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Ref: 14-768-L2-2

Lewis Shaw
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Dear Lewis,

GEOENVIRONMENTAL ASSESSMENT NETWORK RAIL LAND – HEYWOOD ROAD, CASTLETON

1. INTRODUCTION

1.1. BACKGROUND

E3P has previously completed intrusive ground investigations at the Site known as Castleton Sidings, located off Heywood Road, Castleton, in Rochdale (Phase I and II Geoenvironmental Assessment, Report Ref: 14-768-R1-3, March 20223). These investigations were completed in the central sector of the ownership boundary (referred to as the Main Development Site) and did not include investigations in the eastern extent of the Site, currently retained as railway land and herein referred to as 'Network Rail Land'.

Kellen Homes intend to transfer the Network Rail Land to The East Lancashire Railway (ELR). They have therefore commissioned E3P to carry out a geoenvironmental assessment across this part of the Site for environmental indemnity insurance purposes.

1.2. CURRENT AND HISTORIC LAND USE

The Site is currently derelict railway sidings, covered by a mixture of self-seeded vegetation, relict sidings/tracks, hardstanding roads and slabs and areas of compacted gravel. A manned signal box is present in the northeast of the Site, associated with the live railway to the east, and access is gained from a main gate in the far north east of the Site, off Heywood Road. Live railway lines are present along the south eastern site boundary.

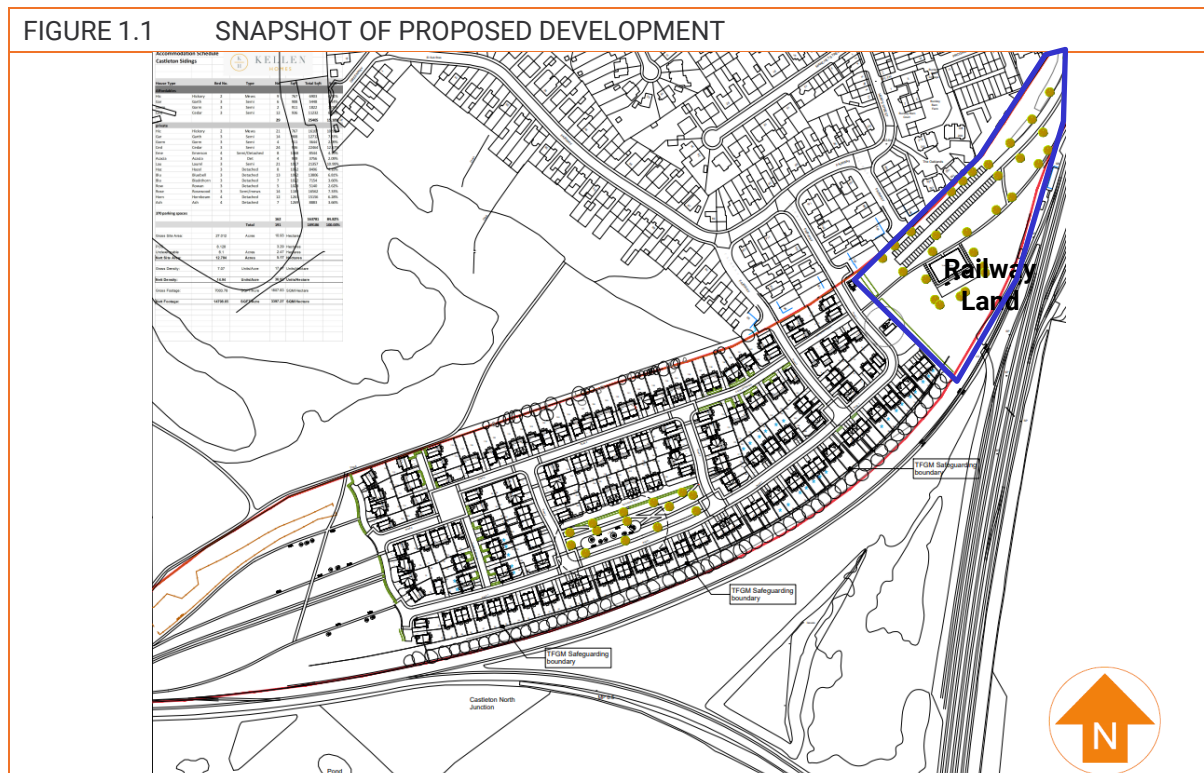
Historically the Site was partially occupied by railway tracks/sidings from the earliest historical map dated 1893, together with Castleton East Junction Signal Box on the eastern boundary. An east-west oriented cutting/embankment is shown to dissect the Site, indicating that artificial levelling has occurred to create a level platform for the railway tracks/sidings. By 1910, the cutting/embankment had moved further north, and additional rail tracks were added south of this between the 1920s and 1950s. Mapping dated 1956 shows a square structure in the south of the Site, with additional smaller structures added by 1973, together with a rail platform extending onto the Site from the west. The Site appears to remain in a similar arrangement until becoming disused sometime in the early 2000s.

1.3. PROPOSED DEVELOPMENT

Kellen Homes are considering the proposed acquisition and future redevelopment of the site for a hybrid planning application comprising the following:

- Full planning application for residential development, including access, car parking, landscaping, open space and associated engineering and infrastructure including an electric substation and foul water pump station.
- Outline planning permission with all matters reserved for the principle of development to facilitate the East Lancashire Railway (ELR) extension.

Figure 1.1 shows the area of the Site to be transferred (outlined in blue).



1.4. PREVIOUS REPORTS

1.4.1. E3P – PHASE I & II GEOENVIRONMENTAL SITE ASSESSMENT, CASTLETON SIDINGS, ROCHDALE REF: 14-768-R1-3, DATED MARCH 2023, ON BEHALF OF KELLEN HOMES.

The above-referenced report was previously completed for the land immediately west of the Site (the Main Development Site) and should be read in conjunction with this report.

The key findings of the site investigation regarding land contamination and ground stability are summarised below, and where necessary, data is used to support the E3P Geoenvironmental Site Assessment for the Network Rail Land.

Ground conditions were found to comprise the following general sequence:

- ✿ MADE GROUND to a maximum proven depth of 6.60 m bgl (RO227), comprising black slightly clayey gravelly medium sand / sandy gravel with mudstone, brick, clinker, coal, and ceramic with less frequent inclusions of metal, shale, glass and timber/wood. Obstructions (reinforced concrete slabs and redundant services) were encountered frequently across the Site, together with visual and olfactory evidence of (hydrocarbon) contamination.
- ✿ Blackish brown pseudo fibrous PEAT was encountered beneath the Made Ground in 26 no. locations, ranging in thickness from 0.20 to 2.60 m thick (CP102), although was predominantly 1.0 m thick or less, and noted to be generally thicker towards the south and west of the Site, and absent in the east (towards the Network Rail Land).
- ✿ Drift deposits comprised alternating SAND/GRAVEL and sandy CLAY and extending to depths in excess of 60.50 m bgl (RB101). Where encountered, shallowest drift deposits were noted to be predominantly granular i.e. medium dense slightly clayey SAND with occasional gravel, sandy GRAVEL of medium subangular to rounded mudstone and sandstone and/or stiff to very stiff medium to high strength sandy CLAY with occasional gravel of fine to coarse angular to rounded mudstone.
- ✿ The solid geology was not encountered. A nearby BGS borehole indicates rockhead at circa 81.00 m bgl.

Chemical analysis found exceedances of heavy metals, non-volatile PAH, naphthalene, toluene, TPH C8-C35 and mercury in the soils at various locations across the Site (including in the POS area and stockpile in the Network Rail Land) between 0.50 m bgl and 4.90 m bgl. Asbestos in the form of chrysotile (<0.001%wt/wt) has also been identified in TP112 (Main Development Site). Visual and olfactory evidence of hydrocarbon impact was also identified at several locations across Site. A vapour risk assessment was carried out, which concluded a low overall risk from hydrocarbons and S/VOCs, except in the vicinity of WS110 (in the east of the Main Development Site).

High concentrations of naphthalene and aromatic hydrocarbon fractions have been encountered in water samples from WS105 in the centre west of the Site. Water samples taken from surrounding boreholes to the north west (WS101 and RO223) and west (RO221) of WS105 contained elevated heavy metal concentrations (copper, nickel and zinc), but did not identify elevated volatile compounds, thus indicating no significant migration of volatile contamination. An M-BAT assessment concluded a low overall risk to surface water networks and aquatic life. Further analysis of the surface water in the peripheral (accessible) drainage ditches is recommended as groundworks progress, to ensure no future mobilisation of contaminants is caused, which may pose a risk to the nearby Roeacre Brook.

In consideration of the nature of the Site, historical land uses, and prevalence of S/VOC impacted soils (albeit generally low vapour risk), E3P consider that gas protection measures in accordance with a CS2 (NHBC Amber 1) classification should be incorporated in all residential properties constructed at the Site.

The Arley Coal seam is conjectured to subcrop beneath the north east of the (main development) site, dipping to the west (away from the Network Rail Land). A nearby BGS borehole indicates drift deposits to extend to circa 80 m bgl. Verbal consultation with the Coal Authority indicated that, due to the depth of the seam, they do not consider it likely that the seam has been worked. Two ~60.0 m deep rotary boreholes were advanced within the identified development high risk areas. Rockhead was not proven due to extensive drift and difficulties drilling at depth leading to termination of the boreholes at circa 60.0 m bgl in granular drift. No evidence of shallow coal seams or historic shallow coal workings was recorded and the resultant risks from coal mining related subsidence were concluded to be low.

2. INITIAL CONCEPTUAL SITE MODEL

In accordance with EA LCRM (2019) and BSI 10175 (Code of Practice for Investigation of Potentially Contaminated Land), E3P has developed an initial conceptual site model (CSM) to identify potential contamination sources, migration pathways and receptors within the study area. This is summarised within Table 2.1.

ON-SITE SOURCES OF CONTAMINATION

The following potential on-site sources of contamination have been identified:

- ✳ Made Ground associated with levelling, railway sidings and former structures: non-volatile PAH, TPH, SVOC, VOC, BTEX compounds, heavy metals and asbestos
- ✳ Fuel leaks and storage: TPH, SVOC, VOC, BTEX compounds
- ✳ Electrical features: PCBs

OFF-SITE SOURCES OF CONTAMINATION

The following potential off-site sources of contamination have been identified:

- ✳ Lancashire and Yorkshire Railway
- ✳ Tanks
- ✳ Welding Shop
- ✳ Travelling Cranes; and
- ✳ Leather Works.

2.1. CONCEPTUAL SITE MODEL

TABLE 2.1 INITIAL CONCEPTUAL SITE MODEL

SOURCE	PATHWAY	RECEPTOR
Human Health		
Heavy Metals and non volatile PAHs associated with Made Ground and Historical Site Use as Railway Sidings and Industrial Uses adjacent to the Site	Dermal Contact and Ingestion. Consumption of Homegrown Produce.	Construction Workers. Commercial End Users.
Discussion: Made Ground is likely to be present on Site, derived from the previous Site uses as Railway Sidings, and adjacent Site uses e.g. Leather Works and a Travelling Crane. Made Ground may contain anthropogenic material and as such may be impacted by heavy metals, hydrocarbons and polycyclic aromatic hydrocarbons (PAH) derived from fuel and coal storage and combustion processes. Given proposals to retain the Site as railway land, the risks to end users is considered low. If present, heavy metals and non-volatile PAHs may pose a short-term risk to construction workers who may come into contact with impacted soils during earthworks (if proposed). However, this risk can be mitigated through the use of appropriate Personal Protective Equipment (PPE) and the provision of adequate welfare facilities.		
Volatile Hydrocarbon Compounds Associated with Historical Site Use of Railway Sidings (fuel leaks and storage)	Volatilisation/Accumulation. Vapour Inhalation.	Construction Workers. Commercial End Users.
Discussion: Historical land use as railway sidings may give rise to the presence of volatile contaminants such as S/VOC, TPH and BTEX compounds (common fuel derivatives). There is potential for spillages and leakages to have occurred over time and the presence of railway sidings and machinery on-site also increases the risk of spillages. Multiple tanks have been identified adjacent to the Site which may have leaked and associated contamination may have been mobilised and migrated beneath the Site. Given proposals to retain the Site as railway land, the risks to end users is considered low. Volatile compounds may pose a risk to construction workers if they come into contact with impacted soils during further earthworks (if proposed), however appropriate PPE/ Respiratory Protective Equipment (RPE) will ensure they are at no unacceptable risk. Future end users may come into contact with impacted soils in garden and landscaped areas, though the main pathway of volatile compounds is considered to be vapour inhalation indoors. If identified, it is likely that additional remediation of impacted soils and/or perched groundwater will be required to mitigate the risk to future residential end users.		
Asbestos-Containing Materials (ACMs) within Made Ground	Fibre/Dust Inhalation.	Construction Workers. Residential End Users. Site Neighbours.
Discussion: ACM may be present within Made Ground underlying the Site from former structures and activities on the Site is considered likely given its insulating and fire resistant properties. Asbestos may be present in the Made Ground associated with historic developments, earth mounds, infilling and demolition activities. Given proposals to retain the Site as railway land (i.e. no soil disturbance), the risks to end users is considered low. ACM poses a risk through fibre and dust inhalation and if present may pose a risk to construction workers during any future earthworks / demolition and to adjacent third-party property should dust be generated during those works (if proposed).		

Hazardous Ground Gases		
Methane and Carbon Dioxide Associated with Possible On-Site Fill Material, Organic Soils	Inhalation. Accumulation.	Construction Workers. Commercial End Users.
Discussion: Historical mapping indicates potential raising of levels to create a level development platform. Nearby potentially infilled features (brick pits) and deep Made Ground on Site and within 250 m of the Site present a moderate ground gas risk . Dependent on the materials used to infilling, there is a possibility for the generation of hazardous ground gases within any of these features which may migrate along preferential pathways to the proposed building. This poses a risk of inhalation of gas to future site users and explosion in confined spaces.		
Controlled Waters		
Hydrocarbon Compounds Associated Within Vehicle Repair Facilities adjacent to the Site	Vertical/Lateral Migration.	Secondary A Aquifers. Roeacre Brook.
Discussion: It is likely that chemicals will have been stored/present on/adjacent to the Site in the past and spillages of mobile contaminants (S/VOC/BTEX) are considered possible. Granular drift if present may permit downward or lateral migration, however, intervening low-permeability clay deposits would interrupt the pathway and afford some protection to the underlying aquifer. The closest groundwater abstraction is located 593 m to the north east of the Site, thus reducing the sensitivity of the receptor. The Rochdale Canal is located east of the Site. However, it is not within influencing distance or in hydraulic continuity of the Site. An inland rivers/drainage ditch is present along the northern boundary (tributary to Roeacre Brook). Lateral migration of contaminants is considered possible due variable nature of the Made Ground deposits and presence of shallow granular strata. The overall risk is considered low/moderate.		
Buildings and Infrastructure		
pH and Sulphate	Corrosion of Concrete.	Foundations/Concrete.
Discussion: Presence of high pH and sulphate within Made Ground deposits may result in corrosion of buried concrete within any potential proposed development. Assessment must be undertaken to confirm the levels of pH and sulphate within the underlying strata and in particular any Made Ground deposits so that a concrete classification can be determined.		
Ecology		
Phytotoxic Contaminants	Plant Uptake	On-site flora and fauna.
Discussion: Made Ground on Site is likely to contain levels of contamination which may inhibit plant growth. Further investigation is required to confirm the presence/absence of phytotoxic contaminants on Site will be required.		

3. SUPPLEMENTARY GROUND INVESTIGATION

3.1. GENERAL OVERVIEW

Investigation works have been designed to provide general coverage of the site area, target with exploratory hole locations advanced to further investigate the ground conditions and to retrieve environmental samples, spatially distributed to attain suitable coverage.

A stockpile situated within the Network Rail Land has been previously sampled as part of the investigation of the adjacent land (Phase I and II Geoenvironmental Assessment, Report Ref: 14-768-R1-2, April 2022). The results from this testing have been included in the below assessment in respect of retaining the material/re-using it within the Network Rail Land.

3.2. LIMITATIONS

The following limitations constrained the extent and coverage of intrusive investigation:

- ✳ A live railway forms the south eastern boundary of the Site. A 15 m easement was applied to prevent any disturbance/vibration to infrastructure.
- ✳ A water main enters the south west of the Network Rail Land and connects to the signal box on the eastern boundary. The route of this is not recorded on statutory service plans and British Rail records are outdated and of low accuracy.
- ✳ An active access road is located along the north east of the site area. A suitable easement was maintained in order to prevent disruption to access/egress (required 24 hours per day).

3.3. SUMMARY OF SUPPLEMENTARY GROUND INVESTIGATION

Exploratory fieldwork was completed on 17th October 2022. The works are summarised in Table 3.1.

TABLE 3.1 SUMMARY OF FIELDWORK

POTENTIAL SOURCE/RATIONALE	HOLE	TYPE	MAXIMUM DEPTH (m bgl)	RESPONSE ZONE
General Ground Conditions, Including the Presence/Nature of Obstructions	TP401–TP404	Mechanically Excavated Trial Pit	3.60	N/A
	WS201	Window Sample Probeholes	5.45	1.00–3.00
	WS202		5.45	1.00–3.00
	WS203		3.38	1.00–3.00
Sampling of On-Site Stockpile for Re-Use (*part of previous investigation Aug 2021).	SP101–SP103	Stockpile Samples	N/A	N/A

Mechanically excavated trial pits were advanced to investigate ground conditions and to retrieve environmental samples.

Window sample probeholes were advanced to undertake in-situ detailed geotechnical testing, obtain environmental samples and install groundwater and ground gas monitoring wells.

The sampling locations are illustrated in Drawing 14-768-115. The ground conditions encountered are indicated on the logs, which are included in Appendix III.

3.4. LABORATORY ANALYSIS

Selected soil samples were submitted for a range of chemical analysis comprising:

- ✳ Metals;
- ✳ pH, total sulphate, water-soluble sulphate (2:1 extract);
- ✳ Sulphide;
- ✳ Cyanide;
- ✳ Phenols;
- ✳ Total and speciated polycyclic aromatic hydrocarbons (PAHs);
- ✳ Semi volatile organic compounds (SVOC);
- ✳ Volatile organic compounds (VOC);
- ✳ Asbestos identification;
- ✳ Banded total petroleum hydrocarbon (TPH);
- ✳ Total organic carbon (TOC); and
- ✳ Soil leachate analysis.

I2 Analytical undertook the analytical work and the testing results are included in Appendix VI and discussed in Section 4.

3.5. SUMMARY OF GROUND CONDITIONS

The ground investigation generally confirms the published geology and identifies the strata set out in Table 3.2.

TABLE 3.2 SUMMARY OF STRATA

HOLE	DEPTH TO STRATUM (M BGL)				
	MADE GROUND (TOPSOIL)	MADE GROUND	SAND	SANDY CLAY	CLAY
TP401	0.00–0.30	0.30–2.60	2.60–3.00 3.20–3.60	3.00–3.20	–
TP402	–	0.00–2.00	–	–	–
TP403	0.00–0.40	0.40–3.00	3.00–3.20	3.20–3.50	–
TP404	0.00–0.30	0.30–2.80		2.80–3.30	–
WS201	0.00–0.20	0.20–3.00	3.00–4.20	–	4.20–5.45
WS202	0.00–0.10	0.10–0.80	2.50–3.40	–	0.80–2.50 3.40–5.38

HOLE	DEPTH TO STRATUM (M BGL)				
	MADE GROUND (TOPSOIL)	MADE GROUND	SAND	SANDY CLAY	CLAY
WS203	0.00–0.20	0.20–3.38	–	–	

3.6. MADE GROUND

MADE GROUND was encountered in each of the exploratory hole locations to a maximum proven depth of 3.00 m bgl. The base of the MADE GROUND remained unproven in WS203 at 3.38 m bgl due to refusal and in TP402 due to encountering a water main.

The material generally comprised reworked topsoil of dark brown silty clay with rare ceramic and plastic overlying brown clayey gravelly sand/sandy gravelly clay with inclusions of brick, concrete, coal and ceramic, with less frequent inclusions of metal and timber/wood.

Obstructions (reinforced concrete slabs and redundant services) were encountered frequently across the Site, together with visual evidence of potential contamination encountered within TP403 and TP404 within the Made Ground, in the form of clinker.

3.7. DRIFT DEPOSITS

Drift deposits were encountered beneath the MADE GROUND in the majority of exploratory hole locations from depths of between 0.80 m and 3.00 m bgl.

The drift deposits generally comprise medium dense yellowish brown silty SAND and firm to stiff orangish brown slightly gravelly sandy CLAY.

3.8. SOLID GEOLOGY

The solid geology was not encountered during the E3P intrusive investigation. The previous ground investigations over the wider Site also did not encounter the solid geology. A nearby BGS borehole indicates rockhead at circa 81.00 m bgl.

3.9. GROUNDWATER

Groundwater strikes were encountered as seepages. The depth of the seepages are shown on the exploratory hole records in Appendix V and are summarised in Table 3.3.

TABLE 3.3 SUMMARY OF GROUNDWATER STRIKES DURING FIELDWORK

LOCATION	DEPTH TO STRIKE (m)	NOTES
TP401	3.30	Slow seepage through natural granular strata.
TP403	3.50	Slow seepage through natural sandy clay strata.

Subsequent monitoring of installations recorded all wells to be dry at c. 2.5 m bgl.

3.10. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

No olfactory evidence of contamination was identified within the exploratory hole locations, however visual evidence of potential contamination was encountered within TP403 and TP404 within the Made Ground, in the form of clinker.

3.11. OBSTRUCTIONS

Obstructions (reinforced concrete slabs and redundant services) were encountered frequently across the Site.

3.12. SOIL CONSISTENCY

Undrained shear strength values were measured where natural cohesive materials were encountered using field hand shear vane tests.

Results of the tests are presented in Table 3.4, which indicate the underlying clay soils to be soft to firm.

TABLE 3.4 SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

LOCATION	DEPTH	SHEAR STRENGTH (kPA)	CALCULATED ALLOWABLE BEARING PRESSURE (kN/m ²)
TP403	3.2	45	105.75
TP404	3.0	39	91.65
TP404	3.2	52	122.2

Notes

ABP Calculated using Stroud and Butler et al 1974.

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 2.5.

TABLE 3.5 STANDARD/CONE PENETRATION TEST RESULTS

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS201	1	MADE GROUND: Black slightly clayey gravel.	9	9.07	Loose	N/A	N/A	N/A	90.73
WS201	2	MADE GROUND: Black slightly clayey gravel.	10	9.14	Loose	N/A	N/A	N/A	91.35
WS201	3	Slightly clayey SAND.	12	10.44	Medium Dense	N/A	N/A	N/A	104.36
WS201	4	Slightly clayey SAND.	10	8.45	Loose	N/A	N/A	N/A	84.49
WS201	5	Slightly silty CLAY.	12	9.96	N/A	Medium strength	Stiff	49.78	102.34
WS202	1	Sandy CLAY.	9	9.07	N/A	Medium strength	Stiff	45.37	93.27
WS202	2	Sandy CLAY.	27	24.67	N/A	High strength	Very Stiff	123.33	253.56
WS202	3	Slightly clayey slightly gravelly SAND.	8	6.96	Loose	N/A	N/A	N/A	69.57
WS202	4	Slightly gravelly CLAY.	12	10.14	N/A	Medium strength	Stiff	50.69	104.22
WS202	5	Slightly gravelly CLAY.	50	41.48	N/A	Very high strength	Very Stiff	207.41	426.43

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING PRESSURE (kN/m ²)*
WS203	1	MADE GROUND: Blackish brown clayey gravelly medium to coarse sand.	28	28.23	Medium Dense	N/A	N/A	N/A	282.28
WS203	2	MADE GROUND: Greyish brown mottled black slightly silty gravelly clay.	8	7.31	N/A	Low strength	Firm	36.54	75.13
WS203	3	MADE GROUND: Greyish brown mottled black slightly silty gravelly clay.	50	43.48	N/A	Very high strength	Very Stiff	217.41	447.00

Notes

* The Allowable Bearing Pressure (ABP) should be considered indicative.

The interpretation of in situ mass undrained shear strength (cu) data from SPT Blow Count (N) results and the influence of the Plasticity Index (PI) was reported in Standard Penetration Test in Insensitive Clays and Soft Rocks. Stroud (1974). The standard penetration test and the engineering properties of glacial materials subsequently. Stroud and Butler (1975) and (1989).

Allowable bearing pressure on sands. Soil Mechanics in Engineering Practice Terzaghi, K. & Peck, R.B. 1996

3.13. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation.

The presence of brick cobbles, concrete and wood within the Made Ground deposits meant that in certain places, excavation was slow through the Made Ground.

3.14. PH AND SULPHATE

Chemical analyses for pH and soluble sulphate content are presented in Appendix VI and summarised in Table 3.6.

TABLE 3.6 SUMMARY OF pH AND SULPHATE DATA

LOCATION	DEPTH (m)	SO ₄ IN 2:1 WATER/SOIL (g/l)	pH VALUE	CLASSIFICATION
TP401	1.00	0.044	7.6	DS-1, AC-1s
TP401	2.70	0.0056	8.1	DS-1, AC-1s
TP402	1.40	0.032	7.9	DS-1, AC-1s
TP403	1.00	0.13	7.5	DS-1, AC-1s
TP403	3.20	0.0081	7.4	DS-1, AC-1s
TP404	0.80	0.088	7.4	DS-1, AC-1s
WS203	1.00	0.071	6.7	DS-1, AC-1s
WS202	0.50	0.057	7.5	DS-1, AC-1s
WS202	1.40	0.016	6.3	DS-1, AC-1s

Results show that the soils generally meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE Special Digest 1 (2005).

4. TIER I QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 1 qualitative risk assessment to determine if any potential contaminants within the underlying soils pose an unacceptable level of risk to the identified receptors.

4.1. HUMAN HEALTH RISK ASSESSMENT

At Tier 1 stage, the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with Generic Acceptance Criteria (GAC) values published in LQM/CIEH S4UL (S4UL3267) based on a continued commercial end use with conservative Soil Organic Matter (SOM) of 1% in the first instance.

Where Tier 1 screening values are not provided by LQM, other screening values have been used and these are referenced in Table 4.1.

The results of this comparison have been summarised within Table 4.1.

TABLE 4.1 SUMMARY OF INORGANIC AND HYDROCARBON TOXICITY ASSESSMENT FOR A COMMERCIAL END USE

DETERMINAND	UNITS	GAC	N	MC	LOC. OF EX	PATH WAY	ASSESSMENT
Arsenic	mg/kg	640	12	120	N/A	1	No Further Action
Cadmium	mg/kg	190	12	<0.2	N/A	1	No Further Action
Chromium (VI)	mg/kg	33	12	<1.8	N/A	1	No Further Action
Lead	mg/kg	2300	12	960	N/A	1	No Further Action
Mercury	mg/kg	58	12	12	N/A	4	No Further Action
Nickel	mg/kg	980	12	49	N/A	1	No Further Action
Selenium	mg/kg	12000	12	<1.0	N/A	1	No Further Action
Copper	mg/kg	68000	12	550	N/A	1	No Further Action
Zinc	mg/kg	730000	12	360	N/A	1	No Further Action
Cyanide - Total	mg/kg	791	12	<1.0	N/A	1	No Further Action
Phenols - Total.	mg/kg	440	12	<1.0	N/A	1	No Further Action
Asbestos	Fibres	NFD	10	NFD	N/A	3	No Further Action
Naphthalene	mg/kg	190	12	25	N/A	4	No Further Action
Acenaphthylene	mg/kg	83000	12	0.23	N/A	2	No Further Action
Acenaphthene	mg/kg	84000	12	21	N/A	1	No Further Action
Fluorene	mg/kg	63000	12	12	N/A	1	No Further Action
Phenanthrene	mg/kg	22000	12	60	N/A	2	No Further Action
Anthracene	mg/kg	520000	12	9.7	N/A	2	No Further Action
Fluoranthene	mg/kg	23000	12	51	N/A	2	No Further Action
Pyrene	mg/kg	54000	12	50	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	170	12	24	N/A	2	No Further Action
Chrysene	mg/kg	350	12	24	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	44	12	25	N/A	2	No Further Action
Benzo(k)Fluoranthene	mg/kg	1200	12	11	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	35	12	23	N/A	2	No Further Action
Indeno(123-cd)Pyrene	mg/kg	500	12	11	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	3.5	12	3.4	N/A	2	No Further Action
Benzo(ghi)Perylene	mg/kg	3900	12	12	N/A	2	No Further Action
TPH C5-C6 (aliphatic)	mg/kg	3200	1	<0.001	N/A	4	No Further Action
TPH C6-C8 (aliphatic)	mg/kg	7800	1	<0.001	N/A	4	No Further Action
TPH C8-C10 (aliphatic)	mg/kg	2000	1	<0.001	N/A	4	No Further Action
TPH C10-C12 (aliphatic)	mg/kg	9700	1	1.3	N/A	4	No Further Action
TPH C12-C16 (aliphatic)	mg/kg	59000	1	6.2	N/A	1	No Further Action
TPH C16-C35 (aliphatic)	mg/kg	1600000	1	107	N/A	1	No Further Action
TPH C5-C7 (aromatic)	mg/kg	26000	1	<0.001	N/A	1	No Further Action

DETERMINAND	UNITS	GAC	N	MC	LOC. OF EX	PATH WAY	ASSESSMENT
TPH C7-C8 (aromatic)	mg/kg	56000	1	<0.001	N/A	4	No Further Action
TPH C8-C10 (aromatic)	mg/kg	3500	1	<0.001	N/A	4	No Further Action
TPH C10-C12 (aromatic)	mg/kg	16000	1	3.3	N/A	4	No Further Action
TPH C12-C16 (aromatic)	mg/kg	36000	1	9	N/A	4	No Further Action
TPH C16-C21 (aromatic)	mg/kg	28000	1	55	N/A	1	No Further Action
TPH C21-C35 (aromatic)	mg/kg	28000	1	150	N/A	1	No Further Action

Notes

Main pathways: PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = vapour inhalation (indoor), PL4 = dust inhalation; PL5 = vertical/lateral migration; PL6 = corrosion of concrete; PL7=tainting of water supply; PL8 = uptake by plants

Abbreviations: GAC = general assessment criteria, n = number of samples, MC = maximum concentration; Loc of Ex = location of exceedance; NFD = no fibres detected.

Referring to Table 4.1, the results of this direct comparison indicates that the contaminant concentrations for soil samples analysed (including the stockpiled material) do not exceed the chosen GAC values for a continued commercial end use and asbestos has not been detected in the soil samples submitted for analysis.

S/VOC analysis was undertaken on 1 no. sample of Made Ground from TP403 at 1.00 m bgl. Within this sample 2-Methylnaphthalene, Dibenzofuran (3500) and Carbazole have been identified above the limit of detection (LOD). No S4UL or C4SL GAC values are available for these contaminants, therefore reference to USEPA Risk Management Levels has been made, which concludes none of the above referenced VOCs to be in exceedance of USEPA GACs for industrial soil.

The overall risk to end-users from soil contamination / volatile contamination is therefore considered to be low.

4.2. CONTROLLED WATERS RISK ASSESSMENT

E3P has undertaken a controlled waters risk assessment for the Site based on the consideration of the conceptual site model and the sensitive receptors which are summarised in Table 4.2.

TABLE 4.2 CONTROLLED WATERS CONCEPTUAL MODEL AND SENSITIVITY PROFILE

DISCUSSION		SENSITIVITY RATING
Contaminant Source		
Made Ground Made ground is present across the Site to depths of 3.00 m and greater. Detectable and elevated concentrations of potentially leachable heavy metals, PAH, TPH and S/VOC have been encountered within the soils (albeit not in exceedance of human health criteria), that have the potential to be mobilised if in contact with groundwater.	Medium	
Pathway		
Vertical Migration The Site is underlain by Secondary A superficial and bedrock aquifers. Due to the Site being underlain by bands of moderate permeability granular drift deposits, vertical migration of contaminants may be facilitated. However, bands of cohesive deposits are known to be present beyond circa 10.0 m bgl (based on previous investigations on adjacent land), thus likely inhibiting downward and lateral flow. Drift deposits are anticipated to be c. 80 m thick.	Low	
	Medium	

DISCUSSION		SENSITIVITY RATING
Lateral migration The Rochdale Canal is located east of the Site. However, it is not within influencing distance or in hydraulic continuity of the Site. An inland rivers/drainage ditch is present along the northern boundary (tributary to Roeacre Brook). Lateral migration of contaminants is considered possible due variable nature of the Made Ground deposits and presence of shallow granular strata.		
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary Undifferentiated / Secondary A Aquifer	Medium
Aquifer Classification in Bedrock	Secondary A Aquifer – overlain by circa 80 m of drift, thus reducing the sensitivity.	Low/Medium
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The Site is not situated with a Groundwater Source Protection Zone.	Low
Distance to the Closest Groundwater Abstraction Point	None identified within a 1 km radius.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	An inland rivers/drainage ditch is present along the northern boundary (tributary to Roeacre Brook). The Rochdale Canal is located east of the Site, albeit not within influencing distance or in hydraulic continuity of the Site.	Medium
The ICSM developed within the context of the site setting has viable pollutant pathway, which would be the lateral migration of potentially mobile phase-soluble contaminants towards nearby surface water courses including the adjacent inland river (northern boundary) and Roeacre Brook.		

TABLE 4.3 QUALITATIVE RISK TO CONTROLLED WATERS FROM SOIL ANALYTICAL RESULTS

CONTAMINANT	ASSESSMENT RATING	DISCUSSION
BTEX > 1 mg/kg	Concentrations are less than 1.0 mg/kg.	None
Total VOC > 1 mg/kg		
Total SVOC > 1 mg/kg	Concentrations are above 1.0 mg/kg in TP403 at 1.00 m bgl.	Further discussion
C5-C10 > 5 mg/kg	All concentrations are less than 5.0 mg/kg.	None
C10-C12 > 10 mg/kg	Concentrations of 110 mg/kg in TP401 at 1.00 m bgl and 13 mg/kg in TP404 at 0.80 m bgl.	Further discussion
C12-C16 > 50 mg/kg	Concentration of 480 mg/kg in TP401 at 1.00 m bgl.	Further discussion
Phenols > 2 mg/kg	All concentrations are below the L.O.D.	None
Naphthalene > 2 mg/kg	Concentration of 25 mg/kg in TP401 at 1.00 m bgl and 12 mg/kg in TP404 at 0.80 m bgl.	Further discussion
Total PAH > 10 mg/kg	Elevated concentrations were recorded in TP401, TP402, TP404, WS203 and WS202.	Further discussion
PCB > 1 mg/kg	No potential sources of PCB have been identified	None
Heavy metals > 500 mg/kg	Concentrations above 500 mg/kg identified within TP404 at 0.80 m bgl and WS203 at 1.00 m bgl.	Further discussion

On return monitoring visits, monitoring wells within the Network Rail Land (WS201-WS203) were recorded to be dry, as such, it has not been possible to carry out groundwater analysis.

Given the absence of a shallow water table to mobilise soil contamination, the risk of leachable contamination migrating vertically or laterally is considered to be reduced. Furthermore, the underlying Secondary A bedrock aquifer is somewhat protected by the overlying thickness of drift deposits (c. 80 m bgl).

At present, the majority of the Site comprises hardstanding surface cover; as such, rainfall is largely intercepted and less likely to infiltrate freely into the underlying Made Ground, thus further reducing the potential for mobilising soil contamination.

The overall risk to controlled waters from the Site is considered low from the subject site. Should a higher water table be encountered i.e. during the winter months, it may be prudent to try to obtain water samples for analysis to confirm the above assessment.

4.3. GROUND GAS RISK ASSESSMENT

Made Ground, infilled features and potential hydrocarbon impact has been identified as potential sources of ground gas. Given the continued use of the Site as railway land (no permanent structures / confined spaces and reduced exposure duration) the risk to end users is reduced. A preliminary monitoring programme comprising three visits has therefore been considered sufficient.

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in:

CIRIA Report 665 – Assessing risks posed by hazardous ground gases to buildings (2007)

BS8485:2015+A1:2019 – Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

BS8485 provides guidance on the level of gas protection requirements based upon the characteristic situation (CS) and the proposed development based on building type.

Therefore, in accordance with BS8485, based on the measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) shall be derived for each monitoring point, from which the site characteristic hazardous gas flow rate (Q_{hgs}), and then the Characteristic Situation (CS) can be determined.

The following equation should be utilised:

$$Q_{hg} = q \left(\frac{C_{hg}}{100} \right)$$

Where:

q is the measured flow rate (in litres per hour) of combined gases from the monitoring standpipe
 C_{hg} is the measured hazardous gas concentration (in percentage volume/volume).

The subsequent derived gas screening value (GSV) should be the maximum Q_{hg} (flow rate x concentration as a percentage volume) for all the monitoring events.

A 'worst case check' may be carried out using the maximum recorded flow in any hole with the maximum concentration in any hole to present the plausible worst case conditions. Adoption of the worst case Q_{hg} requires thorough justification and reference to the CSM.

The final derived GSV can then be used to characterise the Site as summarised in Table 4.4.

TABLE 4.4 SITE CHARACTERISATION BY GSV (BS8485:2015)

CS	HAZARD POTENTIAL	GSV (l/hr) FOR METHANE AND CARBON DIOXIDE	ADDITIONAL FACTORS
CS1	Very Low	< 0.07	Typically <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
CS2	Low	< 0.70	Typical measured flow rate <70 l/h (otherwise consider an increase to CS3)
CS3	Moderate	< 3.5	N/A
CS4	Moderate to High	< 15	N/A
CS5	High	< 70	N/A
CS6	Very High	> 70	N/A

Notes

1. The CS is equivalent to the characteristic GSV in CIRIA C665.
2. The worst-case ground gas regime identified on the Site, either methane or carbon dioxide, at the worst-case temporal conditions that the Site may be expected to encounter should be considered.
3. Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, multiplied by the concentration in the air stream of the particular gas being considered.
4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

4.3.1. MONITORING METHODOLOGY

Concentrations of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) (hydrogen sulphide) were measured using a calibrated infrared gas analyser (GFM435) with gas flow rates measured using an integrated flow meter.

Gas measurements were recorded for a minimum of 500 seconds at each location, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded.

The results of the ground gas monitoring are presented in Table 4.5.

In addition to the raw data, the results for each individual standpipe have been assessed with reference to guidance provided in BS8485:2015. Based on the initial peak measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) have been derived for each monitoring point, from which an individual Characteristic Situation (CS) can ultimately be determined.

TABLE 4.5 GROUND GAS SUMMARY

WELL	STRATA	DATE	CH ₄ PEAK (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ Q _{hg} (l/hr)	CO ₂ PEAK (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ Q _{hg} (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	PEAK FLOW (l/hr)	STEADY FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)	CS CLASS
WS201	Made Ground	26/10/2022	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	986	Rising	0.1	0.1	1.00-3.00	2.20	Dry	CS1
		08/11/2022	0.1	0.1	0.0001	2.9	1.5	0.0029	18.1	973	Steady	0.1	0.1		2.20	Dry	CS1
		21/11/2022	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	981	Falling	0.1	0.1		2.20	Dry	CS1
WS202	Natural CLAY	26/10/2022	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	986	Rising	0.1	0.1	1.00-3.00	2.50	Dry	CS1
		08/11/2022	0.1	0.1	0.0001	4.2	4.1	0.0042	13.9	974	Steady	0.1	0.1		2.50	2.00	CS1
		21/11/2022	0.1	0.1	0.0001	0.1	0.1	0.0001	20.0	974	Falling	0.1	0.1		2.50	1.92	CS1
WS203	Made Ground	26/10/2022	0.1	0.1	0.0001	0.1	0.1	0.0001	20.5	986	Rising	0.1	0.1	1.00-3.00	2.50	Dry	CS1
		08/11/2022	0.1	0.1	0.0001	1.0	1.0	0.0010	19.2	973	Steady	0.1	0.1		2.50	Dry	CS1
		21/11/2022	0.1	0.1	0.0001	0.1	0.1	0.0001	20.1	981	Falling	0.1	0.1		2.50	Dry	CS1

Notes

CIRIA Characteristic Situation

Q_{hg}

CS1

<0.07

Typical Max CO₂ <5 % Typical Max CH₄ <1 %

Values in **BOLD** exceed CS1 Thresholds

CS2

<0.7

Flow rate not to exceed 70 l/hr otherwise consider increase to CS3 Values in **BLUE** denote water above level of response zone (flooded)

CS3

<3.5

CS4

<15

Quantitative Risk Assessment required to evaluate scope of protective measures



4.3.2. SUMMARY OF MONITORING RESULTS

GROUNDWATER

Monitoring wells within WS201 and WS203 were recorded as dry throughout the monitoring period, and groundwater was recorded between 1.92 m and 2.00 m bgl within WS202.

BAROMETRIC PRESSURE

Visit 1 was undertaken during a period of rising pressure, visit 2 was undertaken during a period of relatively low steady pressure with pressure recorded to be 974 mbar and visit 3 was undertaken during a period of falling pressure.

It is therefore considered that the visits have been undertaken over representative conditions.

GAS FLOW

Throughout the monitoring period, flow rates were recorded to be 0.1 l/hr (limit of detection of the analyser).

GAS CONCENTRATIONS

The maximum methane value recorded within the monitoring wells was 0.1% v/v (limit of detection of the analyser).

Carbon dioxide concentrations were recorded at concentrations ranging from 0.1% v/v to 4.2% v/v (WS202).

4.3.3. CONCLUSION

The determined Characteristic Situation for each standpipe for each visit is summarised in Table 4.5. This indicates that based on the peak flow rates the Site can be classified as Characteristic Situation (CS)1 – Very Low Gas Risk.

Risk from inhalation of potential volatile contamination is also concluded to be low (refer to Section 4.1).

5. PRELIMINARY GEOTECHNICAL ASSESSMENT

Kellen Homes intend to transfer the Network Rail Land to The East Lancashire Railway (ELR) and have therefore commissioned E3P to carry out a geoenvironmental assessment across this part of the Site for environmental indemnity insurance purposes.

A detailed geotechnical assessment is outside the scope of this report; however, a brief summary of geotechnical considerations is included below.

5.1. FOUNDATION CONSIDERATIONS

Specific development proposals are currently unknown, other than that the land will be retained as railway land under ownership of ELR.

Should development be proposed in the future, based on the assessment of the relative undrained shear strength and corresponding safe net allowable bearing pressure, the suitable target founding stratum would be the underlying natural medium dense SAND or firm to stiff CLAY at c. 2.00 to 3.00 m bgl, with an estimated allowable bearing pressure (ABP) of 104 kN/m² to 254 kN/m².

Based on the depth to suitable founding strata, depending on loadings, the following foundation options would be considered viable:

- ✦ Piled foundations terminating in natural drift (depth to be determined by structural engineer).
- ✦ Raft foundations (subject to re-engineering of a stiffened soil platform).
- ✦ Ground improvement (subject to re-engineering of a Made Ground to end performance criteria).
- ✦ For commercial/industrial developments, the use of Controlled Modulus Columns (CMC) combined with a load transfer platform could provide a viable ground engineering solution. However, these technologies are not widely warranted by the NHBC or other leading warranty providers.

Peat/organic deposits have not been encountered in the Network Rail Land, but if encountered during any development works/future excavations would require removal from beneath roads and hardstanding as a minimum. Piled foundations would be required for all structures to mitigate the unacceptable risk of total and differential settlement.

Foundation depths should take account of the presence of existing and proposed trees, with foundations deepened locally to mitigate the potential for volumetric instability attributed to fluctuations in moisture content, in accordance with the requirements of NHBC standards. Plasticity/liquid limit analysis was outside of the scope of this investigation. Previous investigations for the adjacent land to the west concluded soils to be of low volume change potential. Confirmatory testing would be required to adopt this in future foundation proposals.



6. CONCLUSIONS & RECOMMENDATIONS

Made ground is present across the Site to depths of 3.00 m and greater. Detectable and elevated concentrations of heavy metals, PAH, TPH and S/VOC have been encountered within the soils, although no contaminants have been found in exceedance of human health assessment criteria based on a continued low sensitivity commercial end-use. The overall risk to end-users from soil contamination/volatile contamination is therefore considered to be low.

The elevated soil contaminant concentrations may theoretically have the potential to leach downwards/laterally towards identified controlled waters receptors i.e. nearby drainage ditches and underlying secondary A bedrock aquifer. However, in the absence of a shallow water table to mobilise soil contamination, and presence of hardstanding cover intercepting rainfall and thus reducing infiltration, the risk of leachable contamination migrating vertically or laterally is considered to be reduced. Furthermore, the underlying Secondary A bedrock aquifer is somewhat protected by the overlying thickness of drift deposits (c. 80 m bgl) which comprises alternating layers of cohesive and granular soils. The overall risk to controlled waters from the Site is considered to be low.

Ground gas monitoring has recorded low concentrations of CO₂/CH₄. The Site is therefore characterised as CS1 (very low risk).

Should development be proposed in the future, further detailed geoenvironmental and geotechnical assessment would be required to fully appraise the Site in respect of the proposed development/end-user. The synopsis provided within this letter report is a preliminary overview. Other geoenvironmental and geotechnical hazards may be identified as part of a thorough and detailed Ground Investigation, Contaminated Land Risk Assessment and Geotechnical Design.

I trust that the above information is sufficient currently, and if you require anything further, please do not hesitate to contact me

Yours sincerely,
For and on behalf of E3P Ltd

Eleanor Canham
Geo-Environmental Consultant

Approved by.
Jessica Sheridan
Senior Geo-Environmental Consultant

Enclosed:

Appendix I	Limitations
Appendix II	Glossary
Appendix III	Drawings
Appendix IV	Photographs
Appendix V	Exploratory Hole Logs
Appendix VI	Chemical Analysis Results
Appendix VII	Origin of Tier 1 Generic Assessment



APPENDIX I

LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between E3P and the client as indicated in Section 1.3.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. 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 it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the Site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. Access considerations, the presence of services and the activities being carried out on the Site limited the locations where sampling locations could be installed and the techniques that could be used.
6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.
7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and do not constitute or replace full and proper surveys.
8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
9. E3P cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by E3P is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by E3P in this connection without their explicit written agreement there to by E3P.
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



APPENDIX II

GLOSSARY

TERMS

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation
MCV	Moisture condition value	WRAP	Waste and Resources Action Programme



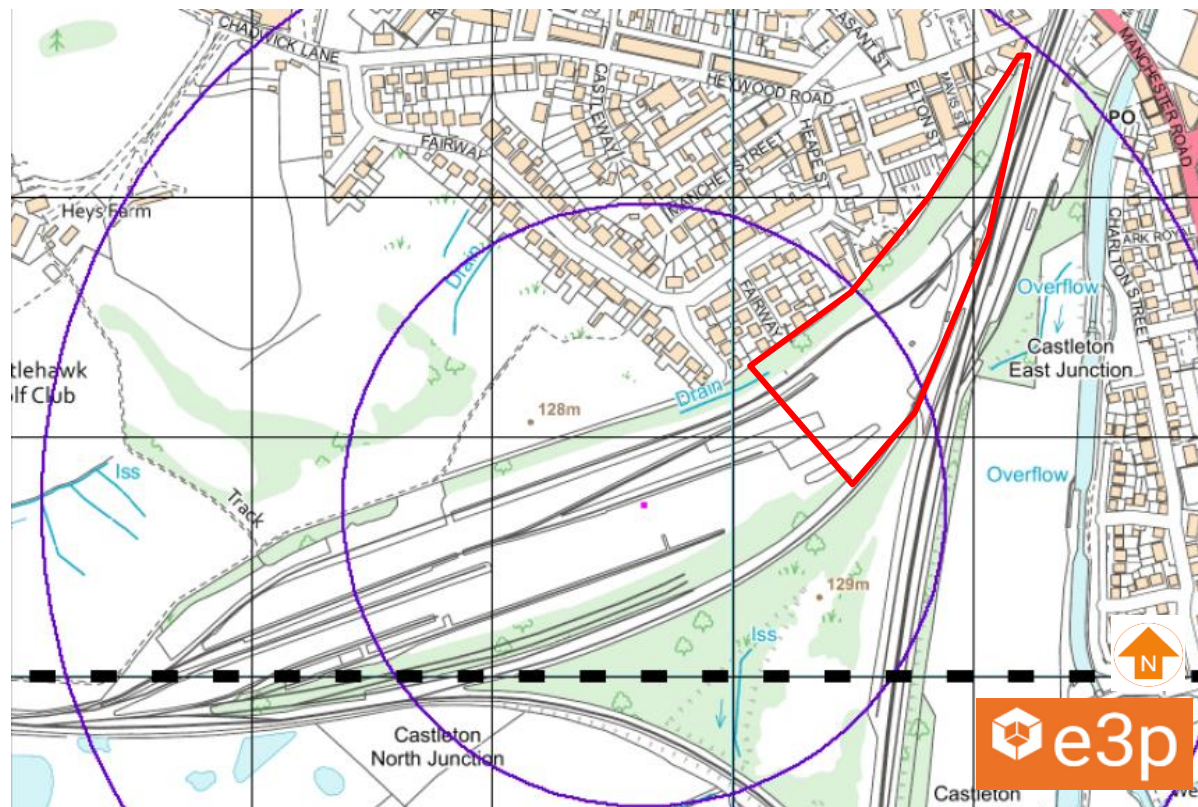
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection



APPENDIX III

DRAWINGS

DRAWING 14-768-001 – SITE LOCATION PLAN





- Site Features
- Stockpiles of Waste (Possible ACM)
 - Self Seeded Vegetation
 - Mature Trees / Hedges
 - Access Track
 - Signal Box
 - Temporary Cabins
 - Car Parking / Compound
 - Former Railway Platform
 - Relic Slabs

Notes:					
P1	REVD	14.12.2022	HM	JS	
P1	REVC	13.12.2022	HM	EC	
P1	REVB	11.03.2022	HM	JS	
P1	REVA	15.04.2021	EB	EF	
Phase	Issue	Date	Drawn	Checked	

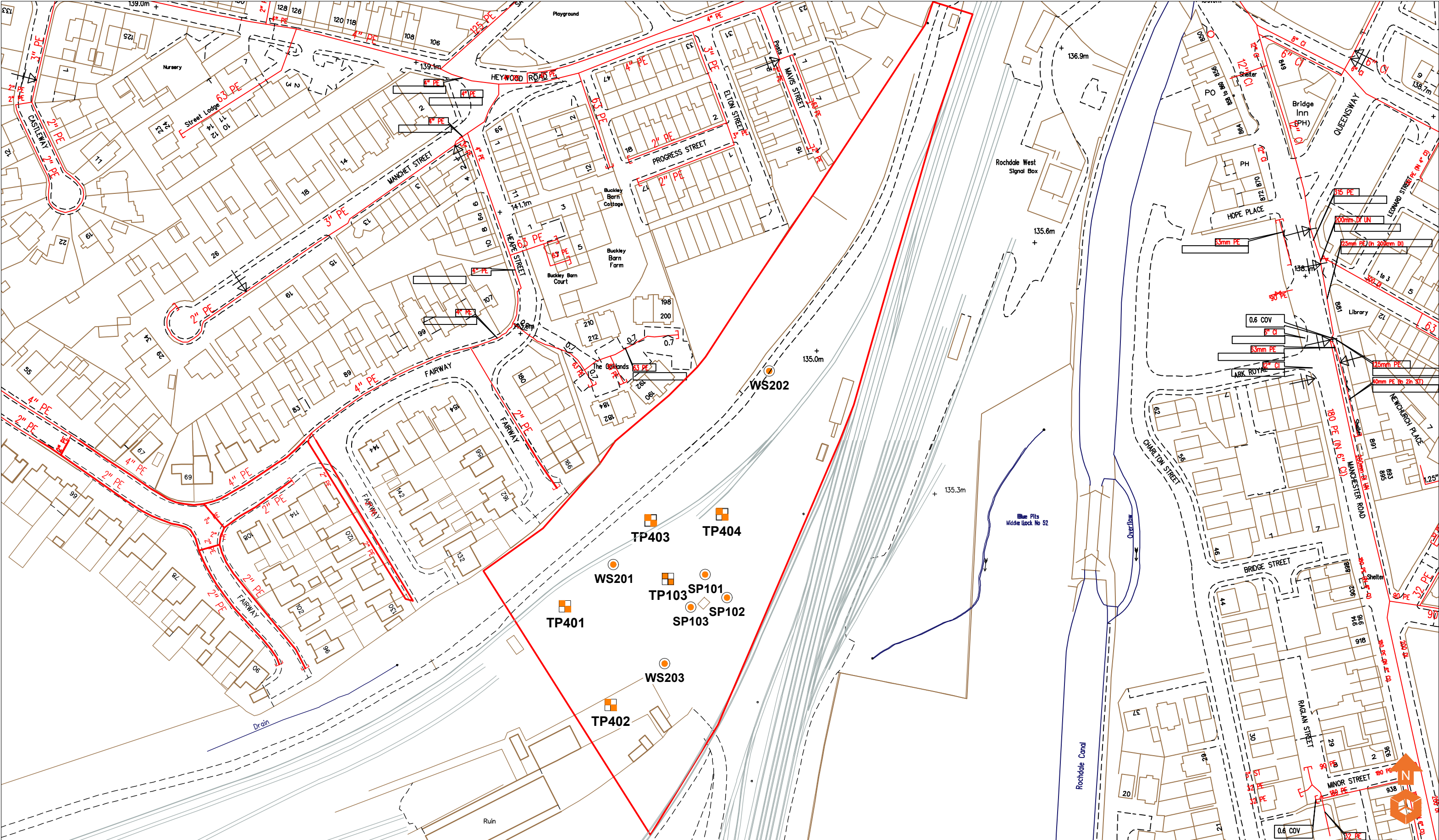
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Kellen Homes		14-768	
Job Title:		Drawing No:	
Heywood Road, Castleton		104	
		Drawing Title:	
		Site Features Plan	

Date:	14.12.2022
Scale:	NTS @ A3



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Location Symbols					
	Approximate Window Sample Probehole Location (March 2021)				
	Approximate Window Sample Probehole Location with Install (March 2021)				
	Approximate Trial Pit Location (March 2021)				
	Approximate Rotary Borehole Location (March 2021)				
	Approximate Stockpile Sample Location (July 2021)				

Phase	Issue	Date	Drawn	Checked
P1	REV F	14.12.2022	HM	JS
P1	REV E	13.12.2022	HM	EC
P1	REV D	19.10.2022	HM	EC
P1	REV C	30.03.2022	EB	JS
P1	REV B	11.03.2022	HM	JS
P1	REV A	25.03.2021	EB	EF

Notes:					

P1	REV F	14.12.2022	HM	JS
P1	REV E	13.12.2022	HM	EC
P1	REV D	19.10.2022	HM	EC
P1	REV C	30.03.2022	EB	JS
P1	REV B	11.03.2022	HM	JS
P1	REV A	25.03.2021	EB	EF

Client:	
Kellen Homes	

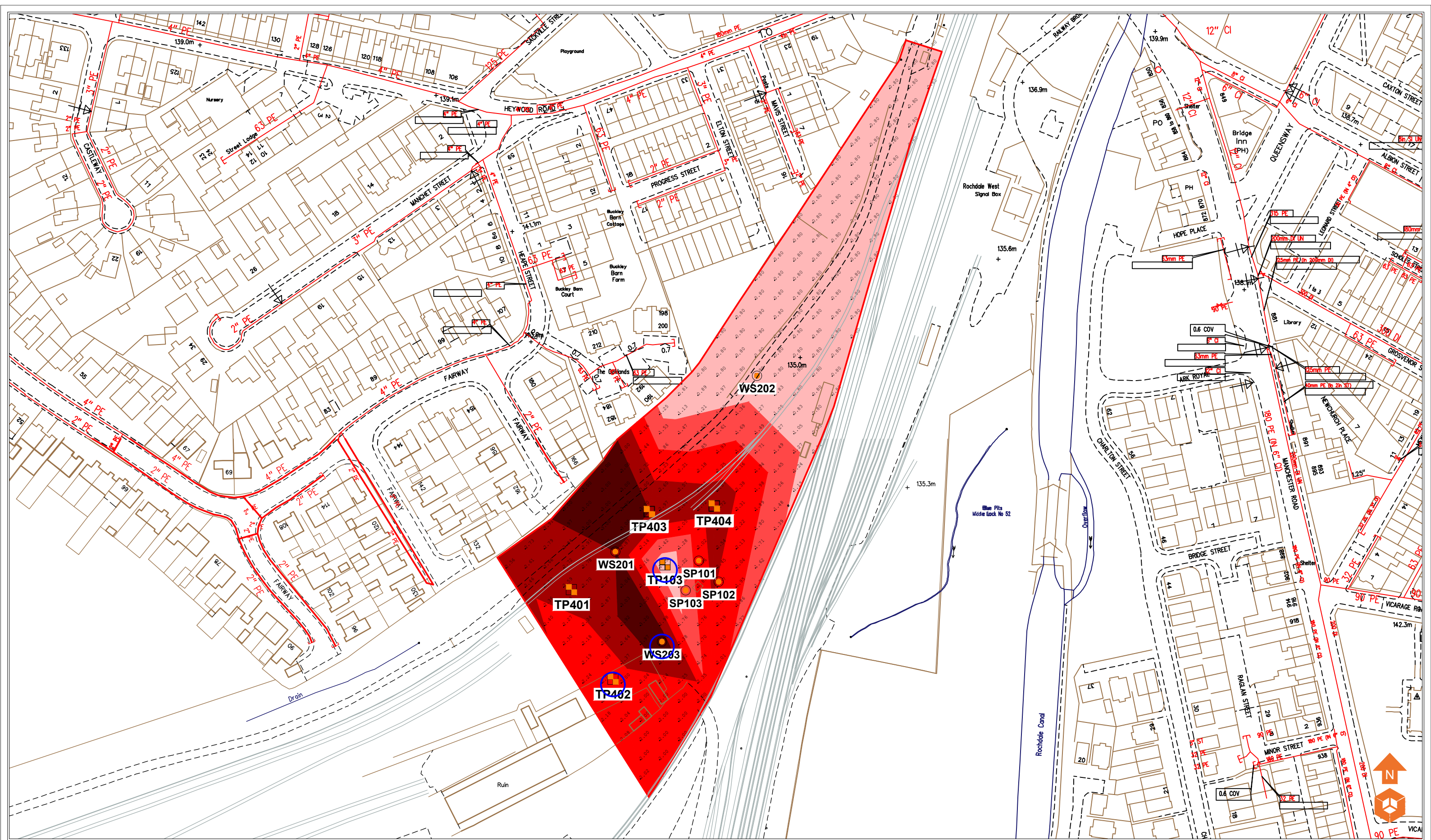
Job Title:	
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Drawing No:	
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Date:	
14.12.2022	
Scale:	
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Location Symbols

- Approximate Window Sample Probehole Location (March 2021)
- Approximate Window Sample Probehole Location with Install (March 2021)
- Approximate Trial Pit Location (March 2021)
- Approximate Rotary Borehole Location (March 2021)
- Approximate Stockpile Sample Location (July 2021)

Made Ground Depth (m)

- Depth of Made Ground 0.00 - 0.59m
- Depth of Made Ground 0.60 - 1.19m
- Depth of Made Ground 1.20 - 1.79m
- Depth of Made Ground 1.80 - 2.39m
- Depth of Made Ground 2.40 - 2.99m
- Depth of Made Ground >3.00m

Base of Made Ground Not Proven

Notes:					
P1	REVF	14.12.2022	HM	JS	
P1	REVE	13.12.2022	HM	EC	
P1	REVD	30.03.2022	EB	JS	
P1	REVC	11.03.2022	HM	JS	
P1	REVB	07.05.2021	EB	JS	
P1	REVA	31.03.2021	EB	EF	
Phase	Issue	Date	Drawn	Checked	

Client:

Kellen Homes

Job Title:

Heywood Road,
Castleton

Job No:

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Drawing No:

106

Date:

14.12.2022

Scale:

NTS @ A3

Drawing Title:

Depth Of Made
Ground Plan

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APPENDIX IV

PHOTOGRAPHS

PLATE 1

TP401



PLATE 2

TP401 ARISINGS



PLATE 3 REPIARED WATER PIPE (TP402)



PLATE 4 WS202 ARISINGS



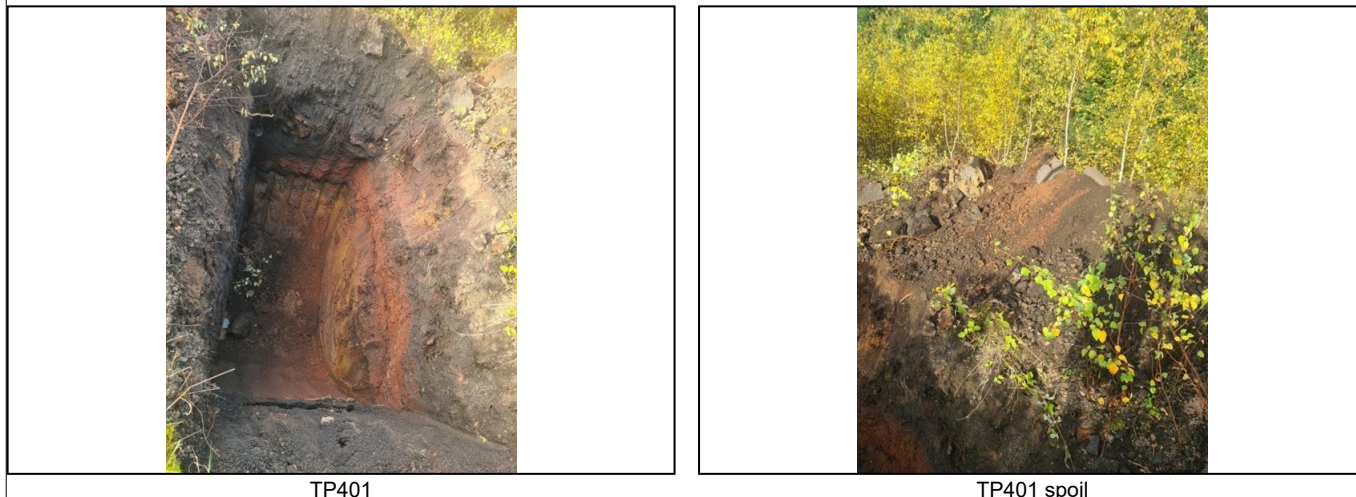
APPENDIX V

E3P EXPLORATORY HOLE LOGS

Project Name: Castleton Sidings	Project No. 14768	Co-ords: 388095.00 - 410270.00 Level:	Date 17/10/2022
Location: Heywood Road, Rochdale		Dimensions (m): 3.50 1.90	Scale 1:45
Client: Kellen Homes		Depth 3.60	Logged E.Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 3.30				0.30			MADE GROUND: Brown gravelly clayey medium to coarse sand with frequent rootlets. Gravel is medium to coarse subangular to subrounded of brick, mudstone and concrete. (Topsoil)	
	1.00	ES					MADE GROUND: Dark brown slightly clayey very gravelly medium to coarse sand with occasional roots and frequent cobbles. Gravel is medium to coarse subangular of brick and ash. Cobbles are intact bricks. Large wooden beam encountered between 0.30m and 0.50m bgl.	1
	1.70	ES		1.50			MADE GROUND: Black and reddish orange clayey gravelly medium to coarse sand. Gravel is fine to coarse subangular to angular of brick and ash.	2
				2.60			Yellowish grey and orange slightly silty medium to coarse SAND with occasional cobbles. Cobbles are subangular of sandstone.	
				3.00			Yellowish grey mottled orange sandy CLAY.	3
				3.20			Reddish brown medium to coarse SAND.	
				3.60			End of Pit at 3.60m	4
								5
								6

Trial Pit Photographs



TP401

TP401 spoil

Remarks: 1. Complete. 2. Water strike encountered at 3.30m bgl- slow seepage.

Stability: Stable.

Project Name: Castleton Sidings	Project No. 14768	Co-ords: 388113.00 - 410237.00 Level:	Date 17/10/2022
Location: Heywood Road, Rochdale		Dimensions (m): 1.80 x 3.30	Scale 1:45
Client: Kellen Homes		Depth 2.00	Logged E.Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	1.40	ES		0.20			MADE GROUND: Grey sandy gravel. Gravel is medium to coarse subangular of concrete.	
				1.00			MADE GROUND: Dark brown clayey gravelly medium to coarse sand. Gravel is medium to coarse subangular to angular of concrete, brick, ceramic and wood.	1
				2.00			MADE GROUND: Dark brown gravelly very clayey medium to coarse sand. Gravel is fine to coarse subangular to angular of concrete, metal, wood, brick and ceramic.	2
							End of Pit at 2.00m	3
								4
								5
								6

Trial Pit Photographs



TP402



TP402 spoil

Remarks: 1. Terminated as water main encountered at 1.50m bgl. 2. Concrete slab encountered in western wall of trial pit.

Stability: Stable.

Project Name: Castleton Sidings	Project No. 14768	Co-ords: 388134.00 - 410297.00 Level:	Date 17/10/2022
Location: Heywood Road, Rochdale		Dimensions (m): 3.60 Depth 3.50	Scale 1:45 Logged E.Canham
Client: Kellen Homes			

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 3.50	1.00	ES		0.40			MADE GROUND: Brown very gravelly clayey medium to coarse sand with frequent rootlets. Gravel is medium to coarse subangular to subrounded of brick, mudstone and concrete. (Topsoil)	1
				1.40			MADE GROUND: Black sandy gravel. Gravel is fine to coarse subangular to angular of clinker, coal and brick.	2
				3.00			MADE GROUND: Black clayey slightly gravelly fine to medium sand. Gravel is fine to coarse subangular to angular of coal, brick and sandstone with large metal fragments.	3
	3.20	ES		3.20			Whiteish grey silty medium to coarse SAND with occasional organic fragments.	4
	3.20	HVP	45	3.50			Firm yellowish grey mottled orange sandy CLAY.	5
							End of Pit at 3.50m	6

Trial Pit Photographs



TP403



TP403 spoil

Remarks: 1. Complete. 2. Water strike encountered at 3.50m bgl- slow seepage.

Stability: Stable.

Project Name: Castleton Sidings	Project No. 14768	Co-ords: 388158.00 - 410312.00 Level:	Date 17/10/2022
Location: Heywood Road, Rochdale		Dimensions (m): Depth 3.30	Scale 1:45
Client: Kellen Homes		1.80 3.40	Logged E.Canham

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 3.30	0.80	ES		0.30			MADE GROUND: Brown gravelly clayey medium to coarse sand with frequent rootlets. Gravel is medium to coarse subangular to subrounded of brick, mudstone and concrete. (Topsoil) MADE GROUND: Black clayey gravelly medium to coarse sand. Gravel is fine to coarse subangular to angular of plastic, ash, coal, clinker and metal. Brick fill encountered between 1.80m and 2.80m bgl.	1
	3.00	HVP	39	2.80			Soft to firm light grey mottled orange slightly gravelly sandy CLAY. Gravel is medium to coarse subangular to subrounded of sandstone and mudstone.	3
	3.20	HVP	52	3.30			End of Pit at 3.30m	4
								5
								6

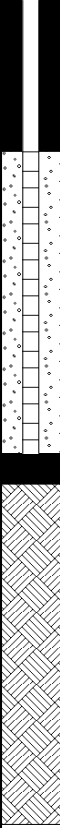
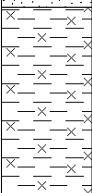
Trial Pit Photographs



TP404

Remarks: 1. Complete. 2. Water strike encountered at 3.30m bgl.

Stability: Stable.

				Borehole Log			Borehole No. WS201 Sheet 1 of 1				
Project Name: Castleton Sidings				Project No. 14768		Co-ords: 388122E - 410294N		Hole Type WS			
Location: Heywood Road, Rochdale				Level:		Scale 1:50		Logged By E.Canham			
Client: Kellen Homes				Dates: 17/10/2022							
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
					0.20			MADE GROUND: Brown gravelly clayey medium to coarse sand with frequent rootlets. Gravel is medium to coarse subangular to subrounded of brick, mudstone and concrete. (Topsoil)	1		
	1.00	SPT	N=9 (1,2/2,2,2,3)	1.00		MADE GROUND: Dark brown clayey gravelly medium to coarse sand. Gravel is medium to coarse subangular to angular oof concrete, brick, ceramic and wood.					
	1.20	ES				MADE GROUND: Loose black slightly clayey gravel. Gravel is fine to medium subangular to angular of ash, clinker and coal.					
					2.00	SPT	N=10 (2,2/2,3,3,2)			2	
					3.00	SPT	N=12 (2,2/3,3,3,3)	3.00		Medium dense greyish brown slightly clayey medium to coarse SAND. Becomes loose circa 4.00m bgl.	3
					4.00	SPT	N=10 (2,2/2,2,3,3)	4.20			Stiff medium strength brown slightly silty CLAY.
					4.50 - 5.00	U					5
					5.00	SPT	N=12 (3,3/3,2,3,4)	5.45			
									End of Borehole at 5.45m	6	
										7	
									8		
									9		
									10		

Remarks
1. Complete. 2. Monitoring well installed- response zone: 1.00-3.00m bgl.



Borehole Log

Borehole No.

WS202

Sheet 1 of 1

Project Name: Castleton Sidings

Project No.
14768

Co-ords: 388173E - 410362N

Hole Type
WS

Location: Heywood Road, Rochdale

Level:

Scale
1:50

Client: Kellen Homes

Dates: 17/10/2022

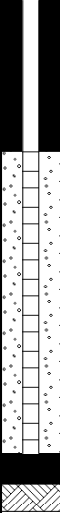
Logged By
E.Canham

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10 0.20			0.10 0.20			MADE GROUND: Brown gravelly clayey medium to coarse sand with frequent rootlets. Gravel is medium to coarse subangular to subrounded of brick, mudstone and concrete. (Topsoil)	
		0.50	ES		0.50			MADE GROUND: Grey slightly clayey gravel. Gravel is fine to coarse subangular to angular of concrete.	
		1.00	SPT	N=9 (2,2/2,2,2,3)	1.00			MADE GROUND: Black clayey gravelly fine to medium sand. Gravel is fine to medium subangular to angular of ash and coal.	1
		1.40	ES					MADE GROUND: Black slightly silty slightly gravelly reworked clay. Gravel is fine to medium subangular of ash and coal.	
		2.00 2.00	SPT SPT	N=27 (3,3/5,7,7,8)				Yellowish brown mottled brown slightly sandy CLAY. Stiff medium strength yellowish grey mottled orange sandy CLAY with cobble encountered at 1.95m bgl. Cobble is subrounded mudstone. Becomes very stiff very high strength circa 2.00m bgl.	2
		3.00 3.00	SPT SPT	N=8 (3,2/2,2,2,2)	2.50			Loose yellowish brown slightly clayey slightly gravelly medium to coarse SAND. Gravel is medium to coarse subrounded sandstone.	3
		4.00 4.00	SPT SPT	N=12 (2,2/3,3,3,3)	3.40			Stiff medium strength brown slightly gravelly CLAY. Gravel is medium to coarse subrounded mudstone. Becomes very stiff very high strength circa 4.00m bgl.	4
		5.00 5.00	SPT SPT	50 (3,4/50 for 230mm)	5.38				5
								End of Borehole at 5.38m	6
									7
									8
									9
									10

Remarks

1. Refusal at 5.38m bgl. 2. Monitoring well installed- response zone: 1.00-3.00m bgl.

				Borehole Log			Borehole No. WS203 Sheet 1 of 1		
Project Name: Castleton Sidings				Project No. 14768		Co-ords: 388113E - 410234N		Hole Type WS	
Location: Heywood Road, Rochdale						Level:		Scale 1:50	
Client: Kellen Homes						Dates: 17/10/2022		Logged By E.Canham	

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20		MADE GROUND: Brown gravelly clayey medium to coarse sand with frequent rootlets. Gravel is medium to coarse subangular to subrounded of brick, mudstone and concrete. (Topsoil) MADE GROUND: Blackish brown clayey gravelly medium to coarse sand with occasional wood fragments. Gravel is fine to coarse subangular to angular of brick and concrete.	1	
	1.00 1.00 1.20	SPT SPT ES	N=28 (4,6/6,6,8,8)						
	2.00 2.00	ES SPT	N=8 (5,4/2,2,2,2)	1.90		MADE GROUND: Greyish brown mottled black slightly silty gravelly clay. Gravel is fine to coarse subangular to angular of ash, brick, coal and concrete.	2		
	3.00	SPT	50 (2,7/50 for 230mm)					3	
					3.38		End of Borehole at 3.38m	4	
								5	
								6	
								7	
								8	
								9	
								10	

Remarks
 1. Refusal at 3.38m bgl. 2. Monitoring well installed- response zone: 1.00-3.00m bgl.



APPENDIX VI

CHEMICAL TESTING

RESULTS

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M41 7JQ

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Business Park,
Watford,
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t: 01923 225404
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e: reception@i2analytical.com

e:

Analytical Report Number : 22-91338

Project / Site name:	Heywood Road	Samples received on:	20/10/2022
Your job number:	14-768	Samples instructed on/ Analysis started on:	20/10/2022
Your order number:	003224	Analysis completed by:	28/10/2022
Report Issue Number:	1	Report issued on:	28/10/2022
Samples Analysed:	9 soil samples		

Signed:

Adam Fenwick
Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :	soils	- 4 weeks from reporting
	leachates	- 2 weeks from reporting
	waters	- 2 weeks from reporting
	asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-91338
Project / Site name: Heywood Road
Your Order No: 003224

Lab Sample Number				2468517	2468518	2468519	2468520	2468521
Sample Reference				TP401	TP401	TP402	TP403	TP403
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.70	1.40	1.00	3.20
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	19	16	16	21	13
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.3	0.3

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	Not-detected	-
Asbestos Analyst ID	N/A	N/A	N/A	SPU	N/A	SPU	SPU	N/A

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.6	8.1	7.9	7.5	7.4
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	4000	94	680	1200	75
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.044	0.0056	0.032	0.13	0.0081
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	89	11	64	270	16
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	44.3	5.6	32.2	134	8.1
Sulphide	mg/kg	1	NONE	4.4	1.6	8.5	39	3.2
Total Sulphur	mg/kg	50	MCERTS	2800	85	680	1700	130
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	-	0.3	4.2	6.1	0.4
Total Organic Carbon (TOC) - Manual	%	0.1	MCERTS	7.2	-	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	-------	-------	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	NONE	25	< 0.05	1	-	< 0.05
Acenaphthylene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.23	-	< 0.05
Acenaphthene	mg/kg	0.05	NONE	21	< 0.05	0.78	-	< 0.05
Fluorene	mg/kg	0.05	NONE	12	< 0.05	0.58	-	< 0.05
Phenanthrene	mg/kg	0.05	NONE	60	< 0.05	6.8	-	< 0.05
Anthracene	mg/kg	0.05	NONE	9.7	< 0.05	2	-	< 0.05
Fluoranthene	mg/kg	0.05	NONE	51	< 0.05	14	-	< 0.05
Pyrene	mg/kg	0.05	NONE	50	< 0.05	13	-	< 0.05
Benzo(a)anthracene	mg/kg	0.05	NONE	24	< 0.05	7.3	-	< 0.05
Chrysene	mg/kg	0.05	NONE	23	< 0.05	6.4	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	NONE	22	< 0.05	9.5	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	NONE	11	< 0.05	2.1	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	NONE	23	< 0.05	6.9	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	9.3	< 0.05	3.7	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	2.7	< 0.05	1.1	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	11	< 0.05	3.8	-	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	355	< 0.80	78.3	-	< 0.80
-----------------------------	-------	-----	------	-----	--------	------	---	--------

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	120	4.7	37	33	2.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	10	40	17	12
Copper (aqua regia extractable)	mg/kg	1	MCERTS	140	6	190	160	9.8
Lead (aqua regia extractable)	mg/kg	1	MCERTS	420	5.7	280	99	8.9
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	1.1	< 0.3	< 0.3

Analytical Report Number: 22-91338
 Project / Site name: Heywood Road
 Your Order No: 003224

Lab Sample Number				2468517	2468518	2468519	2468520	2468521
Sample Reference				TP401	TP401	TP402	TP403	TP403
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.70	1.40	1.00	3.20
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	36	17	49	47	9.8
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	150	30	360	170	18

Analytical Report Number: 22-91338
Project / Site name: Heywood Road
Your Order No: 003224

Lab Sample Number	2468517	2468518	2468519	2468520	2468521
Sample Reference	TP401	TP401	TP402	TP403	TP403
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.00	2.70	1.40	1.00	3.20
Date Sampled	17/10/2022	17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics & Oxygenates

Benzene	µg/kg	1	NONE	-	-	-	< 1.0	-
Toluene	µg/kg	1	NONE	-	-	-	< 1.0	-
Ethylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
p & m-xylene	µg/kg	1	NONE	-	-	-	< 1.0	-
o-xylene	µg/kg	1	NONE	-	-	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	-	-	-	< 1.0	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS, 1D, AL}	mg/kg	0.001	NONE	-	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC6 - EC8 _{HS, 1D, AL}	mg/kg	0.001	NONE	-	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC8 - EC10 _{HS, 1D, AL}	mg/kg	0.001	NONE	-	-	-	< 0.001	-
TPH-CWG - Aliphatic >EC10 - EC12 _{EH, CU, 1D, AL}	mg/kg	1	NONE	-	-	-	1.3	-
TPH-CWG - Aliphatic >EC12 - EC16 _{EH, CU, 1D, AL}	mg/kg	2	NONE	-	-	-	6.2	-
TPH-CWG - Aliphatic >EC16 - EC21 _{EH, CU, 1D, AL}	mg/kg	8	NONE	-	-	-	16	-
TPH-CWG - Aliphatic >EC21 - EC35 _{EH, CU, 1D, AL}	mg/kg	8	NONE	-	-	-	91	-
TPH-CWG - Aliphatic (EC5 - EC35) _{EH, CU+HS, 1D, AL}	mg/kg	10	NONE	-	-	-	110	-

TPH-CWG - Aromatic >EC5 - EC7 _{HS, 1D, AR}	mg/kg	0.001	NONE	-	-	-	< 0.001	-
TPH-CWG - Aromatic >EC7 - EC8 _{HS, 1D, AR}	mg/kg	0.001	NONE	-	-	-	< 0.001	-
TPH-CWG - Aromatic >EC8 - EC10 _{HS, 1D, AR}	mg/kg	0.001	NONE	-	-	-	< 0.001	-
TPH-CWG - Aromatic >EC10 - EC12 _{EH, CU, 1D, AR}	mg/kg	1	NONE	-	-	-	3.3	-
TPH-CWG - Aromatic >EC12 - EC16 _{EH, CU, 1D, AR}	mg/kg	2	NONE	-	-	-	9	-
TPH-CWG - Aromatic >EC16 - EC21 _{EH, CU, 1D, AR}	mg/kg	10	NONE	-	-	-	55	-
TPH-CWG - Aromatic >EC21 - EC35 _{EH, CU, 1D, AR}	mg/kg	10	NONE	-	-	-	150	-
TPH-CWG - Aromatic (EC5 - EC35) _{EH, CU+HS, 1D, AR}	mg/kg	10	NONE	-	-	-	220	-

TPH (C5 - C6) _{HS, 1D, TOTAL}	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	-	< 1.0
TPH (C6 - C8) _{HS, 1D, TOTAL}	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	-	< 0.1
TPH (C8 - C10) _{HS, 1D, TOTAL}	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	-	< 0.1
TPH (C10 - C12) _{EH, CU, 1D, TOTAL}	mg/kg	2	NONE	110	< 2.0	< 2.0	-	< 2.0
TPH (C12 - C16) _{EH, CU, 1D, TOTAL}	mg/kg	4	NONE	480	< 4.0	18	-	< 4.0
TPH (C16 - C21) _{EH, CU, 1D, TOTAL}	mg/kg	1	NONE	900	< 1.0	83	-	< 1.0
TPH (C21 - C35) _{EH, CU, 1D, TOTAL}	mg/kg	1	NONE	1100	< 1.0	290	-	< 1.0
TPH (C35 - C40) _{EH, CU, 1D, TOTAL}	mg/kg	10	NONE	100	< 10	70	-	< 10
TPH Total C5 - C40 _{EH, CU+HS, 1D, TOTAL}	mg/kg	10	NONE	2700	< 10	470	-	< 10

Analytical Report Number: 22-91338
Project / Site name: Heywood Road
Your Order No: 003224

Lab Sample Number				2468517	2468518	2468519	2468520	2468521
Sample Reference				TP401	TP401	TP402	TP403	TP403
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.70	1.40	1.00	3.20
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

VOCs

Chloromethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Chloroethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Bromomethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	< 1.0	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	< 1.0	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Cis-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	-	-	-	< 1.0	-
1,1-Dichloroethane	µg/kg	1	NONE	-	-	-	< 1.0	-
2,2-Dichloropropane	µg/kg	1	NONE	-	-	-	< 1.0	-
Trichloromethane	µg/kg	1	NONE	-	-	-	< 1.0	-
1,1,1-Trichloroethane	µg/kg	1	NONE	-	-	-	< 1.0	-
1,2-Dichloroethane	µg/kg	1	NONE	-	-	-	< 1.0	-
1,1-Dichloropropene	µg/kg	1	NONE	-	-	-	< 1.0	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	< 1.0	-
Benzene	µg/kg	1	NONE	-	-	-	< 1.0	-
Tetrachloromethane	µg/kg	1	NONE	-	-	-	< 1.0	-
1,2-Dichloropropane	µg/kg	1	NONE	-	-	-	< 1.0	-
Trichloroethene	µg/kg	1	NONE	-	-	-	< 1.0	-
Dibromomethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Bromodichloromethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Cis-1,3-dichloropropene	µg/kg	1	NONE	-	-	-	< 1.0	-
Trans-1,3-dichloropropene	µg/kg	1	NONE	-	-	-	< 1.0	-
Toluene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,1,2-Trichloroethane	µg/kg	1	NONE	-	-	-	< 1.0	-
1,3-Dichloropropane	µg/kg	1	NONE	-	-	-	< 1.0	-
Dibromochloromethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Tetrachloroethene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,2-Dibromoethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Chlorobenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,1,1,2-Tetrachloroethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Ethylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
p & m-Xylene	µg/kg	1	NONE	-	-	-	< 1.0	-
Styrene	µg/kg	1	NONE	-	-	-	< 1.0	-
Tribromomethane	µg/kg	1	NONE	-	-	-	< 1.0	-
o-Xylene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,1,2,2-Tetrachloroethane	µg/kg	1	NONE	-	-	-	< 1.0	-
Isopropylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
Bromobenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
n-Propylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
2-Chlorotoluene	µg/kg	1	NONE	-	-	-	< 1.0	-
4-Chlorotoluene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,3,5-Trimethylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
tert-Butylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,2,4-Trimethylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
sec-Butylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,3-Dichlorobenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
p-Isopropyltoluene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,2-Dichlorobenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,4-Dichlorobenzene	µg/kg	1	NONE	-	-	-	< 1.0	-

Analytical Report Number: 22-91338
 Project / Site name: Heywood Road
 Your Order No: 003224

Lab Sample Number				2468517	2468518	2468519	2468520	2468521
Sample Reference				TP401	TP401	TP402	TP403	TP403
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.70	1.40	1.00	3.20
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Butylbenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,2-Dibromo-3-chloropropane	µg/kg	1	NONE	-	-	-	< 1.0	-
1,2,4-Trichlorobenzene	µg/kg	1	NONE	-	-	-	< 1.0	-
Hexachlorobutadiene	µg/kg	1	NONE	-	-	-	< 1.0	-
1,2,3-Trichlorobenzene	µg/kg	1	NONE	-	-	-	< 1.0	-

Analytical Report Number: 22-91338
Project / Site name: Heywood Road
Your Order No: 003224

Lab Sample Number				2468517	2468518	2468519	2468520	2468521
Sample Reference				TP401	TP401	TP402	TP403	TP403
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.70	1.40	1.00	3.20
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

SVOCs

Aniline	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Phenol	mg/kg	0.2	NONE	-	-	-	< 0.2	-
2-Chlorophenol	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	-	-	-	< 0.2	-
1,3-Dichlorobenzene	mg/kg	0.2	NONE	-	-	-	< 0.2	-
1,2-Dichlorobenzene	mg/kg	0.1	NONE	-	-	-	< 0.1	-
1,4-Dichlorobenzene	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	-	-	-	< 0.1	-
2-Methylphenol	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Hexachloroethane	mg/kg	0.05	NONE	-	-	-	< 0.05	-
Nitrobenzene	mg/kg	0.3	NONE	-	-	-	< 0.3	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Isophorone	mg/kg	0.2	NONE	-	-	-	< 0.2	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	< 0.3	-
2,4-Dimethylphenol	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	-	-	-	< 0.3	-
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Naphthalene	mg/kg	0.05	NONE	-	-	-	3	-
2,4-Dichlorophenol	mg/kg	0.3	NONE	-	-	-	< 0.3	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Hexachlorobutadiene	mg/kg	0.1	NONE	-	-	-	< 0.1	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	< 0.1	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	< 0.1	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	< 0.2	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	3.2	-
2-Chloronaphthalene	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Dimethylphthalate	mg/kg	0.1	NONE	-	-	-	< 0.1	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	< 0.1	-
Acenaphthylene	mg/kg	0.05	NONE	-	-	-	0.43	-
Acenaphthene	mg/kg	0.05	NONE	-	-	-	0.62	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Dibenzofuran	mg/kg	0.2	NONE	-	-	-	1.2	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Diethyl phthalate	mg/kg	0.2	NONE	-	-	-	< 0.2	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Fluorene	mg/kg	0.05	NONE	-	-	-	0.72	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Bromophenyl phenyl ether	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Hexachlorobenzene	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Phenanthrene	mg/kg	0.05	NONE	-	-	-	8.2	-
Anthracene	mg/kg	0.05	NONE	-	-	-	2	-
Carbazole	mg/kg	0.3	NONE	-	-	-	0.6	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	< 0.2	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	0.6	-
Fluoranthene	mg/kg	0.05	NONE	-	-	-	13	-
Pyrene	mg/kg	0.05	NONE	-	-	-	12	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	< 0.3	-
Benzo(a)anthracene	mg/kg	0.05	NONE	-	-	-	8.7	-
Chrysene	mg/kg	0.05	NONE	-	-	-	8.7	-
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	-	-	11	-
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	-	-	3.9	-
Benzo(a)pyrene	mg/kg	0.05	NONE	-	-	-	8.3	-

Analytical Report Number: 22-91338
 Project / Site name: Heywood Road
 Your Order No: 003224

Lab Sample Number				2468517	2468518	2468519	2468520	2468521
Sample Reference				TP401	TP401	TP402	TP403	TP403
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	2.70	1.40	1.00	3.20
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	-	-	5.7	-
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	-	-	1.7	-
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	-	-	6.1	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-91338
 Project / Site name: Heywood Road
 Your Order No: 003224

Lab Sample Number				2468522	2468523	2468524	2468525
Sample Reference				TP404	WS203	WS202	WS202
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.00	0.50	1.40
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	23	21	16	12
Total mass of sample received	kg	0.001	NONE	0.3	0.3	0.3	0.3

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	SPU	SPU	SPU	SPU

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.4	6.7	7.5	6.3
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	2600	1200	770	190
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.088	0.071	0.057	0.016
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/kg	2.5	MCERTS	180	140	110	32
Water Soluble SO ₄ (2:1 Leach. Equiv.) 1hr extraction	mg/l	1.25	MCERTS	87.5	70.8	57.4	16.2
Sulphide	mg/kg	1	NONE	25	52	10	2
Total Sulphur	mg/kg	50	MCERTS	1700	2000	870	94
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	5.2	4.9	3.8	0.1
Total Organic Carbon (TOC) - Manual	%	0.1	MCERTS	-	-	-	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	NONE	12	0.94	1.8	< 0.05
Acenaphthylene	mg/kg	0.05	NONE	< 0.05	< 0.05	0.21	< 0.05
Acenaphthene	mg/kg	0.05	NONE	5.6	0.49	3	< 0.05
Fluorene	mg/kg	0.05	NONE	3.8	0.44	2.4	< 0.05
Phenanthrene	mg/kg	0.05	NONE	31	3.9	9.4	< 0.05
Anthracene	mg/kg	0.05	NONE	6.3	0.86	2.6	< 0.05
Fluoranthene	mg/kg	0.05	NONE	38	3.7	8.4	< 0.05
Pyrene	mg/kg	0.05	NONE	36	3.7	7	< 0.05
Benzo(a)anthracene	mg/kg	0.05	NONE	20	2.6	4.1	< 0.05
Chrysene	mg/kg	0.05	NONE	24	2.5	3.7	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	NONE	25	2	4.2	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	NONE	9.2	0.89	2	< 0.05
Benzo(a)pyrene	mg/kg	0.05	NONE	23	1.9	3.5	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	11	0.82	1.6	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	3.4	0.36	0.38	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	NONE	12	0.83	1.9	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	NONE	260	25.9	56.1	< 0.80
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	45	32	24	6.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	21	27	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	550	420	110	17
Lead (aqua regia extractable)	mg/kg	1	MCERTS	960	560	130	9.7
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	9.1	12	0.8	< 0.3

Analytical Report Number: 22-91338
 Project / Site name: Heywood Road
 Your Order No: 003224

Lab Sample Number				2468522	2468523	2468524	2468525
Sample Reference				TP404	WS203	WS202	WS202
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.00	0.50	1.40
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	49	45	39	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	230	150	170	31

Analytical Report Number: 22-91338
Project / Site name: Heywood Road
Your Order No: 003224

Lab Sample Number	2468522	2468523	2468524	2468525
Sample Reference	TP404	WS203	WS202	WS202
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.80	1.00	0.50	1.40
Date Sampled	17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Monoaromatics & Oxygenates

Benzene	µg/kg	1	NONE	-	-	-	-
Toluene	µg/kg	1	NONE	-	-	-	-
Ethylbenzene	µg/kg	1	NONE	-	-	-	-
p & m-xylene	µg/kg	1	NONE	-	-	-	-
o-xylene	µg/kg	1	NONE	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	-	-	-	-

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS, 1D, AL}	mg/kg	0.001	NONE	-	-	-	-
TPH-CWG - Aliphatic >EC6 - EC8 _{HS, 1D, AL}	mg/kg	0.001	NONE	-	-	-	-
TPH-CWG - Aliphatic >EC8 - EC10 _{HS, 1D, AL}	mg/kg	0.001	NONE	-	-	-	-
TPH-CWG - Aliphatic >EC10 - EC12 _{EH, CU, 1D, AL}	mg/kg	1	NONE	-	-	-	-
TPH-CWG - Aliphatic >EC12 - EC16 _{EH, CU, 1D, AL}	mg/kg	2	NONE	-	-	-	-
TPH-CWG - Aliphatic >EC16 - EC21 _{EH, CU, 1D, AL}	mg/kg	8	NONE	-	-	-	-
TPH-CWG - Aliphatic >EC21 - EC35 _{EH, CU, 1D, AL}	mg/kg	8	NONE	-	-	-	-
TPH-CWG - Aliphatic (EC5 - EC35) _{EH, CU+HS, 1D, AL}	mg/kg	10	NONE	-	-	-	-

TPH-CWG - Aromatic >EC5 - EC7 _{HS, 1D, AR}	mg/kg	0.001	NONE	-	-	-	-
TPH-CWG - Aromatic >EC7 - EC8 _{HS, 1D, AR}	mg/kg	0.001	NONE	-	-	-	-
TPH-CWG - Aromatic >EC8 - EC10 _{HS, 1D, AR}	mg/kg	0.001	NONE	-	-	-	-
TPH-CWG - Aromatic >EC10 - EC12 _{EH, CU, 1D, AR}	mg/kg	1	NONE	-	-	-	-
TPH-CWG - Aromatic >EC12 - EC16 _{EH, CU, 1D, AR}	mg/kg	2	NONE	-	-	-	-
TPH-CWG - Aromatic >EC16 - EC21 _{EH, CU, 1D, AR}	mg/kg	10	NONE	-	-	-	-
TPH-CWG - Aromatic >EC21 - EC35 _{EH, CU, 1D, AR}	mg/kg	10	NONE	-	-	-	-
TPH-CWG - Aromatic (EC5 - EC35) _{EH, CU+HS, 1D, AR}	mg/kg	10	NONE	-	-	-	-

TPH (C5 - C6) _{HS, 1D, TOTAL}	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C6 - C8) _{HS, 1D, TOTAL}	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C8 - C10) _{HS, 1D, TOTAL}	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
TPH (C10 - C12) _{EH, CU, 1D, TOTAL}	mg/kg	2	NONE	13	7.7	5.2	< 2.0
TPH (C12 - C16) _{EH, CU, 1D, TOTAL}	mg/kg	4	NONE	38	30	19	< 4.0
TPH (C16 - C21) _{EH, CU, 1D, TOTAL}	mg/kg	1	NONE	180	240	69	< 1.0
TPH (C21 - C35) _{EH, CU, 1D, TOTAL}	mg/kg	1	NONE	660	1000	260	< 1.0
TPH (C35 - C40) _{EH, CU, 1D, TOTAL}	mg/kg	10	NONE	100	120	56	< 10
TPH Total C5 - C40 _{EH, CU+HS, 1D, TOTAL}	mg/kg	10	NONE	990	1400	410	< 10

Analytical Report Number: 22-91338
Project / Site name: Heywood Road
Your Order No: 003224

Lab Sample Number				2468522	2468523	2468524	2468525
Sample Reference				TP404	WS203	WS202	WS202
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.00	0.50	1.40
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status	

VOCs

Chloromethane	µg/kg	1	NONE	-	-	-	-
Chloroethane	µg/kg	1	NONE	-	-	-	-
Bromomethane	µg/kg	1	NONE	-	-	-	-
Vinyl Chloride	µg/kg	1	NONE	-	-	-	-
Trichlorofluoromethane	µg/kg	1	NONE	-	-	-	-
1,1-Dichloroethene	µg/kg	1	NONE	-	-	-	-
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	NONE	-	-	-	-
Cis-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	NONE	-	-	-	-
1,1-Dichloroethane	µg/kg	1	NONE	-	-	-	-
2,2-Dichloropropane	µg/kg	1	NONE	-	-	-	-
Trichloromethane	µg/kg	1	NONE	-	-	-	-
1,1,1-Trichloroethane	µg/kg	1	NONE	-	-	-	-
1,2-Dichloroethane	µg/kg	1	NONE	-	-	-	-
1,1-Dichloropropene	µg/kg	1	NONE	-	-	-	-
Trans-1,2-dichloroethene	µg/kg	1	NONE	-	-	-	-
Benzene	µg/kg	1	NONE	-	-	-	-
Tetrachloromethane	µg/kg	1	NONE	-	-	-	-
1,2-Dichloropropane	µg/kg	1	NONE	-	-	-	-
Trichloroethene	µg/kg	1	NONE	-	-	-	-
Dibromomethane	µg/kg	1	NONE	-	-	-	-
Bromodichloromethane	µg/kg	1	NONE	-	-	-	-
Cis-1,3-dichloropropene	µg/kg	1	NONE	-	-	-	-
Trans-1,3-dichloropropene	µg/kg	1	NONE	-	-	-	-
Toluene	µg/kg	1	NONE	-	-	-	-
1,1,2-Trichloroethane	µg/kg	1	NONE	-	-	-	-
1,3-Dichloropropane	µg/kg	1	NONE	-	-	-	-
Dibromochloromethane	µg/kg	1	NONE	-	-	-	-
Tetrachloroethene	µg/kg	1	NONE	-	-	-	-
1,2-Dibromoethane	µg/kg	1	NONE	-	-	-	-
Chlorobenzene	µg/kg	1	NONE	-	-	-	-
1,1,1,2-Tetrachloroethane	µg/kg	1	NONE	-	-	-	-
Ethylbenzene	µg/kg	1	NONE	-	-	-	-
p & m-Xylene	µg/kg	1	NONE	-	-	-	-
Styrene	µg/kg	1	NONE	-	-	-	-
Tribromomethane	µg/kg	1	NONE	-	-	-	-
o-Xylene	µg/kg	1	NONE	-	-	-	-
1,1,2,2-Tetrachloroethane	µg/kg	1	NONE	-	-	-	-
Isopropylbenzene	µg/kg	1	NONE	-	-	-	-
Bromobenzene	µg/kg	1	NONE	-	-	-	-
n-Propylbenzene	µg/kg	1	NONE	-	-	-	-
2-Chlorotoluene	µg/kg	1	NONE	-	-	-	-
4-Chlorotoluene	µg/kg	1	NONE	-	-	-	-
1,3,5-Trimethylbenzene	µg/kg	1	NONE	-	-	-	-
tert-Butylbenzene	µg/kg	1	NONE	-	-	-	-
1,2,4-Trimethylbenzene	µg/kg	1	NONE	-	-	-	-
sec-Butylbenzene	µg/kg	1	NONE	-	-	-	-
1,3-Dichlorobenzene	µg/kg	1	NONE	-	-	-	-
p-Isopropyltoluene	µg/kg	1	NONE	-	-	-	-
1,2-Dichlorobenzene	µg/kg	1	NONE	-	-	-	-
1,4-Dichlorobenzene	µg/kg	1	NONE	-	-	-	-

Analytical Report Number: 22-91338
 Project / Site name: Heywood Road
 Your Order No: 003224

Lab Sample Number				2468522	2468523	2468524	2468525
Sample Reference				TP404	WS203	WS202	WS202
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.00	0.50	1.40
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Butylbenzene	µg/kg	1	NONE	-	-	-	-
1,2-Dibromo-3-chloropropane	µg/kg	1	NONE	-	-	-	-
1,2,4-Trichlorobenzene	µg/kg	1	NONE	-	-	-	-
Hexachlorobutadiene	µg/kg	1	NONE	-	-	-	-
1,2,3-Trichlorobenzene	µg/kg	1	NONE	-	-	-	-

Analytical Report Number: 22-91338
Project / Site name: Heywood Road
Your Order No: 003224

Lab Sample Number				2468522	2468523	2468524	2468525
Sample Reference				TP404	WS203	WS202	WS202
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.00	0.50	1.40
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
SVOCs							
Aniline	mg/kg	0.1	NONE	-	-	-	-
Phenol	mg/kg	0.2	NONE	-	-	-	-
2-Chlorophenol	mg/kg	0.1	NONE	-	-	-	-
Bis(2-chloroethyl)ether	mg/kg	0.2	NONE	-	-	-	-
1,3-Dichlorobenzene	mg/kg	0.2	NONE	-	-	-	-
1,2-Dichlorobenzene	mg/kg	0.1	NONE	-	-	-	-
1,4-Dichlorobenzene	mg/kg	0.2	NONE	-	-	-	-
Bis(2-chloroisopropyl)ether	mg/kg	0.1	NONE	-	-	-	-
2-Methylphenol	mg/kg	0.3	NONE	-	-	-	-
Hexachloroethane	mg/kg	0.05	NONE	-	-	-	-
Nitrobenzene	mg/kg	0.3	NONE	-	-	-	-
4-Methylphenol	mg/kg	0.2	NONE	-	-	-	-
Isophorone	mg/kg	0.2	NONE	-	-	-	-
2-Nitrophenol	mg/kg	0.3	NONE	-	-	-	-
2,4-Dimethylphenol	mg/kg	0.3	NONE	-	-	-	-
Bis(2-chloroethoxy)methane	mg/kg	0.3	NONE	-	-	-	-
1,2,4-Trichlorobenzene	mg/kg	0.3	NONE	-	-	-	-
Naphthalene	mg/kg	0.05	NONE	-	-	-	-
2,4-Dichlorophenol	mg/kg	0.3	NONE	-	-	-	-
4-Chloroaniline	mg/kg	0.1	NONE	-	-	-	-
Hexachlorobutadiene	mg/kg	0.1	NONE	-	-	-	-
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	-	-	-	-
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	-	-	-	-
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	-	-	-	-
2-Methylnaphthalene	mg/kg	0.1	NONE	-	-	-	-
2-Chloronaphthalene	mg/kg	0.1	NONE	-	-	-	-
Dimethylphthalate	mg/kg	0.1	NONE	-	-	-	-
2,6-Dinitrotoluene	mg/kg	0.1	NONE	-	-	-	-
Acenaphthylene	mg/kg	0.05	NONE	-	-	-	-
Acenaphthene	mg/kg	0.05	NONE	-	-	-	-
2,4-Dinitrotoluene	mg/kg	0.2	NONE	-	-	-	-
Dibenzofuran	mg/kg	0.2	NONE	-	-	-	-
4-Chlorophenyl phenyl ether	mg/kg	0.3	NONE	-	-	-	-
Diethyl phthalate	mg/kg	0.2	NONE	-	-	-	-
4-Nitroaniline	mg/kg	0.2	NONE	-	-	-	-
Fluorene	mg/kg	0.05	NONE	-	-	-	-
Azobenzene	mg/kg	0.3	NONE	-	-	-	-
Bromophenyl phenyl ether	mg/kg	0.2	NONE	-	-	-	-
Hexachlorobenzene	mg/kg	0.3	NONE	-	-	-	-
Phenanthrene	mg/kg	0.05	NONE	-	-	-	-
Anthracene	mg/kg	0.05	NONE	-	-	-	-
Carbazole	mg/kg	0.3	NONE	-	-	-	-
Dibutyl phthalate	mg/kg	0.2	NONE	-	-	-	-
Anthraquinone	mg/kg	0.3	NONE	-	-	-	-
Fluoranthene	mg/kg	0.05	NONE	-	-	-	-
Pyrene	mg/kg	0.05	NONE	-	-	-	-
Butyl benzyl phthalate	mg/kg	0.3	NONE	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	NONE	-	-	-	-
Chrysene	mg/kg	0.05	NONE	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	NONE	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	NONE	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	NONE	-	-	-	-

Analytical Report Number: 22-91338
 Project / Site name: Heywood Road
 Your Order No: 003224

Lab Sample Number				2468522	2468523	2468524	2468525
Sample Reference				TP404	WS203	WS202	WS202
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.80	1.00	0.50	1.40
Date Sampled				17/10/2022	17/10/2022	17/10/2022	17/10/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	NONE	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	NONE	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	NONE	-	-	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-91338

Project / Site name: Heywood Road

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2468517	TP401	None Supplied	1	Brown sand with gravel.
2468518	TP401	None Supplied	2.7	Brown sand.
2468519	TP402	None Supplied	1.4	Brown loam and sand with gravel and vegetation.
2468520	TP403	None Supplied	1	Brown sand with gravel.
2468521	TP403	None Supplied	3.2	Brown sand.
2468522	TP404	None Supplied	0.8	Brown sand with gravel.
2468523	WS203	None Supplied	1	Brown clay and sand with gravel.
2468524	WS202	None Supplied	0.5	Brown clay and sand with gravel.
2468525	WS202	None Supplied	1.4	Brown clay and sand with gravel.

Analytical Report Number : 22-91338

Project / Site name: Heywood Road

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	NONE
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	NONE

Analytical Report Number : 22-91338

Project / Site name: Heywood Road

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L023-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC. Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

APPENDIX VII

ORIGIN OF TIER I GENERIC ASSESSMENT CRITERIA

CONSTITUENT	ORIGIN OF RISK ASSESSMENT VALUE
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs – methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide – Total	2014 LQM/CIEH S4ULs
Phenols – Total	2014 LQM/CIEH S4ULs
Naphthalene	General assessment criteria (GAC) developed by CIEH/LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM.
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene	
Chrysene	
Benzo(b/k)Fluoranthene ⁽ⁱⁱⁱ⁾	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C₅-C₆ (aliphatic)	
TPH C₆-C₈ (aliphatic)	
TPH C₈-C₁₀ (aliphatic)	
TPH C₁₀-C₁₂ (aliphatic)	
TPH C₁₂-C₁₆ (aromatic)	
TPH C₁₆-C₂₁ (aromatic)	
TPH C₂₁-C₃₅ (aromatic)	



