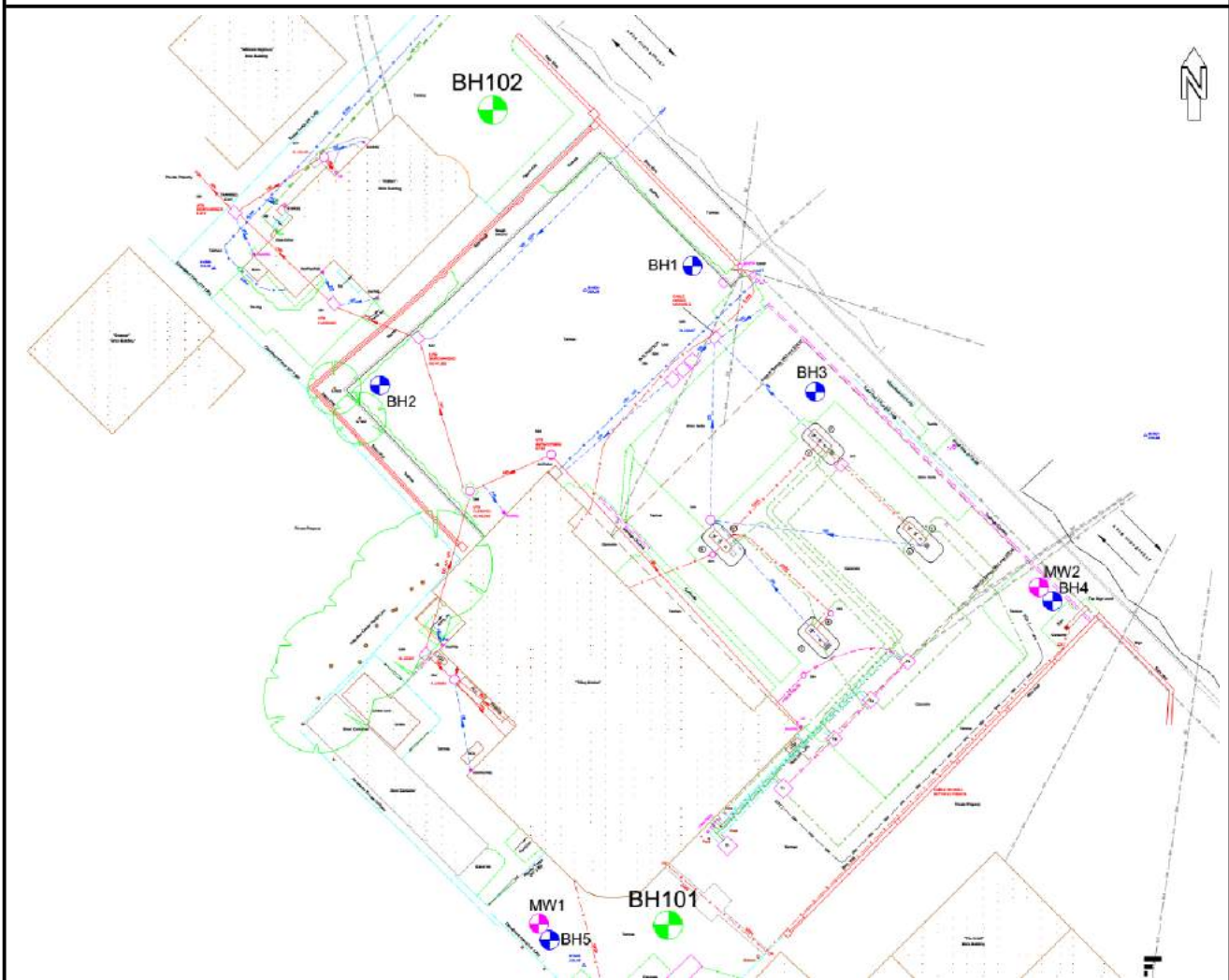


Figure Three: Additional Borehole Locations

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3.3 Site Geology

	Unit	Description
Layer I	Made Ground	STIFF black gravelly CLAY with occasional brick fragments, or LOOSE grey GRAVEL with crushed concrete and brick fragments.
Layer II	Glacial Till	FIRM to STIFF mottled brown grey or orange brown slightly sandy CLAY with occasional poorly sorted sandstone and mudstone gravel.
Layer III	Lower Pennine Coal Measures	VERY WEAK to WEAK grey brown or grey moderately weathered MUDSTONE. Blocky structure, closely fractured. Occasional VERY WEAK black COAL with fractures in-filled with mudstone. [Note: see table below for details of coal seams encountered.]
Depth to Base of Layer		
	BH001	BH002
Layer I	0.6m	0.4m
Layer II	2.8m	7.6m
Layer III	>20.3m	>20.3m

All dimensions in metres below ground level

Table Nine: Soil Lithology

3.4 Encountered Coal Layers

We encountered thin seams of coal in both of the boreholes constructed, at various depths.

	Coal Seams Encountered (thickness)	
	BH001 - Southern corner of the existing forecourt.	BH002 - North western corner of the site (residential property) in the location of the new shop building.
Seam 1	2.8 - 3.6 (0.8m)	9.1 - 10.40 (1.3m)
Seam 2	5.6 - 6.3 (0.7m)	17 - 19.7 (2.7m)
Seam 3	16 - 17.3 (1.3m)	-

All dimensions in metres below ground level/ Number in brackets represents thickness of seam.

Table Ten: Summary of Coal Seams Encountered

3.5 Hazardous Ground Gases Screening

We did not detect any concentrations of hazardous ground gases during the construction of our boreholes.

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3.6 Summary Review of Coal Mining Risks

Potential Site Specific Coal Mining Risk	Comment	Potential Risk
Recorded Workings	The Coal Authority consider the property is not in a surface area that could be affected by past underground mining. Historical maps and other records suggest the nearest recorded historical mine shaft is located ~150m north of the site. Our site investigation has identified layers of intact coal at various depths under the site. The identified coal was encountered within layers of mudstone. There was no evidence of any previous mining activities identified; no voids or evidence of in-filled ground	Negligible
Mine entries	There are no known coal mine entries within, or within 20 metres of, the boundary of the property.	Negligible
Opencast workings	The property is not within the boundary of an opencast site from which coal has been removed by opencast methods. The property does not lie within 200m of the boundary of an opencast site from which coal is being removed by opencast methods.	Negligible
Spontaneous combustion	The limited coal seams we identified were generally present within mudstone bedrock and found >~6m below the site. These seams will not be disturbed by the proposed development as no piled foundations are proposed. A thin pocket of shallow coal was encountered in BH101 (southern corner of the site) at 2.8 - 3.6m depths. The proposed new tank farm will be installed in the southern part of the site to ~4.5m depths. Shallow coal present will therefore be excavated and removed from this area.	Negligible
Hazardous Ground Gas	No detectable concentrations of hazardous ground gases were recorded during the construction of either deep borehole at the site. [Note: The new shop building will be constructed with a gas impermeable membrane / vented floor slab (standard design / radon issues)].	Negligible

Table Eleven: Summary of Potential Coal Mining Activity Risk

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4 Additional Site Investigation Conclusions and Recommendations

The results of our additional site investigation indicates the following:

- Our previous coal mining risk assessment indicated that there are a number of mining shafts located to the north, north west and south of the site. The closest of these is located ~150m to the north. There is no evidence of any shallow coal seam under the site location having ever been worked, although the Coal Authority have noted that their records are not comprehensive.
- The site has been a garage/filling station since 1964, and possibly since 1938. The surrounding area has been extensively developed with residential housing since at least 1964. We are not aware of any subsidence having taken place at or near the site.
- We have confirmed the underlying geology at the site location to comprise a thin layer of Made Ground, overlying a variable thickness of Glacial Till and then Lower Pennine Coal Measures. Coal seams were encountered in both of the boreholes we constructed.
- BH101 was constructed in the southern corner of the site. We encountered Glacial Till (clay) to 2.8m depths, and then a thin layer of coal from 2.8m to 3.6m depths. This shallow coal could form part of the Glacial Till deposits and not be consistent across the site (not recorded in our BH5, constructed in 2017 to the immediate south west). The underlying geology then comprised Lower Pennine Coal Measures, consisting of weathered mudstone to borehole termination depth of 20.3m, with coal seams encountered between 5.6 - 6.3m and from 16 - 17.3m depths. Resting groundwater was recorded at ~17m depths.
- BH102 was constructed in the north western corner of the site, in the front garden of the adjacent residential property and location of the proposed new shop building. Here we encountered Glacial Till (clay) to 7.6m depths. We then encountered the Lower Pennine Coal Measures, comprising weathered mudstone with coal seams recorded at 9.1 - 10.4m and from 17 - 19.70m depths. Resting groundwater was recorded at 8.37m depth.
- We have not recorded any detectable concentrations of hazardous ground gases during the construction of either of our deep boreholes. We understand that the new shop building will be constructed with a gas impermeable membrane / vented floor slab, which will break any potential pathway for hazardous ground gas migration and further reduces any potential risk to future site workers.
- We have not encountered any evidence of historic coal mining activity under the site. On the basis of our site investigation data we consider the conclusions of our previous coal mining risk assessment to remain valid. We do not consider the proposed development to be at risk from coal mining activities.

Table Twelve: Conclusions

We recommend the following:

- We do not recommend any specific mitigation measures are required in the construction of the new shop building. As the underlying geology in this part of the site comprises clay / mudstone to ~9m depths we consider the potential risk posed by the underlying thin coal seams to be negligible.
- We recommend that any shallow coal encountered during the formation of the new tank vault be excavated and removed during the redevelopment works.

Your attention is drawn to the Notice to Interested Parties included as Attachment One.

Table Thirteen: Recommendations

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**ATTACHMENT ONE:
NOTICE TO INTERESTED PARTIES**

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NOTICE TO INTERESTED PARTIES

The purpose of our site assessment is to provide general information on the environmental and/or geotechnical conditions existing at the site and related to soil and/or groundwater. The Client or others specified the scope of the investigation and the validity of our conclusions is limited by the scope of work specified. We are not responsible for any such limitations or omissions.

Where stated in this report, we have used information supplied by third parties. While we have evaluated as far as possible the validity of this information, we cannot guarantee its accuracy in any way whatsoever.

No investigation technique is capable of completely identifying all of the contaminants that might be present in the soil or groundwater under a site. Where specified in our report, we have examined the ground by constructing a number of boreholes and/or trial pits. We recovered samples of soil and/or groundwater from available exposures.

The depth and spacing of our Sampling locations were selected to ensure with a reasonable probability that they would be representative of the actual conditions across the whole site. However, safety considerations relating to existing site infrastructure may have restricted our ability to investigate all potential contaminant sources. Specifically, we were unable to investigate the soil and groundwater condition immediately adjacent to the underground structures and/or buried services. These limitations must be borne in mind when considering the conclusions reached in this report.

Soil is intrinsically variable and the spread of contaminants within the soil is therefore subject to a degree of non-uniformity. For these reasons no sampling technique can completely eliminate the possibility of obtaining samples that are not representative of the actual conditions. Our sampling techniques are intended to reduce the possibility to an acceptable level, within the limits imposed by the scope of the investigation.

Groundwater levels and soil vapour levels that we report were accurate at the time of the investigation. Groundwater and soil vapour levels are variable. Long term monitoring may be required to ensure that the levels recorded during our investigation are representative of long term and possible 'worst case' conditions. In accepting our recommendations and/or conclusions the Client acknowledges that further, more detailed investigation would allow a more accurate assessment of site conditions to be made and that this would reduce any consequential risk to the Client.

This investigation was carried out to assess the significance of contamination resulting from use of the site as identified in this report. Unless we have indicated otherwise, no assessment of the potential impact of any other previous uses has been made. No investigation was carried out to determine whether or not any deleterious or hazardous materials (such as asbestos) have been used in the construction of the buildings present on the site. Unless otherwise stated no investigation or assessment has been made of the presence or otherwise of invasive plant species including but not limited to Japanese Knotweed.

We do not accept any responsibility for the cost of remedial works or other costs incurred in whatever way whatsoever as a result of any omissions, errors or other shortcomings in this report unless we have been given reasonable opportunity to verify ourselves that such faults exist and we have been given a reasonable opportunity to carry out works to remedy such faults ourselves using the most practicable means available to us. We do not accept liability for any consequential losses incurred by you while either we or others carry out any remedial works we deem necessary.

This report has been prepared for the Client, as specified on the cover page of this report. In accepting our recommendations and/or conclusions the Client accepts that the terms of our appointment were as detailed in the Proposal, or Proposals, that we provided to the Client before being appointed and that these terms supersede any other terms and/or conditions set out in any contracts agreed between ourselves and the Client, regardless of when such terms and/or conditions were agreed and/or signed.

Use of, and reliance on, this report by other third parties will be at such third parties own risk, and we are unable to accept any liability or responsibility to third parties.

Neither the whole nor any part of this report, or any reference to it, may be included in any published document circular or statement or published in any way without our prior written approval.

This report and its contents, together with any supporting correspondence or other documentation, remain the property of Subadra Consulting Limited until paid for in full.

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**ATTACHMENT TWO:
SITE PLAN AND BOREHOLE LOGS**

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Borehole Log BH101

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Project Name	CP17129 Petrol Coedpoeth	Coordinates	
Date	11th-13th March 2019	Ground Level	
Site Engineer	Sam King	Drilling Method	MC205 - Percussion Uncased

Depth (m)	Well	Casing & Water Level	Log	Sample Number/ Depth (m)	Sample Type/ Blowcount/ Recovery (cm)	PP or TV Su (kPa)	Description
0.00m - 0.20m							Made Ground Tarmac.
0.20m - 0.60m				S1/0.40 - 0.40	D1, D3	Su = 125	Made Ground
0.60m - 2.80m				S2/0.80 - 0.80	D1	Su = 75	STIFF black gravelly reworked CLAY with occasional brick fragments.
2.80m - 3.60m				S3/1.40 - 1.40	D1	Su = 100	0.60m - 2.80m Glacial Till FIRM TO STIFF mottled orange grey sandy CLAY. With occasional very weak medium sandstone and mudstone gravels.
3.60m - 5.60m				S4/1.80 - 1.80	D1	Su = 100	
5.60m - 6.30m				S5/2.50 - 2.50	D1	Su = 85	
6.30m - 11.50m				S6/3.00 - 3.00	D3		2.80m - 3.60m Pennine Lower Coal Measures VERY WEAK black COAL.
							3.60m - 5.60m Pennine Lower Coal Measures VERY WEAK grey brown moderately weathered MUDSTONE. Highly fractured. Becoming darker in colour at 5.0m. Borehole continued by rock coring from 5.6m.
							5.60m - 6.30m Pennine Lower Coal Measures VERY WEAK black highly weathered COAL. Approximately 30 degree dip. Blocky structure.
							6.30m - 11.50m Pennine Lower Coal Measures WEAK grey highly weathered MUDSTONE. Closely fractured and laminated.

B = Bulk Bag, D1 = 60g Jar, D2 = 250g Jar, D3 = 500g Tub, D4 = 1,000g Tub, D5 = Small Bag, C = Core, U = U100
PP = Pocket Penetrometer, TV = Torvane

 Prism.NET www.prismerp.co.uk	Well Diameter	50mm	Depth of Borehole	20.30m
	Well Casing Length	7.30m	Depth to Groundwater	17.12m
	Well Screen Length	13.00m	Page	One of Three

Borehole Log BH101

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Tel. 01296 739400 Email: consultants@subadra.com

Project Name	CP17129 Petrol Coedpoeth	Coordinates	
Date	11th-13th March 2019	Ground Level	
Site Engineer	Sam King	Drilling Method	MC205 - Percussion Uncased

Depth (m)	Well	Casing & Water Level	Log	Sample Number/Depth (m)	Sample Type/Blowcount/Recovery (cm)	PP or TV Su (kPa)	Description
11							6.30m - 11.50m Pennine Lower Coal Measures WEAK grey highly weathered MUDSTONE. Closely fractured and laminated.
12							11.50m - 16.00m Pennine Lower Coal Measures WEAK grey moderately weathered MUDSTONE. Closely fractured and laminated. Brown staining around fractures from 12.8m.
13							
14							
15							
16							16.00m - 17.30m Pennine Lower Coal Measures VERY WEAK black COAL.
17		At-Rest 17.12m					17.30m - 20.30m Pennine Lower Coal Measures VERY WEAK moderately weathered MUDSTONE. Closely fractured and laminated. Becoming MODERATELY STRONG and less weathered with depth.
18							
19							
20							

B = Bulk Bag, D1 = 60g Jar, D2 = 250g Jar, D3 = 500g Tub, D4 = 1,000g Tub, D5 = Small Bag, C = Core, U = U100
PP = Pocket Penotrometer, TV = Torvane

 Prism.NET www.prismerp.co.uk	Well Diameter	50mm	Depth of Borehole	20.30m
	Well Casing Length	7.30m	Depth to Groundwater	17.12m
	Well Screen Length	13.00m	Page	Two of Three

Borehole Log BH101

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Site Engineer	Sam King	Drilling Method	MC205 - Percussion Uncased

Depth (m)	Well	Casing & Water Level	Log	Sample Number/ Depth (m)	Sample Type/ Blowcount/ Recovery (cm)	PP or TV Su (kPa)	Description
21							17.30m - 20.30m Pennine Lower Coal Measures VERY WEAK moderately weathered MUDSTONE. Closely fractured and laminated. Becoming MODERATELY STRONG and less weathered with depth. Borehole terminated at 20.30m
22							
23							
24							
25							
26							
27							
28							
29							
30							

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 Prism.NET www.prismerp.co.uk	Well Diameter	50mm	Depth of Borehole	20.30m
	Well Casing Length	7.30m	Depth to Groundwater	17.12m
	Well Screen Length	13.00m	Page	Three of Three

Borehole Log BH102

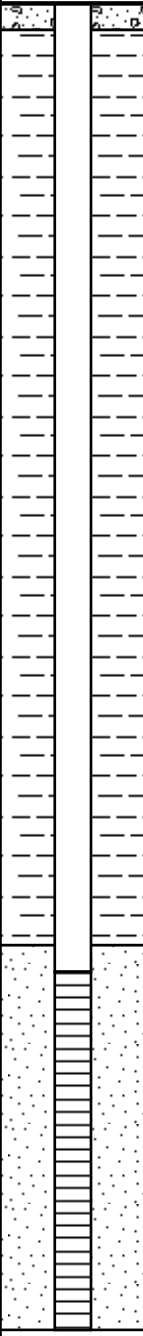
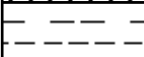
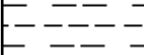
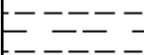
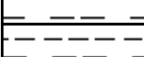
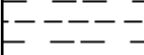
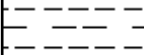
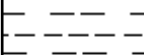
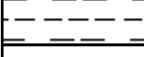
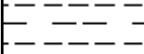
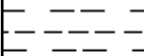
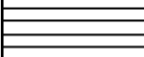
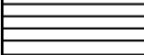
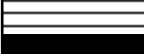
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Site Engineer	Sam King	Drilling Method	MC205 - Percussion Uncased

Depth (m)	Well	Casing & Water Level	Log	Sample Number/ Depth (m)	Sample Type/ Blowcount/ Recovery (cm)	PP or TV Su (kPa)	Description
1		At-Rest 8.37m		S1/0.30 - 0.30	D1, D3		0.00m - 0.10m Made Ground Tarmac.
				S2/0.80 - 0.80	D1	Su = 60	0.10m - 0.40m Made Ground LOOSE light grey fine to medium sub-angular GRAVEL with crushed concrete and brick fragments.
				S3/1.00 - 1.00	D1		
				S4/1.20 - 1.50	U/ /30	Su = 75	0.40m - 1.80m Glacial Till FIRM mottled grey orange CLAY with occasional fine gravel.
2				SPT1/1.50 - 1.50	N=13		
				S5/1.80 - 1.80	D1	Su = 100	
3				S6/2.00 - 2.30	U/ /30	Su = 110	1.80m - 3.60m Glacial Till FIRM TO STIFF mottled brown grey CLAY. With occasional fine to medium sandstone gravel. Becoming VERY STIFF from 3.4m.
				S7/2.60 - 2.60	D1		
				S8/3.00 - 3.00	D3	Su = 110	
4				SPT2/3.00 - 3.00	N=27	Su = 150	
		S9/3.50 - 3.50	5,5,10,4,7,6 D1, D3				
5						Su = 150	3.60m - 7.60m Glacial Till VERY STIFF brown grey CLAY. With frequent fine to coarse angular to sub-rounded black yellow grey sandstone and mudstone gravels. Borehole continued by rock coring from 7.6m.
						Su = 150	
6						Su = 135	
7				S10/6.50 - 6.50	D3		
						Su = 150	
8							7.60m - 9.10m Pennine Lower Coal Measures VERY WEAK grey moderately weathered MUDSTONE. Approximate 20 degree dip. Blocky structure.
							
9							
							
10							9.10m - 10.40m Pennine Lower Coal Measures VERY WEAK black COAL. Blocky structure. East-west fractures infilled with grey mudstone from above. Thin mudstone lenses present at 9.8m and 10.3m.
							

Borehole Log BH102

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Depth (m)	Well	Casing & Water Level	Log	Sample Number/Depth (m)	Sample Type/ Blowcount/ Recovery (cm)	PP or TV Su (kPa)	Description
11							9.10m - 10.40m Pennine Lower Coal Measures VERY WEAK black COAL. Blocky structure. East-west fractures infilled with grey mudstone from above. Thin mudstone lenses present at 9.8m and 10.3m.
12							10.40m - 15.40m Pennine Lower Coal Measures VERY WEAK grey moderately weathered MUDSTONE. Becoming WEAK. Approximately 30-40 degree dip. Blocky structure. Frequent coal bands at 10.5m, 10.8m, 11.0m, 11.2m, 12.5m, 12.6m and 12.8m.
13							
14							
15							
16							15.40m - 17.00m Pennine Lower Coal Measures WEAK grey moderately weathered MUDSTONE. Approximately 30-40 degree dip. Light brown orange staining surrounding fractures.
17							17.00m - 19.70m Pennine Lower Coal Measures VERY WEAK black COAL. Approximately 20-40 degree dip. Mudstone lens at 17.6m.
18							
19							
20							

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21							19.70m - 20.30m Pennine Lower Coal Measures WEAK moderately weathered MUDSTONE. Approximately 25 degree dip. With occasional black veining. Thin band of yellow orange staining at 19.6m. Borehole terminated at 20.30m
22							
23							
24							
25							
26							
27							
28							
29							
30							

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