

Remediation Statement & Validation Proposal Sheets

**To be approved by Rochdale Metropolitan
Borough Council**

Project Reference: 21-763

**Site: Proposed Residential Development – Land at Hollin Bank,
Hollingworth Road, Littleborough**

Prepared by: Phillip Brown



Section A – Introduction

As requested by Vistry Partnerships (Yorkshire), Arc Environmental Ltd were commissioned to produce a Remediation Statement, for the proposed residential development at Hollin Bank, Hollingworth Road, Littleborough.

Section B - Previous Site Investigation Works / Reports

This document should be read in conjunction with the following reports produced for the site:

- CELTIC Outline Foundation Option Plan, dated February 2008 (Reference P10008/09001/10).
- CELTIC Phase 2 Remediation Validation Report, Ref: R1247/08/3436, dated March 2009.
- NHBC LQE Certificate NHBC/LQE/146326 Rev.7, dated 20 August 2009.
- CELTIC Letter to Rochdale MBC, dated 21 October 2011.
- WYG Geo-environmental Review Report, dated October 2017.
- RSK Coal Mining Risk Assessment, dated August 2020.
- RSK Additional Gap Analysis, Ref: 11430 L02 (00), dated 14 August 2020.
- RSK Additional Soil Sampling Report, dated 19 November 2020.
- E&P Review & Summary Document, Ref: KE/45466-001, dated July 2021.
- Arc Environmental Ltd Ground Investigation Report (Factual), Ref: 21-763, dated December 2021.
- Arc Environmental Ltd Hazardous Ground Gas Addendum Report, Ref:21-763.01L, dated June 2022.

Site Location and Description

The site is situated in a rural setting located off Hollingworth Road approximately 1km south from Littleborough town centre, within the Rochdale area of Greater Manchester, encompassing an area of c.7.8Ha. The site is fairly undulating, with a notable low area towards the central portion of the site, with levels ranging from c.149m AOD (central portion) to c.163m AOD (eastern portion). Some areas on the western and central portions of the site have specific 'engineered' plateaus. The site surfacing generally comprises unmanaged (self-seeded) vegetation including grass, shrubs etc.

The Rochdale Canal borders the site to the north, with a railway line around 60m beyond it. The 'island' in between the canal and the railway is an historic landfill. Hollingworth Road and Cleggswood Hill lies to the east and grassland, Hollingworth Lake and a car park to the south. A track and fields to the west with a bridge (Bridge 52) crossing the canal just off the northwest site corner. The Hollingworth Lake Conduit is culverted below the eastern half of the site, connecting Hollingworth Lake to the canal.

Proposed Development

The proposed development comprises 127 no. residential dwellings with associated gardens / soft landscaping, parking and highway infrastructure as shown on the Proposed Layout Plan included within Appendix A to this report. It is understood that foundation options include strip, trench fill and piles.

In addition to residential dwellings, there is also a proposed small play area to be constructed within the northwest corner of the former 'Area C'. With the exception of this small play area there are no other development proposals within the former Area C, with remaining vegetation to be retained.

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Section B - Previous Site Investigation Works / Reports (Cont'd)

Previous Site Uses

Past historical usages of the site include coal mining (two shafts are present on site), sandstone quarry (mid 19th century, adjacent to coal pit) and a former chemical works comprising numerous buildings including offices, laboratory, warehouses and substations as well as featuring underground tanks and interceptors.

Two shafts were recorded on site as detailed below:

- Shaft Reference 393415-008 treated / filled and capped - *'excavated to a depth of 5.2m, through 2m of bedrock. A reinforced concrete cap 12m² at the base increasing to 12.5m² and 1.2m thick formed over shaft'.*
- Shaft Reference 393415-009 treated / filled and capped - *'excavated to a depth of 7.8m removing 2.6m of bedrock where a reinforced concrete cap was formed. The cap measures 8.5m² at the base increasing to 10m² at the top by 1.2m thick'.*

Summary of Ground Conditions (Pre-Remediation)

Historical investigations identified the site to be underlain by between c.0.10m up to c.7.0m of mixed cohesive and granular made ground including some clinker, pitch, quartz, sandstone, mudstone, limestone, coal, asphalt, concrete, brick, ceramic, ash, plastic, metal, textile (rare), wood (rare), tile, glass, metal bolts and occasionally cobbles of concrete.

Superficial deposits predominantly comprised glacial till deposits generally comprising firm becoming stiff with depth, low to medium strength clays with occasional interbedded loose to medium dense variably clayey and sandy gravels and clayey gravelly sands.

Solid geology (Pennine Lower Coal Measures) was recorded at depths of between c.7.0m bgl in the eastern area of the site, between 3.0m and 5.0m bgl in the western area and deeper than 17m in central parts of the site. Coal seams were recorded at approximate depths of c.28.3m bgl and c.38.4m bgl ranging in thickness from c.1.2m and c.0.2m respectively.

A subsequent Coal Mining Risk Assessment concluded that the site is not considered to be at risk from instability associated with shallow coal workings. The Coal Authority confirmed the two mine entries have been treated to industry standards and any development will be advised to avoid these features (suitable stand-off).

Contaminants of concern identified during the investigation works / assessment included asbestos, metals and TPH / VOCs.

Section C – 2008 Remediation Works

Summary of Remedial Works (Area A – Phases 1 & 2)

Remediation and Preparatory Earthworks were undertaken in 2008 to an agreed specification. As part of these works the main site (Area A) and sub-divided into Phase 1 and Phase 2 (which itself was also separated cells 1 to 8) as detailed on the Proposed Site Layout Plan in Appendix A. A summary of the remedial works is detailed below:

- Excavate all made ground to a minimum depth of 2m below finished remediation levels.
- Removal of all structures to base (relict ground slabs, foundations, service ducts or other identified structures). Any deeper structures (e.g. piles) to be left in situ but broken out to the depth of surrounding excavation.

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Section C – 2008 Remediation Works

Summary of Remedial Works (Area A – Phases 1 & 2) (Cont'd)

- Segregate any significantly contaminated soils or other deleterious materials (including asbestos containing products) encountered during the above works for further assessment and bio-physical treatment as required.
- Process / screen all excavation arisings, as necessary, to produce a suitable engineering fill for re-use in the earthworks.
- Compliance with remediation target values for soils placed between 800mm and 1,000mm depth.
- Placement of a minimum 200mm thick hard-dig layer below a minimum 600mm clean capping in gardens / soft landscaping areas.

In total 18 no. contaminant sources were excavated with validation samples taken from sides and base of the excavations and confirmed to be below the agreed site acceptance thresholds. Arisings totalling c.1,340m³ were placed into biopiles on a bunded concrete pad, aerated periodically. Biological nutrients were added regularly. Treated arisings were then used as fill, placed at depth to allow the placement of the cover system.

Cells 4 and 6 were left 'uncapped' due to a shortfall in site-won soils. Completion of these cells was to be undertaken by others as noted below. Materials to form the hard-dig layer within these cells should be placed from the stockpiled validated materials left on site for this purpose. If there is insufficient material for the required minimum 200mm hard-dig layer then additional suitable materials should be imported to site. The location of Cells 4 and 6 can be seen on Drawing No. D1247/3436/A9, a copy of which is included within Appendix A.

The report notes the hard-dig layer material originated from crushing and screening processes undertaken during demolition. Subsequent testing of this material by RSK in 2020 concluded it was ingrained with asbestos, and that mitigation measures are required during future disturbance of the ground including notifying future works to the HSE and 'employing the specialisms of a licensed asbestos contractor to manage such future works appropriately'. Air monitoring around the site perimeter may also be required during drier times of the year.

The report also concluded that hard-dig layer could be considered 'hazardous waste' if removed from site in its current state. If it remains in place, it should be capped with 600mm of clean cover and a visible marker layer. Where services are to be installed, the surrounding soils should also be 'clean'.

Initial post-remediation gas monitoring resulted in GSVs for Carbon Dioxide (CO₂) and Methane (CH₄) of up to 0.02 l/hr and 0.03 l/hr respectively. The recorded GSVs place the site within a Green classification in the NHBC 'Traffic Light' risk derived system, however, the maximum concentrations of Methane were recorded above the threshold of 1% and therefore the classification should be increased by an order of 1 to an Amber 1 classification.

In more recent gas monitoring, undertaken in 2022, no concentrations of CO₂ were recorded within any of the boreholes although detectable levels of CH₄ were recorded, up to a maximum level of 2.8% v/v. Consequently, the GSV for CH₄ only has been calculated at 0.0028 l/hr (using the maximum recorded value of 2.8% v/v, with a maximum flow rate of <0.1/hr). The recorded GSV places the site within a Green classification in the NHBC 'Traffic Light' risk derived system, however, as with the previous monitoring results, as the maximum concentrations of Methane have been recorded above the threshold of 1% it is recommended that the classification should be increased by an order of 1 to an Amber 1 classification.

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Section C – 2008 Remediation Works (Cont'd)

Area C (Events Area)

This area of the site was recorded to have been predominantly greenfield since the 1850s with the existing lake being constructed in the later part of the 19th century. The 1851 historical map notes the culvert (labelled to be a 'conduit') to cross the site. The majority of the site appears to have remained undeveloped until a car park was constructed in the northwestern corner in the early 1990s.

It is understood that investigation and assessment within this area (by WSP and later by Woodford) concluded that there were no significant risks posed to the proposed site end users and that no remediation works were required with the exception of the removal of the former car park hardstanding and subbase.

Post-remediation Requirements

Subsequent to the above works, additional works were required to be undertaken by others during the construction-phase in order to ensure that the site is suitable for re-use and are detailed below:

- Suitable soils to be placed within Cells 4 and 6 to within 200mm of previous remediation level and capped with a hard-dig layer.
- Placement of minimum 600mm "clean" capping soil capping layer above the hard-dig layer in all gardens / soft landscaped areas, using clean imported or approved site-won soils.
- The construction of clean cover soil capping layer to be validated on completion physically on site, and a programme of laboratory testing should be implemented to confirm chemical suitability
- Installation and verification of proprietary ground gas protection measures (Amber 1) in the proposed properties.

Amendments to the Proposed Layout (Post 2008 Remediation Works)

As part of the 2008 remedial works, the eastern part of the site (Phase 1) was prepared to a level for a proposed commercial end. This was subsequently revised, and plans submitted for residential development (as with Phase 2).

It was confirmed that the original remedial targets were set assuming a residential development to the whole site, not just Phase 2, and therefore no further treatment / assessment would be required. However, the report did recommend some additional works within Phase 1 area, including the removal of the hard-dig layer, re-grading of the underlying soils (expected to comprise Glacial Till) and then replacement of the hard-dig layer to achieve the agreed finished remediated levels. Any excess site-won soils generated as part of the above re-grading of the Phase 1 development platform to be used below the hard-dig layer level within Cells 4 and 6 within the Phase 2 area.

However, it should be noted that the requirement / extent of such works will need to be assessed once final design levels have been compared against the previous finished remediated level.

Section D – Remediation Strategy

Following the 2008 remediation / preparatory earthworks, in May 2021 Eastwood & Partners (E&P) undertook a review of all the available information / reports and summarised additional remedial works required. The E&P report (Ref: KE/45466-001) is included within Appendix B to this report. The further remedial works required are summarised below, with elements required to minimise the risk to human health (end users / site operatives) discussed in greater detail.

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Section D – Remediation Strategy (Cont'd)

Phase 1 (Area A)

- Carefully remove the hard-dig layer from the Phase 1 area (former proposed commercial end use)
- Regrade the Phase 1 area to levels for residential end use i.e., to 800mm below finished formation levels to allow replacement of 200mm hard-dig layer and subsequent minimum 600mm clean capping soils with all gardens / soft landscaping areas.
- Validation testing of the re-graded formation to confirm the upper 200mm soils are suitable for re-use below the hard-dig layer (in accordance with Table 1 Celtic 2009 Ref: R1247/08/3436).
- Careful replacement of the minimum 200mm hard-dig layer.

(Note – requirement / extent of above works to be assessed once final design levels have been compared against the previous finished remediated level).

Phase 2 (Area A)

- Placement of suitable soils within Cells 4 & 6 to 800mm below finished design levels (to allow placement of 200mm hard-dig layer).
- Validation testing of the resultant formation to confirm the upper 200mm soils are suitable for re-use below the hard-dig layer.
- Careful placement of the minimum 200mm hard-dig layer within all gardens / soft landscaping areas.

Phase 1 & 2 (Area A)

- Placement and validation of minimum 600mm clean capping soils within all gardens / soft landscaping areas.
- Installation and verification as required of Amber 1 gas protection measures within proposed dwellings.

Events Area (Area C)

- Watching brief during works associated within proposed play area in northwestern corner.

Emplacement of a Suitable Clean Cover System

The clean capping soils above the minimum 200mm hard-dig layer will comprise at least 600mm of clean material in all gardens / soft landscaping areas with a minimum of 150mm topsoil and 450mm sub-soil or capping clay. Due to the presence of asbestos identified within the hard-dig layer, a high-visibility marker / separator should be placed at the base of the 600mm of clean capping soils. The use of cover systems reduces the hazards posed towards human health from ground contamination and provides a suitable medium for plant growth.

Implementation of Gas Protection Measures

To achieve the required gas protection score, a combination of protection elements taken from Tables 5, 6 & 7 (contained within BS8485) should be implemented and installed by qualified and experienced specialist contractors.

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Section D – Remediation Strategy (Cont'd)

Implementation of Gas Protection Measures (Cont'd)

Table 5 – Structural Barrier – Depending upon the foundation type, floor type and the quality of the design & construction, a number of points can be achieved, for example provision of an insitu cast reinforced concrete slab (ground bearing or suspended) will achieve between 0.5 & 1.5 points and a raft can achieve 1.5 points. It should be noted that a suspended block and beam floor will be achieve 0 points and therefore alternative measures from Tables 6 & 7 will need to be adopted (see below).

Table 6 – Ventilation Protection Measures – Where sub-floor ventilation is provided this should comprise either a min. 150mm clear void, void former blanket or gas drains, with ventilation from the sub-floor ventilation through the internal wall to the external wall using telescopic swan neck vents with air bricks providing 1500mm²/m run void ventilation spaced at maximum 2.0m centres will achieve 1.5 points. In addition, cross ventilation will need to be incorporated into sleeper walls / party walls.

Table 7 – Gas Resistant Membrane - The final element of the gas protection measures is the provision of a suitable gas resistant barrier membrane, which should comply with the criteria listed in Table 7. There is also the requirement for the verification of the gas barrier membrane installation, undertaken in accordance with CIRIA C735. The implementation of gas resistant barriers will achieve 2.0 points. Notes on the installation of gas barrier membranes is given below:

- The performance of the gas barrier is dependent on the quality and the design of the installation, and therefore guidance suggests that suitably experienced contractors should carry out the construction / installation of the gas barrier membrane.
- The gas barrier membrane will need to be installed in accordance with the manufacturer's details.
- Either, a blinding layer of soft sand should be applied to the floor construction, or the surface should be adequately cleaned, to prepare a smooth surface free from sharp debris, which may damage the laid membrane.
- The membrane should be installed in a logical sequence across the footprints of the buildings, to achieve a minimum number of joints. A minimum overlap of 150mm is recommended where membranes sections are joined. A combination of thermal welding and butyl double-sided jointing tape can be used for joining gas barrier membranes together. The top lapped edges, where the membrane has been jointed using double-sided jointing tape, should be further protected by the application of gas resistant self-adhesive membrane, to prevent dirt and moisture ingress.
- Where steel stanchions and service entries / ducts penetrate the floor construction these should be suitably sealed, using a pre-formed top-hat or wrapped in gas resistant self-adhesive membrane. Where ducts are used to feed in services, the top of the duct and service should be appropriately sealed, using closed celled foam (Filiform or Filoseal), inside the duct and / or appropriate gas resistant products (i.e. gastite tape or GR SAM) wrapped around the duct and service.
- Following validation of the gas barrier membrane, it is the responsibility of the main contractor / groundworks contractor to protect the gas barrier membrane from damage by follow-on trades or during the construction of subsequent final floor layers, in order to maintain the integrity of the gas barrier membrane.

The design team should provide design drawings showing the proposed installation / construction of the protection measures to be adopted and also the specification of the chosen gas barrier membrane and associated products to be used. These should be provided to Arc Environmental a minimum of 1 month before site works commence and will be reviewed to ensure they meet the BS8485 guidance.

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Section E: Validation of Remediation Strategy

Watching Brief

Validation of the site wide watching brief for both Area A (Phases 1 & 2) and the proposed play area within Area C (Events Area) will be through documented written (site records) and photograph records by the Main Contractor. If no further areas of unknown or unforeseen contamination are encountered, the Main Contractor will provide written confirmation of this. These records will be included in the final Validation Report.

If any visual and / or olfactory evidence of previously unidentified or unforeseen potentially contaminated materials are identified, then the site should notify Arc Environmental as soon as it is possible to allow for further sampling and screening to be undertaken. Details of the appropriate course of action undertaken to deal with these materials will be provided to the Local Authority, prior to carrying out any additional remediation works, if required.

Removal / Placement of Hard-dig Layer

Due to the identified asbestos within the existing hard-dig layer placed across the majority of the site, where practically possible, these materials should remain in-situ undisturbed.

However, where excavations within these materials are required, or during the subsequent placement of these materials, works should be undertaken with due care and attention and appropriate mitigation in accordance with current guidelines / best practice i.e. 2016 CL:AIRE guidance; Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials (CAR SOIL), HSG248 Asbestos: The Analysts' Guide for Sampling, Analysis and Clearance Procedures etc, to negate any possible release of fibres to the atmosphere.

Advice should be sought from an experienced and suitably qualified asbestos analyst / surveyor with regard to the requirement for reassurance background and personal air monitoring during works. The purpose of reassurance air monitoring is to confirm the effectiveness of the control measures being employed to mitigate the risk of airborne asbestos fibres and ensure human health receptors are not put at any unacceptable risk. The results of the recorded data will be utilised to determine a suitable frequency of monitoring required thereafter, following consultation with the analyst.

During works within the hard-dig layer the soils should be kept sufficiently damp to avoid any possible fugitive fibre / dust release. This is typically a bowser with hose attachment to wet down working areas and suppress dust although other alternative techniques (i.e. atomisers) will be considered as necessary.

All site operatives undertaking the above works should be suitably trained for the task been undertaken and should wear the appropriate PPE/RPE, taking into account the weather conditions at the time of the works and any subsequent advice from a qualified and experienced asbestos surveyor/analyst. Personal decontamination should be carried out in accordance with, and as applicable to, the Asbestos Essentials EM8 document. All disposable PPE should be treated as contaminated waste and disposed of appropriately.

Emplacement of a Suitable Clean Cover System

To ensure that all elements of this Remediation Statement are correctly implemented, Validation works resulting in a final Validation Report will be prepared by Arc Environmental, verifying that the remediation works have been completed. The validation works will comprise the following:

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Section E: Validation of Remediation Strategy (Cont'd)

Emplacement of a Suitable Clean Cover System (Cont'd)

- Geographical location from which any imported clean cover material was sourced.
- Description and chemical analysis for the clean cover material brought to site.
- Confirmation of clean cover thickness – **minimum** 600mm and basal **high-visibility marker / separator layer**.
- Photographic evidence – showing emplacement / confirming thickness and including a scale.
- Plans showing pertinent information relating to remediation.

All materials brought on to site, including topsoil and subsoil, for use in all gardens / soft landscaping should be suitably screened and tested for human health assessment prior to delivery, with these results sent to Arc Environmental a minimum of 1 week before delivery to site.

To confirm the suitability of these materials, validation testing will be required following emplacement and / or importation onto site in accordance with the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG) 'Verification Requirements for Cover Systems', Ver 4.1 May 2021 as detailed in Table 1 below.

Table 1 - Verification Requirements for Cover Systems', Ver 4.1 May 2021 - Sampling Frequency

Type	Number of Samples	Testing Schedule	Assessment Criteria
Virgin quarried material	1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.	Standard metals/metalloids (should include as a minimum As, Cd, Cr, Cr (VI), Cu, Hg, Ni, Pb, Se & Zn)	This needs to be agreed with the Local Authority. The Assessment criteria needs to be UK based, e.g. LQM, S4UIs, Defra C4SLs or other similarly derived GACs.
Crushed hardcore, stone, brick (excluding asphalt)	Minimum 1 per 500m ³ .	Standard metals/metalloids (as above) PAH (16 USEPA specification) Asbestos, total TPH. Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).	
Greenfield soils / manufactured soils	Minimum 3. Dependant on source and receptor, between 1 per 50m ³ * and 1 per 250m ³ * (whichever is greater).	Standard metals/metalloids (as above) PAH (16 USEPA specification) Asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)).	
Brownfield soils / screened soils	Minimum 6 Dependant on source and receptor, between 1 per 50m ³ * and 1 per 100m ³ * (whichever is greater).	Standard metals/metalloids (as above) PAH (16 USEPA specification) TPH (CWG banded) Asbestos, Ph and SOM (or calculated from TOC). Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).	

* - LA in the NW usually prefer a higher frequency of validation screening due to topsoil quality issues in the region. Therefore, once suitable sources have been identified discussions should be held with the LA to confirm a screening regime

Prior to delivery, the Main Contractor will be responsible for providing screening results of any imported materials to site, to verify that they meet the criteria given in Table 2 on the following page. These results should be passed onto Arc Environmental a minimum of 1 week prior to delivery and should not be more than 2 months old.

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Section E: Validation of Remediation Strategy (Cont'd)

Emplacement of a Suitable Clean Cover System (Cont'd)

Table 2 - (Assessment Criteria for Imported Soils)

Analyte	Critical Conc. (Cc) mg/kg			Analyte	Critical Conc. (Cc) mg/kg		
Metals/Metalloids	Critical Conc. (Cc) mg/kg			Speciated PAH's (Cont'd)	1% SOM	2.5% SOM	6% SOM
Arsenic	37 ⁽¹⁾			Benzo(a)anthracene	7.2 ⁽¹⁾	11 ⁽¹⁾	13 ⁽¹⁾
Cadmium	11 ⁽¹⁾			Benzo(a)pyrene	2.2 ⁽¹⁾	2.7 ⁽¹⁾	3.0 ⁽¹⁾
	pH 5.0-6.0	pH 6.0-7.0	pH >7.0	Benzo(b)fluoranthene	2.6 ⁽¹⁾	3.3 ⁽¹⁾	3.7 ⁽¹⁾
	3.0 ⁽⁵⁾	3.0 ⁽⁵⁾	3.0 ⁽⁵⁾	Benzo(ghi)perylene	320 ⁽¹⁾	340 ⁽¹⁾	350 ⁽¹⁾
Chromium III	910 ⁽¹⁾			Benzo(k)fluoranthene	77 ⁽¹⁾	93 ⁽¹⁾	100 ⁽¹⁾
	pH 5.0-6.0	pH 6.0-7.0	pH >7.0	Chrysene	15 ⁽¹⁾	22 ⁽¹⁾	27 ⁽¹⁾
	400-600 ⁽⁵⁾	400-600 ⁽⁵⁾	400-600 ⁽⁵⁾	Dibenz(ah)anthracene	0.24 ⁽¹⁾	0.28 ⁽¹⁾	0.3 ⁽¹⁾
Chromium VI	6 ⁽¹⁾			Fluoranthene	280 ⁽¹⁾	560 ⁽¹⁾	890 ⁽¹⁾
Copper	2,400 ⁽¹⁾			Fluorene	170 ⁽¹⁾	400 ⁽¹⁾	860 ⁽¹⁾
	pH <6.0	pH 6.0-7.0	pH >7.0	Indeno(123cd)pyrene	27 ⁽¹⁾	36 ⁽¹⁾	41 ⁽¹⁾
	<100 ⁽⁴⁾	<135 ⁽⁴⁾	<200 ⁽⁴⁾	Naphthalene	2.3 ⁽¹⁾	5.6 ⁽¹⁾	13 ⁽¹⁾
Lead	200 ⁽²⁾			Phenanthrene	95 ⁽¹⁾	220 ⁽¹⁾	440 ⁽¹⁾
Mercury	40 ⁽¹⁾			Pyrene	620 ⁽¹⁾	1,200 ⁽¹⁾	2,000 ⁽¹⁾
	pH 5.0-6.0	pH 6.0-7.0	pH >7.0	Speciated TPH	1% SOM	2.5% SOM	6% SOM
	1.0-1.5 ⁽⁵⁾	1.0-1.5 ⁽⁵⁾	1.0-1.5 ⁽⁵⁾	Aliphatic EC5-EC6	42 ⁽¹⁾	78 ⁽¹⁾	160 ⁽¹⁾
Nickel	180 ⁽¹⁾			Aliphatic EC6-EC8	100 ⁽¹⁾	230 ⁽¹⁾	530 ⁽¹⁾
	pH <6.0	pH 6.0-7.0	pH >7.0	Aliphatic EC8-EC10	27 ⁽¹⁾	65 ⁽¹⁾	150 ⁽¹⁾
	<60 ⁽⁴⁾	<75 ⁽⁴⁾	<110 ⁽⁴⁾	Aliphatic EC10-EC12	130 ⁽¹⁾	330 ⁽¹⁾	760 ⁽¹⁾
Selenium	250 ⁽¹⁾			Aliphatic EC12-EC16	1,100 ⁽¹⁾	2,400 ⁽¹⁾	4,300 ⁽¹⁾
	pH 5.0-6.0	pH 6.0-7.0	pH >7.0	Aliphatic EC16-EC35	65,000 ⁽¹⁾	92,000 ⁽¹⁾	110,000 ⁽¹⁾
	3.0-5.0 ⁽⁵⁾	3.0-5.0 ⁽⁵⁾	3.0-5.0 ⁽⁵⁾	Aliphatic EC35-EC44	65,000 ⁽¹⁾	92,000 ⁽¹⁾	110,000 ⁽¹⁾
Zinc	3,700 ⁽¹⁾			Aromatic EC5-EC7	70 ⁽¹⁾	140 ⁽¹⁾	300 ⁽¹⁾
	pH <6.0	pH 6.0-7.0	pH >7.0	Aromatic EC7-EC8	130 ⁽¹⁾	290 ⁽¹⁾	660 ⁽¹⁾
	<200 ⁽⁴⁾	<200 ⁽⁴⁾	<300 ⁽⁴⁾	Aromatic EC8-EC10	34 ⁽¹⁾	83 ⁽¹⁾	190 ⁽¹⁾
Cyanide	34 ⁽³⁾			Aromatic EC10-EC12	74 ⁽¹⁾	180 ⁽¹⁾	380 ⁽¹⁾
Asbestos	None Present			Aromatic EC12-EC16	140 ⁽¹⁾	330 ⁽¹⁾	660 ⁽¹⁾
Speciated PAH's	1% SOM	2.5% SOM	6% SOM	Aromatic EC16-EC21	260 ⁽¹⁾	540 ⁽¹⁾	930 ⁽¹⁾
Acenaphthene	210 ⁽¹⁾	510 ⁽¹⁾	1,100 ⁽¹⁾	Aromatic EC21-EC35	1,100 ⁽¹⁾	1,500 ⁽¹⁾	1,700 ⁽¹⁾
Acenaphthylene	170 ⁽¹⁾	420 ⁽¹⁾	920 ⁽¹⁾	Aromatic EC35-EC44	1,100 ⁽¹⁾	1,500 ⁽¹⁾	1,700 ⁽¹⁾
Anthracene	2,400 ⁽¹⁾	5,400 ⁽¹⁾	11,000 ⁽¹⁾				

(1)= LQM S4UL's (2014 & 2015) – Residential with home-grown produce, (2) = CL:AIRE C4SL's – Residential with home-grown produce, (3) = ATRISKSOIL SSV, (4) = Potentially Phytotoxic Elements – BS3882:2015 & BS8601:2013, (5) = Sewage sludge in agriculture: code of practise for England, Wales and Northern Ireland (May 2018) – Potentially toxic elements limits in soils for arable farming and grassland. Note the TPH & PAH total should not exceed 1000mg/kg to avoid bringing potentially Hazardous Material on to site.

Validation of Gas Protection Measures

For this site, the implementation of Amber 1 gas protection measures must be witnessed, photographed and validated by an experienced and suitably qualified Engineer to ensure that all works are being completed in strict accordance with this Remediation Strategy, the proposed design details, BS8485 & CIRIA C735.

Each site visit should validate the construction and emplacement of each element of the gas protection measures within the proposed building, as well as confirming that all installation requirements have been met.

Typical inspection should follow the criteria set out in CIRIA C735, and the procedure for inspection / validation of the gas / vapour protection measures is outlined on the following page:

Remediation Statement & Validation Proposal Sheets

To be approved by Rochdale Metropolitan
Borough Council

Project Reference: 21-763

**Site: Proposed Residential Development – Land at Hollin Bank,
Hollingworth Road, Littleborough**

Prepared by: Phillip Brown



Section E: Validation of Remediation Strategy (Cont'd)

Validation of Gas Protection Measures (Cont'd)

- The verification of each inspection will be recorded visually using the proforma outlined in Appendix A5 of CIRIAC735 to verify that the works have been carried out in full accordance with the submitted design drawing and product specifications.
- The visual inspection will be accompanied by a full photographic record. The inspected / photographic record will include (as a minimum) the verification of the following construction details: -
- Passive sub-floor dispersal ventilation: Inspection of sub-floor ventilation, presence of cross ventilation in sleeper /party walls and installation of telescopic swan-neck vents.
- External wall vents: to assess the number and size of telescopic swan-neck vents and airbricks around the perimeter of the building, including spacing of side ventilation, and to assess that vents are free from debris and extend beneath the gas protection membrane into the passive sub-floor dispersal ventilation below the floor slab.
- Construction of structural barrier: confirmation of the construction of any insitu cast reinforced concrete slabs /rafts(not anticipated at this stage).
- The underside of the gas barrier membrane: to assess that no uneven / rough surfaces are present.
- Gas / vapour barrier membrane type: full product / manufacturers specification, gauge, colour, batch / roll number.
- Gas / vapour barrier membrane condition: to assess that there are no punctures, tears, rips or other defects to the membrane.
- Joining tape: to assess product type, brand, thickness, material, width and colour.
- Lapping design: to assess whether joints are lapped and sealed in accordance with the manufacturer's specifications (including double taping and correct overlapping)
- Laps and sealed joints: to assess double sided tape has been used and welds are undertaken correctly.
- Service entries: to assess whether service entries have been appropriately sealed i.e. assessing top hat arrangements with the use of Jubilee clips, use of GR SAM and sealing of ducts used for service feeds.

Section F: General Requirements

When considering the risks to any future maintenance or construction workforce, appropriate PPE should be provided to protect against the levels of contaminants recorded during the previous investigation works. Similarly, the results can also be used by the Main Contractor / Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations. For further guidance reference should be made to the Health and Safety Executive (HSE) document EH40/2005 (2nd Edition, 2011) Workplace exposure limits.

If during these or any other site works, any evidence of previously unidentified or unforeseen contaminated or suspect materials are identified then recourse should be made to Arc Environmental for advice including the requirement for any further sampling and screening to be undertaken. Details of the appropriate course of action undertaken to deal with any such materials will be provided to the Local Authority, prior to carrying out any additional remediation works, if required.

Appropriate measures shall be implemented at all times during the remediation works, to minimise any dust emissions. During all operations, the risk of dust release will be continuously assessed and appropriate mitigation measures put in place. Any haul roads shall, where practical to do so, be constructed of crushed hardcore products. These haul roads shall be maintained for the duration of their use to minimise any build-up of mud, loose spoil etc. Mobile water bowsers and sprayers shall be made available to dampen unpaved haul roads and working areas.

Remediation Statement & Validation Proposal Sheets

**To be approved by Rochdale Metropolitan
Borough Council**

Project Reference: 21-763

**Site: Proposed Residential Development – Land at Hollin Bank,
Hollingworth Road, Littleborough**

Prepared by: Phillip Brown



Section F: General Requirements (Cont'd)

An adequate supply of clean water shall be maintained on site at all times to allow dust suppression activities to be carried out at short notice.

Traffic both entering and working on the site shall obey the site speed limit. Regular inspections of the public highway adjacent to the site entrance shall be carried out by the Main Contractor. If deemed necessary, the highway shall be swept regularly to remove any mud, slurry or dust deposited by vehicles entering or departing the site, and a wheel wash provided for exiting vehicles if required.

If the Main Contractor considers that significant amounts of any detritus have been deposited on the public highway, then operations shall be suspended until appropriate cleaning operations have been undertaken. During the proposed works, all soils should be kept sufficiently damp at all times to avoid any possible dust release.

Any materials designated for off-site disposal shall be sampled and analysed, by the Main Contractor, at rates sufficient to allow the material to be adequately categorised to the satisfaction of the receiving landfill operator. All unsuitable materials shall be exported from site to a suitably licensed landfill facility, in accordance with the requirements of the DoC Regulations, and where appropriate, the HWR, or any superseding legislation. Material exported from site to landfill shall be hauled by a registered waste carrier in a sheeted wagon in accordance with the HWR and DoC regulations. A waste transfer or consignment note shall be completed, signed and retained by all parties involved.

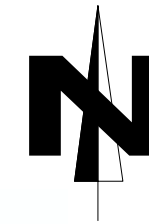
Any site works involving the re-use of site-won soils and / or import of additional soils to achieve final design levels should be undertaken under a CL:AIRE Definition of Waste: Code of Practice; Materials Management Plan (MMP); the MMP will need to be declared to CL:AIRE prior to commencement of earthworks.

Section G - Action Items & Persons Responsible

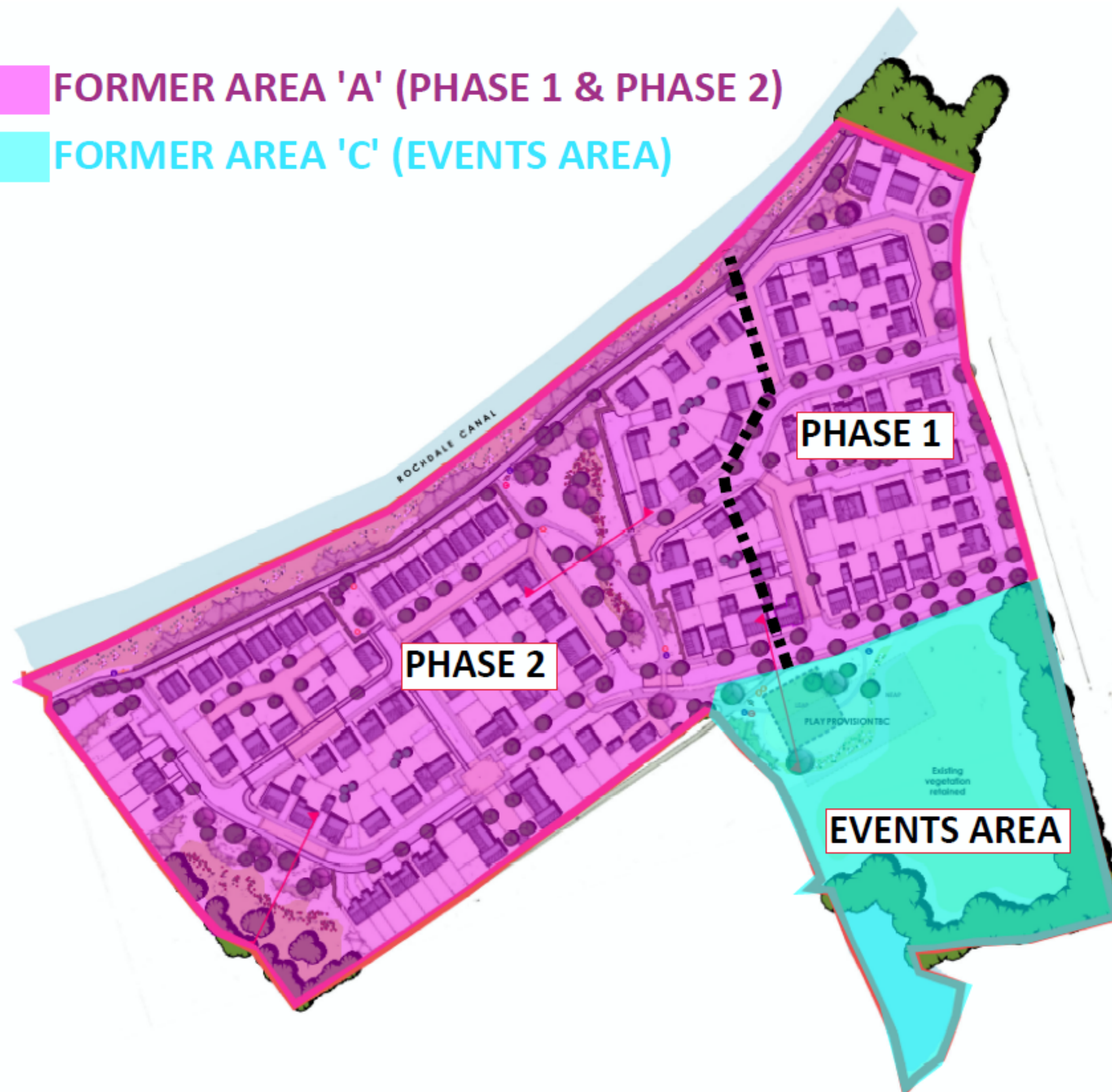
- Completion of 'watching brief' – Main Contractor.
- Asbestos monitoring during the works (as advised / if required) – Main Contractor
- Additional sampling, screening and risk assessment of any unknown / unrecorded ground contamination (if required) – Arc Environmental Ltd.
- Additional confirmatory sampling / assessment of site-won materials used within Cells 4 & 6 below the anti-dig layer in accordance with Table 1 Celtic 2009 Report (Ref: R1247/08/3436) – Arc Environmental Ltd
- Sourcing the necessary clean cover materials – Main Contractor.
- Provision of pre-delivery imported soil screening results – Main Contractor.
- Confirmation of suitability of imported soils. All validation screening will be discussed with the LA and assessed against the Level 1 Target Concentration Values in Table 2 – Arc Environmental Ltd.
- Emplacement of suitable high-visibility separator / marker above the hard-dig layer – Main Contractor.
- Emplacement of clean cover materials – Main Contractor.
- Confirmation of the correct thickness, make up and suitability of clean cover placed within all gardens / soft landscaping areas – Arc Environmental Ltd.
- Collection and provision of all documentation relating to waste disposal: - as a minimum, provision of total volumes excavated and removed to tip, waste consignment / transfer notes, landfill tip receipts – Main Contractor.
- Construction & installation of gas protection measures – Main Contractor.
- Validation of installation of gas protection measures – Arc Environmental Ltd.
- Completion of final Validation Report incorporating all the above – Arc Environmental Ltd.

APPENDIX A

Drawings



- FORMER AREA 'A' (PHASE 1 & PHASE 2)**
- FORMER AREA 'C' (EVENTS AREA)**



ARC ENVIRONMENTAL LTD

Solum House
Unit 1 Elliott Court
St. John's Road
Meadowfield
Durham, DH7 8PN
Tel: (0191) 378 6380

e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.
© Copyright Reserved

rev.	date	amendments	drawn	chkd

Client:

VISTRY

Project Title:

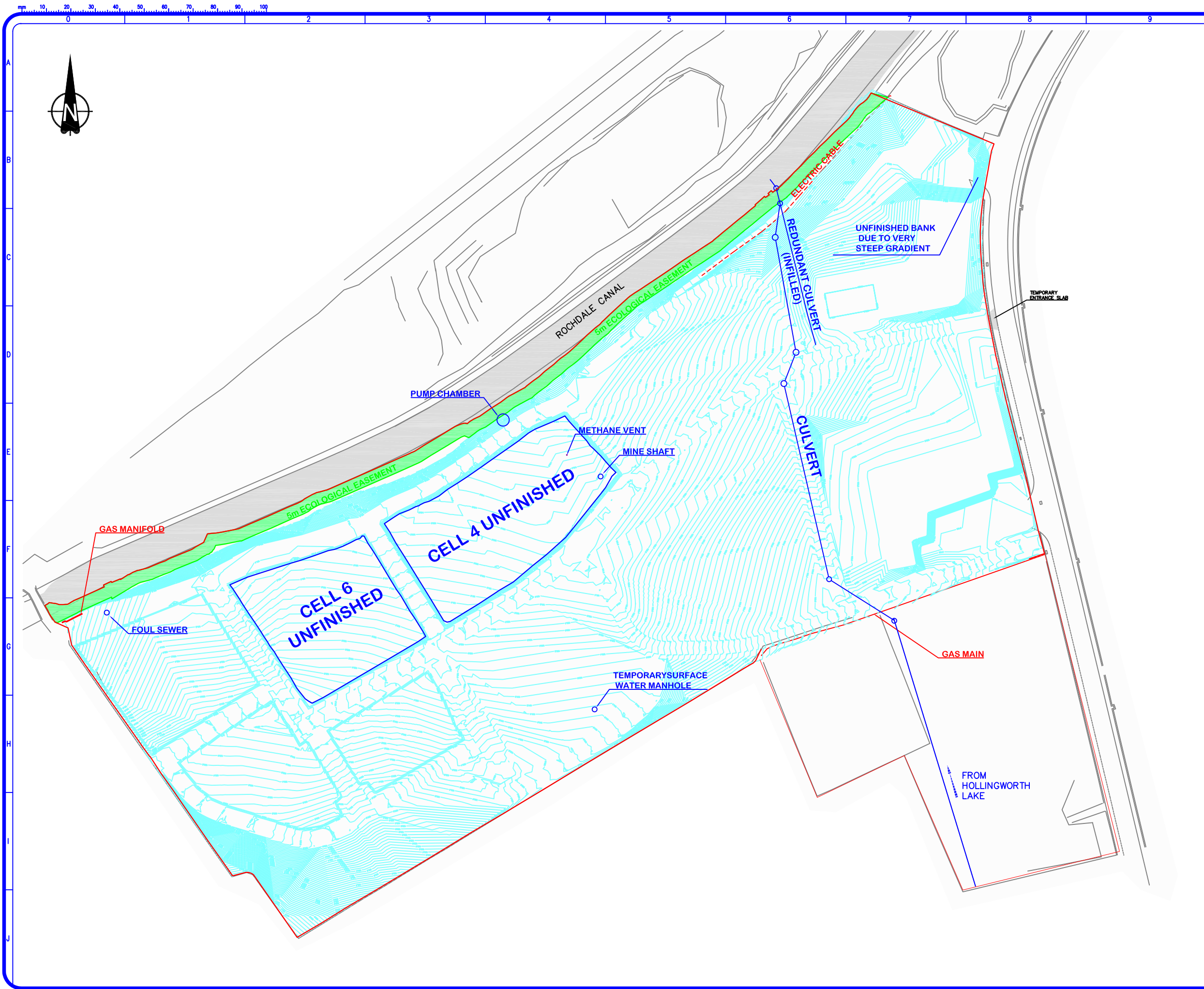
Land at Hollin Bank, Hollingworth Road, Littleborough

Drawing Title:

Proposed Layout Plan
(Former Phasing Plan)

Scale at A3:	Date:	Drawn by:	Approved by:
NTS	15/09/22	J.D.	P.B.

Job Ref:	Drg no:	Rev:
21-763	-	-



Legend

Site Boundary

NOTE: CONSTRAINTS ON THIS DRAWING ARE SHOWN FOR INDICATIVE PURPOSES ONLY. CELTIC ACCEPTS NO LIABILITY FOR THE ACCURACY OF THE SERVICES SHOWN. IT IS THE RESPONSIBILITY OF ANY PERSONS USING THIS INFORMATION TO LOCATE ALL SITE SERVICES PRIOR TO COMMENCING ANY SITE WORKS.

Drawing Status

FOR COMMENT

REV	COMMENT	DATE
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Columbus House Village Way Cardiff CF15 7NE 029 2036 8636	Centrix House Crow Lane East Newton Le Willows WA12 9UY 01925 273222	enquiries@celtic-tech.co.uk www.celtic-td.com
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Client

WOODFORD LAND PLC

Project

FORMER AKZO NOBEL SITE,
LITTLEBOROUGH

Title

POST-REMEDICATION
CONSTRAINTS

Drawn by	SC	Checked	AP	Date	05/09	Authorised		Date	
Original Scale	1/1000	Date	03/09	Rev	-	Paper	A2		

Drawing Number

D1247/3436/A9

APPENDIX B

E&P Review Summary Document

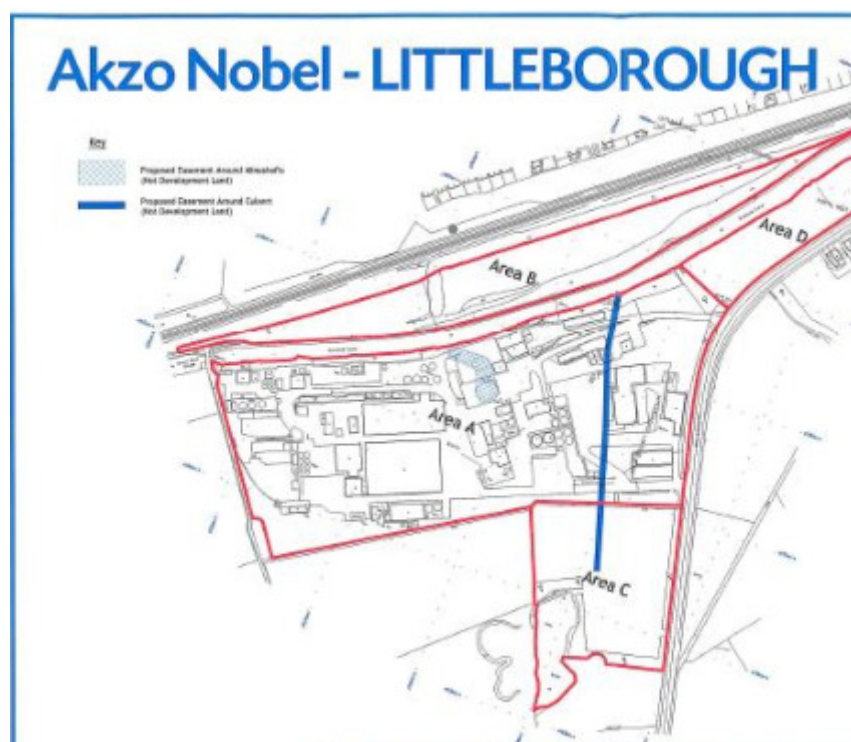
Jill Thwaite
Vistry Partnerships Yorkshire
Strategic Business Centre
Blue Ridge Park
Thunderhead Ridge
Glasshoughton WF10 4UA

KE/45466-001

11 July 2021

Dear Jill,

Former Akzo Nobel Site, Hollingworth Road, Littleborough



For above outlined site which comprises Areas A and D, we have undertaken a high level review of the following documents:

- CELTIC's Outline Foundation Option Plan, dated February 2008, reference P10008/09001/10;
- CELTIC's Phase 2 Remediation Validation Report, Draft for Regulator Comment, March 2009;
- NHBC LQE certificate, 20 August 2009;
- CELTIC's Letter to Rochdale MBC, 21 October 2011;

Directors: P Richardson BSc CEng MICE FStructE S R Ellis BEng CEng MStructE MICE C A Topliss BSc CEnv CSci CGeol SiLC MICE FGS
S J English BEng CEng MStructE A R Priest BEng A G Marshall BEng CEng MStructE
Technical Directors: A Allison BEng M P Chappell BEng IEng AMStructE K Edwards MSc CGeol FGS
P A Harrison BEng CEng MStructE C Hodge EngTech MICE A J Kerslake BEng FGS
Senior Associates: C A Wood BSc, CEng, MStructE, MICE M Dyson BSc CEng MStructE
Associates/Principals: A M Cross MEng CEng MICE A Lavelle MEng CEng MICE R A Noble BSc FGS
C L Capes BSc FGS R Wall BSc CGeol FGS
Consultants: S D Preston BEng CEng FICE FStructE K R Pursall BEng CEng MStructE S J Mitchell BSc MSc CEng MEI MCIBSE MASHRAE

- WYG's Geo-environmental Review Report, October 2017;
- RSK's Coal Mining Risk Assessment, August 2020;
- RSK's Additional Gap Analysis, 14 August 2020; and
- RSK's Additional Soil Sampling Report, 19 November 2020.

Site Description

The Rochdale Canal borders the approximate 7.8 hectare site to the north, with a railway line around 60 m beyond it. The 'island' in between the canal and the railway is a landfill. Hollingworth Road and Cleggswood Hill lies to the east and grassland, Hollingworth Lake and a car park to the south. A track and fields to the west with a bridge (Bridge 52) crossing the canal just off the north west site corner.

Past historical usages of the site include coal mining (two shafts are present on site), sandstone quarry (mid 19th century, adjacent to coal pit) and a former chemical manufacturing works, including the processing of animal fats and tallow for use in soaps and detergents. An oil distillery works was present on later 19th century maps.

The former Akzo Nobel site comprised numerous buildings including offices, labs, warehouses, storage and substations as well as featuring underground tanks and interceptors.

The Hollingworth Lake Conduit is culverted below the eastern half of the site, connecting Hollingworth Lake to the canal.

Historical investigations identified the site to be underlain by between 0.1 and 7.0 m of mixed cohesive and granular made ground, with natural Glacial Till below and Coal Measures strata encountered from between 1.0 and 17 m depth.

A shallow perched water table was encountered in the made ground as well as a deeper groundwater table within the Coal Measures. Flow is expected towards the north. A 'deep stone culvert' is present in the eastern half of the site, connecting the lake offsite to the south to the river north of the canal.

Remediation of the site is understood to have been completed in 2008; this comprised removal of underground structures, turning over the made ground within minimum 2.0 m of finished ground levels and replacement of arisings as engineered fill. A further phase of remediation was planned in 2011 but is not believed to have been undertaken.

remediation target values for the soils placed between 800 and 1,000 mm depth (also to be done during remediation).

Turnover

Relic foundations (including piles) were grubbed out to a depth of 2.0 m below remediation level i.e. top of hard to dig layer. The upper 2.0 m of ground below remediation level was also turned over to inspect for signs of impacted ground. Drawing D1247/3436/A5 denotes depth of turnover; where natural ground was found, turnover was terminated apart from in a few select locations.

Where sandstone bedrock was found at shallow depth below roads, this was excavated to allow for ease of drainage excavations, and sandstone arisings used to bulk up the hard to dig layer material.

Bio-physical Treatment

18 no. contaminant sources were excavated, as shown on drawing D1247/3436/A4.

The report notes that all samples taken from sides and base of the excavations returned results which were below the site soil acceptance guidelines.

Arisings (~1,340 m³) were placed into biopiles on a bunded concrete pad, aerated periodically. Biological nutrients were added regularly. Treated arisings were then used as fill, placed where a 1,000 mm thick cover system is to be installed.

Hard to Dig Layer

38 no. samples of crushed concrete were tested and the material was deemed suitable for use.

Crushed concrete placed to form roadways has not been chemically validated and should not be re-used within the upper 1,000 mm of final ground level without further assessment.

Post Remediation Constraints

Cells 4 and 6 have been left 'uncapped' due to a shortfall in site won soils. When soil is available, material should be placed to within 200 mm of proposed remediation level and capped with a hard to dig layer.

During times of heavy rainfall, there is significant surface run off from the fields off the southern boundary and from the southwestern site corner where springs were encountered. These springs emerged from sand layers within the Glacial Till.

Culvert was diverted through Phase 2; part of abandoned run remains in place below Phase 1; this remaining section has been sealed and backfilled with site won material.

A methane vent serving one of the capped mine shaft remains on site.

Gas main remains below southern boundary, may need diverting as part of the development.

Former site entrance in northeastern site corner has not been remediated due to close by underground services.

Post remediation gas monitoring wells were installed on a 75 m grid. Four rounds of monitoring were undertaken. Amber 1 gas measures were recommended.

NHBC LQE certificate, 20 August 2009

This LQE includes a review of a number of reports from 2003 to 2008, including CELTIC's 'Remediation Validation Report for Phase 2 (draft for regulator comment)' from March 2009.

CELTIC's Site Set Up Plan included in their March 2009 report notes the area of the site proposed for housing west of the culvert is titled 'Phase 2' whilst the area east of the culvert and south of the proposed residential area is 'Phase 1':



It is now understood that the 2011 remediation works planned were to revert the Phase 1 area to a residential end use.

The southern part of the site is formerly referred to as the 'Events Area' (also known as Area C by Celtic and Area D by WSP). For ease of reference, we will refer to this area as the 'Events Area' in this review.

The Events Area is noted to have been predominantly greenfield since the 1850s with the existing lake being constructed in the later part of the 19th century. The 1851 historical map notes the culvert (labelled to be a 'conduit') to cross the site. The majority of the site appears to have remained undeveloped until a car park was constructed in the north western corner in the early 1990s.

The LQE notes the investigation into the Events Area was reported by WSP in their Ground Investigation Report (May 2006) and later by Woodford in 2007 who also undertook sampling. Exploratory holes included 5 window sample holes to maximum 5 m (including 3 monitoring well installations), 11 trial pits to maximum 4 m, 1 rotary hole to 40 m and 22 monitoring rounds. The LQE notes one soil sample recorded a nickel concentration of 66 mg/kg – further testing was proposed to confirm material from the Events Area was suitable for reuse, however this 66 mg/kg concentration does not exceed current assessment value of 180 mg/kg (derived for a residential with home-grown produce end use). The monitoring wells did not report methane concentrations over 1% or carbon dioxide concentrations over 5%. No significant risks were therefore considered to be posed from the Events Area to site end users.

Woodford's 2008 Remediation Statement notes both the car park and the grassland areas of this part of the site have been investigated and do not require remediation except for the removal of the car park hardstanding and subbase.

The document also notes:

No significant observations of soil contamination were identified in the eastern area of the development site, the POS land or the car park area. The EA and EHO have confirmed that the investigations completed to date and including the WSP remediation strategy are acceptable for the POS and car park area. Refer to Appendix A.

As part of Celtic's 2009 works, and reported in their report for Phase 1 (dated July 2009), the LQE notes 7 samples were tested from near surface soils and/or stockpiled topsoil. Although testing recorded one very slightly elevated concentration of Aromatic C12-16 (5.79 ppm compared to 5.60 ppm threshold), no significant concerns were considered to be present.

The LQE summarises the following environmental and geotechnical/engineering outstanding issues:

Environmental	Geotechnical/Engineering
Gas protection strategy required – minimum CS2 or Amber 1 Events Area – CS1	Submit proposals for existing groundwater and surface water drainage system.
Validate placement of lower 600 to 1000 mm of capping in Cells 4 and 6 including placement of 200 mm of anti-dig layer, and chemical test results of material used from 800 to 1000 mm below finished level.	Remediation of Cells 4 and 6 to planning levels to agreed specification with validation testing. Remove all softened surface materials first.
Validate placement of upper 600 mm of capping in all landscaping.	Submit foundation designs.

The LQE notes that at the time, Rochdale MBC had confirmed acceptance of the Phase 2 Validation Report's conclusions and had no concerns relating to Phase 1.

A temporary drain is believed to have been installed on southern boundary but may not have been approved by the local authority as a permanent structure. A temporary drain is also understood to have been installed along the northern boundary to stop surface run off from entering the canal.

CELTIC's Letter to Rochdale MBC, 21 October 2011

This letter notes the eastern part of the site was remediated in 2008 for a commercial end use; it was then recognised that the area should instead be submitted for residential development, meaning additional remediation may have been required. The letter states the original remedial targets were set assuming a residential development applied to the whole site, not just Phase 2.

The strategy was to remediate hydrocarbon impacted soils for re-use below a 1000 mm cover system, provide a 200 mm thick anti-dig layer, following which a 600 mm or 800 mm thick capping would be installed in landscaped areas (800 mm was where a 1000 mm of clean cover is proposed over hydrocarbon impacted soils). A 200 mm thick band of soil below the anti-dig layer was also to be validated.

Regrading of the development platform was recommended for the former Phase 1 area and proposed works included removal of anti-dig layer, regrade underlying soils (expected to comprise Glacial Till) and use excess arisings on Phase 2, test soils which will be located below the anti-dig layer i.e. between 800 and 1000 mm below final ground level and then replace the anti-dig layer.

Planning conditions dated 20 December 2011 includes condition 4 which notes the 2008 Remediation Statement and the 2011 Celtic proposals should be adhered to. Condition 5

also notes gas protective measures should be installed. These conditions are also included on the planning conditions dated 3 October 2017.

WYG's Geo-environmental Review Report, October 2017

This report was prepared for Homes & Communities Agency and provides a summary of the remediation undertaken on the former Akzo Nobel site and a desk study for the farmland to the east and south of the site.

The report notes elevated concentrations of hydrocarbons and metals were recorded in the west of the site, associated with former process/storage areas. Odours and impacted ground were noted here, extending into the Glacial Till. Asbestos was also identified across the site. Groundwater impacted with hydrocarbons and ammonia was encountered in the north west corner.

The early investigations recommended a 600 mm clean capping in all landscaped areas and the incorporation of DS-4 AC-4 sulphate measures in below ground concrete. No treatment of groundwater was recommended, and the gassing regime was classified as Characteristic Situation 3 (CS3).

Post investigation, demolition of various structures was carried out including removal/flushing of storage vessels and tanks as well as the removal of 'nearly all' asbestos from buildings, eleven months of gas monitoring, drainage investigation including into the mine sump.

The WSP report notes the remediation strategy included 'removal of buildings and foundations with a site wide turnover of site soils to a nominal depth of 2.0 m below proposed finished levels.' Easements were left either side of the canal, culvert and the mine shafts (approximately 5 m).

Contaminants of concern included asbestos, metals, TPH, VOCs and ground gas. Mitigation measures proposed included a 200 mm thick anti-dig layer below a minimum 600 mm clean capping in gardens, with a 200 mm capillary break layer below the anti-dig layer *[this capillary break layer was refuted in other reports as no longer being required, although the lower 200 mm of material below the anti-dig layer still needed to be below site specific assessment criteria]*. Gas/vapour protective measures were also recommended, as well as keeping all services within the capping layer.

After consultation with the EA, a perimeter interceptor drain was to be installed along the western and southern boundaries to limit offsite run off, post remediation groundwater and surface water sampling was to be undertaken, and an interceptor/bund to be installed along the northern boundary during the remediation works.

The WSP notes 'the remediation strategy was designed to ensure the site was suitable for a commercial and residential development'. Post remediation constraints include:

- Construction works/service installers must ensure no contact between impacted arisings and capping material (200 to 400 mm anti-dig layer with or without a capillary break);
- Site will be engineered to allow for 2 to 3 storey plots with semi-stiff rafts;
- Gas measures required;
- Obstructions may be left in situ >1.5 m below plots and >3 m below roads;
- 600 mm capping with basal geogrid/geotextile required in all landscaping;
- DS3/DS-4 AC4 sulphate measures;
- Permanent land drains and groundwater control may be required on northern and southern boundaries;
- No development within 5 m of canal. Easements also required around shafts and culvert, or culvert diversion undertaken;
- Well on south western slope to be retained;
- All future extensions to plots, ponds, trees etc must not extend below the anti-dig layer, and must include gas measures where appropriate.

The WYG report notes the 2011 CELTIC letter confirmed the site had been remediated in 2008 (Phase 1 for commercial end use, Phase 2 for residential) and that further remediation needs to take place to allow for Phase 1 to now be residential as well. The strategy included remediation of hydrocarbon contamination to enable material to be re-used below a 1.0 m thick capping system, regrading of ground levels, installation of 200 mm thick anti-dig layer and validation of 200 mm of soil below the anti-dig layer.

WYG have subsequently identified a number of 'data gaps':

- A review is required of all reports pertaining to the 2008 and 2011 CELTIC remediation works to see if additional site investigation is required and confirm if previously agreed remedial targets meet current guidance;
- Update gas risk assessment to see if CS3 regime is still applicable.

RSK's Coal Mining Risk Assessment, August 2020

This report was prepared for Homes England and includes a summary of WYG's 2006 'Report on Past Mining Activities', as well as consultation of abandonment plans, geological maps and a Consultant Coal Mining Report. The Littleborough Civic Trust have advised that clay extraction took place in the local area.

Historically, the 1851 map shows an 'old shaft' near the northern boundary. By the 1890s, Cleggswood Works (possible oil distillery) and Clough Field Works are shown on site, but no reference to a shaft. Several coal pits and shafts are evident in the surrounding area. Cleggswood Hill's pits are labelled 'clay' from 1910.

Pennine Lower Coal Measures strata underlie the site, with eastern half of the site underlain by the Milnrow Sandstone group. Superficial Till is also shown to cover the majority of the site, with a thin band of Head deposits possibly extending onto the centre-south of the site.

Two faults trending north west to south east cross the site on the eastern and western boundaries. The strata are inferred to dip to the south and west between 7 and 20 degrees.

The BGS hold a record for the on-site shaft associated with Cleggswood Colliery. This record notes the shaft is around 115 m deep and the following stratigraphic sequence:

Drift deposits (clay and gravel, sand and loam)	Surface to 6.4 m
Milnrow Sandstone	To 19.8 m
Coal Measures	To 46.7 m
Inch Coal	To 46.7 m (0.02 m thick)
Coal Measures	To 71.9 m
Upper Mountain Mine coal	To 72.3 m (0.41 m thick)
Coal Measures	To 82 m
Inch Mine coal	To 82 m (0.03 m thick)
Coal Measures	To 102.8 m
Bullion coal	To 103.1 m (0.31 m thick)
Coal Measures	To 114 m
Lower Mountain Mine coal	To 114.7 m (0.66 m thick)
Coal Measures	To >115 m

The Lower Mountain Mine coal was economically the most valuable seam in the area, and was found to be underlain by a 0.44 m thick layer of ganister. The overlying Bullion, Inch Mine and Inch coals were not worked. The Upper Mountain Mine coal along with an underlying bed of fireclay (thought to be around 1.5 m thick) were known to be worked in the area, including Cleggswood Colliery.

The Consultants Coal Mining Report, obtained in July 2020, notes there is not likely to be unrecorded shallow workings (i.e. within the upper 30 m), but past workings are recorded in the Upper Mountain coal (0.3 m thick, 59 m depth) and Lower Mountain coal (0.6 to 1 m thick, 84 to 96 m deep).

RSK's review of the information obtained concludes there are no recorded workings in the Upper Mountain Mine (anticipated to lie from at least around 72 m depth) or Lower Mountain Mine coal (anticipated to lie at around 90 to 139 m below the site) which extend below the site.

Clay extraction may have also taken place alongside the Upper Mountain Mine and Lower Mountain Mine coal seams, although since the CA plans indicate no coal was worked below the site the likelihood of clay workings being present would be low. A 2.5 m thick band of fireclay may be present below the Inch coal but even if workings are present, they should have at least 40 m of competent cover above.

Precautions against the effects of shallow coal workings are therefore not considered to be required.

Two shafts are recorded on site, with an adit recorded offsite at Cleggswood Hill. The RSK report notes the following:

CA Reference	Details
393415-008	On site shaft. Cleggswood Colliery downcast shaft, ovoid shape, 2.7 by 4.3 m dia, brick lined, 112.7 m deep to Lower Mountain seam. Possibly capped in 1935. Later treated November 1984, filled with 'fatty waste material' and capped by Akzo Nobel; cap detail shows a 1.15 m thick reinforced concrete plug founded on bedrock, overlain by 4 m of 'compressed infill material' and a 0.35 m thick concrete cap. CCMR notes '<i>shaft was excavated to a depth of 5.2 m, through 2 m of bedrock. A reinforced concrete cap 12 m² at the base increasing to 12.5 and 1.2 m thick formed over shaft. Excavation backfilled and compressed.</i>' Located in vicinity of former boiler house. A pipe extends 6 m into shaft is connected to a concrete duct which connects to the culvert. The 'off-take pipe' located 6 m below the top of the shaft is positioned to restrict fatty deposits from blocking the discharge pipework. Water flow from the shaft estimated at 3 litres/sec. A second pipe joins the shaft discharge pipe, draining water from weathered bedrock at a rate of 2.8 litres/sec. Combined discharge into River Roch is up to 5.8 litres/sec
393415-009	On site shaft. Cleggswood Colliery upcast shaft, brick lined, 2.4 or 3 m dia, 114.5 m deep. Filled with 'fatty waste material'. Possibly capped in 1952. Akzo Nobel also capped shaft in same spec as downcast shaft, but at a higher level and with no drainage. CCMR notes '<i>excavated to a depth of 7.8 m removing 2.6 m of bedrock where a reinforced concrete cap was formed. The cap measures 8.5 m² at the base increasing to 10 m² at the top by 1.2 m thick. The excavation was backfilled to the surface with compressed fill. An inspection pipe was installed passing through the cap and incorporating an inspection plate at the surface. Branching from this is a ventilated pipe fitted with a flame arrestor.</i>' Located in vicinity of former boiler house.

393415-010	Offsite adit, approx. 50 m east of site from Hollingworth Road to the Upper Mountain workings. No treatment details recorded.
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The RSK report notes chemical residue is present in the shafts and this is prevented from discharging into the river by the design of the drainage system.

RSK's Additional Gap Analysis, 14 August 2020

This report was prepared for Homes England and was aimed to confirm the integrity of the existing monitoring wells, determine the thickness of anti-dig layer, confirm if asbestos fibres were present, and discuss the site with regulators. The area covers excludes the Events Area.

Monitoring Wells

RSK noted historical gas monitoring data was incomplete and that it was uncertain if additional monitoring would be required. RSK found 15 monitoring wells, 10 of which were deemed suitable for re-use subject to finding out the well construction details. The depth of the wells ranged between 0.68 and 3.86 m, most were dry except for three which recorded water in the upper 1 m.

Hard Dig Layer

The report notes that the past two remediation phases included placing a 250 to 300 mm thick hard dig layer on the development platform. Eight 'cells' were completed, with two 'cells' to be completed by the developer. Material for use in these two cells is stockpiled; additional material may need to be imported.

The report notes the hard dig layer material originated from crushing and screening processes undertaken during demolition. Since there was potential for asbestos to be present within this material, additional testing was recommended. Using an excavator, RSK carried out 21 shallow trial pits across the eight 'cells', recording an average 380 mm thickness of the hard dig layer, which ranges between 0.1 and at least 0.9 m thick.

A geotextile was encountered below the hard dig layer in most positions.

A concrete obstruction was noted in HD07. In HD08, no hard dig layer was recorded; RSK thought this was due to HD08's location near the southern edge of the cell. RSK also note there was a noticeable thinning of the layer towards the southern boundary and towards the elevated mound in the south east corner.

Five pits were also excavated in two stockpiles, finding coarse limestone aggregate.

27 samples of the hard dig layer were tested and RSK noted 'numerous' fragments of possible asbestos containing material (ACM) at the site surface. Five samples recorded amosite or chrysotile fibres, 0.003% or less. Of the fragments tested, two were identified as ACM.

Regulators

RSK contacted Rochdale in July 2020 who confirmed the past report recommendations should still be relevant, but that a new 'review' will likely be required for a new application to confirm the reports comply with current guidance.

The EA confirmed to RSK in July 2020 that there are no outstanding permit related issues.

The Coal Authority confirmed the two mine entries have been treated to industry standards and development will be advised to avoid these features.

Summary

Some remedial work is required for the 10 wells found before they can be suitable for use. It is unclear if additional gas monitoring is required.

The hard dig layer is between 100 mm and >900 mm thick, occasionally underlain by a geotextile, and its base may be difficult to differentiate. Asbestos was encountered in the material and in ACM fragments noted at site surface.

A formal review of past reports will be required by Rochdale for a new planning application.

RSK's Additional Soil Sampling Report, 19 November 2020

This is a factual report on soil sampling and asbestos analysis. The report mentions additional sampling is ongoing. RSK's July 2020 report noted visible ACM at the site surface, and fibres up to 0.003% in the hard to dig layer (at depths of up to 0.9 m) in 5 out of 27 samples tested.

This investigation included a walkover by an asbestos consultant to identify suspected ACM, and sampling and analysis of 8 bulk bags and 55 samples taken between site surface and 0.3 m. The hard to dig layer comprised sandy cobbles of concrete and brick with fragments of wood, plastic and rebar, and was found up to 0.2 to 0.6 m thick. Three locations found a geotextile below the layer and in seven locations, the layer appeared more cohesive. The report notes the hard to dig layer was absent in selected pits. Concrete obstructions were also noted in five holes.

Visible ACM was noted in four surface locations, and 27 of 55 samples recorded up to 0.019%. Of the 8 bulk bags, 4 contained ACM.



The report concludes the material is ingrained with asbestos, and that mitigation measures are required during future disturbance of the ground including notifying future works to the HSE and 'employing the specialisms of a licensed asbestos contractor to manage such future works appropriately'. Air monitoring around the site's perimeter may also be required during drier times of the year. The hard to dig layer could be considered 'hazardous waste' if removed from site in its current state. If it remains in place, it should be capped with 600 mm of clean cover and a visible marker layer. Where services are to be installed, the surrounding soils should also be 'clean'.

E&P Summary

- Asbestos fibres and ACM have been noted at site surface of the main development area and in the material placed to act as an anti-dig layer. Safe methods of working should be implemented when investigating and excavating through this material;
- Further remediation is required to trim the area east of the culvert to a residential end use;
- Capping to be placed in landscaped areas to be 1,000 mm thick; this should comprise 600 mm of clean cover, 200 mm anti-dig layer, 200 mm of material below a certain

site specific threshold. Levels in Cells 4 and 6 have been left low due to a shortfall of material; lowest layer of capping still to be placed;

- Should any landscaped areas be present in the Events Area, no capping is at this stage assumed to be required based on previous testing. However, should material from the main development area be moved to the Events Area, a capping will then need to be provided;
- Regrade in ground levels to be reviewed to ensure impacted ground still has sufficient cover; further investigation required to assess if material is suitable to remain below 800 to 1000 mm;
- Level of gas measures to be Amber 1 or CS2 for main development area, and CS1 for Events Area. We assume precast concrete floors will be the developer's preference, meaning Amber 1 measures should be appropriate. Additional gas monitoring is recommended to confirm this level is appropriate;
- Permanent drainage works required along the southern and western site boundaries;
- A well is expected in the south western site corner; structure will need exposing if still in use by farmer;
- Slope stability assessments required for offsite slopes, including northern boundary adjacent to the canal;
- Regulatory discussion required to confirm remediation proposals are still appropriate;
- No build easements required on northern boundary, around mine shafts and either side of the culvert.

Yours sincerely,

A handwritten signature in black ink that reads 'Kate Edwards'.

Kate Edwards