

REPORT ON SITE INVESTIGATION

AT

**KILDONAN STREET, COATBRIDGE OFFICE CONVERSION
AND NEW BUILD HOUSING**

FOR

COLLECTIVE ARCHITECTURE - NORTH LANARKSHIRE

COUNCIL

Version 1, October 2021



COLLECTIVE ARCHITECTURE – NORTH LANARKSHIRE COUNCIL

KILDONAN STREET, COATBRIDGE OFFICE CONVERSION AND NEW BUILD HOUSING

REPORT ON SITE INVESTIGATION

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Issue No			Prepared By	Reviewed By	Approved By
V1	October 2021	ORIGINAL	<i>C. Walker</i>	<i>Jennifer McCall Walker</i>	<i>Alex Hill</i>
			Craig Walker	Jennifer McCall Walker	Alex Hill
			Geo-environmental Engineer	Associate	Associate
<p>G3 Consulting Engineers Ltd Orion House, 7 Robroyston Oval, Nova Business Park, Glasgow, G33 1AP Telephone: 0141 558 3255 Email: enquiries@g3eng.co.uk</p>					

EXECUTIVE SUMMARY

Site Details	Site Name	Kildonan Street, Office Conversion
	National Grid Reference	273592E, 665248N
	Post Code	ML5 3BT
	Site Area	0.40Ha (Approx.)
	Local Authority	North Lanarkshire Council (NLC)
	Current Usage	NLC offices and hardstanding car park.
	Former Usage	Office buildings
Brief	Investigation of existing ground, geo-environmental conditions and mineral stability of the site.	
Nature of Development	Re-development of the existing sandstone building and construction of new low-rise residential properties with associated gardens, areas of soft landscaping and car parking.	
Physical Investigation Works	2No. cable percussive boreholes to depths of 8.00m; 2No. Rotary cored borehole to a depth of 40.00m; 3No. window sample boreholes to depths of between 4.30m and 5.00m; 6 No. Gas/Groundwater monitoring visits	
Laboratory Analysis	Chemical analysis of 9No. soil samples (including 4No. leachate tests); WAC Testing of soil likely to be removed from the site (2No.); Geotechnical testing of the natural soils.	
Summary of Encountered conditions	<p>Made ground was recorded in all exploratory holes to depths of between 1.50mbgl and 4.20mbgl, comprising generally an upper layer of hardcore below tarmac surfacing underlain by silty sand and gravel containing inclusions of ash, brick, cobbles and sometimes concrete, slag and pockets of clay. Other than the anthropogenic materials described above, no overt visual or olfactory evidence of contamination was noted.</p> <p>The made ground is underlain by cohesive glacial till, generally comprising firm becoming stiff with depth sandy gravelly CLAY with cobbles. Glacial till was recorded to a maximum depth of 24.00mbgl within rotary boreholes. Bedrock, described as mudstone was recorded at depths of 22.00mbgl and 24.00mbgl.</p>	
Foundations	<p>The development proposals for the site comprise the re-development of the existing listed main building and the construction of new low rise residential properties in the east of the site. The loads associated with the new proposed buildings are not known at the time of reporting but are anticipated to be in the order of 35-50kN/m run of wall.</p> <p>Made ground has been recorded to depths of between 1.50mbgl and 4.20mbgl. Made ground is not generally considered suitable for the support of foundations. As a result, it will be necessary to carry all loads through these deposits to the underlying competent Glacial till. The anticipated loads associated with the proposed development and recorded thickness of made ground necessitates deepened trench fill foundations placed on to the firm (or better) natural cohesive deposits at depths of up to 2.50m across approximately 80% of the new-build area of the site. For the remaining 20% a deep foundation solution placed on to the firm (or better) natural cohesive deposits is considered appropriate. A ground improvement solution such as vibro-columns may be suitable, however, a specialist ground improvement contractor will need to confirm its suitability at the site. A copy of borehole logs have been forwarded to a specialist contractor for their comment. Should it be concluded that the ground is not suitable for vibro, piling will need to be considered.</p> <p>Based on the geochemical data, concrete utilised for the construction operations should generally be Design Class DS-1, ACEC Class AC-1 as defined within BRE SD1.</p> <p>Open sump pumping should cope with the volumes of groundwater which may be expected to enter shallow foundation or services excavations, unless these are left open for a protracted time.</p>	
Chemical Contamination	Chemical analysis has not identified any elevated concentrations of contaminants within the soil samples tested when compared to the relevant human health assessment criteria. No specific remediation measures in regard to human health are considered necessary.	

	A Water Environment risk assessment has concluded that risks to identified water receptors are low and no further action is required.
Gas Emissions Data	<p>No elevated concentrations of ground gas, along with no gas flow were detected throughout the monitoring undertaken, however it is recommended that the site is classified as CS-2 on the basis of the site being underlain by shallow coal workings. Coal workings are a known potential source of ground gas generation and the proposed grouting works considered necessary prior to the development of the new-build housing could potentially create new flow pathways. As such it, gas preclusion measures corresponding to a score of 3.5 as described in British Standard BS 8485:2015 + A1:2019 will be required for all newly constructed properties proposed at the site.</p> <p>The site is indicated as being in an area where less than 1% of homes are above the Radon Action Level. However, current HPA guidance recommends that all new development include basic radon protection measures as standard. It is considered that the proposed gas barrier membrane would also provide suitable radon protection for the development.</p>
Mining Constraints	<p>A coal mining report procured from the Coal Authority indicates that the site is in an area that could be affected by known historical underground mining within four coal/ironstone seams at depths of between 37m and 153m. The Coal Authority also notes that the site lies within an area of probable unrecorded shallow workings.</p> <p>Site investigations included the drilling of two rotary cored boreholes which were subsequently logged by a specialist mining geologist. Solid coal conjectured to be the Glasgow Ell Coal was recorded within rotary borehole RC101 at shallow depths. A void, with possible waste and a loss of drilling flush considered to be representative of workings within the upper leaf of the Ell Coal was recorded at shallow depths within rotary borehole RC102. In addition, friable bright coal considered representative of workings within the lower leaf of the Ell Coal was also identified. It is considered there is insufficient solid rock cover above the worked seams and as such there is a risk from mineral instability at the site. Mineral stabilisation works, by the drilling and injection of grout within the workings of the Ell Coal, is necessary within areas of the proposed new build residential housing and adjacent areas. There are no known recorded mine entries within the site, however as in all areas of historic mining, the possibility of encountering an unrecorded mine entry cannot be discounted. Vigilance should be maintained throughout the development works.</p>
Other Constraints	<p>Made ground was encountered throughout the site. As such a full 600mm capping layer is likely to be required for any new roads constructed at the site. If any new adoptable roads are proposed, the build and design would require to be approved by North Lanarkshire Council Roads department.</p> <p>Several utilities including Virgin Media apparatus and a Scottish Power extremely high voltage underground cables are shown to cut through the centre of the site. Depending on the finalised development layout these services may have to be rerouted. It is recommended discussions are had with the relevant providers prior to development works.</p>
Potable Water Supplies	At this stage no UKWIR chemical analysis testing has been carried out. Available chemical results suggest that the use of PE or PVC water mains will be feasible at the site.
Additional Works	<p>Once the line and level of any new water supply pipes has been established, a route-specific UKWIR assessment should be undertaken.</p> <p>Prior to site development, it should be ensured that all redundant borehole standpipe locations are identified, logged and decommissioned in accordance with SEPA guidance to ensure they do not act as a preferential pathway for ground gas migration into future buildings.</p> <p>Made ground has been recorded across the site. A suitable growing medium comprising of a minimum 100mm of topsoil should be imported and placed in all private gardens and areas of communal soft landscaping.</p> <p>Copies of all reports prepared for the site should be submitted in support of any planning application for redevelopment.</p> <p>The current proposals include the demolition of the police station wing of the building, with façade retention on Muirhall Street. A post demolition site investigation will be required to investigate the made ground and superficial deposits underlying this portion of the building. A rotary bore will be included in the scope to obtain further information on the shallow mine workings.</p>

Note: The above should be read as a brief summary of the interpretative report, the aim of which is to highlight the principal outputs of the investigation and areas of concern, and is for guidance purposes only. Any quantification given is an estimation based on the density and resultant interpolation between sampling points, and may be subject to variation.

Unless expressly stated otherwise, all depths and thicknesses are quoted from existing ground levels and no adjustment has been made in relation to any proposed pre-development site re-profiling.

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1.0 INTRODUCTION

1.1 General

G3 Consulting Engineers Limited were appointed by Collective Architects on behalf of North Lanarkshire Council (the Client) to provide a Phase 2 Geo-environmental Report relative to a proposed residential development and office conversion project located at Kildonan Street, Coatbridge. A site location plan is included as Figure 1.

Preliminary development plans indicate the conversion of the existing office buildings to residential developments and new low-rise residential properties with associated gardens, communal soft landscaping and car parking.

The aim of this investigation was to provide an assessment of the ground conditions within the site and to evaluate the impact the identified conditions could potentially have on the development. The objectives included:

- Establishing the geological conditions at the site and in the surrounding area.
- The identification of potential constraints related to soil contamination and to provide recommendations on appropriate remediation solutions.
- To investigate the mineral stability of the site in regards to historic mine workings.
- An assessment of the ground gas regime at the site.
- Provision of recommendations on the load bearing characteristics of the encountered strata and possible foundation options.

For this work, reliance has been placed on publicly available data and that obtained from the sources identified above. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information, it has been assumed that it is correct and that those responsible for its preparation have used proper professional care and expertise.

This report details the findings of the site investigation, identifies potential geotechnical and environmental constraints, potentially significant pollutant linkages and provides recommendations in relation to the proposed development in terms of compliance with Part IIA of the Environmental Protection Act 1990 and the appropriate Planning Advice Note (PAN33).

While every effort has been made to determine the conditions across the area of investigation, it should be noted that ground conditions can vary between sample locations and consequently, conditions may exist within certain areas, which may be at variance to those disclosed by this report.

This report and the conclusions contained herein have been written in the context of the purpose stated above and should not be utilised in any differing context without prior reference to us, to ensure continued pertinence of the recommendations advised.

We would advise that changes in accepted practices, legislation, regulation or guidance may necessitate review and possible revision of the report in part, or in whole, following its submission. In the event that appropriate regulatory approval and recommendations of the report have not been implemented following a period of 12 months from the report date, it should be referred to us for review and, if necessary, amendment.

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party for the contents of this report unless by prior contractual agreement in writing, stating the purpose for which the report is to be used.

This report constitutes an interim issue as various aspects of the assessment are ongoing. The conclusions and recommendations provided within, should therefore be considered preliminary only. A final issue will be provided upon completion of ground gas monitoring and once all laboratory test results have been received.

2.0 SITE DETAILS

The site occupies a plot of land bound by Kildonan Street to the north, Dunbeth Road to the west and Muiryhall Street to the south. A car parking area for Coatbridge High School is located to the immediate east. The site is generally split, with a stone wall separating the main council office buildings taking up the majority of the west and central site areas, and a hardstanding vehicle car park to the east. Vehicular access to main site area and eastern car park is currently taken from Kildonan Street in the north. Vehicle access to the main site area only, is available from Muiryhall Street in the south.

The site location is shown on Figure 1.

Site Name:	Kildonan Street
National Grid Reference:	273592E, 665248N
Closest Postcode:	ML5 3BT
Site Area (development site):	0.40Ha (Approx.)
Local Authority:	North Lanarkshire Council

2.1 Site Description

The site is currently occupied by a large sandstone building located along Kildonan Street, Dunbeth Road and Muiryhall Street with an open 'courtyard' type area at a lower level from street level, accessible from the centre of the site. The north eastern part of the building is constructed of more modern brick, understood to have been rebuilt following a fire in the 1990s. A separate small single storey building is located in the east with several dangerous substances signs noted. This building is understood to have been in use to store various chemicals and poisons to deal with pests however no access was available at the time of our survey. A stone wall separates the eastern hardstanding car park which has its own access point along Kildonan Street. The main building was, until recently, in use as council offices. The car park in the east is still in use to store and park council pool vehicles.

The site is generally surfaced in building cover and hardstanding with a limited area of soft landscaping. There is a sudden change in levels in the centre of the site, with a ramp sloping to the west to get to the open 'courtyard' area. Overall the site slopes gently towards Dunbeth Road in the west.

2.2 Properties in Proximity

The site is bound by Kildonan Street with residential properties. Dunbeth Road bounds the site to the west with a large hardstanding car park beyond. Muiryhall Street forms the southern site boundary with high rise tower flats located beyond. The playground and parking area of Coatbridge High School are located to the immediate west of the site.

2.3 Tanks and Drums

No tanks or drums were noted at the site at the time of the walkover. Warning and Dangerous Chemicals signage was noted on the small single storey structure in the centre of the site, however no obvious storage containers were recorded however it is noted no access was available to the interior of the building.

2.4 Contamination

No visual or olfactory evidence of contamination was identified at the site at the time of the walkover. As above, there was no staining or odours noted adjacent to the chemical storage building. There was no obvious staining in the surrounding drains.

2.5 Ground Conditions

Ground conditions throughout the site comprised predominantly of hardstanding surfacing and building cover. Small areas of limited soft landscaping are located in the centre of the site in the 'courtyard' area and in the eastern car park area.

2.6 Invasive Species and Animal Habitats

A detailed invasive plants survey was out with the scope of this report and has not been undertaken. Soft landscaping at the site is limited and localised and therefore the potential for invasive species is considered to be low; however, it cannot be discounted. It would therefore be prudent to have a detailed survey undertaken ahead of site redevelopment.

It is understood the existing sandstone building is generally vacant and as such, has a potential to be a roosting site for species such as bats and other protected birds. It would be prudent to have a preliminary assessment undertaken prior development works to ensure that any potential ecological constraints are identified.

2.7 Watercourses

No surface water courses were recorded during the site walkover survey.

3.0 APPRAISAL OF EXISTING INFORMATION

3.1 Information Sources

The following sources of information have been utilised in the compilation of this report:

- Envirocheck Report 282778378 dated 30/07/2021 (Appendix A)
- SEPA online Flood Risk Management and River Basin Management Plan maps
- British Geological Survey Geology of Britain Viewer and Environmental Geology Maps NS576NW (1:10,000 scale)
- Coal Authority online mining interactive map and Coal Mining Consultants Report (51002562262001, dated 30/07/2021)
- Health Protection Agency

3.2 Site History

An examination of the history of the site was made utilising extracts from historical editions of the Ordnance Survey. The objective of these studies was to determine the former uses of the site and that of the surrounding area (typically within 250m), and to obtain any information which may identify potential constraints to its development, particularly the presence of any industrial processes in the vicinity of the study area. The key findings of our historical researches are presented in Table 1.

Table 1: Site History

Edition/ (Source Map Scale)	Significant Features – On Site	Significant Features – Surrounding Area (~250m)
<p>Lanarkshire 1860 (1: 2,500)</p> <p>Lanarkshire 1864 (1: 10,560)</p>	<ul style="list-style-type: none"> • The earliest plan available records the site as a small building and a road or path going through the site in an approximate south west to north east direction. • The south and south east area of the site is generally open land, presumably in use for agriculture. 	<ul style="list-style-type: none"> • Town of Coatbridge is located approximately 150 m to the west of the site. The surrounding area to the south, north and east is generally rural. • Within the general area, numerous coal pits and old coal pits are recorded. • An old coal pit is recorded approximately 75m to the sites south west. Additional old coal pits are located approximately 150 m south west and 250m to the south east. • A road that goes through the site leads to a small quarry or opencast located approximately 80m to the west. • A large structure noted as “Coats” is located approximately 150 m to the south east. Mining memoirs make mention of Coats Colliery operating in the area during this time period.

Edition/ (Source Map Scale)	Significant Features – On Site	Significant Features – Surrounding Area (~250m)
Lanarkshire 1899 (1: 10,560)	<ul style="list-style-type: none"> The site has been redeveloped. Large U shaped building is located in the centre and east of the site, very similar to the present day layout. A high school is located to the immediate east, with part of the school grounds located within the east of the site. Two smaller buildings associated with a school are located in the east of the site. 	<ul style="list-style-type: none"> Coatbridge has expanded significantly. Surrounding area is generally urban and industrialised including several different Steel Works over 500m to the south, north and north west. Kildonan Street, Dunbeth Road and Muiryhall Street have been developed in their general present configuration. A high school is indicated to the east of the site. The site is surrounded by residential properties to the north, west and south. A school is located to the east.
Lanarkshire 1912-1913 (1: 2,500) Lanarkshire 1914 (1: 10,506)	<ul style="list-style-type: none"> The main large building is now recorded as a Municipal Building. No further changes noted. 	<ul style="list-style-type: none"> Continued expansion of Coatbridge in all directions. Several Iron Works are located approximately 300m to the south.
Lanarkshire 1938 (1: 10,560) Lanarkshire 1939 – 1940 (1: 2,500)	<ul style="list-style-type: none"> A small building currently in use as chemical/poison store, has been constructed in the centre of the site. An additional small school building has been developed in the east of the site. 	<ul style="list-style-type: none"> Continued expansion of Coatbridge to the east. Roads have been extended to the east however no buildings have been developed.
Lanarkshire 1956 (1: 2,500) Lanarkshire 1958 (1: 10,000)	<ul style="list-style-type: none"> No significant changes are recorded to the site. A police station is noted in the south east of the main building. 	<ul style="list-style-type: none"> Continued residential expansion of Coatbridge to the east of the site.
Lanarkshire 1966 (1: 2,500) Lanarkshire 1967-1968 (1: 10,000)	<ul style="list-style-type: none"> No significant changes are recorded to the site. 	<ul style="list-style-type: none"> No significant changes are recorded within 250m of the site.
Lanarkshire 1971-1990 (1: 1,250) Ordnance Survey Plan 1982 (1: 10,000) Ordnance Survey Plan 1986 – 1990 (1:1,250)	<ul style="list-style-type: none"> The buildings in the north of the site have been demolished. The buildings in the north of the site have been demolished. 	<ul style="list-style-type: none"> Terraced residential properties to the immediate south of the site have been demolished and replaced by a tower block of flats and open space. Terraced residential properties to the immediate south of the site have been demolished and replaced by a tower block of flats and open space. Many of the iron works in the south and north west are no longer recorded.

Edition/ (Source Map Scale)	Significant Features – On Site	Significant Features – Surrounding Area (~250m)
Ordnance Survey Plan 1990 – 1993 (1: 10,000) Ordnance Survey Plan 1992 (1: 1,250)	<ul style="list-style-type: none"> A new building has been constructed in the centre of the site. 	<ul style="list-style-type: none"> Coatbridge shopping centre and associated car parking has been developed to the sites south west.
10k Raster Plan 1999 (1: 10,000)	<ul style="list-style-type: none"> No significant changes have been recorded within the site. 	<ul style="list-style-type: none"> No significant changes have been recorded within 250m of the site.
Ordnance Survey Plan 2021 (1: 10,000)	<ul style="list-style-type: none"> Previous school buildings in the east of the site have been demolished and re-developed as a separate car park area. 	<ul style="list-style-type: none"> School to the east has been redeveloped.

3.3 Geological Conditions

The geology underlying the site was established via review of the British Geological Survey (BGS) online geological map viewer, BGS Geological Sheet NS76NW (1: 10,000 scale Solid, Drift and Drift Thickness editions), and historical borehole records from the site and surrounding area.

Made Ground

No made ground is recorded onsite in published plans. However, made ground of unknown depth and composition is anticipated as being present, associated with historical development and demolitions within the site.

Superficial Deposits

Published plans record the superficial deposits at the site as comprising glacial till deposits, consisting predominantly of cohesive soils. The drift is indicated to be in the region of 20.0m thick.

Four historical borehole records are positioned within the site boundaries. Borehole BS76NW373 in the north west of the site recorded brown sandy clay to 3.25m and underlying boulder clay to rockhead at 21.03m. Borehole NS676NW375 located in the 'courtyard' area of the main building recorded clay and stone fill to a depth of 2.44m and then underlying boulder clay to a depth of 18.64m. A borehole in the centre north of the site (NS76NW376) recorded tar over concrete over fill to 2.45m and then underlying boulder clay to a depth of 20.48m. In the north east of the site, in the north of the eastern car park tar over 0.15m of concrete was encountered and ash and sandstone fill was recorded to a depth of 7.63m before recording boulder clay to rockhead at 22.63m (Borehole NS76NWNW374). There are no historical publicly available boreholes for the southern area of the site.

Bedrock

Published plans record the bedrock below the site as belonging to the Scottish Middle Coal Measures comprising cyclical sequences of sandstones, mudstones, siltstones with seams of coal and ironstone.

The strata is indicated to dip to the south west at an unspecified angle. The Glasgow Splint Coal and Virgin Coal are shown to outcrop approximately 125m to the east of the site and are conjectured to underlie the site at shallow depths. The Airdrie Blackband Ironstone/Coal and Airdrie Virtuewell Coal are shown to outcrop approximately 500m and 600m to the north east and may potentially underlie the site at shallow depths. Although not shown to outcrop within the site, based on the recorded geological stratigraphy of the area, the Ell Coal (also known as the Glasgow Ell) is also conjectured to underlie the site at shallow depths.

Historical boreholes sunk in the north of the site all recorded two solid seams of coal. The upper seam often recorded as 'splinty' was recorded at depths of between 29.17m and 38.60m and a thickness of between 0.46m and 1.59m. The lower seam, often described as bright coal was encountered at depths of between 30.54m and 33.28m and a thickness of between 1.08m and 1.45m. The general descriptions of the seams, recorded depths and thickness suggest that they are representative of the Glasgow Splint and Glasgow Virgin seams respectively however it is noted that the Ell is known to exist as two distinct leaves of coal and the recorded seams may be representative of the Ell.

Depth to bedrock from historical boreholes is recorded between depths of 18.64m – 23.52m and generally comprising mudstone.

3.4 Preliminary Mineral Stability Risk Assessment

The Coal Authority online interactive map indicates that the site is located within a Coal Mining Reporting Area and within a Development High Risk Area. The site is also noted to be within an area of shallow probable workings and as a result, a Coal Mining Consultants Report was procured from the Coal Authority.

The report indicates that the site is within an area of past underground mining with the Airdrie Black Band Ironstone, Virtuewell Coal and Kiltongue Coal, known to have been worked beneath the site at depths of between 37m and 102m below ground level. The Report notes that the seams dip to the south west at angles of between 1.0 degrees to 5.7 degrees.

The report notes that there are probable unrecorded shallow workings beneath the site.

The Coal Authority holds over nine mine abandonment plans that intersect some, or all of the site boundary.

There are no recorded mine entries within the site. There are no recorded coal mine entries known to the Coal Authority on, or within 20 metres of, the site boundary. Five mine shafts have been recorded in the wider area, and the closest of these is located 32m south.

The site is not within the boundary of an opencast site from which coal has been removed by opencast methods, nor is it within 200m of the boundary of an opencast from which coal is currently being removed by opencast methods.

There is one claim of coal mining subsidence approximately 50m to the north east of the site, for a residential property on Kildonan Street. There is no current stop notice delaying the start of remedial works or repairs on the property however the Coal Authority notes the site is adjacent to an area of previous interest where there was an investigation and where necessary, remediated issues relating to coal mining subsidence were carried out. The Coal Authority has not received a damage notice or claim for the site, or any property within 50m of the site, since 31st October 1994 and the Coal Authority has no record of a mine gas emissions requiring action.

BGS Geological Sheet NS76NW Mining Within 30m of Rockhead (Coal and Ironstone) 1:10,000 scale map edition records a known area of mining within 30m of rockhead in the south and north east of the site. In addition, the map shows several boreholes approximately 100m to the west which encountered old mineworkings less than 30m below rockhead outwith an area of known mineworkings.

From the review of the anticipated geology underlying the site, it is conjectured that the Glasgow Ell, Glasgow Splint, Virgin, and Airdrie Virtuewell Coals and Airdrie Blackband Ironstone underlie the site at potentially shallow depths. The Coal Authority notes that the Airdrie Blackband Ironstone, Airdrie Virtuewell and Kiltongue Coals were worked below the site and that unrecorded shallow workings could also be present. Review of the Economic Geology of the Central Coalfield of Scotland notes that both the Glasgow Splint and Virgin Coal seams were worked extensively within the Coatbridge area.

Historical boreholes within the site have recorded two seams of coal considered to be representative of either the Glasgow Splint and Virgin Coal seams or leaves of the Glasgow Ell Coal. No workings were recorded within the historical boreholes sunk within the site, however borehole records are limited and there is no publicly available borehole data for the south of the site. In addition, a borehole approximately 25m to the west of the site (NS76NW5341/8) recorded packed waste, considered representative of historic workings at the general depths considered of the Glasgow Splint and Virgin seams or the Ell Coal Seam.

In consideration of the above, the risk associated with mineral instability is considered to be high and further assessment is required.

3.5 Quarrying

No evidence of quarrying has been recorded at the site or nearby surrounding area on historical map extracts and consequently risks are considered to be low.

3.6 Hydrology and Hydrogeological Conditions

While definitive information in relation to the precise groundwater conditions was not possible from the available documentary information, we can provide the following general comments based on our researches:

Table 2: Hydrology and Hydrogeology

Surface infiltration	The rate of surface water infiltration or of possible lateral shallow groundwater migration will be determined by the nature of the shallow soils and their permeability. The superficial deposits at the site are anticipated to made ground over cohesive glacial till. Infiltration rates are therefore anticipated to be low to medium.
Surface water run-off	Surface water run-off from the site is anticipated to drain to existing sewers.
Surface Watercourses	The closest surface watercourse is noted to be an unnamed drain 426m to the south west.
Shallow Aquifer	The Groundwater Framework Directive created the definition of groundwater as being any groundwater present within the ground and established that all groundwater required protection. The superficial deposits underlying the site may contain limited volumes of groundwater. To be classified as a groundwater body, the shallow aquifer would need to be capable of supplying 10m ³ a day or 50 people with water. The superficial deposits beneath the site are likely to comprise significant thicknesses of cohesive glacial till and are therefore unlikely to meet this definition. In addition, SEPA does not hold any information on the superficial deposits at the site.

Deep Aquifer	<p>The SEPA/ BGS Bedrock Aquifer Map records the underlying bedrock as minor or moderately permeable aquifer.</p> <p>According to the SEPA Water Environment Hub, the bedrock belongs to the Glasgow and Motherwell groundwater body which is assessed as being of 'Poor' overall quality with 'Poor' water quality. Pressures on the water quality of the aquifer are listed as legacy pollution (legacy mining or quarrying) and point source discharge (Past land contamination).</p>
Water Supply	There are no recorded water abstractions within 1km of the site.

3.7 Public Register and Regulatory Consultation

The following section includes a summary of information obtained by Landmark Group from the Local Authority and other sources; a correspondence summary is presented within Table 3 below. The distances to the environmental features have generally been established from the centre of the site, with relevant features within 250m of the site noted. Landmark have advised that the Scottish Environment Protection Agency does not currently supply any of its data to third-party companies including Landmark, due to data licensing restrictions. Within the Envirocheck Report there are certain datasets which were provided to Landmark by SEPA as a 'one-off' supply in the late 1990s and early 2000s. Other SEPA datasets have never been available to Landmark, nor to any other third-party company, and therefore will not be present in the Envirocheck Report.

Table 3: Public Register Information

Environmental Information	Contaminated Land Register	Not on register.
	Discharge Consents	There are no discharge consents registered to the site. The nearest consent is located approximately 443m south east of the site, relating to a surface water sewage discharge. The receiving surface water body is not recorded.
	Pollution Incidents	None recorded within 1km of the site.
	Statutory Enforcement or Prohibition Notices	None recorded within 1km of the site.
	L A Pollution Prevention & Controls	None recorded onsite. The nearest authorised consent is located approximately 298m south west of the site, registered to Asda Stores Ltd, relating to Part B air pollution processes.
	IPPCs or IPCs	None recorded onsite. The nearest IPC is registered to Allied Distilleries 856m south of the site relating to combustion processes within the fuel and power industry.
	COMAH* or NIHHS**	None recorded within 1km of the site. The HSE Planning Advice Web App (accessed 03/08/2021) confirms that the site does not fall within the consultation distance of any major hazard site or major accident hazard pipeline.
	Radioactive Substance Licenses	None recorded within 1km of the site.
	Urban Soil Chemistry	<p>No BGS estimated soil chemistry for the site. The closest BGS estimated soil chemistry recorded is located 144m to the east and is as follows:</p> <ul style="list-style-type: none"> • Arsenic: 7.4mg/kg; • Cadmium: 0.10mg/kg; • Chromium: 94.20mg/kg; • Lead: 180.3mg/kg;

		<ul style="list-style-type: none"> • Nickel: 54.20mg/kg.
Waste	Registered Landfill Sites	None recorded within 1km of the site.
	Local Authority Recorded Landfill Sites	Nearest site is recorded 958m northeast of the site, described as 'Northburn Landfill site, Northburn Road, Coatbridge'. Types of waste is not described.
	Waste Transfer Sites	Nearest site is recorded 931m northwest of the site, described as 'Greenhill Waste Transfer and Recycling'. Types of waste is not described.
	Waste Treatment or Disposal Sites	Nearest is recorded 725m east of the site and relates to a scrapyards (Fallon Motor Spares).
Mining	The Coal Authority interactive map indicates that the site is located in a Coal Mining Reporting Area and lies within a development high risk area. This is discussed in more detail in Section 3.4 of this report.	
Ground Stability Hazards	The site is in an area which may be affected by coal mining activity. There are no other recorded ground stability hazards at the site.	
Mineral Sites	Nine BGS recorded mineral sites are recorded within 250m of the site. The closest are Dunbeth Coal Pit located 40m to the north west and High Coats No 3 Pit located 54m to the south west. Both pits were retrieving coal.	
Fuel Stations	Closest Fuel Station is noted 202m south.	
Contemporary Trade Directory Entries	There are no Contemporary Trade Directory entries for the site itself, however several active entries are located within close proximity to the site including: <ul style="list-style-type: none"> • Esso Petrol Filling Station located 202m south/ Wallpaper and wall coverings retailers located 8m north and 31m south east; • An inactive dry cleaners 204m south west. 	
Sensitive Land Uses	An area of adopted green belt is located approximately 468m north east.	
Listed Buildings	The municipal buildings including boundary walls, railings and gates are a category B listed building. There are no listed buildings at the site or in the immediate site surrounds. The site is within the Blairhill and Dunbeth Conservation area.	
Groundwater Vulnerability	The natural superficial soils are likely to be of low permeability drift deposits. The underlying bedrock strata is indicated to be a minor or moderately permeable aquifer.	
Surface Watercourses	The closest surface water feature is noted to be the Monkland Canal which is culverted and appears at the surface briefly approximately 326m to the south west. It appears to approximately flow to the west. SEPA classifies the Monkland Canal to have a 'High' Water quality and an overall status of 'Good'.	
Flood Risk	According to the online SEPA flood risk management map the A small area in the centre of the site is indicated to be at low to medium risk of surface water flooding.	
Radon Control	The Public Health England UK Map of Radon indicates that the site is in an area where less than 1% of homes are at or above the action level. However, current HPA guidance recommends that all new development include basic radon protection measures as standard.	

* COMAH – Control of Major Accident Hazard Sites

** NIHHS – Notification of Installations Handling Hazardous Substances

3.8 Preliminary Unexploded Ordnance Risk Assessment

In line with the guidance contained within CIRIA Report C681 – Unexploded Ordnance: a Guide for the Construction Industry, it is recommended that consideration be given to the risk of encountering unexploded ordnance (UXO) at development sites.

A review of Zetica UXOs Unexploded Bomb (UXB) Risk Map indicates that the site is located in a low UXB risk area and consequently no special precautions are considered to be required in relation to future ground investigations or site redevelopment.

4.0 PRELIMINARY CONCEPTUAL SITE MODEL

4.1 General

The risk-based approach to the assessment of sites is founded on the "contaminant— pathway— receptor" relationship, using the following definitions;

Contaminant: ("source") - the hazardous substance/agent. In many cases this will be a potentially hazardous chemical present on or within the ground at concentrations that are considered potentially hazardous.

Receptor: ("target") - the entity (e.g. human, animal, water, vegetation, buildings, services) that is vulnerable to the adverse effects of the hazardous substance or agent.

Pathway: the means by which a hazardous substance or agent comes into contact with, or otherwise affects a receptor.

For a risk to exist there must be a contaminant capable of causing harm, a receptor sensitive to that contaminant, and a pathway linking them. If there is no link between the contaminant and receptor then there will be no unacceptable risk to that receptor posed by the contaminant.

The contaminant—pathway—receptor relationship is often known as a "pollutant linkage". On an individual site there may be more than one such pollutant linkage, and each of these requires individual assessment. An effective risk assessment and Conceptual Site Model (CSM) aims to identify all the pollutant linkages.

In broad terms, risk assessments consider the following types of receptor:

- Humans (current and future site users or construction workers).
- Environment, i.e. water (ground and surface waters), flora and fauna.
- Structure and fabric of buildings and the associated infrastructure.

The conceptual site model is derived from the data collected from the desk-top researches and walkover survey. The model draws together and summarises the key information. The conceptual site model presents a picture of the current and potential future contamination at the site in the context of the site's environmental setting, taking into account the local hydrology, hydrogeology, geology and historical land use. It includes an assessment of the following:

- The known or potential sources of contamination at a site.
- The potential pathways whereby chemicals could be introduced into the ground e.g. via leakages from underground tanks, deposition of dust etc.
- The potential for those chemicals to migrate away from the source areas e.g. transport through the unsaturated (soils) and saturated (groundwater) zones.
- Identifies the different types of human populations (e.g., residents, workers, recreational visitors) who might come into contact with contaminated media.
- Lists the potential exposure pathways (e.g., ingestion of contaminated water, inhalation of chemicals in air, contact with contaminated soil etc.) that may occur for each population or receptor.

The model forms a central tool in both the assessment of the need for a site investigation and the design of any investigation. It should be recognised, however, in most cases, the development of a site introduces additional receptors, which may not be present in the pre-development stage.

The potential sources of contamination identified by this desk study are listed in Table 4 below.

Table 4: Contaminants of Concern.

THE SITE	Industrial Activity/Site Use	Potential Contaminative Processes	Associated Potential Contaminants
Current	<ul style="list-style-type: none"> Disused office space; Car park. 	<ul style="list-style-type: none"> Potential leaks and spills from parked cars; Potential leaks and spills of any hazardous materials stored at the site; Ground and mine gas emissions. 	Unknown, but may include asbestos, metals and hydrocarbons (TPH and PAHs), BTEX, phenol, VOCs, SVOCs, ground gas (carbon dioxide, methane).
Historical	<ul style="list-style-type: none"> Construction/demolition materials; Office Space; Chemical/poison store; School; Car Park. 	<ul style="list-style-type: none"> Potential contamination within any made ground/demolition materials present at the site; Ground and mine gas emissions; Potential leaks and spills of hazardous materials stored within former buildings; Waste management and material storage. 	Unknown, but may include asbestos, metals and hydrocarbons (TPH and PAHs), BTEX, phenol, VOCs, SVOCs, ground gas (carbon dioxide, methane).
SURROUNDING AREA	Industrial Activity/Site Use	Potential Contaminative Processes	Associated Potential Contaminants
Current	<ul style="list-style-type: none"> Construction/demolition materials; School; Car Park; Residential properties. 	<ul style="list-style-type: none"> Potential contamination within an made ground/demolition materials; Potential leaks and spills from cars. Ground and mine gas emissions. . 	Unknown, but may include asbestos, metals and hydrocarbons (TPH and PAHs), BTEX, phenol, VOCs, SVOCs, ground gas (carbon dioxide, methane).
Historical	<ul style="list-style-type: none"> Construction/demolition materials; School; Car Park; Residential properties; Coal Mining. 	<ul style="list-style-type: none"> Potential contamination within any made ground/demolition materials present at the site. Potential made ground/arising from historical mining activities. Ground and mine gas. 	Unknown, but may include asbestos, metals and hydrocarbons (TPH and PAHs), BTEX, phenol, VOCs, SVOCs, ground gas (carbon dioxide, methane).

The potential contaminants listed above are intended as a guide to the possible contaminant species which may be encountered in such sites, and other contaminants could potentially be present. Off-site sources within 300m of the site boundaries have primarily been considered, as sources at greater distances would generally be considered unlikely to impact upon the subject area.

On the basis of the above, a preliminary qualitative risk assessment has been prepared. The potential source-pathway-receptor relationships identified at the site, based on the preliminary qualitative risk assessment, are summarised below:

Table 5: Preliminary Qualitative Risk Assessment

Contaminant Sources (potential)	<p>Potential sources of contamination have been identified at the site associated with current and historical onsite land uses and potential onsite migration from nearby offsite sources. The following contaminants could be encountered:</p> <ul style="list-style-type: none"> • Metals; • Petroleum hydrocarbons (TPH, BTEX and PAHs); • Asbestos; • VOCs and SVOCs; • Ground gas (carbon dioxide, methane, etc.); • pH; • Inorganic chemicals (sulphates, sulphides, cyanides, etc.).
Pathways (potential)	<p>The exposure pathways relevant to the proposed residential end use are:</p> <ul style="list-style-type: none"> • Direct ingestion of impacted soils and groundwater or inhalation of contaminated dust and / or asbestos fibres; • Dermal contact with soil and impacted groundwater directly and dermal contact with indoor dust; • Inhalation of dust and vapours from ambient air and indoor air; • Uptake by flora and ingestion of homegrown vegetables; • Direct contact of contaminated soils and / or groundwater with foundation structures and buried services. <p>In addition, the following migration pathways have also been identified:</p> <ul style="list-style-type: none"> • Migration of ground gas into future properties and confined spaces; • Migration of ground gas through preferential pathways created by future foundation solutions (e.g. piled foundations or vibro stone columns); • Leaching of contaminants and migration through soils; • Migration of contaminants via groundwater.
Receptors (potential)	<p>The receptors relevant to the proposed residential end use are:</p> <ul style="list-style-type: none"> • Human: Site users (residents and visitors); • Human: Off-site receptors (the general public, surrounding residents and workers); • Human: Construction personnel working on the site during development activities; • Human: Service and utility personnel working on the site following development; • Building foundations constructed and services laid on the site; • Flora & Fauna; • Water Environment: Glasgow and Motherwell bedrock groundwater body;

Based on the former historical uses of the site and surrounding area, the site is considered to present a medium risk of contamination with respect to human health, building foundations and services and flora and fauna and a low to medium risk to the Water Environment.

4.2 Development Constraints related to Documented Ground Conditions

Contamination There is a potential for contamination within the soils and groundwater at the site associated with historical land uses (Chemical/poison store), made ground soils from historical demolitions and leaks and spills from vehicles within the car park. There is a history of potentially contaminative land uses in the nearby surrounding area including coal mining and consequently the potential for onsite contaminant migration through granular deposits cannot be discounted.

Intrusive investigation and environmental risk assessment are required to determine the site's suitability for a proposed residential end use and the requirement for and scope of any remedial measures. An assessment of potential risks to Water Environment receptors is also required.

Gas Emissions Potential sources of ground gas have been identified at the site. A programme of ground gas monitoring is therefore required to determine the level of risk present and the requirement for ground gas protection measures in future built development.

Foundations	It is anticipated that made ground will be present across the development area, although the nature and thickness of these materials has not been confirmed. The underlying natural soils (where present) are anticipated to comprise cohesive Glacial till at depth. There is also a potential for remnant foundations to be present associated with historic properties at the site.
Mineral Stability	A coal mining report procured from the Coal Authority indicates that the site is within an area of past coal mining with known economic coal seams beneath the site at shallow depths and a risk of unrecorded workings has also been highlighted. Historical boreholes sunk to the west of the site recorded conditions considered representative of shallow workings. The risk associated with mineral instability is therefore considered to be high and further action is required.

4.3 Site Investigation

An appropriate scope of works was therefore devised to accommodate the requirements of the brief, which was to attempt to determine any significant development constraints. These works were undertaken by reputable contractors and were implemented in general accordance with BS10175: 2017 - Investigation of Potentially Contaminated Sites and BS5930: 2015-Code of Practice for Site Investigations.

The objectives of the investigations, based on the information derived from the CSM were as follows:

- Provide information in relation to the nature of the superficial soils, thickness of made ground (where present) and spatial distribution of materials.
- Investigate the possible presence of contamination constraints based on the historical use and subsequent remedial measures.
- Assess the potential presence of elevated ground gas conditions or vapours.
- Assess the hydrogeological conditions beneath the subject area.
- Assess the geotechnical properties of the soils in relation to possible foundation solutions.
- Assess the mineral stability at the site.

The positioning of the sampling points was devised to provide reasonable coverage over the site area. The sampling rationale adopted from 0.0m - 1.0m was determined in accordance with R&D Technical Report P5-066/TR Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination and was specifically designed to assess potential surface contamination constraints.

Table 6: Rationale for Sampling at Different Depths

Depth Range	Rationale
0 – 0.5m*	To assess: <ul style="list-style-type: none"> • Human/animal intake arising from ingestion and dermal contact • potential for wind entrainment leading to inhalation (of contaminated soils and dusts) or deposition onto neighbouring land • surface water run-off (e.g. due to flash flooding) • uptake by shallow rooting plants (e.g. crops, ornamental and wild species) • surface leaching to groundwater
> 0.5m in made or natural ground	To assess: <ul style="list-style-type: none"> • Intake via ingestion/inhalation/dermal contact arising from ‘abnormal’ (or unpredicted) excavation (e.g. children digging dens) or for other purposes such as swimming pools, ponds, house extensions • Uptake by deep rooting shrubs and trees • Intake by, or arising from, the activities of burrowing animals • Intake arising from construction/maintenance of buildings and services, for example: <ul style="list-style-type: none"> <input type="checkbox"/> Foundations (usually within 2m of final formation level). <input type="checkbox"/> Water supply pipes, telecommunications, gas & power (0.5 – 1m of final formation level). <input type="checkbox"/> Sewers (from 0.5m > 1m of final formation level). • To locate perched water or groundwater. • To confirm depth of made ground. • To locate possible lateral pathways for gas or vapour migration in made ground. • To establish extent of any leaching of soluble constituents from superficial soils. • To detect ‘deep’ contaminants (e.g. gas generating materials, leachable materials, dense solvents located on top of an impermeable stratum). • To obtain information on ‘background’ soil properties. To locate ‘natural’ lateral migration pathways.
* Note that in some applications (particularly where an established use is in place, or where surface soil or deposits are susceptible to windblow, run-off or uptake by fauna and shallow rooting flora) it may be necessary to characterise the top 0 – 0.20m depth range	

Accordingly, the scope of works as detailed within Table 6 was implemented at the site. Detailed sampling protocols are included within Appendix B.

Aitken Laboratories Ltd carried out a ground investigation on the site with site work being undertaken in late June and early July 2021 under the direction of G3.

The site investigation comprised the drilling of 2 No. light cable percussive boreholes (numbered CP101 and CP102), 3 No. window sample boreholes (WS101 – WS103) and 2 No. rotary-percussive cored boreholes (RC101 and RC102).

Numerous services including an extremely high voltage Scottish Power underground cable and virgin media appliance cut through the site. A suitable standoff distance had to be maintained from the power cable, as such exploratory positions apart from WS101 were moved to the eastern car park site area.

An obstruction was encountered in borehole CP101, resulting in it being re-drilled at an adjacent location as CP101A. Standpipes were installed in selected borehole locations on completion of drilling to facilitate post-investigation groundwater and ground gas monitoring.

An Exploratory Hole Location Plan is included as Figure 3.

4.4 **Health & Safety**

No incidents were recorded during the fieldwork period.

Table 7: Scope & Methods of Investigation

Investigation Method	Justification/Description	Number	Depth Range	Sample Strategy/Density	Comments
Light Cable Percussive Boreholes (Aitken Laboratories Ltd – July 2021)	To determine the nature, composition and distribution of the superficial materials and to obtain representative samples for chemical analysis. Sampling frequency was generally at 0.1 and 0.5m, with subsequent samples taken every half metre or at each change of strata. The samples obtained were considered to be representative of the materials encountered. To provide an assessment of the geotechnical properties of the underlying materials.	2 (3 including re-drill)	8.00m	Non-targeted general site assessment.	<ul style="list-style-type: none"> • ‘Bulk’ (~1kg) samples obtained for general geo-environmental analysis – placed in clean sealed plastic tub. • Soils sampled and placed in clean amber glass container and sealed. • Sampling for volatiles was implemented into clean specialist vials. • All samples placed in cool storage containers for transfer to laboratory. • Borehole logs presented within Appendix A.
Rotary Cored Borehole (Aitken Laboratories Ltd – April 2021)	To allow assessment of the rock profile, ascertain the mineral stability and to obtain rock cores for laboratory testing.	2	40.00m	Non-targeted general site assessment.	<ul style="list-style-type: none"> • All borehole progress recorded by driller. • Rock core samples were logged by specialist mining geologist Mr Finlay Black. • Borehole log is presented within Appendix A.
Window Sample Boreholes (Aitken Laboratories Ltd – June 2021)	To determine the nature, composition and distribution of the superficial materials and to obtain representative samples for chemical analysis. Sampling frequency was generally at 0.1 and 0.5m, with subsequent samples taken every half metre or at each change of strata. The samples obtained were considered to be representative of the materials encountered. To provide an assessment of the geotechnical properties of the underlying materials.	3	4.30m – 5.00m	Non-targeted general site assessment.	<ul style="list-style-type: none"> • Samples obtained for geochemical analysis. • Samples obtained for general geo-environmental analysis placed in sealed amber glass jars and vials. • Sampling for volatiles was implemented into clean specialist vials. • All samples placed in cool storage containers for transfer to laboratory. • Window sample logs presented within Appendix A.
Gas Standpipe Installation (Aitken Laboratories Ltd – June and July 2021)	50mm combined gas/groundwater monitoring standpipe installed to assess potential presence of elevated ground gas concentrations and determine flow rates.	5	3.00m – 5.00m	Non targeted general site assessment	<ul style="list-style-type: none"> • Gas Measurements obtained from calibrated monitoring device. • Gas measurements included within Appendix A.
Groundwater Standpipe Installation (Aitken	50mm combined gas/groundwater standpipe to assess groundwater conditions and permit sampling for geo-environmental analysis. The monitoring well was constructed from 50mm diameter threaded HDPE slotted well screen	5	3.00m – 5.00m	Non targeted general site assessment of underlying groundwater conditions	<ul style="list-style-type: none"> • Groundwater observations included within Appendix A. • Standpipe construction detail included in Appendix A on borehole logs.

Investigation Method	Justification/Description		Number	Depth Range	Sample Strategy/Density	Comments
Laboratories Ltd – June and July 2021)	and blank casing. Washed filter gravel was utilised to fill the annulus between the screened section and borehole wall. Bentonite or lean mix concrete were placed above the filter gravel. The bore was completed with a threaded standpipe cap and cover.					
Geo-technical Laboratory Analysis (Aitken Laboratories Ltd-	To assess the geotechnical properties of the soils.	Quick undrained triaxial compression test	3	2.00m – 6.50m	Targeted assessment of various geotechnical parameters to assist in evaluating possible foundation solutions.	<ul style="list-style-type: none"> • Sampling and testing undertaken at the UKAS accredited laboratories of Aitken Laboratories. • Test results presented within Appendix A.
		Particle size distribution test.	2	4.00m – 5.00m		
Geo-chemical Laboratory Analysis (DETS Ltd – July 2021)	To assess the geochemical properties of the soils	G3 Soil Suite 1	9	0.20m – 2.00m	Targeted assessment of materials to assist in establishing presence and mobility of potential contaminants	<ul style="list-style-type: none"> • Sampling and testing undertaken at the UKAS accredited laboratories of DETS. • Test results presented within Appendix A.
		G3 Soil Suite 3	4	0.20m – 0.50m		
		Asbestos Screen	10	0.20m – 2.00m		
		Waste Acceptance Criteria	2	0.20m – 0.50m		

5.0 ENCOUNTERED CONDITIONS

5.1 Superficial Soils

Details of the ground conditions encountered at each of the exploratory locations are presented on the respective borehole and trial pit logs. The relevant data is presented within the contractor's factual report, included as Appendix A of this report. A summary is presented below.

Surfacing

Tarmac surfacing was recorded in all exploratory hole locations. Thicknesses ranged from 0.10m to 0.15m.

Made Ground

Made or disturbed ground was encountered in all exploratory hole locations from ground level to depths of between 1.50mbgl (WS101) and 4.20mbgl (CP101). It is noted that made ground was recorded to a depth of 10.00m within both rotary boreholes. The recorded depth of made ground within the soil boreholes are considered representative of the actual thickness of made ground deposits at the site. Due to the difficulty in logging superficial deposits within rotary holes, the recorded thickness of made ground soils in the rotary holes are considered erroneous.

Made ground generally appeared as an initial horizon of hardcore present below tarmac surfacing to depths of between 0.30m and 0.50mbgl with the exception of borehole CP102 which recorded fine to coarse sand and gravel of hardcore with ash and cobbles to a depth of 1.90mbgl.

Underlying the above, with the exception of CP102, further made ground generally described as dark grey sometimes silty fine to coarse sand and gravel with ash brick, cobbles, sometimes concrete, slag and pockets of clay was recorded to a maximum depth of 4.20m (CP101).

With the exception of the extraneous material described above, there was no other visual or olfactory evidence of contamination recorded.

Natural Strata

Underlying the made ground, the natural superficial deposits were recorded to comprise the anticipated cohesive glacial till generally described as firm or stiff greyish brown sandy gravelly CLAY with cobbles. In general, the natural deposits increased in strength with depth.

5.2 Solid Geology

Bedrock described as mudstone was encountered at a depth of 22.00m in rotary borehole RC101 and 22.00m in borehole RC102. The solid geology recorded was generally the anticipated sedimentary sequences of mudstones, sandstones and siltstones. Solid very soft coal was encountered in borehole RC101 between depths of 26.20m and 27.40m however no core could be retrieved. In addition a thin band of ironstone between depths of 32.64m and 32.83m was recorded and hard bright coal at a depth between 33.76m and 34.13m. Borehole RC102 recorded a void, with a loss of flush, immediately underlain by waste or collapsed ground between depths of 32.65m and 34.16m. At a depth of between 35.29m and 35.89m solid bright coal was recorded.

A loss of flush, cavities and recorded waste or collapsed ground recorded in RC102 is considered representative of workings conjectured at the level of the Glasgow Splint or the upper leaf of the Glasgow Ell seam. The underlying black bright coal encountered in both rotary boreholes

between a depth of 33.76m and 35.89m with a thickness of between 0.37m and 0.60m is considered representative of the lower leaf of the EII seam.

5.3 Obstructions

An obstruction recorded as bedrock or a boulder was recorded in WS103 at 4.30m depth. Adjacent rotary drilling confirmed rockhead at a depth of 22.00m – 24.00m. As such this obstruction in the natural glacial till is considered to be representative of a boulder.

5.4 Groundwater

Groundwater was recorded in two locations during the fieldwork at depths of 2.00mbgl and 4.20mbgl, generally at the horizon between the made ground and cohesive Glacial till.

Groundwater monitoring standpipes were installed in selected boreholes to allow for groundwater levels to be monitored. Monitoring was undertaken on six occasions over a two-month period. A summary of groundwater strikes encountered during site works, details of the borehole installations and the groundwater levels recorded during post-site works monitoring are presented in Table 8 below.

Table 8 – Groundwater Levels

Location	Depth to water in fieldwork (m)	Standpipe Response Zone	Median depth to groundwater in monitoring (m)
CP101	4.20	Made Ground and natural cohesive deposits	3.34
CP102	2.00	Made Ground and natural cohesive deposits	2.75
WS10	Dry	Made Ground and natural cohesive deposits	1.20
WS102	Dry	Made Ground and natural cohesive deposits	1.99
WS103	Dry	Made Ground and natural cohesive deposits	2.04

5.5 Scope of Chemical Analysis

Based on the historical assessment, former site use, Preliminary Conceptual Site Model and information obtained from the previous investigations, the analysis was implemented in accordance with the general guidance presented within Science Reports SR2 and SR3 – ‘Human health toxicological assessment of contaminants in soil’ and ‘Updated technical background to the CLEA model’.

In order to confirm whether the superficial soils present any risk to human health of future site users, soil samples for chemical analysis and contamination risk assessment were recovered from the trial pits.

The analysis suite selected for 9 No. soil samples included a range of common contaminants relevant to human health risk assessment including metals (arsenic, cadmium, chromium, chromium VI, copper, lead, mercury, vanadium, nickel, selenium and zinc), cyanide, sulphide, phenol (total), speciated total petroleum hydrocarbons (TPH), and speciated polyaromatic hydrocarbons (PAH). Soil organic matter (SOM) content, sulphate and pH testing were also carried out and all made ground samples were screened for the presence of asbestos.

A total of 4 No. samples of soil were subject to leachate analysis testing to include metals (arsenic, cadmium, chromium III, chromium VI, copper, lead, mercury, nickel, selenium and zinc), boron, calcium, sulphate, sulphide, cyanide, speciated total petroleum hydrocarbons (TPH), speciated polyaromatic hydrocarbons (PAH), phenol, hardness and pH.

A total of 2 No. samples were subject to Waste Acceptance Criteria (WAC) testing to provide an initial indication of the likely categorisation of soils which may have to be removed from the site as part of the development.

All samples were submitted to Derwentside Environmental Testing Services Ltd (DETS) in Consett, which is a UKAS accredited laboratory, for chemical analysis. The results are presented within DETS Certificates of Analysis Ref. 21-14075, dated 14th July 2021 included here as Appendix A.

The testing strategy was devised to predominantly target made ground soils, ensuring spatial coverage, both horizontally and vertically. In addition to the made ground, the underlying natural soils were also tested locally to give an indication of the potential for vertical contaminant migration. Table 8 below summarises the testing undertaken:

Table 9 – Testing Strategy

Location	Strata identified	No of samples assessed
CP101	Tarmac over 2 No. made ground horizons and cohesive Glacial till Deposits. Water strike at 4.20mbgl.	2 No. soils suite and asbestos screen (made ground); 1 No. leachate suite (made ground);
CPC102	Tarmac over 1 No. made ground horizons and cohesive Glacial till Deposits. Water strike at 2.00mbgl.	1 No. soils suite and asbestos screen (made ground); 1 No. soils suite and asbestos screen (natural Glacial Till); 1 No. WAC (made ground).
WS101	Tarmac over 2 No. made ground horizons and cohesive Glacial till Deposits. No groundwater.	2 No. soils suite and asbestos screen (made ground); 1 No. leachate suite (made ground).
WS102	Tarmac over 2 No. made ground horizons and cohesive Glacial till Deposits. No groundwater.	2 No. soils suite and asbestos screen (made ground); 1 No. leachate suite (made ground).
WS103	Tarmac over 2 No. made ground horizons and cohesive Glacial till Deposits. Boulder obstruction at 4.30m depth. No groundwater.	1 No. soils suite and asbestos screen (made ground); 1 No. leachate suite (made ground); 1 No. WAC (made ground).

6.0 GEOTECHNICAL CONSIDERATIONS

6.1 General

For the purposes of the assessment and for summarising the geotechnical properties, we have split the materials into the following sub-groupings:

- Made Ground;
- Cohesive Glacial Till;
- Sedimentary Bedrock.

6.2 Made Ground

Made ground was recorded in all exploratory holes to depths of between 1.50m and 4.20mbgl, generally comprising upper horizons of greyish brown silty fine to coarse sand and gravel of hardcore with ash and cobbles and often an underlying strata of made ground generally described as grey slightly silty fine to coarse sand and gravel with ash, concrete, brick, slag, pockets of clay and cobbles. No overt visual or olfactory evidence of contamination was recorded in any of the exploratory holes.

Made ground, by its nature is heterogeneous and it is likely that it will vary in consistency and content across the footprint of the site. In total 7 No. SPT tests were carried out within the made ground and these recorded N values of between 4 and 12, reflecting the highly variable nature of this horizon. Consequently, no further geotechnical assessment has been undertaken.

6.3 Glacial Till

Underlying the made ground, natural soils comprised cohesive Glacial Till Deposits.

Cohesive deposits are generally described as firm often becoming stiff grey or brown sandy gravelly CLAY with cobbles. A total of 7 No. SPTs were carried out, recording N values of between 12 and 15 generally indicative of firm strength soils. Using the correlation suggested by Stroud and Butler, these results can be used to calculate approximate shear strengths of between 62.4kN/m² and 78kN/m².

Three undrained triaxial compression tests were carried out on samples of natural cohesive glacial till at depths of 2.00m, 4.00m and 6.50m. An average shear strength of between 49kN/m² and 72kN/m² was recorded. The results of the triaxial tests are summarised in table 10 below.

Table 10 – Summary of Quick Undrained Triaxial Tests

Sample	Depth (m)	Moisture Content (%)	Angle of Shear Resistance (°)	Average Shear Strength (kN/m ²)	Indicative Strength
CP101	5.00	17.2	2	72	Medium
CP102	6.50	16.2	2	61	Medium
WS101	2.00	15.5	2	49	Medium

6.4 Bedrock

Rockhead was recorded in rotary boreholes at a depth of 22.0mbgl and 24.00mbgl described as mudstone. The bedrock beneath the site comprised of sequences of mudstones, siltstones,

sandstones, seatclays and seams of coal. No geotechnical assessment has been undertaken on the bedrock at the site.

Voids with a loss of drilling flush and packed waste both considered representative of historical workings were recorded in the south of the site. The mineral stability of the site is discussed further in section 10.0

6.5 Foundation Design Criteria

In consideration of the geotechnical properties of the soils established above, and of the observations made during the investigations, we would provide the following general comments in relation to possible foundation options.

The development proposals for the site comprise the development of the existing main building and the construction of new low rise residential properties in the east of the site. The foundation loads associated with the new buildings proposed for the site are not known at the time of reporting but are anticipated to be in the order of 35-50kN/m run of wall. The following assessment has been prepared to give an indication of likely foundation options associated with the construction of new properties at the site. Given the nature of the anticipated development it is considered that the structures will meet the criteria of Geotechnical Category 1 of Euro Code 7.

Made ground is present across the site, recorded to depths of between 1.50mbgl and 4.20mbgl. Due to its inherent variability, made ground is not generally considered suitable for the support of foundations. As a result, it will be necessary to carry all loads through these deposits to the underlying Glacial till Deposits. A drawing indicating the recorded depth of made ground deposits is indicated in Figure 4.

Cohesive glacial till deposits are recorded immediately below the made ground in all exploratory positions. The cohesive soils were recorded as firm strength soils often becoming stiff with depth. 'N' values of between 12 and 15 were recorded in the natural soils, which correlate to shear strength of 62.4kN/m² and 78kN/m². A bearing capacity of 100kN/m² would be appropriate for these soils.

Based on the anticipated loads likely to be generated by the proposed structures, and in consideration of the extent and depth of unsuitable made ground, shallow strip foundations will not be suitable for use at the site. It is considered approximately 80% of the site is suitable for deepened trench fill placed on to the natural, firm or better cohesive glacial till at depths of up to 2.50m. For the remaining 20% of the site in the north, where made ground was recorded at depths of 4.20m in borehole CP101, it is considered piled foundations are necessary, driven through the unsuitable made ground and placed on to the firm (or better) cohesive glacial till. It is generally considered by most specialist foundation contractors that the use of vibro-improvement is only considered suitable on made ground that has remained in situ for at least 10 years. As the origin of the made ground beneath the site is unknown and in recognition of Ordnance Survey maps indicating the east car park area being redeveloped during the same time as the adjacent high school relatively recently, the made ground soils are unlikely to be considered suitable for vibro-improvement. However, copies of borehole logs have been passed on to specialist ground-improvement contractors for their assessment on the suitability of vibro-stone piles as an alternative to conventional driven piled foundations.

6.6 Adoptable Road & Car Park Construction

Made ground is anticipated to be present at roads and car park formation level across the site. As a result, it is recommended that a full capping layer be used beneath any new roads or car parking areas. In the event that a new adoptable road is proposed at the site, the design of road build-up should be discussed and agreed with the local authority Roads Department.

6.7 Foundation Concrete

A total of 19 No. soil samples from depths between 0.20m and 2.00m were tested in accordance with BRE Special Digest 1 (2005). The soil samples recorded soluble sulphate levels of between 37mg/l and 1,100mg/l and pH values in the range 6.1 to 8.7. It is noted that recorded soluble sulphate levels were generally between 37mg/l and 220 mg/l with a level of 1100mg/l recorded in one occasion from a sample retrieved from borehole WS102 at 1.0m depth.

The site has been assessed as brownfield in view of the site history and made ground of unknown origin, and we have assumed a potentially mobile shallow groundwater system to be present, based on the findings of the investigations.

Following the guidance set out in the Table C2 of the Digest the general characteristic soluble sulphate content is 220mg/l and the characteristic pH is 7.2. On the basis of these characteristic values, the Design Sulphate class for the site has been determined as DS-1 and the Aggressive Environment for Concrete Class as AC-1. It is recommended that any concrete used below ground on the site is designed for this class of environment. However, consideration should be given to locally increasing the Design Sulphate class to DS-2 AC-1s in the area around borehole WS102.

6.8 Site Drainage

Soil infiltration tests have not been carried out at the site due to the presence of thick variable made ground soils and underlying low permeability glacial till. It is considered that soakaway drainage is unlikely to be possible at this site.

6.9 Other Considerations

Water strikes were recorded locally within boreholes CP101 and CP102 generally at the interface between made ground deposits and the underlying cohesive glacial till at depths of 2.00m (CP102) and 4.20m (CP101) Subject to weather conditions open sump pumping should cope with the volumes of groundwater which may be expected to enter shallow foundation or services excavations, unless these are left open for a protracted time. Care should be taken to ensure that the pumping operation does not remove material from surrounding ground thus causing instability. To prevent the deterioration of prepared formations in the presence of water, it would be advisable to place a blinding layer of concrete, or foundation concrete itself as soon as practicable after excavation.

If any field drains or old sewer pipes are encountered in the development works then they should be diverted into new intercepting drains and not allowed to discharge water into the solum of any building or the formation of roadways.

All excavations should be inspected by a competent person and if signs of instability are evidenced then suitable precautions, such as close support or battering back to a safe angle should be employed.

7.0 CHEMICAL CONTAMINATION

7.1 Statutory Position

The contaminated land regime in Part IIA of the Environmental Protection Act 1990 (Part IIA) was introduced specifically to address the historical legacy of land contamination. One of the key features of Part IIA is a statutory definition of “contaminated land” – which is:

“any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

- a) Significant harm is being caused or there is a significant possibility of such harm being caused;
or
- b) Pollution of the Water Environment is being, or is likely to be caused”.

A revised Statutory Guidance Edition 2 (Paper SE/2006/44) to the Act was published by the Scottish Executive in May 2006, which, in addition to the above, raised the issues of what is determined to be ‘significant’.

Neither the above definition, nor the accompanying statutory guidance provides any absolute, measurable criteria. Therefore, determining whether any land is “contaminated land” is likely to involve local authorities making a judgemental decision in each individual case.

The legislation does, however, seek to ensure the identification and remediation of sites that pose “unacceptable risks” to human health or the wider environment, in the context of their current or proposed use.

The approach to “unacceptable risk” is based on the principles of risk assessment, including the concept of a contaminant, a pathway and a receptor, which if combined, form a pollutant linkage. This relationship has previously been described within the site Preliminary Conceptual Model (Section 4.0).

The legislation was designed and intended to encourage the application of voluntary remediation of land scheduled for redevelopment, rather than regulatory enforcement action, and to integrate with the established role of Planning and Building Control departments in the approvals process. Both remediation and the associated validation now form a critical part of the regulatory procedure.

Current Planning Policy clearly states, that the standard of remediation to be achieved through the grant of planning permission for new development, is the removal of unacceptable risk and making the site ‘suitable’ for its new use.

The “suitable for use” approach then consists of three elements:

- Ensuring that land is suitable for its current use.
- Ensuring that land is made suitable for any new use.
- Limiting requirements for remediation, to only the work necessary to prevent unacceptable risks to human health or the environment in relation to the current or future use of the land, for which planning permission is being sought.

As a minimum, after carrying out the development and commencement of its use, the land should not be capable of being determined as ‘contaminated land’ under the definitions stated above.

7.2 Technical Guidance - Soil Guideline Values

To provide an initial assessment of the potential significance of contaminant concentrations detected in soil samples collected from the site, a generic risk assessment is presented below using soil assessment criteria that are derived to be protective of human health.

The soil assessment criteria are intended to provide a conservative means of initial assessment. Where contaminant concentrations are less than the appropriate assessment criteria, it is considered unlikely that the contaminant concentrations will pose a potentially unacceptable risk to human health. Where a contaminant concentration exceeds the assessment criteria, it does not automatically follow that an unacceptable risk exists, but that further assessment may be necessary to quantify the risk taking into account site-specific information.

A conversion of the existing listed office building and several new residential properties in the east of the site are proposed. Development proposals comprise the construction of new low rise residential housing with private gardens, areas of communal soft landscaping and car parking. For initial screening of the soil data the test results obtained have been assessed with respect to a 'residential with homegrown produce' end-use scenario. Should this configuration or proposed land use change then the basis of the risk assessment presented in this report will require to be reviewed and amended to reflect changes to the CSM, as appropriate.

To assess the potential risks for this end use, assessment criteria for soil have been used that are protective of human health. Soil Guideline Values (SGVs) have been used where available; where SGVs are not available, other generic assessment criteria (GAC) have been used (based on the same pathway and receptor data as used in deriving SGVs). The SGVs used are those produced by the Environment Agency in 2009. For contaminants where no SGV exists, assessment criteria for soil have been utilised that are protective of human health and these are based on the published LQM/CIEH S4ULs Generic Assessment Criteria (GACs). The only exception to this is lead which is based on the C4SL published by DEFRA in 2013. The SGVs and GACs are intended to provide a means of assessing chronic risks to human health, and are dependent on exposure in the context of the specified land use, in accordance with the 'suitable for use' approach; they do not alter the assessment of risk to other environmental receptors (groundwater, surface water, flora, fauna, etc.) or to acute risks to health. The SGVs and GACs represent intervention values which indicate that soil concentrations above these values could pose an unacceptable risk to the health of site users, and that further risk assessment/ investigation or remedial action is required.

7.3 Phytotoxicity

It is recognised that the CLEA derived SGVs do not provide any protection against the potential effects of phytotoxicity. In this respect, the assessment of phytotoxicity of the existing site soils with respect to future landscaping potential has been made by reference to maximum concentrations of potentially toxic elements provided in the Scottish Executive publication 'Prevention of Environmental Pollution from Agricultural Activity, A Code of Good Practice' (2005).

7.4 Risk Assessment – Soil Analysis

The Tier 1 risk assessment has been implemented utilising SGVs/GACs as described above and chemical analysis derived from the site as part of the current investigation. The site is proposed for a residential use understood to comprise a conversion of the existing listed building to residential flats with communal soft landscaped areas and car parking and the construction of several new low rise residential properties with associated private gardens and car parking. In consideration of the current development proposals, a 'residential with homegrown produce' end use was considered most suitable for the assessment. Some of these assessment criteria are

variable depending on Soil Organic Matter (SOM) content. At this site, SOM varied from 0.9% to 9.7% and consequently values for 1.0% SOM have been adopted as this represents the most conservative value. The risk assessment screening guidelines are included in Appendix C.

A summary of the range of concentrations relative to their respective reference concentrations is presented in the following tables, where exceedances are indicated by bold print.

Table 11 – Results of Inorganic Chemical Testing on Soils

Contaminant	Contaminant Range In All Samples (mg/kg)	Soil Reference Values Residential without Produce (mg/kg)	Soil Reference Values Phytotoxic pH>7 (mg/kg)
Arsenic	1.3 - 16	37	50
Boron (Water Soluble)	<0.2 – 0.9	290	
Cadmium	<0.1 – 0.3	10	3
Chromium	7.7 – 97.0	910	400
Chromium VI	<1.0	4.3	
Copper	29 – 120	2400	200
Lead	5 – 95	200	300
Mercury	<0.05	1.20	1
Nickel	13 - 61	180	110
Selenium	<0.5 – 2.8	250	3
Zinc	64 - 100	3700	450
Total Cyanide	<0.1	25	
Sulphide	20.0 – 240.0	250	
Water Soluble Sulphate (mg/l)	16 – 1100	500*	
pH	6.1 – 8.7	<6.5*	

* BRE

The Tier 1 soil contamination risk assessment recorded elevated concentrations of Water soluble sulphate and acidic pH, however this is discussed further in section 6.7 above.

It was noted the phytotoxic soil criteria was based on a pH of >7.0. It is considered this is the most relevant criteria to utilise as all samples tested with the exception of WS102 at 1.00m had a pH greater than 7.0. No samples tested recorded concentrations in excess of the phytotoxic assessment criteria.

All samples were also screened for the presence of asbestos, with no positive identifications.

Table 12 – Results of Organic Chemical Testing on Soils

Contaminant	Contaminant Range In All Samples (mg/kg)	Soil Reference Values Residential with Plant Uptake (mg/kg)
Total Phenols	<0.3	280
TPH Aliphatic C5-C6	<0.01	42
TPH Aliphatic C6-C8	<0.01	100
TPH Aliphatic C8-C10	<0.01	27
TPH Aliphatic C10-C12	<1.5 – 3.6	130
TPH Aliphatic C12-C16	<1.2 – 6.7	1,100
TPH Aliphatic C16-C21	<1.5 – 26.0	65,000
TPH Aliphatic C21-C35	<3.4 – 500	65,000
TPH Aromatic C5-C7	<0.01	70
TPH Aromatic C7-C8	<0.01	130
TPH Aromatic C8-C10	<0.01	34
TPH Aromatic C10-C12	<0.9 – 6.8	74
TPH Aromatic C12-C16	<0.5 – 7.2	140
TPH Aromatic C16-C21	<0.6 – 32.0	260
TPH Aromatic C21-C35	<1.4 – 870	1,100
Naphthalene	<0.03 – 0.06	2.30
Acenaphthylene	<0.03 – 0.16	170
Acenaphthene	<0.03 – 0.15	210
Fluorene	<0.03 – 0.13	170
Phenanthrene	<0.03 – 0.35	95
Anthracene	<0.03 – 0.31	2400
Fluoranthene	<0.03 – 0.80	280
Pyrene	<0.03 – 0.78	620
Benzo(a)anthracene	<0.03 – 0.28	7.2
Chrysene	<0.03 – 0.24	15.0
Benzo(b)fluoranthene	<0.03 – 0.30	2.6
Benzo(k)fluoranthene	<0.03 – 0.20	77
Benzo(a)pyrene	<0.03 – 0.44	2.2
Indeno(123-cd)pyrene	<0.03 – 0.18	27
Dibenzo(ah)anthracene	<0.03 – 0.04	0.24
Benzo(ghi)perylene	<0.03 – 0.25	320

The Tier 1 soil contamination risk assessment has not recorded any elevated concentrations of organic contaminants, when compared to the relevant human health assessment criteria

Human Health Risk Assessment

As indicated above, chemical testing has not recorded any elevated concentrations of contaminants when compared to the relevant assessment criteria in regards to human health. The risk to human health is considered to be low.

Construction Workers

As outlined above, chemical testing has not identified any contaminants of concern.

The health and safety of all construction workers should be managed appropriately during the works, including the provision of appropriate welfare facilities, decontamination facilities, and personal protective equipment (PPE) commensurate with the contaminants present on the site and the activities being undertaken. All future site staff should be made aware of the potential for contamination (including asbestos) and a procedure should be in place for staff to report any potential contamination uncovered during Site works. All potential contamination should be further investigated.

Vegetation

Chemical testing has not recorded any exceedances of phytotoxicity criteria. However made ground has been encountered across the site and is not typically regarded a suitable growing medium. As such it should be ensured that a minimum growing medium is placed in all areas of soft landscaping.

7.5 Water Environment

The Glasgow and Motherwell bedrock groundwater aquifer has been identified as a sensitive Water Environment receptor for this site.

The Monkland Canal is the closest surface water body to the site at a distance of 326m to the south west at its closest point. The canal is considered to be at a sufficient distance for the potential migration of leachable contaminants to be limited. In addition, the canal is generally culverted, further limiting access of leachates to the surface water body. As such the Monkland Canal is not considered to be a sensitive water environment for this site.

With respect to groundwater, assessment criteria have been established using the guidance contained with SEPA position statement WAT-PS-10-01 "Assigning groundwater assessment criteria for pollutant inputs". This guidance indicates that the risk to groundwater from hazardous substances should be assessed through the use of Minimum Reporting Values (MRV), which are the lowest concentrations of a substance that can be routinely determined with a known degree of confidence. These limits apply to all groundwater. The impact of non-hazardous substances on groundwater resources should be determined through the use of Resource Protection Values (RPVs). Where no MRV or RPV value exists for a substance, the laboratories limit of detection (LOD) has been utilised as assessment criteria to provide an indication of the presence of potential contaminants.

Soil Leachability Analysis Summary

In total, 4 No. samples of soil were subject to leachate analysis, the results of which are summarised in table 13 below. Exceedances are indicated by bold print:

Table 13 – Results of Leachate Testing

Contaminant	Contaminant Concentration (µg/l)	Resource Protection Values (µg/l)
Arsenic	0.27 – 1.2	10
Boron	<12	1000
Cadmium	<0.03	5
Chromium	<1.0	50
Chromium VI	<7.0	7.0 (LOD)
Copper	0.8 – 2.6	2000 (DWS)
Lead	0.5 – 1.6	25

Contaminant	Contaminant Concentration (µg/l)	Resource Protection Values (µg/l)
Mercury	<0.01	-
Nickel	1.1	20
Selenium	<0.25	10
Zinc	1.6 – 4.4	-
Cyanide, Total	<40	50 (Free Cyanide)
Naphthalene	<0.05	-
Anthracene	<0.01	-
Fluoranthene	0.01	-
Benzo(b)fluoranthene	<0.01	-
Benzo(k)fluoranthene	<0.01	-
Benzo(ghi)perylene	<0.01	-
Benzo(a)pyrene	<0.01	0.01
PAH ¹	<0.04	0.1
Aliphatic C5 – C6	<0.1	0.1 (LOD)
Aliphatic C6 – C8	<0.1	0.1 (LOD)
Aliphatic C8 – C10	<0.1	0.1 (LOD)
Aliphatic C10 – C12	<1.0	1.0 (LOD)
Aliphatic C12 – C16	<1.0	1.0 (LOD)
Aliphatic C16 – C21	<1.0	1.0 (LOD)
Aliphatic C21 – C35	<1.0	1.0 (LOD)
Aromatic C5 – C7	<0.1	0.1 (LOD)
Aromatic C7 – C8	<0.1	0.1 (LOD)
Aromatic C8 - C10	<0.1	0.1 (LOD)
Aromatic C10 – C12	<1.0	1.0 (LOD)
Aromatic C12 – C16	<1.0	1.0 (LOD)
Aromatic C16 – C21	<1.0	1.0 (LOD)
Aromatic C21 – C35	<1.0	1.0 (LOD)

1. Sum of benzo(b) and benzo(k)fluoranthene, Benzo(ghi)perylene and indeno(1,2,3-cd)pyrene

No samples were found to be elevated when compared to the relevant Resource Protection Values (RPVs). In addition the recorded relatively thick glacial till is anticipated to have a low permeability and would likely prohibit any vertical migration of water. As such the risk to the Glasgow and Motherwell bedrock aquifer is considered to be low.

As already discussed, the Monkland Canal is the closest surface water receptor. Due to its distance from the site (326m at its closest point) and the general culverted nature of the water body, the potential for the migration of leachable contaminants to the canal is considered to be very limited. As such the risk to the surface water environment is considered to be low.

Groundwater Analysis Summary

An attempt was made on several occasions to retrieve groundwater samples, however boreholes were dry or there was insignificant recharge following purging to allow a sample to be recovered. This generally confirms our assessment that there is no continuous shallow water table within the site.

7.6 Waste Management

A hazardous property assessment has been undertaken using HazWasteOnline™.

HazWasteOnline™ is a web-based tool for classifying hazardous waste. The tool follows the latest Environment Agencies guidance and European regulations. A summary of the assessment results is presented in table 14 below and Certificates are presented in Appendix D.

Table 14 – Hazardous Property Assessment

Location	Stratum	Depth of Sample (mbgl)	Hazardous	WAC Test Completed	Anticipated Landfill Classification
WS101	Made Ground (Hardcore with ash and cobbles)	0.20	Yes	No	Presumed Stable non-Reactive Hazardous Waste
WS101	Made Ground (Sand and gravel with ash, brick and cobbles)	0.50	No	No	Inert
WS102	Made Ground (Slightly silty sand and gravel of hardcore)	0.20	No	No	Inert
WS102	Made Ground (slightly silty sand and gravel with ash, brick and cobbles)	0.50	No	No	Inert
WS103	Made Ground (Slightly silty sand and gravel of Hardcore)	0.20	No	Yes	Inert
WS103	Made Ground (Silty sand with concrete, brick, burnt shale, metal and cobbles)	0.50	No	No	Inert
CP102	Made Ground (Slightly silty sand and gravel of hardcore with ash and cobbles)	0.50	No	Yes	Inert
CP102	Natural Cohesive Glacial Till (Sandy gravelly CLAY)	2.00	No	No	Inert
CP101	Made Ground (Slightly silty sand and gravel of hardcore)	0.20	No	No	Inert

The results of the hazardous property assessment indicate that the one made ground soil samples out of seven samples tested, contained hazardous properties due to elevated TPH.

WAC testing was undertaken on 2No. samples of Made Ground. Hazardous property assessment completed on similar strata of made ground generally suggested the soils were non-hazardous and WAC testing has indicated the soils could generally be classified as Inert. The acceptance of wastes will be at the discretion of the receiving facility and the terms of their license. Specific WAC testing will be required on all made ground soils to be removed from site.

WAC testing has not been undertaken on the natural soils. However, if selected for disposal, these materials are likely to be classified as Inert as natural ground. Good site management will be required to ensure segregation of different soil types and to reduce the potential for mixing of made ground and natural soils.

It is considered that the removal of soils from the site can be minimised by their reuse on site. Any re-use of soils on site should be in accordance with SEPA waste management guidelines,

subject to appropriate sampling and testing, risk assessment and compliance with the criteria contained within Section 3.1 of the SEPA guidelines.

Acceptance of waste is at the discretion of the receiving site. It is recommended that the receiving site operator is consulted at the appropriate time to discuss the conditions of its waste management licence / PPC permit, especially in relation to waste containing asbestos.

7.7 Conclusions

The Tier 1 soil contamination risk assessment has not recorded any concentrations of elevated contaminants, when compared to the relevant human health assessment criteria. However made ground has been recorded across the site, therefore it is recommended that an imported suitable growing medium is necessary in all gardens and areas of soft landscaping.

On the basis of leachate analysis, the site is not considered to represent a significant risk to sensitive Water Environment receptors.

A hazardous properties assessment has identified potentially hazardous soils in one sample of made ground tested (WS101 at 0.20m). The remaining six samples tested were non hazardous. Limited WAC testing has generally indicated the non-hazardous soils could be classified as inert waste. Specific chemical and WAC testing will be required on all made ground soils to be removed from site.

8.0 GAS EMISSIONS

8.1 General

The preliminary conceptual site model has identified onsite and offsite made ground / infilling and shallow coal workings beneath the site as being potential sources of ground gas generation. The monitoring standpipes installed as part of this investigation have therefore been designed to allow for an assessment of these sources.

Gas measurements were taken from borehole installations on six occasions over an approximate twelve week period. During each monitoring visit, the peak and steady concentration readings of methane (CH₄), carbon dioxide (CO₂), oxygen (O₂), carbon monoxide (CO), hydrogen sulphide (H₂S) and the measurement of gas flow and atmospheric pressure was recorded at each installed monitoring standpipe using an infrared gas analyser. The water level in each standpipe was also recorded.

8.2 Gas Assessment Criteria

The monitoring and assessment of ground gas emissions has been undertaken in accordance with:

- BS 8485:2015+A1:2019 - Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings;
- CIRIA Report C665 (2007) – Assessing Risks Posed by Hazardous Ground Gases to Buildings;
- BRE 211 (2015) – Radon – Guidance on Protective Measures for New Buildings.

A summary of the ground gas risk assessment guidelines is included in Appendix E.

8.3 Standpipe Monitoring

The following summary data was obtained from the boreholes during the period of monitoring.

Table 15: Gas Data Summary

BH No.	Methane Range (%v/v)	Carbon Dioxide Range (%v/v)	Oxygen Range (%v/v)	Carbon Monoxide Range (ppm)	Hydrogen Sulphide Range (ppm)	Borehole Steady Flow Range (l/hr)	Atmospheric Pressure Range (mB)
CP101	<0.1	0.2 – 0.9	19.1 – 20.0	<1.0	<1.0	<0.1	1002 – 1015
CP102	<0.1	<0.1 – 0.2	19.4 – 20.7	<1.0	<1.0	<0.1	1002 – 1015
WS101	<0.1	<0.1 – 0.2	19.5 – 21.1	<1.0 – 1.0	<1.0	<0.1	1002 – 1015
WS102	<0.1	0.1 – 0.9	18.9 – 21.0	<1.0	<1.0	<0.1	1002 – 1015
WS103	<0.1	0.1 – 0.7	19.3 – 20.1	<1.0 – 2.0	<1.0	<0.1	1002 – 1015

As highlighted in the table above, gas monitoring did not record concentrations of methane (CH₄) or carbon dioxide (CO₂) above the respective guideline values of 1.0%v/v and 5%v/v in any of the borehole installations. The concentrations recorded are considered representative of 'typical' made ground and natural soils containing limited organic materials.

Carbon monoxide concentrations ranged from less than the limit of detection (i.e. 1ppm) to 2.0 ppm. As these concentrations are below both long-term and short-term HSE exposure limits, risks are considered to be low and no further action is considered to be required. Hydrogen sulphide (H₂S) was not recorded in any of the borehole installations.

Oxygen (O₂) concentrations were recorded between 19.9% and 21.1% which is generally considered representative of 'normal' conditions.

Gas flow rates in the standpipe installations were measured on each occasion when gas readings were taken. The measured steady gas flow rates did not exceed the 0.1l/hr limit of detection of the flow meter used in any of the borehole installations.

8.4 Gas Screening Value (GSV)

The formula for assessing the characteristic gas screening value is as follows, based on the worst-case gas conditions presented:

Limiting borehole gas volume flow rate = Gas concentration (decimal) x Measured borehole flow rate.

In determining the *site-specific* conditions:

Maximum observed concentration	CO ₂ = 0.9%
	CH ₄ = 0.1%
Maximum observed borehole flow (discounting temporary peaks)	(l/Hr) = 0.1

Therefore: **Worst Case Preliminary Gas Screening Value (CO₂) = 0.0009 l/hr**

Worst Case Preliminary Gas Screening Value (CH₄) = 0.0001 l/hr

Based on the results obtained to date, the preliminary GSV for the site is taken as 0.0009 l/hr. A GSV of 0.0009 l/hr is consistent with Characteristic Situation 1 (CS-1) (Very Low Risk).

8.5 Conclusions

Based on the monitoring results, the preliminary GSV for the site is 0.0026/hr (very low risk). In addition, no elevated concentrations of ground gas were detected above their guideline values.

The site is underlain by shallow mine workings which is considered a potential source of ground gas generation. Mineral stabilisation works by the drilling and injection of grout is considered necessary for the proposed development. While the grout consolidation works will effectively reduce the volume of potential mine gas present within the treated workings, pockets of ground gas could remain. In addition, off site changes, such as grouting of other mine workings in the vicinity of the site could affect the flow of ground gas in the area. Furthermore, the action of treating the workings could result in disturbance of the overlying rock strata, allowing for the creation of new ground gas migration pathways. As such, it is recommended that ground gas protection measures be installed within all new properties constructed at the site as a conservative measure, in line with the requirements for a Characteristic Situation 2 site.

The site is indicated by the Health Protection Agency as being in an area where less than 1% of homes are above the radon Action Level. However, guidance issued by the HPA in 2011 recommends that all new development include basic radon protection measures as standard. It is considered that the ground gas barrier recommended above will also provide basic radon protection.

Following the recommendations outlined in the 2019 RSK Stirling report (*Research project to investigate prevalence of CO₂ from disused mineral mines and the implications for residential buildings*), it should be ensured (prior to site development) that all redundant borehole standpipe locations are identified, logged and decommissioned in accordance with SEPA guidance to ensure they do not act as a preferential pathway for ground gas migration into future buildings. Further detail is provided in SEPA document, '*Good Practice for Decommissioning Redundant Boreholes and Wells*'.

9.0 POTABLE WATER SUPPLIES

9.1 General

The WRAS guidelines (*WRAS Information & Guidance Note, October 2002, No 9-04-03 Issue 1: The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land*) have now been withdrawn, and as of autumn 2011 Scottish Water have required the selection of pipe materials for water supply pipes to be carried out in line with the *UKWIR Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites*, dated 2010.

The Scottish Water guidance (2012) requires a suite of analysis to be carried out where a developer wishes to install water supply pipes and connections. Soil samples must be taken along the proposed line of the water main and subjected to chemical analysis at an appropriate laboratory for a suite of analysis as specified in the UKWIR report. It is noted that this suite is applicable to both brownfield and greenfield sites.

Scottish Water do not accept that barrier pipe (PE-Aluminium-PE) may be used as a default pipe medium, and require the submission of a full site investigation report to justify the choice of pipe material.

The UKWIR testing costs are high and have to be done on samples taken on the line and level of the water pipes, and so cannot be usefully undertaken at this preliminary stage. However, based on the results of laboratory analysis, it may not be possible to use PE or PVC water mains at the site. Further assessment is required to ensure that appropriate materials are selected.

10.0 MINERAL STABILITY ASSESSMENT

10.1 Mining

The site is within a Coal Authority reporting area and is highlighted to lie within a Development High Risk area. The Airdrie Blackband Ironstone, Virtuewell Coal and Kiltongue Coal have been noted by the Coal Authority to underlie the site at depths of between 37m and 102m and be worked to some extent. The strata is indicated to dip at a shallow angle to the south west. The Glasgow Splint and Virgin coal seams, both known economic workable seams in the Coatbridge area, are indicated to outcrop to the east of the site and are considered to underlie the site at potentially shallow depths. In addition, upon review of the geology of the area it is conjectured that the Glasgow Ell and Pyotshaw Coal also underlie the site at shallow depths.

The general vertical succession in this area of Coatbridge is summarised below;

Table 16: Generalised Vertical Section

Seam	Typical Thickness (m)	Approximate Separation (m)
Ell Coal	1.20 (often two distinct leaves of Coal)	
		4
Pyotshaw Coal	1.40	
		1 – 4
Glasgow Main Coal	1.15	
		5
Humph Coal	0.55 (often two distinct leaves of Coal)	
		4
Splint Coal	1.20	
		1
Virgin Coal	0.85	
		6
Blackband Ironstone	0.90	
		7
Virtuewell Coal	0.85	

As discussed in detail in section 3.4 of the report, publicly available historical boreholes within the north west of the site record two solid coal seams conjectured to be representative of the Glasgow Splint and Virgin Coal Seams or two leaves of the Glasgow Ell Coal at shallow depth. Historical borehole records to the immediate west of the site record solid coals and packed wastes considered representative of past workings.

Further investigations were required and 2 No. cored rotary boreholes (RC101 and RC102) were sunk to confirm the depth and condition of any coal seams considered to be within influencing distance below the development area of proposed new low-rise properties. The depth of rock head and the condition of the underlying geology at the site was also considered to determine the mineral stability at the site. The drilling and drilling flush conditions were recorded by the driller on-site and the rock cores and encountered seams were described and correlated by a specialist mining geologist (Mr Finlay Black).

The locations of the boreholes are shown in figure 3 of this report. Rotary borehole logs are included in Appendix A and specialist seam correlation in Appendix F. The conditions encountered in the rotary boreholes are summarised below:

Table 17: Summary of Mineral Position

Borehole	Depth to Rockhead	Evidence of Coal/ironstone/workings	Seam encountered	Ratio of working to overburden
RC101	22.00m	Very soft Coal described by driller only, no core recovered. 26.20m – 27.40m. No loss of flush	Conjectured EII Coal	-
		Ironstone 32.64m – 32.83m	Musselband/Cambuslang Marble	-
		Hard bright coal. 33.76m – 34.13m	Musselband/Cambuslang Marble	-
RC102	24.00m	Cavity with a loss of flush 32.65 -33.00 underlain by disturbed possible WASTE or collapsed ground 33.00-34.16m.	Workings within upper leaf of EII Coal	1:5.7
		Friable bright solid coal 35.29 – 35.89m with underlying possible WASTE of seatclay 35.89 – 37.04m.	Workings within lower leaf of EII Coal.	1:6.4

Borehole RC101 encountered rockhead at a depth of 22.00m and a very soft coal was recorded by the driller between depths of 26.20m – 27.40m. Due to the low strength of this strata, no core was able to be recovered however specialist correlation by a mining geologist conjectures this is likely the EII Seam. As drilling flush was maintained while drilling through this seam, it is not considered worked at this specific location. In addition a thin band of ironstone was recorded between depths of 32.64m and 32.83m and hard bright coal between depths of 33.76m and 34.13m. It is considered these are representative of the Musselband seam or part of the Cambuslang Marble Strata. Similarly, no loss of flush was recorded and there is no evidence of workings.

A cavity with a sudden loss of flush was recorded in borehole RC102 at a depth of 32.65m to 33.00m. Immediately underlying the cavity, possible waste or collapsed ground of granulated coal, seatclay, siltstone and sandstone was recorded to a depth of 34.16m. The packed waste and recorded void was considered to be representative of collapsed workings at the level of the upper leaf of the EII. Borehole RC102 also recorded solid bright coal at depths of between 35.29m to 35.89m and underlying possible waste of disturbed grey seatclay with crushed coal and sandstone to a depth of 37.04m considered to be representative of workings at the level of the lower leaf of the EII.

In order to provide an indication of stability, the ratio of intact rock to working thickness has been calculated. Where the ratio of the thickness of disturbed workings compared to the depth of overlying undisturbed rock compared was greater than 1:10, it was considered that the mine workings were at a sufficient depth as to not have any impact on the surface stability at the site.

Evidence of workings at the level of both leafs of the EII Coal Seam has been recorded within borehole RC102 and the ratio of workings to overburden was calculated as 1:5.7 and 1:6.4. As such evidence of instability has been identified in the south of the site. The ratio for the lower leaf did not consider the overlying workings within the upper leaf, however sufficient overburden is still not recorded and instability has been identified regardless.

Mineral stabilisation works within areas of the site of proposed new residential housing is considered necessary. In order to ensure the stability of the proposed new construction of low

rise properties, it will be necessary to carry out consolidation works by the drilling and pressure injection of grout in up to two seams of workings, considered at the level of the upper leaf and lower leaf of Ell Coal. The works are carried out by specialist drilling and mine working treatment contractors, with cement/pulverised fuel ash/sand mixture inserted into the workings via a series of boreholes, drilled in a 3.5m grid across the affected areas.

There are no recorded mine entries within the site, however the Coal Authority notes four mine shafts are recorded within 50m of the site. It is considered there is a low risk of mine entries within the site, however as in all areas of historic mining, the possibility of unrecorded mine entries cannot be fully discounted. Should such potential features become apparent during the construction phase, further technical guidance should be sought immediately by ourselves.

10.2 **Quarrying**

There is no documentary or physical evidence that suggests that quarrying has taken place at the site and no associated risk has therefore been identified. No further action is considered necessary.

11.0 REVISED CONCEPTUAL SITE MODEL

11.1 General

The tier 1 soil contamination risk assessment has not recorded any elevated concentrations of contaminants and no specific remedial measures in regards to human health are considered necessary. No instances of phytotoxic contaminants have been identified above their generic guideline values, however made ground has been recorded across the site. It is recommended a suitable growing medium is imported to the site and placed in all gardens and soft landscaped areas. NHBC standards require a minimum thickness of 100mm topsoil is provided in all garden areas within 20m of habitable accommodation.

A Water Environment risk assessment has concluded from analysis of leachate samples that risks to identified receptors are low and no further action is required. Groundwater samples could not be retrieved due to an insufficient recharge within groundwater wells.

Due to the underlying shallow coal mine workings beneath the site, the site should be classified as CS-2 and as a result, ground gas protection measures corresponding to a Characteristic Site 2 (CS2) are considered to be necessary in future buildings at the site.

The site is indicated by Public Health England as being in an area where less than 1% of homes are above the Radon Action Level. However, current HPA guidance recommends that all new developments include basic radon protection measures as standard. It is considered the gas preclusion measures corresponding to a CS2 site will also protect from radon.

For water pipe material selection, it is a requirement that detailed soil sampling and analysis to the UKWIR suite be undertaken once the line and level of water mains has been established. Scottish Water now require justification of the water pipe material and will not accept the default use of barrier pipe. However, the available results suggest that PE or PVC water supply pipes will likely be suitable for use at the site.

11.2 Assessment of Potential Remediation Options

Based on the results of the site investigation and contamination risk assessment, remedial measures are not required to break the pollutant linkage between future site residents and visitors and the identified made ground, however, measures will be required to provide protection against the migration and accumulation of ground gas.

Ground gas protection measures, in line with the requirements for a Characteristic Situation 2 site will be required within the proposed new properties. These should comprise a ground gas resistant membrane which meets all of the requirements of BS8485:2015 +A1:2019, a pressure relief pathway and a well reinforced cast in-situ floor slab.

It will be necessary to undertake sampling and analysis to UKWIR standards once the line and level of the water supply mains are known, to allow selection and justification of water pipe material.

Due to the made ground encountered across the site, it is considered an imported 'clean' growing medium comprising a minimum 100mm of topsoil is required within all gardens and soft landscaped areas.

The site does not represent a significant risk to Water Environment receptors and consequently no further action is required.

As our evaluations are formulated upon risk-based assessments, we would recommend that discussions proceed with the relevant Local Authority Department to ensure appropriate approvals are obtained prior to detailed design.

11.3 Final Conceptual Site Model

A graphic representation of the final conceptual model for the site, assuming all of the recommendations within this report are followed is included as Figure 5 of this report. The risk assessment can be summarised as follows:

Table 18: Final Quantitative Risk Assessment

Receptor	Source	Pathway	Risk Assessment	Justification/mitigation
Human Health				
Future residents, site visitors and maintenance personnel.	Ground Gas/Radon	Inhalation, accumulation in confined spaces	Low	<p>Due to the underlying shallow coal mine workings which are considered a potential source of ground gas generation the site has been assessed as Characteristic Situation 2 and ground gas protection measures to meet the required 3.5 points of protection should be installed within all new properties.</p> <p>The proposed CS2 gas preclusion measures will also provide basic protection from radon.</p> <p>Once installed, the residual risk to human health receptors would be low.</p>
Construction workers	Ground Gas, Depleted Oxygen	Inhalation, accumulation in excavations	Low	<p>Elevated ground gas and depleted oxygen has not been recorded during site investigations however, it is considered the proposed mine consolidation works may affect/change the ground gas regime at the site. As such, the potential for locally depleted oxygen should be taken into consideration by future groundworks contractors. Whilst the scope of required mitigation will be subject to contractor's risks assessments, as a minimum the atmosphere should be checked before man entry into deep excavations or confined spaces at the site and entry should only be undertaken by appropriately qualified personnel in line with the Confined Spaces Regulations.</p>

Property				
Buried structures and services	None	Direct contact	Low	<p>On the basis of laboratory test results from the current investigation, it is considered the use PE of PVC water mains may be likely. However, a detailed assessment will be required by Scottish Water once the exact route of the water supply main is known.</p> <p>Buried concrete should be designed for class DS-1 AC-1 conditions.</p>
Vegetation	Made ground	Root uptake	Low	<p>Whilst risks associated with phytotoxicity are assessed as low; it should be ensured that the clean cover system required to mitigate human health risks also provides a clean growing medium for future vegetation.</p>
The Water Environment				
Monkland Canal	Leachable copper, lead, and PAH;	Leaching and migration in groundwater	Low	<p>The Monkland Canal is noted to be 326m to the south at its closest point to the site. In addition, it is generally culverted. As such it is considered there is a very limited potential for potential migration of contaminants to the canal. The risk to the surface water environment is considered to be low.</p>
Glasgow and Motherwell Bedrock groundwater body	Elevated copper, lead and PAH in leachate	Leaching of contaminants and migration through soils	Low	<p>Leachate from samples of made ground have not recorded any contaminants in excess of RPV assessment criteria. No consistent groundwater has been recorded within the made ground and it is considered unlikely any vertical migration of water would occur though the relatively impermeable cohesive glacial till. The risk to the bedrock water environment is considered to be low.</p>

12.0 SUMMARY & CONCLUSIONS

12.1 General

It is understood that the site is proposed for re-development of the existing listed main building and the construction of several new low-rise housing with associated private gardens, areas of communal soft landscaping and car parking.

This report and the conclusions contained herein have been written in the context of the development as described and should not be utilised in any differing context without prior reference to us.

It should be recognised that data interpolation is required whenever engineering or related disciplines are utilised to interpret subsurface conditions and conditions can be subject to considerable variation between survey/sampling points.

12.2 Foundation Options

The development proposals for the site comprise the construction of new low-rise residential properties. The foundation loads associated with the new buildings proposed for the site are not known at the time of reporting but are anticipated to be in the order of 35-50kN/m run of wall.

Made ground is present across the site at depths of between 1.50mbgl and 4.20mbgl. Due to its inherent variability, made ground is not generally considered suitable for the support of foundations. As a result, it will be necessary to carry all loads through these deposits to the underlying natural glacial till deposits.

Firm or stiff cohesive glacial till deposits are recorded immediately below the made ground. Rockhead was encountered in rotary boreholes at depths of 22.00mbgl and 24.00mbgl.

In consideration of the extent and depth of unsuitable made ground, shallow strip foundations will likely not be suitable for use at the site. Deepend trench fill foundations, placed on to the firm (or better) natural glacial till at depths of up to 2.50m is considered suitable for approximately 80% of the site across the new-build area of the site. For the remaining 20% of the new-build area of the site, it is considered piled foundations are considered the most suitable foundation solution. Piles should be driven through the unsuitable made ground and placed on to the firm (or better) cohesive glacial till. Vibro-improvement solutions such as vibro-stone columns may be considered an alternative solution to piled foundations, however specialist ground improvement contractors will need to confirm its suitability at the site. A copy of the borehole logs have been forwarded to a specialist contractor and the report will be updated upon receipt of their comments.

12.3 Chemical Contamination

Chemical analysis has not identified any contaminants of concern in the soil samples tested when compared to the relevant human health assessment criteria. No specific remediation measures are considered necessary in regards to human health, however made ground was recorded across this site and a suitable imported growing medium comprising a minimum thickness of 100mm of topsoil should be placed within all private gardens and communal soft landscaped area.

On the basis of leachate analysis, the site is not considered to represent a significant risk to sensitive risk to the Water Environment.

A hazardous properties assessment has identified one potentially hazardous soils at the site out of seven samples assessed. Specific WAC testing will be required on all made ground soils to be removed from site.

12.4 Gas Emissions

On the basis of evidence of shallow coal mine workings beneath the site, considered a potential source of ground gas generation, the site has been classified as CS-2 as a conservative measure and as a result, ground gas protection measures are considered to be necessary in future properties at the site.

British standard BS8485:2015 + A1:2019, the code of practice for the Characterisation and Remediation from Ground Gas in Affected Developments uses a points system to assess what level of protection is required for a proposed development.

Private housing classified as Characteristic Situation 2 requires a protection score of 3.5 points. This could be achieved through the use of a selection of two of the following:

- Ground gas resistant membrane, selected to meet the requirements outlined within BS8485 (2points);
- Sub-floor venting designed to achieve good performance (1.5 points) or very good performance (2.5 points);
- Well reinforced cast in-situ floor slab with minimal service penetrations (1.5 points).

Ground gas should not be permitted to build up beneath the floor slab. If the ground gas protection measures selected comprise a ground gas resistant membrane with well reinforced floor slab, it will be necessary to ensure that gas build up does not occur and this can be achieved by incorporating a gas pressure relief pathway into the foundation design. This venting layer does not need to be designed to achieve a good or very good level of performance but should allow gas to vent to the atmosphere.

The site is indicated by the Health Protection Agency to be in an area not to have a probability of 1% or more of homes being above the Action Level although guidance issued by the HPA in 2011 suggested that all new development include basic radon protection measures as standard. It is considered that gas preclusion measures relevant to CS2 would also provide a basic level of protection against radon ingress.

The potential for depleted oxygen concentrations should be taken into consideration by future groundworks contractors. Confined spaces, such as excavations, should not be entered and if entry cannot be avoided, it should only be undertaken by trained operatives with appropriate risk assessment, and, if necessary, the use of additional PPE and RPE.

12.5 Potable Water Supplies

Scottish Water now require testing to UKWIR standards to justify the selection of water pipe material, and will not accept that barrier pipe (PE-Aluminium-PE) could be the default water supply pipe choice for the site.

At this stage no UKWIR chemical analysis testing has been carried out. However, on the basis of the laboratory analysis results available to date, it is likely that PE or PVC water mains will be suitable for use across the site. It will be necessary to undertake sampling and UKWIR testing once the line and level of any new water supply pipes has been established.

12.6 Mining & Mineral Instability

Areas of instability have been identified across the site, associated with former mine workings within the Ell Coal Seams. As a result, grout consolidation works are required in the areas of the proposed new-build housing and adjacent areas.

12.7 Other Considerations

A Design Sulphate class of DS1 and an Aggressive Chemical Environment for Concrete (ACEC) designation of AC-1 has been established for the site. Concrete conforming to this specification should be utilised for concrete structures likely to be in contact with the ground however consideration should be given to locally raise the design sulphate class to DS-2 AC1s in the areas around borehole WS102. All other recommendations given in the Digest should be followed when designing concrete mixes for use on this site.

Due to extensive made ground soils encountered across the site, a full capping layer (600mm) will likely be required as part of the construction of any proposed roads and areas of car parking.

Subject to weather conditions open sump pumping should cope with the volumes of groundwater which may be expected to enter shallow foundation or services excavations, unless these are left open for a protracted time.

If any field drains or old sewer pipes are encountered in the development works then they should be diverted into new intercepting drains and not allowed to discharge water into the solum of any building or the formation of roadways.

A potential for depleted oxygen has been highlighted and should be taken into consideration by future groundworks contractors. Confined spaces, such as excavations, should not be entered where ever possible and if needed only by trained operatives with appropriate risk assessment, and, if necessary, the use of additional PPE and RPE.

Several utilities including Virgin Media apparatus and a Scottish Power extremely high voltage underground cables are shown to cut through the site. Depending on the finalised development layout these services may have to be rerouted. Copies of utility plans are included in Appendix F

12.8 Additional Works

Once the line and level of any new water supply pipes has been established, a route-specific UKWIR assessment should be undertaken.

It should be ensured (prior to site development) that all redundant borehole standpipe locations are identified, logged and decommissioned in accordance with SEPA guidance to ensure they do not act as a preferential pathway for ground gas migration into future buildings. Further detail is provided in SEPA document, '*Good Practice for Decommissioning Redundant Boreholes and Wells*'.

A Remediation Strategy should be prepared for the site and submitted to the local authority for approval. Once the remedial works have been completed, a validation report should be prepared to demonstrate the works have been undertaken to the necessary standard.

Copies of all reports prepared for the site should be submitted in support of any planning application for redevelopment.

The current proposals include the partial demolition of the existing sandstone building in the south east, retaining the external façade on Muiryhall Street. A post demolition site investigation will be required to investigate the superficial deposits underlying this portion of the building. These investigations should also include a rotary borehole to further investigate the mineral stability of the site.

Figures



Kildonan Street, Coatbridge
 E: 267300
 N: 665250
 PC: ML5 3LG

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rev	description	by	chkd	date

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client
 NORTH LANARKSHIRE COUNCIL

project
 KILDONAN STREET OFFICE CONVERSION

title
 SITE LOCATION PLAN

G3 CONSULTING ENGINEERS
 Orion House, 7 Robroydon Oval, Nova Business Park, Glasgow, G33 1AP
 T: 0141-558-3255, E: enquiries@g3eng.co.uk

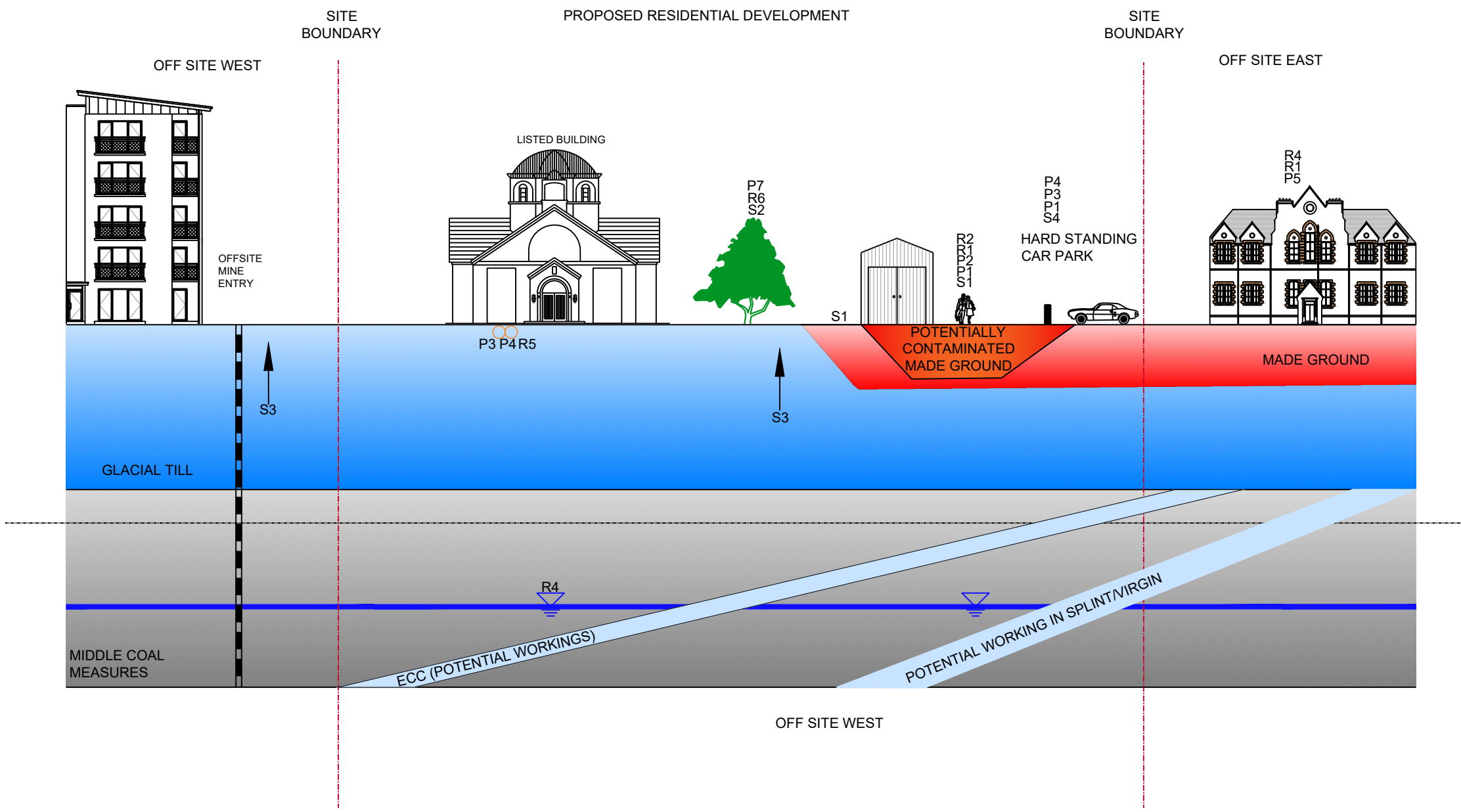





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drawn	checked	date
AC	CW	26/08/21
scales	N/A	sheet size A3
Drawing Number	J5194-SI-Fig 1	Revision

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- POTENTIAL SOURCES**
- S1 POTENTIAL CONTAMINATION ASSOCIATED WITH CURRENT AND HISTORICAL ON-SITE LAND USE.
 - S2 POTENTIALLY CONTAMINATED MADE GROUND DEPOSITED FROM AN OFF-SITE SOURCE
 - S3 POTENTIAL GROUND GAS AND MINE GAS.
 - S4 POTENTIAL SPILLAGES OF FUEL OR OIL.

- POSSIBLE PATHWAYS**
- P1 DERMAL CONTACT/INGESTION
 - P2 INHALATION OF CONTAMINATED DUST OR ASBESTOS FIBRES
 - P3 MIGRATION AND ACCUMULATION OF GROUND GAS OR VAPOUR
 - P4 LEACHING OF CONTAMINANTS AND MIGRATION THROUGH SOILS
 - P5 MIGRATION OF CONTAMINANTS IN GROUNDWATER
 - P6 DIRECT CONTACT
 - P7 ROOT UPTAKE

- PLAUSIBLE RECEPTORS**
- R1 FUTURE SITE USERS (VISITORS AND RESIDENTS)
 - R2 FUTURE CONSTRUCTION/MAINTENANCE PERSONNEL
 - R3 OFFSITE LAND USES
 - R4 BEDROCK GROUNDWATER AQUIFER
 - R5 BUILDINGS AND BURIED SERVICES
 - R6 PLANTS AND LANDSCAPED AREAS

rev	description	by	chkd	date

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project
KILDONAN STREET OFFICE CONVERSION

title
PRELIMINARY CONCEPTUAL SITE MODEL

G3 CONSULTING ENGINEERS
Orion House, 7 Robroydon Oval, Nova Business Park, Glasgow, G33 1AP
T: 0141-558-3255, E: enquiries@g3eng.co.uk

aco
The Building
FQM
FQM

drawn	checked	date
AC	JMW	28/09/21

scales Not To Scale sheet size A3

Drawing Number	J5194-SI-Fig 2	Revision	
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 4. ALL WORK TO CONFORM TO THE RELEVANT BRITISH STANDARDS.

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project
KILDONAN STREET OFFICE CONVERSION

title
SITE INVESTIGATION LOCATION PLAN

Legend

-  Site Boundary
-  RC Rotary Cored Borehole
-  CP Cable Percussion Borehole
-  WS Window Sample Borehole

Sampling and in-situ testing to be to G3 specification.



Orion House, 7 Robtroyson Oval, Nova Business Park, Glasgow, G33 1AP
T: 0141-558-3255, E: enquiries@g3eng.co.uk

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 4. ALL WORK TO CONFORM TO THE RELEVANT BRITISH STANDARDS.

rev	description	by	chkd	date

DOCQUET
We hereby certify this is a true and fair copy of the plan/drawing referred to in the Application.
Dated _____ Signed _____

client
NORTH LANARKSHIRE COUNCIL

project
KILDONAN STREET OFFICE CONVERSION

title
SITE INVESTIGATION LOCATION PLAN SHOWING RECORDED DEPTH OF MADE GROUND

G3 CONSULTING ENGINEERS
Orion House, 7 Robroydon Oval, Nova Business Park, Glasgow, G33 1AP
T: 0141-558-3255, E: enquiries@g3eng.co.uk

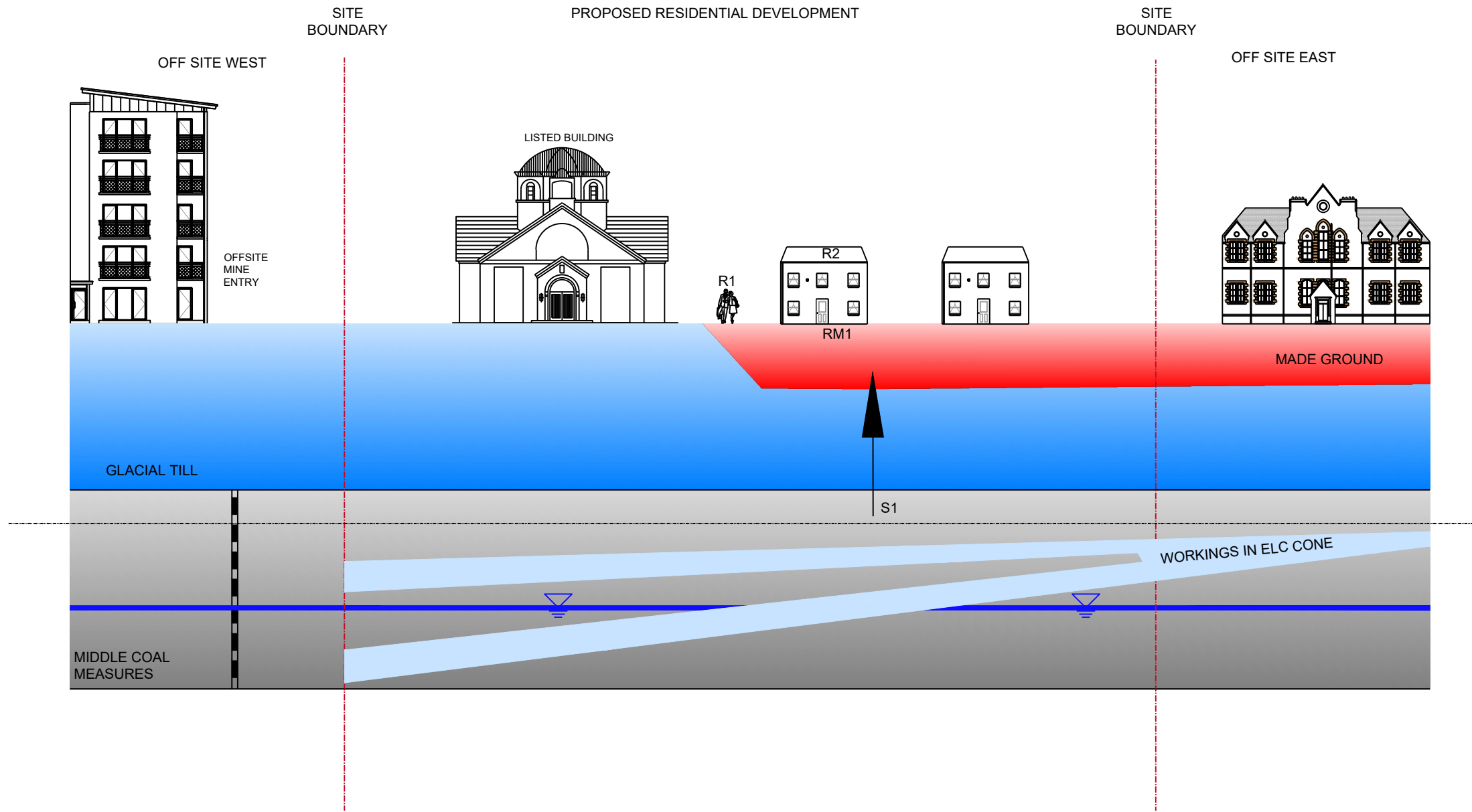
acg
FQM
FQM

Legend

- Site Boundary
- Rotary Cored Borehole
- Cable Percussion Borehole
- Window Sample Borehole
- Recorded depth of made ground.

Sampling and in-situ testing to be to G3 specification.

drawn	checked	date
AC	CW	29/0921
scales 1:500		sheet size A3
Drawing Number J5182-SI-Fig 4		Revision



IDENTIFIED SOURCES
S1 POTENTIAL MINE GAS

RECEPTORS AT RISK
R1 FUTURE SITE RESIDENTS AND SITE VISITOR
R2 PROPERTY

REQUIRED REMEDIAL MEASURES
RM1 GROUND GAS PROTECTION MEASURES TO MEET THE REQUIRED FOR A CHARACTERISTIC SITUATION 2 SITE

Notes

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4. ALL WORK TO CONFORM TO THE RELEVANT BRITISH STANDARDS.

rev	description	by	chkd	date

DOCQUET
We hereby certify this is a true and fair copy of the plan/drawing referred to in the Application.
Dated _____ Signed _____

client
NORTH LANARKSHIRE COUNCIL

project
KILDONAN STREET OFFICE CONVERSION

title
FINAL CONCEPTUAL SITE MODEL

G3 CONSULTING ENGINEERS
Orion House, 7 Robroyston Oval, Nova Business Park, Glasgow, G33 1AP
T: 0141-258-3255, E: enquiries@g3eng.co.uk

acc
The Building
FQM
FQM

drawn	checked	date
AC	JMW	29/09/21

scales Not To Scale sheet size A3

Drawing Number **J5194-SI-Fig 5** Revision

Appendix A

Aitken Laboratories Ltd Factual Report

**FACTUAL REPORT
ON
GROUND INVESTIGATION
AT
KILDONAN STREET
COATBRIDGE**

August 2021

Ref No: N051

Engineer: G3 Consulting Engineers Limited



Aitken Laboratories Limited

SITE INVESTIGATION CONTRACTORS
Castlehill House, Slamannan, FK1 3EZ
Tel: 01324 851389 E: office@aitkenlabs.co.uk

Date: 16 August 2021

G3 Consulting Engineers Limited
Orion House
7 Robroyston Oval
Nova Business Park
G33 1AP

Our Ref: JA/N051

Your Ref:

FAO: Mr C. Walker

Dear Sirs

SITE INVESTIGATION AT KILDONAN STREET, COATBRIDGE

Please find enclosed our report for the above ground investigation.

This report was prepared by Mr A. Dobinson.

We trust this report is satisfactory, however if we can be of any further assistance, please do not hesitate to contact us.

As part of our Quality System, we encourage feedback from our clients. On this basis, if you have any comments or suggestions, or if you feel we could improve our service to you in any way, we would be most interested to hear from you.

Yours faithfully
for and on behalf of
AITKEN LABORATORIES LIMITED

Alastair Dobinson
B. Eng. (Hons), C. Eng., M.I.C.E.



CONTENTS

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2. SITE WORK	1 of 3
3. LABORATORY WORK	2 of 3
4. REFERENCES	3 of 3

Appendix 1

Site Plan	
Soils Borehole Logs	CP101 – CP102, WS101 – WS103
Rotary Borehole Logs	RC101 – RC102
Gas Monitoring Results	Table A

Appendix 2

Laboratory Test Report

Laboratory Testing References		
Summary of Test Results	Table 1	Page 1 of 8
PSD Test Results		Page 2 – 3 of 8
Triaxial Test Results		Page 4 – 8 of 8

Appendix 3

Environmental Test Results



**FACTUAL REPORT
ON
GROUND INVESTIGATION
AT
KILDONAN STREET
COATBRIDGE**

1. INTRODUCTION

It is proposed to construct a development at Kildonan Street, Coatbridge.

At the request of G3 Consulting Engineers Limited, an investigation was carried out to confirm the ground conditions at the site to provide an assessment to the conditions with respect to design and construction of the proposed scheme.

This report presents the information established by observation, boring, sampling and in-situ testing. It should be noted that natural strata vary from point to point and that man-made deposits are subject to an even greater diversity. Groundwater conditions are dependent upon seasonal and other factors. Whilst an attempt is made in reporting to assess the likelihood or extent of such variations at the site, it should be recognised that there may be conditions pertaining which are not disclosed by the investigation.

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.

2. SITE WORK

The field works were carried out during the period 29th June to 9th July 2021 and comprised:-

2 No. Light Cable Percussion Boreholes to a depth of 8.00 metres

3 No. Terrier Rig Boreholes to a maximum depth of 5.00 metres

2 No. Rotary Open Hole and Core Boreholes to a depth of 40.00 metres

Details of the boreholes including daily progress of hole and casing, descriptions of strata encountered, records of sampling and in-situ testing carried out, observations of groundwater conditions while boring and drilling, depths to changes in strata and details of standpipe installations are presented in the exploratory hole records in Appendix 1.

The locations of the exploratory holes were set out and recorded by the Engineer.



3. LABORATORY TESTING

The samples of soil taken during the site works were transported to the laboratory for systematic examination and testing. The characteristics of the soils determined in the laboratory were used to supplement field observations in the preparation of the final exploratory hole records.

Testing was carried out on selected samples to the requirements of the relevant British Standards, or in accordance with current good practice, as appropriate.

The Laboratory Testing References section of Appendix 2 details the tests performed in the laboratory which are UKAS accredited.

Tests marked "Not UKAS Accredited" in this report are not included in the UKAS Accreditation Schedule for our laboratory.

Laboratory Testing Comprised:-

Classification Tests
Undrained Triaxial Strength Tests
Environmental Analysis

The results are presented in summary and detailed Tables and Figures in Appendices 2 and 3.



REFERENCES

1. BS5930:2015 Code of Practice for "Site Investigation" British Standard Code of Practice, British Standards Institution, London
2. BS1377:1990 Parts 1 to 9 British Standard "Methods of Test of Soils for civil engineering purposes". British Standards Institution, London.
3. BS10175:2011 Investigation of potentially contaminated site – Code of Practice.
4. Building Research Establishment, Special Digest 2005, Concrete in Aggressive Ground.

Appendix 1

J5194 Kildonan Street, Coatbridge Sketch SI layout



● Cable Percussion borehole to 8m depth (with standpipe)

● Rotary cored borehole to 40m

● Window sample borehole to 5m (standpipes in WS101 and WS103)



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole
Number
CP101

Boring Method
Cable Percussion

Casing Diameter
150mm cased to 8.00m

Ground Level (mOD)

Client

Job
Number
N051

Location

Dates
01/07/2021

Engineer
G3 CONSULTING ENGINEERS LIMITED

Sheet
1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20	E1					0.15	#MADE GROUND (Tarmac)	[Cross-hatch pattern]		
0.50	E2					0.30	MADE GROUND (Greyish brown slightly silty fine to coarse sand and fine to coarse gravel of hardcore with ash and cobbles)	[Cross-hatch pattern]		
1.00	E3					0.45	MADE GROUND (Grey slightly silty fine to coarse sand and fine to coarse gravel of ash with brick, concrete, slag, pockets of clay and cobbles)	[Cross-hatch pattern]		
1.20-1.65	SPT N=7 B1			1,2/2,2,1,2						
2.00-2.45	SPT N=4 E4 B2			1,1/1,1,1,1		(3.75)				
3.00-3.45	SPT N=7 E5 B3			1,2/2,1,2,2						
4.00-4.45	SPT N=12 E6 B4			1,1/2,3,3,4 Water strike(1) at 4.20m. (Slight seepage)		4.20	Medium strength firm consistency greyish brown slightly sandy slightly gravelly CLAY with cobbles. Gravel content is fine and medium	[Dotted pattern]	▽1	
5.00-5.45	E7 U5			65 blows						
5.50	B6									
6.00-6.45	SPT N=15 B7			1,3/3,4,4,4		(3.80)				
7.50-7.95	U8			75 blows						
8.00	B9			01/07/2021:DRY		8.00	Complete at 8.00m			

Remarks

A 50mm diameter standpipe was installed at a depth of 5.00m
Denotes driller's description
Chiselling from 3.50m to 4.00m for 0.50 hours. Chiselling from 6.60m to 7.20m for 0.50 hours. Excavating from 0.00m to 1.20m for 1 hour.

Scale (approx)

1:50

Logged By

SM

Figure No.

N051.CP101



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole
Number
CP102

Boring Method Cable Percussion	Casing Diameter 150mm cased to 8.00m	Ground Level (mOD)	Client	Job Number N051
	Location	Dates 02/07/2021	Engineer G3 CONSULTING ENGINEERS LIMITED	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20	E1					(0.15)	#MADE GROUND (Tarmac)			
0.50	E2						MADE GROUND (Dark grey silty fine to coarse sand and fine to coarse gravel of hardcore with ash and cobbles)			
1.00	E3					(1.75)				
1.20-1.55	SPT 50/200 B1			5,15/13,17,20						
2.00	E4			Water strike(1) at 2.00m. (Seepage) 75 blows		1.90	Stiff consistency brown and grey sandy gravelly CLAY with cobbles. Gravel content is fine to coarse		∇1	
2.00-2.45	U2 B3					(0.90)				
3.00-3.45	SPT N=14 B4			2,4/3,3,4,4		2.80	Medium strength firm consistency grey sandy gravelly CLAY with cobbles. Gravel content is fine to coarse			
4.00-4.45	U5			65 blows						
4.50	B6									
5.00-5.45	SPT N=13 B7			1,3/3,3,3,4		(5.20)				
6.50-6.95	U8			60 blows						
7.00	B9									
7.50-7.95	SPT N=15 B10			2,3/4,4,3,4						
				02/07/2021:DRY		8.00	Complete at 8.00m			

Remarks A 50mm diameter standpipe was installed at a depth of 5.00m # Denotes driller's description Chiselling from 1.55m to 2.00m for 1 hour. Excavating from 0.00m to 1.20m for 1.50 hours.	Scale (approx)	Logged By
	1:50	PM
	Figure No. N051.CP102	



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole Number
WS101

Boring Method TERRIER RIG	Casing Diameter		Ground Level (mOD)	Client	Job Number N051
	Location		Dates 29/06/2021	Engineer G3 CONSULTING ENGINEERS LIMITED	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20	E1					(0.20)	#MADE GROUND (Tarmac)			
0.50	E2					0.20 0.30	MADE GROUND (Grey slightly silty fine to coarse sand and fine to coarse gravel of hardcore with ash and cobbles)			
1.00	E3					(1.20)	MADE GROUND (Dark grey fine to coarse sand and fine to coarse gravel with ash, brick and cobbles)			
1.20-1.65	SPT N=7 B4			2,2/1,2,2,2		1.50	Medium strength firm consistency mottled brown sandy slightly gravelly CLAY. Gravel content is fine and medium			
2.00-3.00	U5					(1.40)				
3.00-3.45	SPT N=13 B6			3,4/4,3,3,3		2.90	Firm consistency grey sandy gravelly CLAY with cobbles. Gravel content is fine to coarse			
4.00-5.00	U7					(2.10)				
				29/06/2021:DRY		5.00	Complete at 5.00m			

Remarks A 50mm diameter standpipe was installed at a depth of 5.00m # Denotes driller's description Excavating from 0.00m to 1.20m for 1 hour.	Scale (approx)	Logged By
	1:50	PM
	Figure No. N051.WS101	



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole
Number
WS102

Boring Method
TERRIER RIG

Casing Diameter

Ground Level (mOD)

Client

Job
Number
N051

Location

Dates
29/06/2021

Engineer

G3 CONSULTING ENGINEERS LIMITED

Sheet
1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20	E1					(0.20)	#MADE GROUND (Tarmac)			
0.50	E2					(0.30)	MADE GROUND (Grey slightly silty fine to coarse sand and fine to coarse gravel of hardcore)			
1.00	E3					0.50	MADE GROUND (Dark grey slightly silty fine to coarse sand and fine to coarse gravel of ash with brick and cobbles)			
1.20-1.65	SPT N=12			2,1/5,2,3,2		(1.95)				
1.20-1.65	B4									
2.00-2.45	SPT N=10			1,4/2,2,3,3		2.45	Medium strength firm consistency mottled grey and brown slightly sandy slightly gravelly CLAY. Gravel content is fine and medium			
2.00-2.45	B5									
3.00-4.00	U6					(1.75)				
4.00-4.45	SPT N=13			3,4/3,4,3,3		4.20	Firm consistency grey sandy gravelly CLAY with cobbles. Gravel content is fine to coarse			
4.00-4.45	B7					(0.80)				
				29/06/2021:DRY		5.00	Complete at 5.00m			

Remarks
A 50mm diameter standpipe was installed at a depth of 4.50m
Denotes driller's description
Excavating from 0.00m to 1.20m for 1 hour.

Scale (approx)

1:50

Logged By

PM

Figure No.
N051.WS102



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole Number
WS103

Boring Method TERRIER RIG	Casing Diameter	Ground Level (mOD)	Client	Job Number N051
	Location	Dates 29/06/2021	Engineer G3 CONSULTING ENGINEERS LIMITED	Sheet 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20	E1					(0.20)	#MADE GROUND (Tarmac)			
0.50	E2					(0.20) (0.25) 0.45	MADE GROUND (Grey slightly silty fine to coarse sand and fine to coarse gravel of hardcore)			
1.00	E3						MADE GROUND (Dark grey slightly silty fine to coarse sand and fine to coarse gravel of ash with hardcore and cobbles)			
1.20-1.65 1.20-1.65	SPT N=12 B4			3,2/5,2,2,3		(2.05)				
2.00-2.45 2.00-2.45	SPT N=11 B5			6,3/3,2,2,4		2.50	Low strength soft consistency mottled brown sandy slightly gravelly CLAY. Gravel content is fine and medium			
3.00-4.00	U6					(1.40)				
4.00-4.30 4.00-4.30	SPT 54/150 B7			4,4/4,50		3.90 (0.40) 4.30	Stiff consistency grey sandy gravelly CLAY with cobbles. Gravel content is fine to coarse			
				29/06/2021:DRY			#OBSTRUCTION (Bedrock or boulder)			
							Complete at 4.30m			

Remarks # Denotes driller's description A 50mm diameter standpipe was installed at a depth of 3.00m Excavating from 0.00m to 1.20m for 1 hour.	Scale (approx)	Logged By
	1:50	PM
	Figure No. N051.WS103	



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole Number
RC101

Machine : D17 Flush : Air and Water Core Dia: 76 mm Method : Rotary Open Hole and Core	Casing Diameter 125mm cased to 22.00m	Ground Level (mOD)	Client	Job Number N051
	Location	Dates 08/07/2021 - 09/07/2021	Engineer G3 CONSULTING ENGINEERS LIMITED	Sheet 1/5

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							(10.00)	#MADE GROUND		

Remarks # Denotes driller's description Driller records full flush returns throughout	Scale (approx)	Logged By
	1:50	JH/RB
	Figure No. N051.RC101	



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole
Number
RC101

Machine : D17
Flush : Air and Water
Core Dia: 76 mm
Method : Rotary Open Hole
and Core

Casing Diameter
125mm cased to 22.00m

Ground Level (mOD)

Client

Job
Number
N051

Location

Dates
08/07/2021 -
09/07/2021

Engineer
G3 CONSULTING ENGINEERS LIMITED

Sheet
2/5

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							10.00	#CLAY		
							(12.00)			

Remarks
Denotes driller's description
Driller records full flush returns throughout

Scale (approx)	Logged By
1:50	JH/RB
Figure No. N051.RC101	



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole Number
RC101

Machine : D17		Casing Diameter 125mm cased to 22.00m		Ground Level (mOD)		Client		Job Number N051	
Flush : Air and Water		Location		Dates 08/07/2021-09/07/2021		Engineer G3 CONSULTING ENGINEERS LIMITED		Sheet 3/5	
Core Dia: 76 mm									
Method : Rotary Open Hole and Core									

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
23.00	97	75	17	12			22.00	#MUDSTONE	[Horizontal lines]	
							23.00	Weak, occasionally very weak thin poorly bedded grey SILTSTONE, occasional muddy bands, fresh, closely spaced rough to smooth irregular tight bedding at 5 degrees, closely spaced rough undular tight fractures at 72 degrees, widely spaced polished undular tight fractures at 62 degrees	[Cross-hatch]	
26.00							26.00 (0.20)	Very soft MUDSTONE recorded by driller, no recovery	[Horizontal lines]	
							26.20	Very soft COAL recorded by driller, no recovery	[Dark grey]	
29.00	34	19	4	24			27.40	Medium strong very thin bedded pale grey banded silty fine SANDSTONE, occasional fossil rootlets, fresh, very closely spaced rough undular tight bedding at 4 degrees, widely spaced rough irregular tight fractures at 40 degrees to 80 degrees	[Dotted]	
							28.06	Weak, occasional medium strong bands very thin bedded grey finely banded sandy SILTSTONE, very closely spaced rough undular tight bedding at 4 degrees, medium spaced rough irregular tight fractures at 36 degrees	[Cross-hatch]	
							29.80	Strong thin bedded pale grey fine SANDSTONE, fresh,	[Dotted]	

Remarks # Denotes driller's description Driller records full flush returns throughout								Scale (approx) 1:50	Logged By JH/RB
								Figure No. N051.RC101	



AITKEN LABORATORIES LTD

Site
KILDONAN STREET, COATBRIDGE

Borehole Number
RC101

Machine : D17 Flush : Air and Water Core Dia: 76 mm Method : Rotary Open Hole and Core	Casing Diameter 125mm cased to 22.00m	Ground Level (mOD)	Client	Job Number N051
	Location	Dates 08/07/2021- 09/07/2021	Engineer G3 CONSULTING ENGINEERS LIMITED	Sheet 4/5

Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
31.00	100	39	5	21	08/07/2021:DRY 09/07/2021:DRY		(0.22)			
							30.02	closely spaced rough undular tight fractures at 80 degrees	XXXXXX	
34.00	86	28	6	17			(0.89)	Medium strong, occasional thin weak bands very thin bedded grey finely banded SILTSTONE, fresh, very closely spaced rough undular tight bedding at 4 degrees, widely spaced rough undular tight fractures at 88 degrees	XXXXXX	
							30.91	Medium strong very thin bedded grey silty fine SANDSTONE, fossil plant stems, fresh, very closely spaced rough to smooth planar tight bedding at 4 degrees	XXXXXX	
							31.16	Weak thin bedded grey to dark grey banded MUDSTONE, fresh, closely spaced smooth undular tight bedding at 4 degrees, medium spaced smooth undular tight fractures at 26 degrees and 36 degrees	XXXXXX	
							(1.22)			
							32.38	Medium strong very thin bedded grey SILTSTONE, 0.05m ironstone band at top, very closely spaced rough undular tight bedding at 4 degrees, medium spaced rough undular tight fractures at 40 degrees and 80 degrees	XXXXXX	
							32.64			
							32.83			
							33.03	Strong poorly bedded grey and black banded IRONSTONE, fossil mussel bands, fresh	XXXXXX	
							33.15			
							(0.61)	Medium strong very thin bedded black MUDSTONE, fossil mussels, fresh, very closely spaced smooth undular tight bedding at 3 degrees	XXXXXX	
37.00	100	76	47	10			33.76	Weak poorly bedded dark grey MUDSTONE, fresh, fossil mussels, fresh, broken core	XXXXXX	
							(0.37)			
							34.13	Very weak poorly bedded grey silty SEATCLAY, fresh, broken core, 0.11m recovered	XXXXXX	
							(0.76)	Hard black bright COAL, fresh, not intact core, smooth planar bedding at 2 degrees, smooth planar cleats at 86 degrees	XXXXXX	
40.00	97	56	15	18			34.89	Medium strong very thin poorly bedded dark grey with black top and base very carbonaceous SILTSTONE, fossil rootlets, fresh, very closely spaced rough irregular tight bedding at 2 degrees to 11 degrees	XXXXXX	
							(1.37)	Medium strong with occasional thin weak bands thin bedded pale grey with occasional dark bands fine SANDSTONE, thin carbonaceous silty bands up to 0.05m thick, fresh, closely spaced rough undular tight bedding at 4 degrees	XXXXXX	
							36.26	Strong thin bedded pale brownish grey medium SANDSTONE, mainly fresh with faint ironstains, closely spaced rough undular tight bedding at 2 degrees to 10 degrees, medium spaced extensive rough undular tight fractures at 86 degrees	XXXXXX	
							(1.16)			
40.00							37.42	Medium strong very thin bedded grey finely banded SILTSTONE with occasional sandy bands, 0.02m ironstone at base, very closely spaced smooth planar tight bedding at 3 degrees, medium spaced smooth planar tight fractures at 88 degrees	XXXXXX	
							(0.58)			
							38.00	Weak very thin bedded black to dark grey carbonaceous MUDSTONE, fresh, very closely spaced smooth planar tight bedding at 3 degrees, medium spaced smooth planar tight fractures at 88 degrees	XXXXXX	
40.00							(0.35)			
							38.35	Medium strong, occasional thin weak bands very thin bedded grey finely banded SILTSTONE with occasional thin siltstone bands, ironstained, very closely spaced rough undular to planar tight stained bedding at 4 degrees, medium spaced extensive in top 0.50m, rough undular tight to slightly open fractures at 88 degrees	XXXXXX	
(1.65)										
					09/07/2021:DRY					

Remarks # Denotes driller's description Driller records full flush returns throughout	Scale (approx)	Logged By
	1:50	JH/RB
	Figure No. N051.RC101	