



e3p

Remediation Strategy
Castleton Sidings, Rochdale
Reference: 14-768-R4-2
Date: March 2024



REMEDIATION STRATEGY

MAIN DEVELOPMENT AREA

Land to the South of Heywood Road
Castleton Sidings
Rochdale
OL11 3AU

Prepared for:
Kellen Homes



Report Ref: 14-768-R4-2
Date Issued: 5 March 2024



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QUALITY ASSURANCE

Report reference **14-768-R4**

REV REF:	DESCRIPTION	AUTHOR	CHECKED	AUTH	DATE
R4-1	First issue	NS	JS	MD	13/11/23
R4-2	Updated to include most recent controlled waters assessment data.	NS	JS	SC	05/03/24

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EXECUTIVE SUMMARY

Site Address	Castleton Sidings, Heywood Road, Rochdale OL11 3AU
National Grid Reference	E 387930, N 410140
Site Area	Approximately 6.0 Ha.
Background	E3P has been instructed by Kellen Homes to develop a remediation strategy for the proposed residential development at the site located off Heywood Road in Rochdale. The E3P Remediation Strategy has been produced in due consideration of the Geoenvironmental Site Investigation and contaminated land assessments previously undertaken by E3P.

CONTAMINATED LAND RISK ASSESSMENT

Human Health Risk Assessment	Exceedances of heavy metals, non-volatile PAH, naphthalene, toluene, TPH C8-C35 and mercury have been identified at various locations across the site between 0.50 m bgl and 4.90 m bgl. Visual and olfactory evidence of hydrocarbon impact has also been identified at several locations across site. The risk to chronic human health associated with the elevated concentrations of inorganic heavy metals, non-volatile PAH compounds, and trace asbestos can be mitigated through the installation of a suitable cover system in all proposed private gardens, landscaping, and public open space to remove any potential for direct exposure to impacted soils. In relation to the exceedances of S/VOCs, mercury and visual and olfactory evidence of hydrocarbon impact, on review of the options appraisal, point source removal and ex-situ treatment by a specialist contractor is considered the most viable option, with a view to then replacing/re-using the treated material within the development area. The exact treatment method will be defined by the remediation contractor in their Remediation Implementation Plan and Method Statement. Where TPH/SVOCs have been identified in the groundwater (WS104, WS105, WS301 and WS303), this impact is inferred to be soil-derived. Therefore, point source removal as part of the ex-situ treatment (process to be defined in the remediation contractor in their Remediation Implementation Plan and Method Statement) would remove this source. However, residual impacted groundwater may present a risk of vapours/ground gas emission if allowed to volatilise. Groundwater in excavations and areas of point source removal/treatment shall be pumped, treated, and discharged to foul sewers, thus removing the risk to end users. Incorporation of VOC-resistant membranes in plots where the impacted material remains or is re-placed will be required to reduce the long-term risks to receptors. A build phase strategy will be required to determine plots requiring VOC resistant membranes.
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Human Health Risk Assessment	In respect of mercury, a SSRTV of 1.73 mg/kg has been derived using the CLEA model. Where elemental mercury is confirmed to be greater than the SSRTV, delineation will be undertaken. Total mercury analysis will be undertaken on Made Ground samples at a rate of 1 per 1000 m³, with speciation undertaken where exceedances of 1.73 mg/kg occur. Impacted soils will be placed in an area of reduced sensitivity (e.g. POS or parts of the site where VOC resistant membranes are to be installed). It should be noted that a build phase strategy will be required to determine plots requiring VOC resistant membranes on completion of remediation works and review of soil placement. It is considered that chemical analysis of the natural clay drift deposits will identify these soils to be acceptable for use as subsoil within the proposed garden areas subject to further chemical validation; however, given the depth of Made Ground on-site, it is unlikely that subsoils will be excavated. There are no suitable sources of topsoil available on the site. A part time watching brief will be required during turnover and soil excavation to ensure that if any as yet unidentified contaminant point sources are identified, appropriate remediation action will be implemented.
Controlled Waters Risk Assessment	High concentrations of naphthalene and aromatic hydrocarbon fractions were recorded in the initial groundwater sample taken from WS105. 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 towards the west or north west i.e. down-hydraulic gradient and in the direction of the primary receptor, the Roeacre Brook via peripheral drainage channels. Additional wells were installed to the south and east of WS105 to assess the extent of groundwater impact. TPH fractions, naphthalene and SVOCs have been found in exceedance of GAC values in WS301 and WS303, located to the east of WS105, albeit at lower concentrations than in WS105. Only heavy metals and non-volatile PAH compounds were found to be in exceedance in WS302, WS304 and WS305, suggesting the contamination is not migrating much further south. The identified hydrocarbon and volatile contamination in the groundwater (WS105, WS301 and WS303) is located within the area of defined visual and olfactory hydrocarbon contamination in soils (refer to drawing no. 14-768-118). It is therefore considered likely that the contamination is confined to the perched water and is directly derived from the soils as a point source. No surface water receptors have been identified within influencing distance of the site to the south or east. There is therefore considered to be no unacceptable degree of future risk to controlled waters receptors from the site.
Ground Gas	Current monitoring indicates that gas protection measures in accordance with a CS2 (NHBC Amber 1) classification will be required for all residential properties constructed at the site as a minimum. However, development proposals include the removal of large volumes of peat from beneath specific areas of the site (roads, drainage, hardstanding), which will lead to dewatering and aerobic degradation of in-situ / exposed peat, which may alter the ground gas regime. Post remediation monitoring will be required, along with a build phase strategy, to confirm the final classification.
Vapours	Areas with elevated concentration of TPH, SVOCs and mercury have been identified.



	In the areas where impacted material remains, or is re-placed, VOC resistant membranes will be required to reduce the long-term risks to receptors A build phase strategy will be required to determine plots requiring VOC resistant membranes.
Coal Mining and Historical Workings	The Arley Coal seam is conjectured to subcrop beneath the north east of the site. Rotary boreholes encountered alternating bands of cohesive and granular drift to depths in excess of 60.5 m bgl. Rockhead was not proven. Based on the presence of extensive drift, it is likely that any coal seams will be at significant depth and thus highly unlikely to have been worked. Even if the seam has been worked, it is considered that the overlying thickness of drift would be sufficient to mitigate the risk of subsidence at the surface.
Invasive Plants	The remediation contractor must satisfy themselves with respect to the extent of all species deemed invasive prior to the commencement of works on site.
Potable Water Supply	Based on the assessment of current site conditions, it is likely that a barrier pipe will be required at the proposed development. This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.

GEOTECHNICAL ASSESSMENT

Relict Sub-Structures	Relict obstructions have been encountered at numerous locations and should be anticipated in areas of former structures including travelling cranes and former rail platforms. Redundant services were also encountered at a number of locations within the Mage Ground, including electrical cabling, polyethylene pipes, drainage infrastructure etc. An unrecorded drainage culvert (of known position) crosses north-south through the development site, which will require a suitable development easement. All such materials will require removal from beneath proposed structures and infrastructure to the depths and extents as defined within this specification.
Adverse Ground Conditions	All historical features where deleterious/putrescible material is identified should be located and subject to the necessary remediation works. Peat material has been encountered beneath the Made Ground across much of the development area. This material is identified as potentially degradable with high consolidation potential, which may represent a risk associated with future consolidation induced by earthworks surcharge loading, temporary works and infrastructure loading. Peat and compressible materials will require removal from beneath areas of adopted highway, infrastructure and external hard standing in accordance with the E3P Geotechnical Performance Specification (ref: 14-768-R3-1, September 2023). Where peat remains beneath external garden areas, settlement analysis will be required to assess the potential for future consolidation within all areas of upfill (surcharge).



	The E3P Intrusive Ground Investigation has identified loose/collapsible deep Made Ground. Allowances should be made for battering back excavations and provisions of supports for open trenches. Allowances for dewatering and supporting excavations will be necessary during peat removal works.
Proposed Foundations	Made Ground deposits extend to proven depths of up to 6.60 m bgl (R0227). PEAT has been encountered beneath the Made Ground in the majority of (deep) exploratory hole locations extending to a maximum proven depth of 7.80 m bgl (R0210 and R0228). The peat encountered beneath the site was found to range in thickness from 0.20 to 2.60 m thick (CP102), although it was predominantly 1.0 m thick or less, and noted to be generally thicker towards the south and west of the site. Made Ground and Peat are not considered to be suitable founding strata due to their variable and compressible nature respectively. Adoptable foundation solutions are therefore as follows: ✿ Driven piled foundations will be required for plots across the site. However, detailed consideration must be given to working in proximity to the live rail infrastructure. ✿ Traditional strip / deep mass trench foundations bearing onto suitable firm/stiff CLAY or medium dense SAND (where present – limited to the north west of the development area). Where piled foundations are adopted, controlled waters and associated generation of pollutant pathways will need to be adequately assessed in the form of a piling risk assessment. Piles will need to be designed by a specialist piling contractor to mitigate all adverse ground conditions including peat and negative skin friction.
Highways and Infrastructure	All proposed adopted roads will be constructed in accordance with the geotechnical engineering requirements as defined within the MCHW Series 600. Specific engineering and compaction of materials will be completed in strict accordance with the standalone E3P Geotechnical Performance Specification (ref: 14-768-r3-1, Sept 2023). All materials outside of structural/infrastructure development will be engineered and compacted to ensure consolidation associated with the self-weight settlement is limited to < 50 mm in accordance with the standalone E3P Geotechnical Performance Specification (ref: 14-768-r3-1, Sept 2023).

REMEDIATION WORKS

Objectives	The site remediation strategy provides a comprehensive specification for the regeneration of the land to negate identified pollutant linkages and construct a development platform that will be geotechnically suitable for the proposed end use. A standalone E3P Geotechnical Performance Specification (ref: 14-768-r3-1, Sept 2023) has been prepared to detail the site specific enabling/earthworks strategy, which should be read in conjunction with this remediation strategy.
Remediation and Enabling Works	The salient features of the Remediation Strategy are summarised as follows: ✿ Implementing all work in strict accordance with UK Environmental Permitting and local planning authority requirements.



	✳ Controlled removal of all trees and vegetation. ✳ Removal and treatment of all invasive plant species (as required) in accordance with specialist contractor method statement, validation and independent certification. ✳ Segregation of organic topsoil deemed unsuitable for use within a residential garden and placement in an area of no sensitivity or removal from the site in accordance with UK waste management legislation. ✳ Surface water monitoring. ✳ Ex-situ treatment of naphthalene and TPH-impacted soils. ✳ Delineation, excavation and treatment of the identified mercury hotspots. ✳ Management of all anthropogenic material impacted by trace asbestos fibre in a controlled and legislatively compliant manner. ✳ Identification, delineation, and removal of organic materials within the infilled 'reservoir' identified on historical mapping. ✳ Removal of all structures, relict foundations and buried features in their entirety. ✳ Removal of all materials considered geotechnically deleterious. ✳ Excavation and processing of Made Ground in a controlled manner with the sorting, processing and segregation of identified deleterious materials to geotechnical specification. ✳ Validation sampling and leachate testing to confirm material retained on site pose no unacceptable risk to the residential end users, controlled waters or wider environment. ✳ Importation of suitable material to achieve the required development levels. ✳ Replacement / engineering of material per the E3P Geotechnical Earthworks Specification (Ref: 14-768-R3-1, September 2023).
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BUILD PHASE REQUIREMENTS

Summary of Build-Phase Mitigation Requirements	A separate build phase strategy will be required on completion of the pre-build remediation works, which will detail the exact build phase requirements. However, in brief this will cover the completion of the following additional elements: ✳ Provision of a 600 mm cover system using certified material with appropriate validation within proposed rear garden areas, comprising 450 mm subsoil (potentially site-won natural drift deposits) overlain by 150 mm topsoil. ✳ Provision of a 300 mm cover system using certified material with appropriate validation within front gardens, proposed areas of public open space and soft landscaping. ✳ Construction of dwellings with appropriate gas and vapour mitigation. This will require further post remediation assessment and a specialist design, mitigation and validation specification, which will be included in the build phase strategy. ✳ Construction of appropriate potable water supply infrastructure.
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DRAWING LIST

14-768-001 - Site Location Plan
14-768-103 - Historical Features Plan
14-768-104 - Site Features Plan
14-768-105 - Exploratory Hole Location Plan
14-768-106 - Depth of Made Ground Plan
14-768-107 - Depth and Thickness of Peat Plan
14-768-118 - Contamination Issues Plan
14-768-010 - Controlled Waters Conceptual Site Model
McAuliffe Volumetric Appraisal Drawing No. KELL 3703 VA 02
Kellen Homes Finished Floor Levels Drawing No. KH003-010
Kellen Homes Development Strategy Drawing No. KH003-101



1. INTRODUCTION

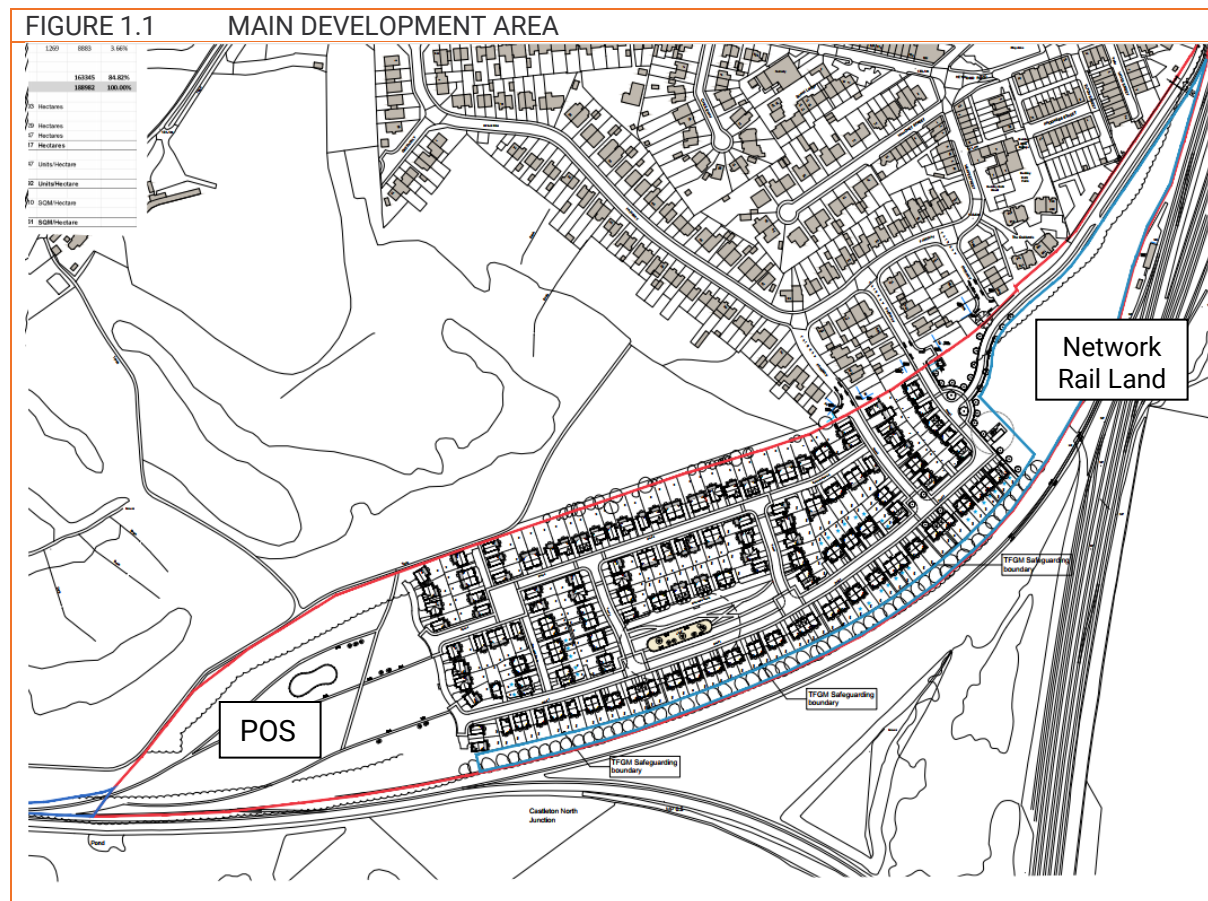
1.1. BACKGROUND

Kellen Homes has submitted a hybrid planning application for proposed redevelopment of a parcel of land to the south of Heywood Road, Rochdale, also known as Castleton Sidings. The application comprises 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.

E3P has been instructed by Kellen Homes to develop a Remediation Strategy for the residential development as shown in Figure 1.1.

A snapshot of the proposed development layout is indicated in Figure 1.2.



1.2. REPORT OBJECTIVES

The objectives of this report are to:

- ✳ Prepare overview of contaminated land remediation requirements;
- ✳ Evaluate feasible remedial technologies;
- ✳ Define validation criteria to demonstrate the successful implementation of a site remediation plan;
- ✳ Ensure the safe, cost effective and regulatory-compliant redevelopment of the site.

1.3. SCOPE OF WORKS

The development of the risk management strategy for the subject site includes the following tasks:

- ✳ Identification of the relevant pollutant linkages;
- ✳ Review of site characteristics;
- ✳ Development of remedial objectives;
- ✳ Selection of appropriate remedial technology; and
- ✳ Development of remedial strategy.

1.4. PREVIOUS WORKS

The following phases of geoenvironmental investigations have previously been carried out at the site:

- ✳ **E3P** – *Phase I & II Geoenvironmental Site Assessment*. Ref: 14-768-R1-3, dated March 2023.
- ✳ **E3P** – *Supplementary Ground Investigation*. Ref: 14-768-L4-2, dated 13th March 2023.
- ✳ **E3P** – *Geoenvironmental Assessment – Network Rail Land* . Ref: Report No. 14-768-L2-2, dated 13th March 2023.
- E3P** – *Geoenvironmental Assessment – Public Open Space* . Ref: Report No. 14-768-L3-2, dated 13th March 2023.

To inform the assessment of the potential risk to contaminated land within the context of the proposed residential development and to inform the preparation of the remediation strategy, the pertinent points from the above reports are summarised within Section 2.

To avoid doubt, the E3P Geo-Environmental Site Investigation Reports should be read both as a precursor to and in conjunction with this document.



1.5. SUMMARY OF PARTIES INVOLVED

Function/interest	Name of Party
Local Planning Authority	Rochdale Borough Council
Developer	Kellen Homes
Geoenvironmental Consultant	E3P
Main Contractor	Kellen Homes
Remediation/Enabling Works Contractor	McAuliffe Group
Human Health Regulator	Rochdale Borough Council
Controlled Waters and Waste Regulator	Environment Agency
Highways Adoption Authority	Rochdale Borough Council

1.6. REGULATORY CORRESPONDENCE

Kellen Homes is in the process of submitting a detailed planning application to the local planning authority for the proposed redevelopment of the site for low-rise residential housing with associated adopted estate roads and infrastructure.

It is presumed that as part of the planning approval process, the planning authority will undertake consultation with the pertinent statutory consultees, which will include:

- ✳ Environmental health/contaminated land officer at the local authority (or external adviser);
- ✳ Environment Agency planning liaison; and
- ✳ The Coal Authority.

1.7. SITE DETAILS

Site Address	Castleton Sidings, Heywood Road, Rochdale OL11 3AU
National Grid Reference	E 387930, N 410140
Site Area	Approximately 6.0 Ha.

All acronyms used within this report are defined in the glossary presented in Appendix II.

A site location plan is presented in Appendix III as Drawing 14-768-001.



1.8. SITE SUMMARY

TABLE 1.1 SITE DESCRIPTION AND SETTING

Occupancy/Use	The site is a roughly semi-circular parcel of land to the south of Heywood Road in Rochdale and to the west of Castleton railway station. Live railway lines are present along the southeastern site boundary and the site itself forms derelict railway sidings open to the adjacent active railway.	
	All former structures except for an active signal box (located in the Network Rail land) have now been removed; however, track sidings, ballast, relict hardstanding and concrete slabs remain. A relict platform also remains in the southeast of the main development area. Self-seeded vegetation and young trees have now grown across the site and along the peripheries.	
Environmental Setting	Drift Geology	North: Glacio-fluvial Deposits – SAND and GRAVEL South: Glacial Till – CLAY, SAND, GRAVEL
	Bedrock Geology	Pennine Lower Coal Measures Formation – MUDSTONE, SILTSTONE, SANDSTONE.
	Hydrogeology	Unproductive and Secondary A strata (drift) overlying Secondary A aquifer (solid). No groundwater abstractions have been identified within a 1 km radius.
	Hydrology	There are no surface water courses within influencing distance of the site. However, drainage ditches are located along the northern site boundary, which may feed into water courses further afield.
	Flood Risk	The site is not located within a fluvial flood risk zone.
	Subsidence Hazard	Moderate risk of compressible ground identified in the south of the site (associated with Peat deposits).



Site History	A review of the pertinent Ordnance Survey mapping dating from circa 1850 to the present day confirmed the following land use: ✿ The earliest historical mapping (1851) shows the site to comprise agricultural land, with the railway shown to be present along the southern boundary and brick kiln/clay pits immediately to the northwest. ✿ By 1893, the site was in use as railway sidings with an engineering store and sawmills with chimneys located in the west. Ancillary structures encroached the western sector together with wetlands/possible marshes encroaching the central northern sector. ✿ Tanks and a gasometer are later shown in the centre north and northeast respectively, together with an earth working/embankment in the centre of the site, which moves north over time (likely associated with raising levels to create a level platform for expansion of the railway sidings). ✿ By 1956 the engineering works / saw mill had been removed and by the 1970s a welding shop, travelling crane, engineering shed, electricity substation and tanks are indicated to be present in the central sector of the site. ✿ Aerial imagery between 2000-2005 shows the site to be covered by hardstanding/ballast, tracks, sheds and various structures. The site appears to have been dismantled/demolished sometime between 2005 and 2013.
Landfill Sites and Ground Gases	Historical landfill located c. 475 m north west of site: Land South of Chadwick Lane, Heywood, Rochdale – Received Inert, Industrial, Commercial, Household and Special Waste between 31/12/1984 and 31/12/1986. Given the time that has passed since last deposit and distance to the site, the risk from migrating ground gas from this source is reduced.
Radon	Based on updated UK Radon Map (2023), the maximum radon potential is 1-3% (previously unaffected). No special precautions required.

1.9. SUMMARY OF REPORTED GROUND CONDITIONS

E3P has prepared a detailed Site Investigation Report (Ref: 14-768-R1-3, dated March 2023). The summary of reported ground conditions is given in Table 1.2.



TABLE 1.2 SUMMARY OF GROUND CONDITIONS

Made Ground	Made Ground deposits have been encountered within all of the exploratory hole locations from ground level to a maximum proven depth of 6.60 m bgl (RO227). The full depth of Made Ground remained unproven in c. 50% of exploratory hole locations due to its extent or the presence of obstructions. The material generally comprises a black slightly clayey gravelly medium sand / sandy gravel. Gravel constituents predominantly include mudstone, brick, clinker, coal, and ceramic with less frequent inclusions of metal, shale, glass and timber/wood. Track ballast comprising greyish black subangular gravel was encountered in areas along rail tracks, with a thickness of c. 0.50-1.00 m. Obstructions (reinforced concrete slabs and redundant services) were encountered frequently across the site, together with visual and olfactory evidence of (hydrocarbon) contamination.
Topsoil	No topsoil that would be deemed suitable for re-use has been identified within any of the exploratory hole locations.
Peat	Blackish brown pseudo fibrous PEAT was encountered beneath the Made Ground in 27 no. locations. The peat encountered beneath the site was found to range 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	Drift deposits were encountered beneath the Made Ground and Peat (where proven) and comprised of alternating SAND/GRAVEL and sandy CLAY extending to depths in excess of 60.50 m bgl (RB101). Where encountered, the shallowest drift deposits were noted to be predominantly granular. Drift deposits were generally described as follows: ✿ Medium dense light brown variably slightly clayey SAND with occasional gravel of fine to coarse angular to rounded of sandstone. Loose silty sand was encountered in WS103 from 4.50 m bgl. The granular soils were also noted to be loose and collapsing in TP207 and TP212 ✿ Light brown sandy GRAVEL of medium subangular to rounded mudstone and sandstone. ✿ Stiff to very stiff medium to high strength sandy CLAY with occasional gravel of fine to coarse angular to rounded mudstone. At one location (CP101), directly beneath the Made Ground, a soft very low strength brown sandy CLAY was encountered between 4.20 m and 5.00 m bgl.
Bedrock	The solid geology was not encountered within the deeper cable holes or rotary open holes which extended to a maximum depth of 60.50 m bgl. A nearby BGS borehole indicates rockhead at circa 81.00 m bgl.
Groundwater	Groundwater strikes were generally encountered as seepages between 1.20 m and 4.80 m bgl. During the subsequent monitoring visits (March-August 2021), the monitoring wells were predominantly found to be dry or containing only small volumes of water. Water sampling undertaken during January-February 2024 recorded water levels in the west of the site (WS105, WS301-WS305) to be between 1.75 m and 3.02 m bgl (approximately 129-130.25 mAOD based on approximate elevation of 132 mAOD).



2. E3P CONTAMINATION RISK ASSESSMENT

2.1. BACKGROUND

E3P has completed a Tier 1 Qualitative Contaminated Land Risk Assessment to determine the potential risk to human health, controlled waters, and the wider environment. This assessment is documented in full within the following reports:

- ✦ **E3P** – Phase I & II Geoenvironmental Site Assessment. Ref: 14-768-R1-3, dated March 2023.
- ✦ **E3P** – Supplementary Ground Investigation. Ref: 14-768-L4-2, dated 13th March 2023.
- ✦ **E3P** – Geoenvironmental Assessment – Network Rail Land. Ref: 14-768-L2-2, dated 13th March 2023.
- E3P** – Geoenvironmental Assessment – Public Open Space. Ref: 14-768-L3-2, dated 13th March 2023.

For clarity, the findings are summarised in the following sections of this document.

2.2. HUMAN HEALTH RISK SUMMARY

The E3P Tier 1 Qualitative Human Health Risk Assessment identified concentrations of the following contaminants at concentrations above the GAC values for residential end use with plant uptake in the main development area:

✦ Heavy Metals:

- Arsenic;
- Lead; and,
- Mercury (including elemental mercury).

✦ Non-Volatile PAH:

- Acenaphthene;
- Acenaphthylene;
- Fluorene;
- Phenanthrene;
- Fluoranthene;
- Benzo(a)Anthracene;
- Pyrene
- Chrysene;



- Benzo(b)Fluoranthene;
- Benzo(k)fluoranthene;
- Indeno(1,2,3cd)pyrene
- Benzo(a)Pyrene;
- Dibenzo(a,h)Anthracene;
- Benzo(ghi)perylene
- ✿ Petroleum Hydrocarbon Fractions C8-C35 (potentially volatile in C5-C16 range)
- ✿ S/VOC – Naphthalene & Toluene
- ✿ Asbestos – Loose chrysotile <0.001% wt/wt (TP102 – POS area)

The locations of contaminant exceedances for the main development area are shown in Drawing no. 14-768-118 in Appendix III.

Three samples taken from TP101, TP113 and TP124 were tested for PCBs due to the historical presence of railway sidings and substations on the site. Concentrations were found to be below the limit of detection (LOD) in each of the samples.

Concentrations of Isopropylbenzene, p-isopropyltoluene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene, and 2-Methylnaphthalene (VOCs) were found above the LOD in the Made Ground in WS104 at 1.40 m and 3.20 m bgl. No screening criteria is available for p-isopropyltoluene, however, comparison of the other identified VOCs to available GAC values indicates no exceedances in respect of human health. The identified VOCs are typical derivatives of oil and petroleum products. WS104 is located in the centre west of the site, in the location of a former tank and gasometer and it is thus inferred that localised spillage / leakage has occurred here.

Other potentially volatile contaminants have also been detected at concentrations in exceedance of GAC values at numerous locations, including Toluene (WS104 at 3.20 m bgl), Naphthalene (with a maximum concentration 10000 mg/kg in TP211 at 1.90 m bgl) and TPH C8-16 (with a maximum concentration also detected in TP211 at 1.90 m bgl). It is noted that TP211 is located in the area of a former travelling crane and in close proximity to WS105, and southwest of WS104; in both locations, Naphthalene and volatile TPH were also recorded, together with visual and olfactory evidence of contamination.

In these areas, further 'delineation' trial pitting has been undertaken to determine the extent of visual and olfactory evidence of hydrocarbon/volatile contamination. Again, chemical analysis has confirmed Naphthalene and TPH C8-C16 to be in exceedance of GAC values in a number of these additional locations, with highest concentrations recorded in TP116S at 1.20 m bgl (north east of site) and TP211E3 at 3.10 m bgl (south west of site). It is noted that concentrations of Naphthalene were higher in the sample taken from 3.10 m than 1.90 m in TP211E3 thus indicating downward migration is occurring to deeper soils. In addition, strong odours and sheens were observed in the northerly and easterly TP211 trial pits, indicating impact extends in these directions (albeit reducing based on concentrations recorded).

Elevated Mercury has also been frequently encountered. Mercury comes in three different forms; elemental mercury, inorganic mercury and organic mercury (or methyl mercury), each with a specific GAC value. Elemental mercury is volatile (vapour inhalation risk) and therefore has the most conservative GAC value of 1.2 mg/kg. Speciation was carried out on the samples found to contain concentrations of total mercury in exceedance of 1.2 mg/kg. The results are summarised in Table 2.1 which confirm that TP121, WS112 and RO304 may be treated as hotspots for delineation and removal.



TABLE 2.1 MERCURY SPECIATION

LOCATION	DEPTH (m)	INORGANIC MERCURY (mg/kg)	ORGANO-MERCURY SPECIES (mg/kg)	ELEMENTAL MERCURY (mg/kg)
TP115	1.00	1.283	0.042	0.398
TP121	1.00	1.693	0.168	1.608
TP213a	0.60	4.081	0.217	0878
WS112a	1.00	3.992	1.335	2.176
WS113a	2.20	41.62	0.319	0.458
WS114a	1.70	0.934	0.09	0.231
RB304	2.00	8.985	0.116	5.957

In relation to these exceedances, the following can therefore be determined:

✿ The main exposure pathways based on the Tier I exceedances are:

- Soil ingestion;
- Vapour inhalation (indoor);
- Dermal contact and ingestion;
- Consumption of homegrown vegetables; and,
- Fibre/dust inhalation.

Note: No exceedances of POS or commercial GACs were recorded in the soil samples analysed in these corresponding areas (other than trace asbestos in TP102). However, exceedances of residential GACs were noted in these area, thus further assessment in respect of re-use of soils won from these areas within the main residential area would be necessary, if proposed.

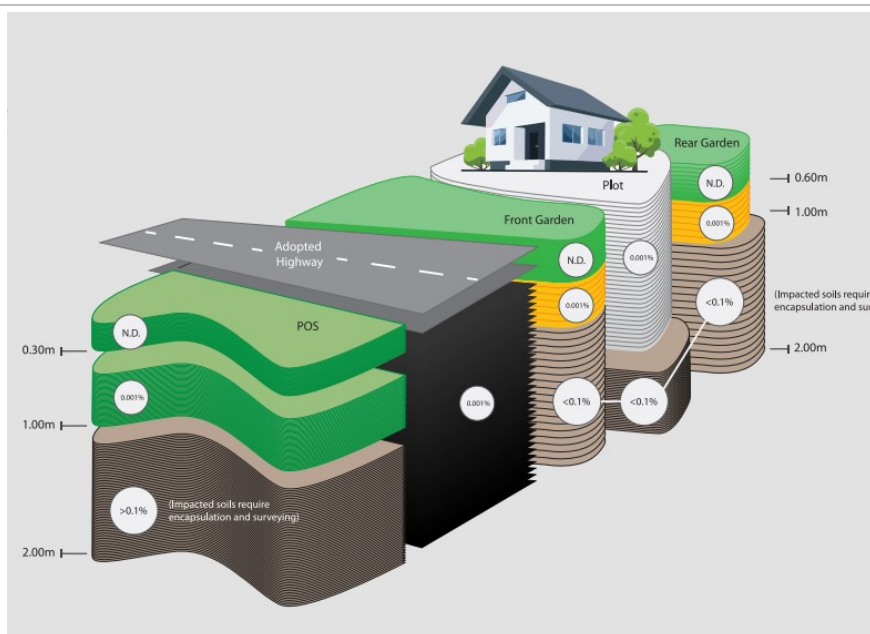
HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils, inhalation of particulate and consumption of homegrown vegetables. The risk to chronic human health associated with the elevated concentrations of inorganic heavy metals and non-volatile PAH compounds can be mitigated through the installation of a suitable cover system. Given the widespread distribution of the contamination, the cover system would be required in all proposed private gardens, landscaping, and public open space to remove any potential for direct exposure to impacted soils.

Asbestos in the form of chrysotile has also been identified within a localised area in shallow Made Ground at TP112 located to the west of the development area (proposed POS), in the location of the former saw mill, engine stores and travelling crane. Asbestos quantification was undertaken to further assess where these soils may be placed, this indicated a level detected at <0.001%. No visual signs of ACM were encountered in the area of identified ACM during the ground investigation; it is therefore likely that only trace fibres are present. Impacted soils should be managed according to the asbestos risk mitigation conceptual site model shown in Figure 2.1. In this instance, the risks can be mitigated by placing the impacted soil from TP112 beneath a 600 mm clean cover system in garden/landscaped areas or placed beneath roadways or at 1.0 m beneath plots.



FIGURE 2.1 ASBESTOS CONCEPTUAL SITE MODEL



S/VOC contamination (elemental mercury, naphthalene, toluene and aromatic hydrocarbon fractions C8-C16) has been encountered across the site in Made Ground at depths of between 0.50 m and 4.90 m bgl. Given the spread and depth of encounters of other identified SVOCs, it is considered that the contamination is widespread.

In order to assess the risks from the identified volatile contaminants a Tier 2 DQRA has been undertaken to model the actual vapour emission risk from residue within the anthropogenic material in order to determine whether specialist hydrocarbon-resistant membranes will be required in the construction of the new dwellings.

The results of the Tier 2 assessment to assess the vapour risk from hydrocarbon, naphthalene, toluene and mercury are summarised below:

- ✳ Vaporific TPH C10-C12 aromatic has been found marginally in exceedances of the SSSGV within WS110 in the east of the site.
- ✳ To avoid the requirement for specialist VOC resistant membranes in the vicinity of WS110, a process of delineation and subsequent excavation of the soils is recommended. The resulting void will then require validation and excavated soils may be suitable for retention in an area of no future sensitivity (proposed POS in the west of the site – subject to concentrations) or removal from site.
- ✳ With respect to mercury, due to the very low SSSGV ($0.0643038 \mu\text{g}/\text{m}^3$), vapour sampling options were limited at the time of assessment due to external factors such as seasonal changes to water levels and moisture in the monitoring wells affecting the data. Passive samplers confirmed the concentration of elemental mercury to be below the limit of detection ($0.2 \mu\text{g}$) in each location. A worst case concentration of $0.19 \mu\text{g}/\text{m}^3$ must therefore be assumed.
- ✳ In addition, allowances should be made for removal of contaminated soils where volatile impact is encountered in the groundwater, to thus remove the point source e.g. WS104 / WS105.



- Monitoring in the southwest suggested a reduced vapour risk, however, further targeted assessment in and around TP211 (extending north and east) should be carried out to fully appraise the risk.

The gross Naphthalene/TPH impact and visually and olfactorily impacted soils (refer to Drawing no. 14-768-118) will require remediation to mitigate long term potential vapour accumulation and migration, odour issues, risk to construction workers/end users and potential future risks to controlled waters. Treatment may include ex-situ bioremediation and/or soil stabilisation to 'lock in' contaminants where the material remains in-situ. As a precaution, it would be prudent to also incorporate VOC resistant membranes in plots in the areas where the impacted material remains, or is re-placed, to reduce the long term risks to receptors.

It is considered that chemical analysis of the natural clay drift deposits will identify these soils outside of the identified TPH/SVOC impact to be acceptable for use as subsoil within the proposed garden areas subject to further chemical validation; however, given the depth of Made Ground on-site, it is unlikely that subsoils will be excavated.

There are no suitable sources of topsoil available on the site.

All proposed garden and landscaped areas within the development are to be installed with a 600 mm chemically suitable cover system, which will ensure that future site users will be at no unacceptable risk from the identified contaminant exceedances.

It is concluded that the site will be suitable for the proposed residential end use subject to the completion of the supplementary assessments and the following build-phase mitigation items:

- Management of soils to ensure that materials impacted by TPH, SVOCs and asbestos fibres are placed in areas of low sensitivity during the site enabling works.
- Use of potable water supply infrastructure that will be compliant with United Kingdom Water Infrastructure Risk (UKWIR) assessment criteria. Barrier pipe likely to be required.
- Construction of dwellings with ground gas mitigation measures that conform to CS2/Amber 1 requirements of BS 8485, with vapour resistant membranes in plots where impacted material remains or is re-placed.
- Construction of a 600 mm clean cover system to all areas of private garden in accordance with the detailed methodologies herein.

2.3. CONTROLLED WATERS CONTAMINATION RISK SUMMARY

A Tier 1 Controlled Water Risk Assessment was completed by E3P as part of the Phase II Geo-Environmental Site Assessment ref; 14-768-R1-3, dated March 2023 and Supplementary Controlled Waters Assessment Letter, ref; 14-768-L5-1, dated February 2024, the findings of which are summarised as follows:

- Historically, the site has been subjected to extensive industrial uses including railway sidings and, engineering stores/sheds. Widespread leachable heavy metal, PAH, TPH and SVOC contamination has been identified in the soils across the site, thus posing a risk to controlled waters.



- ✳ The site is underlain by a mixed geology, generally cohesive clay in the northeast of the site and generally granular sand and gravel in the southwest, with thick bands of clay beyond 10.0 m bgl. The clay deposits will afford for the protection of the underlying bedrock aquifer. Given the extensive thickness of drift (>60.0 m) and absence of a nearby water abstraction borehole, the risk to the underlying bedrock aquifer is considered to be significantly reduced and therefore deemed to be at a low risk from on-site contamination.
- ✳ However, high concentrations of naphthalene and aromatic hydrocarbon fractions were recorded in the initial groundwater sample taken from WS105 (sample-1, March 2021) in the west of the site, potentially representative of a plume.
- ✳ The site sits at an approximate elevation of 130-135 m AOD and is inferred to slope very gently down to the southwest. The land to the north west and Roeacre Brook (circa 150 m to the north west) is noted to be at a lower elevation (~125 m AOD) and thus down hydraulic gradient of the site. Although this is considered outside of typical influencing distance, a surface water drain is present along the northern boundary, which may act as a conduit for site derived contamination to enter nearby watercourses. The ditch was dry at the time of the initial phase of works but further sampling was recommended when possible.
- ✳ Further sampling of WS105 (sample-2) was therefore undertaken in November 2021 to determine whether the identified elevated concentrations were persistent within the shallow/perched groundwater. The results again showed high concentrations of volatile compounds at this location, including naphthalene and aromatic hydrocarbon fractions, together with heavy metals and non-volatile PAHs.
- ✳ Water samples taken from surrounding boreholes to the north west (WS101 and RO223) and west (RO221) of WS105 contained elevated heavy metal concentrations, but did not identify elevated volatile compounds, thus indicating no significant migration of volatile contamination towards the west or north west i.e. down-gradient and in the direction of the Roeacre Brook / peripheral drainage channels.
- ✳ Subsequent sampling of the on-site drainage ditch also confirmed the absence of TPH/volatile compound exceedances. Furthermore, the ditch was not observed to be flowing and is considered more likely to hold excess run-off and terminate within the site boundary, rather than acting as a tributary to the off-site watercourse. There is therefore not considered to be a complete pollutant linkage between the groundwater contamination identified at the site and the Roeacre Brook.
- ✳ Additional wells were also installed to the south and east of WS105 to assess the extent of groundwater impact. TPH fractions, naphthalene and SVOCs have been found in exceedance of GAC values in WS301 and WS303, located to the east of WS105, albeit at lower concentrations than in WS105. Only heavy metals and non-volatile PAH compounds were found to be in exceedance in WS302, WS304 and WS305, suggesting the contamination is not migrating much further south.
- ✳ The identified hydrocarbon and volatile contamination in the groundwater (WS105, WS301 and WS303) is located within the area of defined visual and olfactory hydrocarbon contamination in soils (refer to drawing no. 14-768-118). It is therefore considered likely that the contamination is confined to the perched water and is directly derived from the soils as a point source. No surface water receptors have been identified within influencing distance of the site to the south or east. There is therefore considered to be no unacceptable degree of future risk to controlled waters receptors from the site.
- ✳ As part of the previous human health risk assessment (E3P Supplementary Site Investigation, ref: 14-768-L4-2, March 2023) it was recommended that remedial treatment would be necessary for the soils to mitigate long term potential vapour accumulation and migration, odour issues, risk to construction workers/end users and potential future risks to controlled waters.



- ✳ Point source removal and ex-situ treatment of the soils by a specialist contractor is considered the most viable option. This method would remediate the soil impact and as a result remove the point source and result in improved groundwater conditions.
- ✳ During the enabling works, the following surface water management mitigation measures should be adopted to ensure no risk to neighbouring water courses:
 - Treatment of pumped water from excavations and discharge to local sewers (in accordance with the relevant permit),
 - Prevention of run-off to local drainage ditches (bund along length of ditches) in accordance with an appropriate surface water management plan.
 - Ensure any stockpiles of excavated materials are located in central areas of the site and banded to prevent any lateral runoff.

2.4. GROUND GAS

Ground gas has been assessed by E3P as part of the E3P Geoenvironmental Site Assessment. The assessment was completed in accordance with the methodology outlined with the CIRIA publication C665, utilising the results of the ground gas monitoring surveys to calculate a tentative gas screening value (GSV). The GSVs for the monitoring positions are summarised in Table 2.1.

TABLE 2.1 GAS RISK PROFILE AND LOCATION

LOCATION	MAX FLOW (l/hr)	MAX CH ₄ (% v/v)	MAX CH ₄ Q _{hg} / GSV (l/hr)	MAX CO ₂ (% v/v)	MAX CO ₂ Q _{hg} / GSV (l/hr)	CHARACTERISTIC SITUATION	NHBC TRAFFIC LIGHT
WS101	0.52	0.10	0.00052	0.50	0.00260	CS1	Green
WS103	2.88	0.10	0.00288	3.40	0.09792	CS2	Green
WS104	0.52	0.10	0.00052	0.60	0.00312	CS1	Green
WS105	0.52	0.10	0.00052	3.90	0.02028	CS1	Green
WS106b	0.88	0.10	0.00088	5.00	0.04400	CS1	Green
WS107	0.52	0.10	0.00052	2.90	0.01508	CS1	Green
WS108	2.06	0.10	0.00206	3.70	0.07622	CS2	Green
WS109	1.24	0.10	0.00124	1.30	0.01612	CS1	Green
WS110	0.52	0.10	0.00052	1.60	0.00832	CS1	Green
WS111	1.24	0.10	0.00124	2.40	0.02976	CS1	Green
WS112	1.00	0.10	0.00100	6.60	0.0660	CS2*	Green
WS113	1.29	0.10	0.00129	5.90	0.07611	CS2	Green
WS114b	4.79	0.10	0.00479	2.30	0.11017	CS2	Green

Notes:

Values in **BOLD** exceed thresholds for CS1 classification.

*Consideration for CS2 based on CO₂ concentration >5%. Further discussion required.

E3P has assessed the previous variables and come to the following conclusions:



- ✳ Current monitoring indicates that gas protection measures in accordance with a CS2 classification will be required for all residential properties constructed at the site as a minimum.
- ✳ However, the CSM identifies potential gas sources in the form of deposited organic materials (Peat). Development proposals include the removal of large volumes of peat from beneath specific areas of the site (roads, drainage, hardstanding – refer to E3P Geotechnical Earthworks Specification, ref: 14-768-R3-1), which will lead to changes in the groundwater regime and aerobic degradation of in-situ / exposed peat, which may increase the risk from hazardous ground gasses.
- ✳ **Post remediation monitoring will therefore be necessary, along with a build phase strategy, to confirm the final classification. It may be possible to zone the site to reduce the risk classification in parts of the site.**
- ✳ It should be noted that areas with elevated concentration of TPH, SVOCs and mercury have also been identified. In the areas where impacted material remains, or is re-placed, VOC resistant membranes will be required to reduce the long-term risks to receptors
- ✳ **A build phase strategy will be required to determine plots requiring VOC resistant membranes.**

2.5. POTABLE WATER SUPPLY INFRASTRUCTURE

Based on the assessment of current site conditions, it is likely that a barrier pipe will be required at the proposed development.

This will need to be confirmed following the completion of a UKWIR risk assessment. Post-remediation and enabling works ground conditions may be different from those identified during this site investigation.



3. SITE REMEDIATION AND ENABLING WORKS

3.1. REMEDIATION OPTIONS APPRAISAL

A remediation options appraisal has been completed per the principles set out within the Environment Agency publication Land Contamination: Risk Management (LC:RM)(updated May 2020).

The LC:RM requires that the following tiered assessments are followed to ensure sufficiently detailed and robust appraisal of remediation options to inform the selection of the preferred approach and utilisation of the correct technologies to promote safe and sustainable land remediation:

- ✦ Identification of feasible remediation technologies;
- ✦ Detailed evaluation of viable options; and,
- ✦ Selection of appropriate remediation option.

3.2. DETERMINATION OF SUFFICIENCY OF INFORMATION

Prior to the commencement of the tiered assessment of remediation options, it is a requirement to assess the sufficiency of available information and validity of the risk-based assessment on which the remediation options appraisal is based.

In this instance, it is considered that there is sufficient information to inform the detailed site characterisation.

3.3. REQUIREMENT FOR REGULATORY CONTROL

The LC:RM requires that due consideration be given to the following key issues which will impact the appropriate selection of suitable remediation options.

- ✦ Requirement for regulatory permits (to include necessary Network Rail agreements / permits to work in proximity of live infrastructure);
- ✦ Noise restrictions;
- ✦ Baseline ambient air quality; and,
- ✦ Weather conditions.

The processing of recycled aggregates will be completed using LAPC Part B licensed plant with the appropriate deployment notification to the local authority prior to commencement of works. All materials that are recovered as recycled aggregate will be compliant with the requirements of the WRAP protocol and the E3P validation testing requirements and as such would not be deemed to be a waste material.

Where necessary, operations as outlined within the remediation enabling works rationale summarised in this report may be subject to regulation using the appropriate environmental permit, standard rules exemption and materials management plan, to be created in accordance with version 2 of the CL:AIRE *Definition of Waste: Code of Practice (DoW CoP)*.

It is noted that if material is to be imported utilising the CL:AIRE DoW CoP from an alternative development site, then only chemically certified, clean, naturally occurring material can be transferred.



The MMP will be created with due consideration of all proposed remediation and enabling works operations prescribed within this document and will be undertaken by a qualified person with a signed declaration submitted to the EA prior to re-use of materials on the site.

The importation of material for use within the proposed construction of a development platform will be subject to the compliance with the E3P protocol for the importation of materials as set out within the specification for material import included within Appendix IV of this report.

Noise Restrictions

Numerous sensitive receptors are identified in the form of residential dwellings to the periphery of the area that will be subject to remediation works.

The contractors environmental plan of works will include boundary noise monitoring stations to assess the noise impact, daily monitoring and mitigation measures to ensure no unacceptable degree of impact to the identified receptors. Given that noise impact can be controlled, this is not considered a limiting factor in the selection of the correct remediation option.

Baseline Air Quality

An air quality assessment may be required under a separate cover due to the presence of odorous contaminants within the soils.

Weather Conditions

Given the size and scale and variable remediation works required, it will be possible to ensure that the programme allows for a differentiation in operations to ensure works can proceed in areas depending on the prevailing weather for a specific period of time.

3.4. CONTAMINANTS OF CONCERN (COC)

3.4.1. METALS, PAH, NON-VOLATILE HYDROCARBON (PETROLEUM RANGE) COMPOUNDS

The human health risk drivers for the carcinogenic PAHs and metal CoC are:

- ✳ Direct contact with the soil source by future on-site residents; and
- ✳ Ingestion of impacted soils by future on-site residents.

Therefore, a cover system is considered to be an appropriate remediation technique to address these impacts, as the installation of a cover system to unsurfaced areas of the site will sever the pathway of contact for human health receptors.

A cover system is not considered to be required in future hardstanding areas or beneath buildings, as it can reasonably be assumed that the presence of a hardstanding will prevent direct contact.

3.4.2. ASBESTOS

Asbestos in the form of chrysotile has been identified within a localised area in shallow Made Ground at TP112 located to the west of the main development area, in the location of the former saw mill, engine stores and travelling crane. Asbestos quantification was undertaken to further assess where these soils may be placed, this indicated a level detected at <0.001%.



It should be assumed that asbestos fibres are present throughout the Made Ground on site. The risk to chronic human health associated with the elevated concentrations of loose chrysotile and fibres (<0.001%) can be mitigated through the installation of a suitable cover system in all proposed landscaping and hardstanding to remove any potential for direct exposure to impacted soils.

Where asbestos is identified at concentrations above <0.001%, a hotspot excavation will be required, and the impacted Made Ground will require placement >1.00m beneath an area of low sensitivity, such as public open space in accordance with the E3P conceptual site model (Figure 2.1).

All ACM-impacted soils must be managed so as to ensure no airborne fibre release during construction or placement of impacted material in such a manner as to ensure no future exposure risk.

Soils will be placed in areas of no unacceptable future risk in accordance with the E3P validation method.

If any visible pieces of asbestos-containing material are identified during the site remediation and enabling work, this material must be dealt with in strict accordance with the Control of Asbestos Regulations (CAR) 2012, UK Waste Management Legislation and the Environmental Protection Act 1994. Due to the close proximity of residential dwellings, asbestos in air monitoring in accordance with HSG248 may be required to confirm that no asbestos fibres have been generated from the enabling works activities.

Should off-site disposal be required, then additional asbestos quantification and waste classification testing should be undertaken to ensure that it is classified correctly and disposed at a suitably licensed facility.

3.4.3. NAPHTHALENE AND VOLATILE TPH

Vaporific TPH C10-C12 aromatic has been found marginally in exceedances of the SSGV within WS110 in the east of the site. Monitoring in the southwest suggested a reduced vapour risk, however, no targeted vapour monitoring has been completed around TP211 where exceedances of volatile contaminants has been confirmed in the soils by visual and olfactory observations and chemical data.

The gross Naphthalene/TPH impact and visually and olfactorily impacted soils (refer to Drawing no. 14-768-118) will require remediation to mitigate long term potential vapour accumulation and migration, odour issues, risk to construction workers/end users and potential future risks to controlled waters.

It is noted that peat deposits beneath the site will require removal from beneath roadways, drives, drainage infrastructure etc. Where peat is removed, the overlying impacted Made Ground will also be excavated, thus removing the contaminant source from these locations. Ex-situ treatment of the material may be a viable solution to facilitate its placement elsewhere.

As a precaution, it would be prudent to also incorporate VOC resistant membranes in plots in the areas where the impacted material remains, or is re-placed, to reduce the long term risks to receptors.

3.4.4. MERCURY

Speciation was carried out on the samples found to contain concentrations of total mercury in exceedance of 1.2 mg/kg. The results confirm that TP121, WS112 and RO304 may be treated as hotspots for delineation and removal.



3.5. IDENTIFICATION OF FEASIBLE REMEDIATION OPTIONS

3.5.1. OBJECTIVES

The remediation works must be completed in a safe and sustainable manner that ensures that the post remediation condition of the site poses no unacceptable risk to controlled waters or the wider environs. The developed Conceptual Site Model must ensure no complete pollutant linkage to ensure successful implementation.

The remediation works must be completed in a manner that promotes sustainable re-use of material in a manner that minimises waste and maximises retention of material on-site.

The works should be designed and implemented in a manner that ensure no risk to an identified receptor during the works in terms of odour, air quality or noise impact.

Works should be designed, planned and implemented in a manner that ensures full compliance with all pertinent waste management and environmental permit legislation.

3.5.2. AVAILABLE TECHNOLOGIES

Potential remedial technologies that can be applied in order to remediate the identified contaminants of concern are summarised in Table 3.1. The remedial techniques considered would potentially break any source-pathway-receptor linkages, thereby reducing the risk to human health from vapour inhalation to acceptable levels.

TABLE 3.1 SOIL REMEDIATION TECHNOLOGIES

REMEDIAL TECHNOLOGY	CLASSIFICATION	APPLICATION	MEDIUM	LINKAGE ELEMENT AFFECTED
Capping	Containment	In situ	Soil	Pathway interruption
Electro-remediation	Physical	In situ / ex-situ	Soil	Removes source
Soil washing	Physical	Ex-situ	Soil	Source management
Soil vapour extraction	Physical	In situ	Soil	Removes source
Ex-situ bioremediation	Biological	Ex-situ	Soil	Removes source
Thermal desorption	Thermal	Ex-situ	Soil	Removes source
Vitrification	Thermal	In situ	Soil	Removes source / breaks pathway
Stabilisation / Solidification	Chemical	In situ / ex-situ	Soil	Pathway Interruption
Excavation and offsite disposal	Civil Engineering	Ex-situ	Soil / groundwater	Removes source
Enhanced Bioremediation	Chemical / Biological / Natural attenuation	In situ	Soil / groundwater	Removes source / breaks pathway



REMEDIAL TECHNOLOGY	CLASSIFICATION	APPLICATION	MEDIUM	LINKAGE ELEMENT AFFECTED
Monitored Natural Attenuation	Natural attenuation	In situ	Soil / groundwater	Pathway interruption / eventual removal of source
Vacuum Enhanced Recovery	Physical / Chemical	In situ	Soil / groundwater	Removes source / breaks pathway
Air sparging / Biosparging	Physical / Biological	In situ	Soil / groundwater	Removes source / Pathway interruption
In situ oxidation	Chemical	In situ	Soil / groundwater	Removes source / Pathway interruption

3.5.3. SELECTION OF TECHNOLOGY OPTIONS

Several remedial technologies have been considered in addressing the contaminant linkages of concern identified at the site, as summarised in Table 3.2.

In order to assess which of these technologies are most viable for this particular project, each technology has been reviewed on the basis of applicability, permissibility, cost, timescale and acceptability (including sustainability).

A combination of remediation solutions and technologies will be required to address and treat the numerous contamination issues identified on this site.

Aspects of sustainable remediation are also included within the review element of applicability.

Sustainable remediation is, 'the practise of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact and that the optimum remediation solution is selected through the use of a balanced decision-making process', (as defined within 'A Framework for Assessing the Sustainability of Soils and Groundwater Remediation', produced by Sustainable Remediation Forum UK, dated March 2010).



TABLE 3.2 ASSESSMENT OF REMEDIATION TECHNOLOGIES APPLICABILITY

REMEDIAL TECHNOLOGY	APPLICABILITY	REGULATORY APPROVAL / PERMITRY	COST	TIME-FRAME	SCORE	SUITABILITY COMMENT
Capping	5	5	5	5	20	Essential remediation solution to remove direct exposure pathways.
Electro-remediation	1	1	1	1	4	Technique unlikely to treat identified contaminants of concern in an efficient manner.
Soil washing	1	1	1	1	4	Technique unlikely to treat identified contaminants of concern in an efficient manner.
Soil vapour extraction	1	1	1	1	4	Technique unlikely to treat identified contaminants of concern in an efficient manner.
Ex-situ bioremediation	4	4	3	3	14	It is considered viable to treat soils to ensure residual concentrations pose reduced risk in terms of vapour inhalation and migration in dissolved phase to controlled waters.
Thermal desorption	1	2	2	2	7	Limited application due to nature and depth of material and ability to achieve required results.
Vitrification	1	1	1	1	4	Technique unlikely to treat identified contaminants of concern in an efficient manner.
Stabilisation / Solidification	4	4	3	4	15	The addition of stabilisation and binding agents will limit volatilisation and impede migration.
Excavation and off-site disposal	5	5	1	5	16	Quantities of material that cannot be treated will be removed. Likely to form one aspect of the remediation approach. Extent would be limited by cost being prohibitive.
Enhanced Bioremediation	4	4	1	3	12	Considered viable to treat soils to ensure residual concentrations pose reduced risk in terms of vapour inhalation and migration in dissolved phase to controlled waters.
Monitored Natural Attenuation	4	3	5	1	13	Likely to form one aspect of the remediation solution. Long term monitoring to demonstrate residual impact poses no significant and ongoing risk.



REMEDIAL TECHNOLOGY	APPLICABILITY	REGULATORY APPROVAL / PERMITRY	COST	TIME-FRAME	SCORE	SUITABILITY COMMENT
Vacuum Enhanced Recovery	1	1	1	1	4	Technique unlikely to treat identified contaminants of concern in an efficient manner.
Air sparging / Biosparging	1	1	1	1	4	Technique unlikely to treat identified contaminants of concern in an efficient manner.
In situ oxidation	3	3	3	3	12	Limited ability to treat significant impact, however where isolated areas of notable organic impact present, this may provide a viable solution to treat aromatic, aliphatic and chlorinated impact.



3.6. SUMMARY OF PREFERRED REMEDIATION OPTIONS

Based on the options appraisal, it is considered that the following combination of remediation technologies provides the most sustainable, viable and economic solutions that will ultimately result in the successful remediation for the site:

- ✳️ Construction of low permeability **capping system** in gardens and soft landscaping areas to ensure no direct exposure pathway to future receptors.
- ✳️ Construction of dwellings with **specialist membranes** and mitigation measures to ensure no ingress of hazardous ground gas or volatile phase hazardous compounds into a dwelling;
- ✳️ **Ex-situ treatment** of excavated materials by a specialist contractor in accordance with a Mobile Treatment License (MTL). The precise method will be defined within the remediation contractors Remediation Implementation Plan / Method Statement.
- ✳️ **Solidification and stabilisation** to bind compounds within the soil matrix to reduce volatilisation and migration into the dissolved phase. Works to be completed by a specialist contractor in accordance with a MTL / Environmental Permit (EP);
- ✳️ **Off-site removal** of hazardous materials which cannot be treated will be required, this operation needs to be limited to materials that cannot be treated on-site to promote sustainability and ensure viable regeneration;

3.7. OVERVIEW OF WORKS

Prior to the commencement of works on site, the contractor must establish all necessary plant, equipment and site welfare facilities as is required to complete the contract within the agreed timescales to the rationale as outlined in the following subsections.

For the avoidance of any doubt, the proposed operations as set out herein document the required performance objectives and validation sampling protocols; however, the specific methods of work deployed to ensure the remediation objectives are achieved in a compliant manner on site will be the responsibility of the appointed contractor.

RE-1 – Pre-commencement Regulatory Compliance

Prior to the commencement of any works on site, all reports relating to the assessment of risk to contaminated land should be submitted to the regulatory authorities to gain written approval.

All relevant Standard Rules Permits should be registered with the EA.

The LAPC Part B Notification for deployment of mobile crushing plant should be implemented prior to the establishment of equipment on site.

If the proposed volume of soils to be re-used (excluding crushed materials) exceeds the parameters of the Standard Rules Permit, a CL:AIRE Materials Management Plan (MMP)-qualified declaration should be made by the contractor, having obtained full written approval for the remediation strategy from the LPA and Environment Agency.



There will be a requirement to treat impacted materials on site (hydrocarbon-impacted soil or groundwater). The contractor must either notify E3P and, if appropriate, relevant regulators of their intention to complete the works or arrange for the deployment of the appropriate environmental permit for the specified function.

The contractor will be required to prepare and submit a Remediation Implementation Plan / Method Statement for any specific point source remediation works.

RE-2 – Environment and Nuisance Control

Management of all works is required so as to ensure that no environmental nuisance is created through dust emissions, noise, odour or vibration levels.

All works are to be completed in a manner so as not to disturb adjacent highways or neighbouring properties, including railway infrastructure.

Temporary works are to be implemented as necessary to support excavations throughout the duration of the works.

In the event that a complaint is made in respect of dust emissions, noise, odour or vibration levels, remedial measures and a programme of ongoing monitoring should be agreed with the local authority and implemented on site.

RE-3 – Risk to Infrastructure

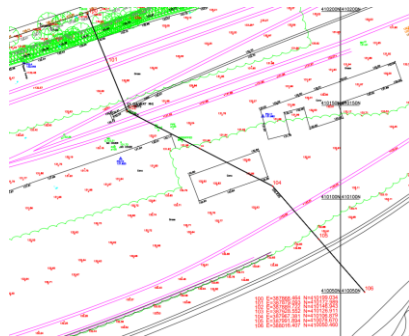
Site works should be completed in a manner that ensures no risk of disturbance to the adjacent properties, signal box or railway infrastructure.

Works should also ensure that no risk is posed to the existing culvert on-site if this is to be retained. The location of this feature, with co-ordinates, is shown in Figure 3.1.

A live railway also runs along the southern site boundary. The assigned TRGM Safeguarding Boundary must be adhered to and vibratory works in proximity must be monitored/kept to a minimum. Consultation with Network Rail may be necessary to establish acceptable vibration limits and plant operations within proximity of the railway.

It will be the contractors responsibility to obtain the relevant permits to work in proximity of live rail infrastructure.

FIGURE 3.1 LOCATION OF CULVERT IN EAST OF DEVELOPMENT AREA



RE-4 – Identification, Isolation and Treatment of Invasive Plants

The remediation contractor must satisfy themselves with respect to the extent of all species deemed invasive prior to the commencement of works on site. The contractor shall employ a suitably qualified expert to investigate the presence of invasive plant species on or adjacent to the site. If invasive plant species are identified, these will be treated in strict accordance with an approved method statement to be submitted to the supervising consultant for review prior to the instigation of any works.

Where invasive plant species are identified at the site boundary, a suitable barrier shall be installed to prevent any future reinfestation of the subject site.

Upon completion of the eradication of all invasive species, a validation report should be prepared documenting all identified invasive plant species, their location and the treatment methodology. Where materials are removed from site, all waste transfer notes/duty of care certificates should be included within the validation statement.

RE-5 – Site Clearance Operations

General site clearance and provision of welfare, offices and site security are to be determined as per the contract requirements.

Vegetation should be removed in a controlled manner with full compliance with any ecological mitigation measures that are required for the works. Any such measures are outside the scope of this report.

All vegetation should either be stockpiled at a pre-agreed location or alternatively removed from site in accordance with waste permitting regulations.

All root networks are to be removed in accordance with the requirements of the NHBC/LABC.

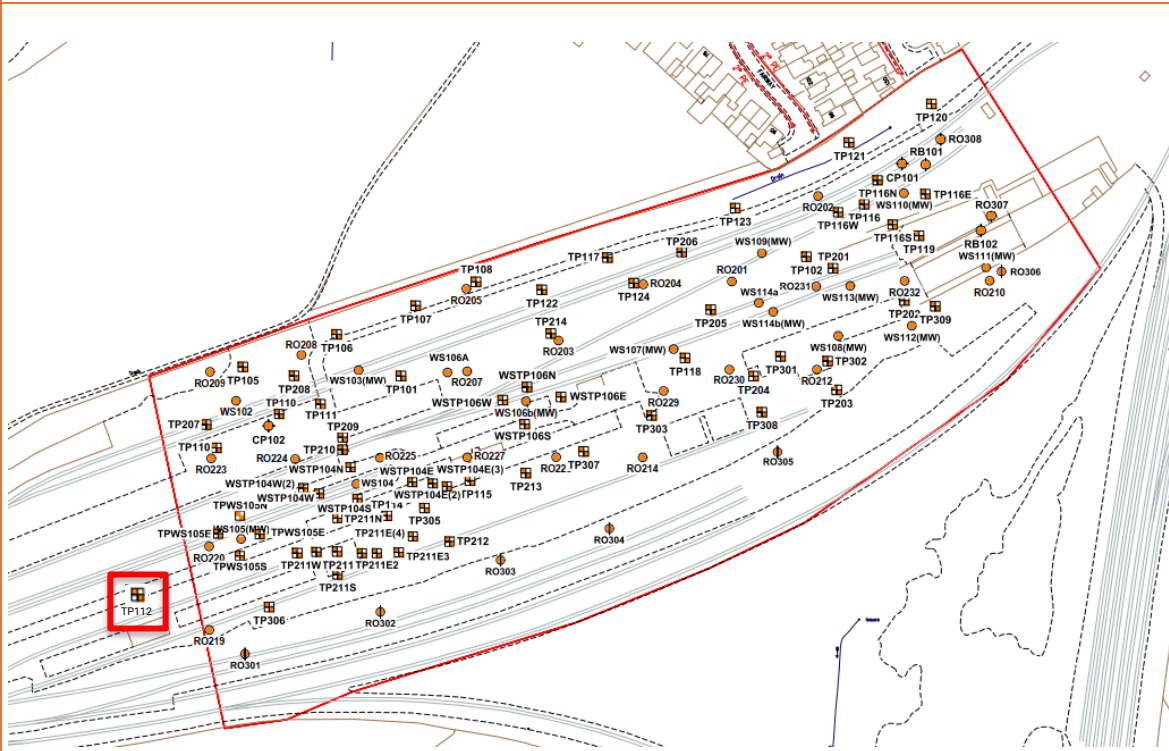
RE-6 – Delineation, Excavation and Treatment of Identified Asbestos Impact

Asbestos in the form of chrysotile has been identified within a localised area in shallow Made Ground at TP112 located to the west of the development area, (in the proposed area of public open space). Asbestos quantification was undertaken to further assess where these soils may be placed, this indicated a level detected at <0.001%. Asbestos has not been identified within the development sector to date.

The location of known asbestos impacted soil is shown in Figure 3.2.



FIGURE 3.2 LOCATION OF IDENTIFIED ASBESTOS IMPACT



However, due to the nature and age of the filled material, it must be assumed that trace fibres are present throughout the Made Ground. The E3P Developed Conceptual Site Model demonstrates a suitable method for management of soils to negate any future risk.

The contractor must ensure that all personnel working on site are trained in the identification of ACM and the risks associated with impacted soils.

Where any visual evidence of ACM is identified, these materials should be carefully segregated and removed from the soil matrices (if/where possible).

Validation sampling of the processed Made Ground should be completed to demonstrate compliance with the developed conceptual site model.

This process should be completed under strict controls to be devised and employed by the nominated contractor to ensure no potential for fibre release into ambient air.

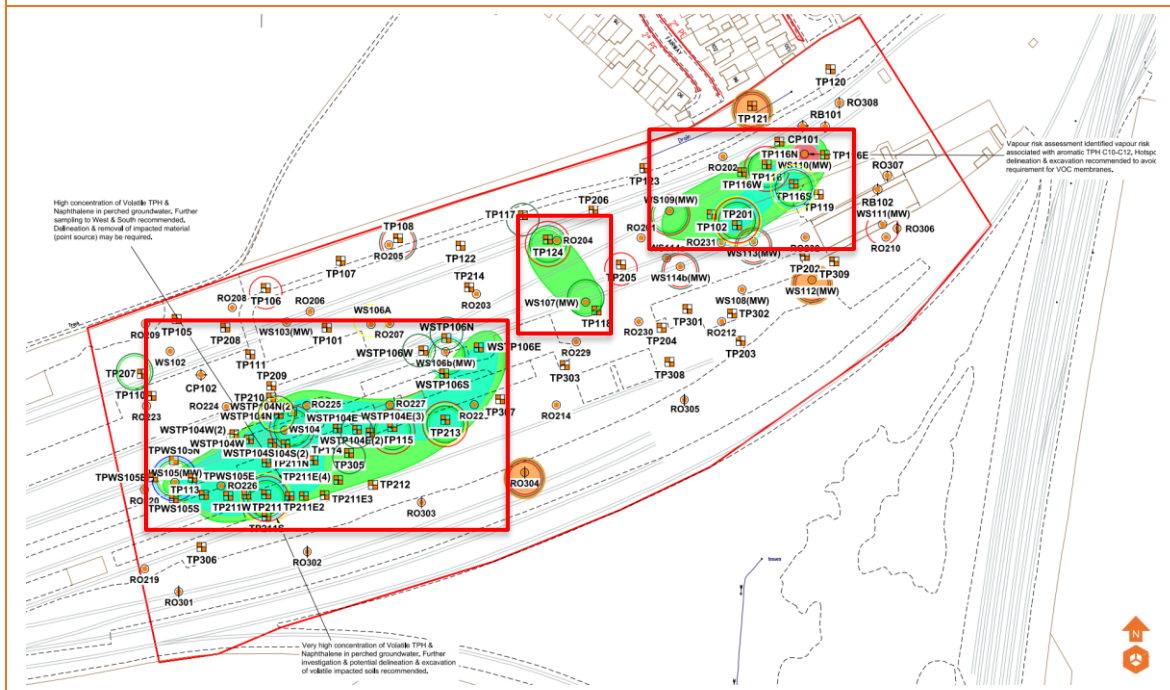
If necessary, reassurance air testing in accordance with the requirements of HSG248 should be completed during the operation to move the soils to demonstrate the deployment of the required control procedures and safe working methods.

RE-7 – Further Investigation and Remediation of Naphthalene & TPH Impact

The gross Naphthalene/TPH impact and visually and olfactorily impacted soils (refer to Drawing no. 14-768-118 and Figure 3.3) will require remediation to mitigate long term potential vapour accumulation and migration, odour issues, risk to construction workers/end users and potential future risks to controlled waters.



FIGURE 3.3 LOCATION OF TPH/NAPHTHALENE IMPACT



Where TPH/VOCs have been identified in the groundwater, this impact is inferred to be soil derived, therefore, point source removal would remove this source. However, residual impacted groundwater may present a risk of vapours/ground gas emission if allowed to volatilise. Groundwater in excavations shall be pumped and treated and discharged to foul sewers (subject to obtaining the appropriate permit), thus removing the risk to end users and also to controlled waters by removing the secondary source of contamination. Discharged water shall be tested periodically to ensure water quality thresholds are not exceeded.

During remediation and enabling works, measures will be established to prevent surface water runoff from or into targeted excavation and treatment areas by sealing of existing manholes, bunding treatment areas and restricting excavations to facilitate daily re-instatement and deferring works in periods of poor/wet weather.

In the unlikely event of a pollution incident, works will cease until appropriate measures can be put in place to stop and prevent further impact to the watercourse, these may include forming further temporary bunds, interception trenches and deployment of additional pumps and treatment plant or targeted disposal options.

A surface water management plan and piling risk assessment should be prepared for the proposed development.

As a precaution, it would be prudent to also incorporate VOC resistant membranes in plots in the areas where the impacted material remains, or is re-placed, to reduce the long-term risks to receptors. A build phase strategy will be required to determine plots requiring VOC resistant membranes.

When considering the prior land use, as yet unidentified potentially volatile/soluble phase compounds cannot be discounted. The proposed remediation works will include the full depth turnover of all Made Ground beneath plot footprints +2.00 m under the supervision of an independent geoenvironmental consultant from E3P. Note: A reduced turnover to 1.50 m bgl will be conducted in gardens to plots and proposed areas of soft landscaping.

If any as yet unidentified contaminant is identified, this will be the subject of further investigation including laboratory analysis and subsequent assessment of risk within the context of the agreed parameters. Where a theoretical risk to either human health, controlled waters or the wider environs is identified, appropriate (ex-situ treatment) methods are to be instigated.

Material deemed to be impacted through either visual or olfactory observations or as a result of notable PID readings (> 50 ppm) will be excavated and stockpiled on an impermeable membrane. The membrane will be placed upon a clay containment bund to negate the risk of soils leaching. This material will then be subject to laboratory analysis to determine the suitability for re-use or treatment by ex-situ treatment.

Upon completion of the delineation and excavation, the sides and base of the resulting void(s) where impacted material is present will be chemically validated to confirm that no impacted materials remain in-situ.

Validation samples will be collected at 10 linear metre centres from the side and base of the excavation.

The results of this validation testing will be directly compared to the site-specific remediation targets (as defined within Appendix IV of this report) to demonstrate that no unacceptable level of risk to human health, controlled waters or the wider environment remains.

RE-8 – Delineation, Excavation and Treatment of Elemental Mercury Hotspots

The LQM S4UL GAC value for elemental (volatile) mercury is 1.2 mg/kg. This GAC value is conservatively applied to total mercury in the tier 2 human health risk assessment, and where exceedances are identified, speciation is carried out to determine if the elemental fraction is >1.2 mg/kg.



During investigations to date, total mercury concentrations >1.2 mg/kg have been identified in 11 samples of Made Ground. Speciation has confirmed three of these to contain elemental (volatile) mercury in exceedance of 1.2 mg/kg, as summarised in Table 3.3:

TABLE 3.3 LOCATION OF ELEMENTAL MERCURY >1.2 mg/kg

LOCATION	DEPTH (M)	TOTAL MERCURY CONCENTRATION (MG/KG)	ELEMENTAL MERCURY CONCENTRATION (MG/KG)
TP121	1.00	3.6	1.608
WS112	1.00	7.9	2.176
RO304	2.00	16.0	5.957

With the above in mind, it should be anticipated that during the remediation/earthworks phase and general sampling of Made Ground for re-use, frequent exceedances of total mercury are likely to be encountered.

An Environmental Agency CLEA 1.071 assessment for elemental mercury has therefore been undertaken to generate a site specific value for mercury, taking into account more refined parameters. The assessment is conservatively based on a residential end use with plant uptake (semi-detached property), female receptor age 1-6, sandy loam soil type with pH 7 and SOM 6% (based on average of TOC% data obtained during E3P investigations).

Indoor occupancy periods have been reduced from default 23 hours to 20-21 hours on the basis that it is unlikely they will be inside the property for 23 hours, particularly when of nursery and school age.

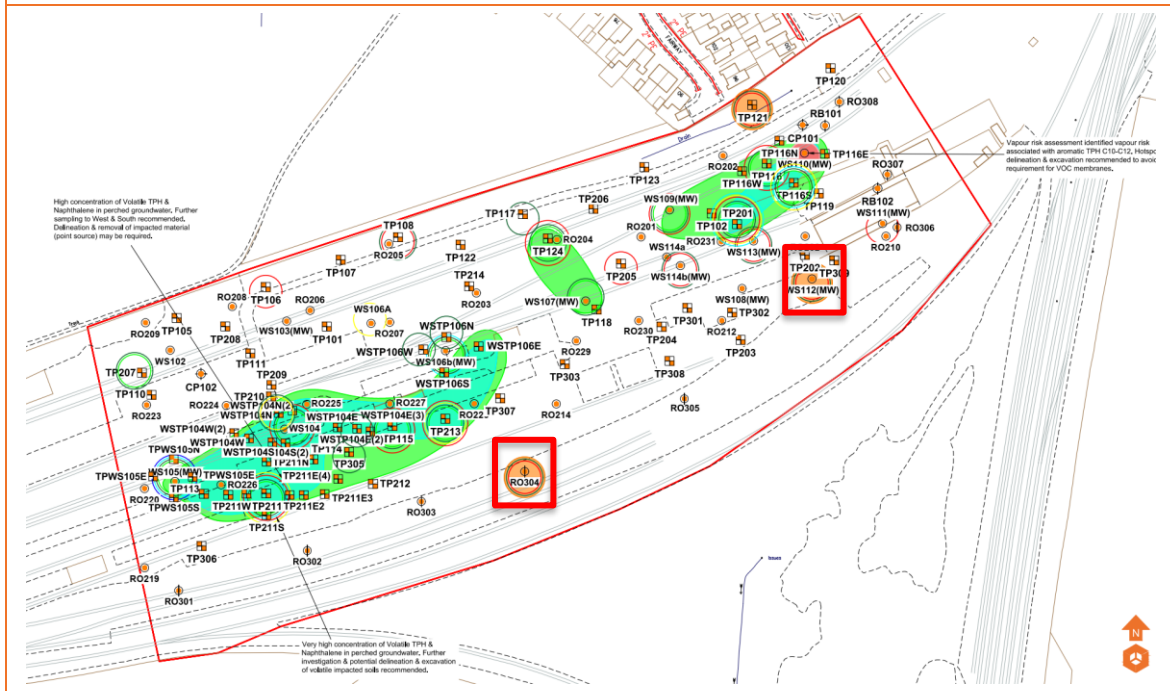
The building footprint area has been increased from default 40 m² to 50 m² based on proposed development plans provided by Kellen Homes. The depth to top of source (beneath building) has also been increased to 90 cm and the depth to top of source (no building) has been increased to 40 cm based on proposed build up depths for building footprints and drives. It should be noted that in gardens a 600 mm (60 cm) cover system will be incorporated, but 40 cm has been applied to be conservative.

Using the above altered parameters, the model has created a site specific screening remediation target value (SSSRTV) of 1.73 mg/kg for elemental mercury which is considered suitable for application at the subject site, meaning to date, only elemental mercury in WS112 and RO304 is in exceedance.

The location of WS112 and RO304 are shown in Figure 3.4.



FIGURE 3.4 LOCATION OF IDENTIFIED MERCURY HOTSPOTS



Where elemental mercury is confirmed to be in exceedance of 1.73 mg/kg, hotspot delineation will be required. Upon completion of the delineation and excavation, the sides and base of the resulting void(s) where impacted material is present will be chemically validated to confirm that no impacted materials remain in-situ.

Validation samples will be collected at 10 linear metre centres from the side and base of the excavation.

The results of this validation testing will be directly compared to the site-specific remediation target value to demonstrate that no unacceptable level of risk to human health.

Total mercury analysis will be undertaken on Made Ground samples at a rate of 1 per 1000 m³, with speciation undertaken where exceedances of 1.73 mg/kg occur.

Impacted soils will be placed in an area of reduced sensitivity (e.g. POS or parts of the site where VOC resistant membranes are to be installed). It should be noted that a build phase strategy will be required to determine plots requiring VOC resistant membranes on completion of remediation works and review of soil placement.

RE-9 – Excavation, Breaking and Processing of All Above- and Below-Ground Structures

Obstructions, relict foundations and infrastructure (apart from live services) are to be removed from the areas of proposed residential development, to include plot footprints, rear gardens, private driveways, adopted highway and utilities infrastructure (road box) in their entirety.

Artificially hard materials should be broken out and crushed. Stockpiles will be made, validation testing undertaken, and site-won material re-used on site where required. It is also understood that an estimated 8000 m³ of track ballast is present on-site, together with an estimated 4000 m³ crush that may be generated from existing hard structures on-site, which may be utilised in pile mats and road build up (subject to suitability testing). Materials will be processed as per the specifications provided in Section 5 using licensed plant.

E3P drawings denote the extent of known historic features with obstructions; however, it will be the contractor's responsibility to remove all obstructions.

Obstructions encountered within the near-surface soils will be chased to their full depth and removed; if not possible, the obstruction must be surveyed with the location communicated to E3P, the client and the developer.

Where natural soils are present at a relatively shallow depth, extreme care should be taken to ensure that the natural cohesive deposits remain undisturbed with a full reduced-level survey to be completed to map the depth of filled/processed material.

RE-10 – Delineation and Excavation of Identified Peat

Where peat deposits have been identified, the highly compressible material will require removal from beneath all roads, drives and drainage infrastructure. The specific procedure for this will be detailed within the E3P Geotechnical Performance Specification (report ref: 14-768-R3, September 2023) and the contractors method statement.

In summary, all materials that are deemed to be organic and thus exhibit unsatisfactory geotechnical properties must be removed with the resulting excavation to be backfilled with materials that in deemed compliant with the E3P Geotechnical Performance Specification, with appropriate compaction for the intended land use.

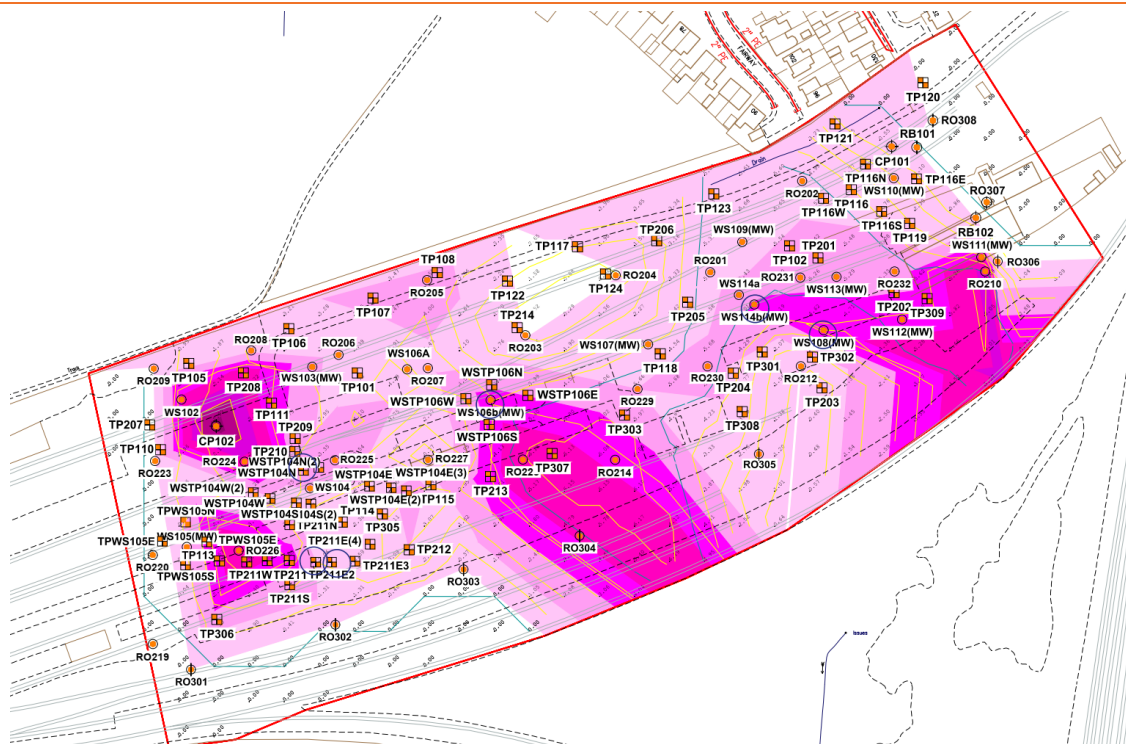
A suitably qualified geotechnical engineer will need to monitor the works and confirm when all unsuitable material has been excavated and removed from beneath any proposed structure or infrastructure.

The excavated peat soils will be temporarily stockpiled in an available area of the site e.g. proposed POS, to allow drying, the resultant material will then be subject to validation testing for suitability to determine where it may be retained / re-used on-site (e.g. within topsoil, subject to validation testing for suitability) or alternatively disposed of off-site.

The location of the identified peat deposits are shown in Figure 3.5.



FIGURE 3.5 DEPTH AND THICKNESS OF PEAT PLAN



RE-11 – Delineation, Excavation and Treatment of Infilled Reservoir

A reservoir is noted on mapping in the location of a former gasometer will need to be clearly identified and investigated to assess the nature of materials and extent of any organic or deleterious elements. Organic / peat deposits here are anticipated to be deeper. It is possible that this was a former small scale gas reservoir / holder as opposed to a water holding feature.

The location of the former reservoir is identified within the E3P Historical Features Plan (Drawing 14-768-003 in Appendix III and in Figure 3.6.

Prior to the commencement of the main earthworks (where possible), the feature should be clearly identified and demarked and investigated to assess the nature of materials and extent of any deleterious elements.

Based on the encountered Naphthalene/TPH impact and visually and olfactorily impacted soils (refer to Drawing no. 14-768-118 and Figure 3.3) the presence of impacted/contaminated soils in this area is considered likely. Removal/treatment of this material will need to be addressed by the remediation contractor.

All materials that are deemed to be organic or clearly impacted with contamination – and thus exhibiting unsatisfactory chemical and geotechnical properties – must be removed, with the resulting excavation to be backfilled with materials deemed compliant with the E3P Geotechnical Performance Specification (report ref: 14-4768-R3, September 2023) with appropriate compaction for the intended land use.



FIGURE 3.6 LOCATION OF INFILLED RESERVOIR

The location of the historic tanks is shown in Figure 3.7. Unrecorded USTs may exist elsewhere on-site.

Where the development levels require material to be filled, site-derived (confirmed suitable) Made Ground must be sorted in a controlled manner prior to replacement, in accordance with the requirements of this specification for the intended land use.



The maximum dry density must be determined in laboratory conditions utilising UKAS-accredited testing prior to the commencement of filling and compaction works. In-situ density testing is required to demonstrate compliance with the E3P Geotechnical Earthworks Specification (Refer 14-768-R3-1, April 2023).

RE-16 – Construction of Temporary Working Platform

Where plots are to be prepared in a manner that will facilitate ground improvement by vibro-stone column or piled foundations, a temporary working platform will be constructed.

The specific design for such a platform should be obtained from E3P; however, as a minimum this will comprise:

- ✳ Proof rolling of the subgrade to ensure a California bearing ratio (CBR) > 3%; and
- ✳ Placement of 300 mm of certified 6F2 to be rolled and compacted to ensure a CBR > 5%.

RE-17 – Replacement of Materials, Geotechnical Engineering Requirements

Material is to be backfilled in strict compliance with the E3P Geotechnical Earthworks Specification (Refer 14-768-R3-1, April 2023), which generally requires the reinstatement and compaction criteria presented in Table 3.4.

TABLE 3.4 GEOTECHNICAL ENGINEERING WORKS SCHEDULE

Land Use	Construction Requirement	Requirement
Footprint of Proposed Structure (2 m on All Elevations)	Pile Foundation	Backfill using general method compaction to CBR of 5%.
	Vibro-Stone Column	Particle size distribution (PSD confirmed as < 125 mm with no more than 10% fines (0.63 micron). Or Compaction to achieve > 95% of the laboratory determined maximum dry density (DD) with < 5% air void ratio. CBR > 6% with suitable pile mat. PSD testing of backfill material at 1 sample per 2000 m ³ to confirm.
	Traditional Spread Foundation	Ensure no disturbance of natural soil at shallow depth.
Highways	Adopted Estate Road/Drainage	Manual of Contract Documents for Highways Works (MCHW) Series 600 ensuring CBR > 5% in subgrade (engineered fill).
Driveways	Private Drives and Car Parking	Method compaction to CBR > 5%.



Gardens and Public Open Space	N/A	Method compaction to ensure no settlement.
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RE-18 – Importation of Bulk Fill

Where there is a net shortfall of material required to achieve the proposed ground levels, it will be necessary to import natural inert soils and aggregate as per the engineering requirements in the E3P Geotechnical Earthworks Specification).

Imported material must be certified as suitable for use in strict accordance with the E3P Geotechnical Earthworks Specification (Refer 14-768-R3-1, April 2023) and in conjunction with the required duty of care notes and waste transfer exemption.

If recycled aggregates are imported, then laboratory testing should be completed to demonstrate compliance with the Waste and Resources Action Programme (WRAP) protocol.

Where inert soils are imported, laboratory testing should be completed in accordance with the requirements of the pertinent environmental permit (i.e. U1 Standard Rules) or CL:AIRE MMP for the re-use of clean, naturally occurring soils.

RE-19 – Preparation of Garden for Cover System

As part of the land remediation works, garden areas will be prepared in a manner that will facilitate the placement of the clean cover system during the development phase of the works. The preparation of the areas requiring clean cover is critical in ensuring delivery of the site in a manner that will ensure no risk to the proposed end users.

Where Made Ground is deemed unsuitable for retention in a garden, the area will be subject to a reduced-level dig to remove unsuitable material to a minimum depth of 600 mm below finished garden level or verified natural stratum (whichever is the shallower).

Excavated soil will be stockpiled pending the results of the appropriate validation testing (to be completed in accordance with this specification) prior to re-use in an area of no sensitivity or, where necessary, this material will be removed from site in accordance with UK waste management legislation.

The placement of certified subsoil and topsoil will be completed as part of the developer works/build-phase mitigation plan. All garden areas where a cover system is required will be subject to plot-specific independent validation.

RE-20 – Provision of Subsoil

The natural drift deposits (predominantly cohesive soils) are deemed suitable for use within the clean cover to residential rear gardens and areas of soft landscaping. However, given the depth of Made Ground on-site, it is unlikely that subsoils will be excavated.



The garden and landscaped areas will require depth validation to satisfy the requirement of the Council of Mortgage Lenders (CML) in order to demonstrate that the appropriate thickness has been provided as a growing medium.

RE-21 – Provision of Topsoil

No material that would be deemed suitable for use as topsoil is present on site and as such there will be a requirement to import suitable material for use within the proposed development.

Topsoil will require testing in line with the schedule present within Section 3.8 and Table 3.4.

The garden and landscaped areas will require depth validation to satisfy the requirements of the CML in order to demonstrate that the appropriate thickness has been provided.

RE-22 – Independent Validation: Watching Brief

Given the site history and potential contamination sources identified within the ICSM, a degree of uncertainty remains with regard to the potential for as yet unidentified contamination impact within the near-surface soils and groundwater.

It will therefore be necessary to instigate the site-wide remediation and enabling works under the supervision of a suitably qualified and independent specialist. The specialist is required to attend site as and when appropriate to monitor works, record ground conditions and fully investigate all potential sources of as yet unidentified contamination.

RE-23 – Waste Soils Surplus to Requirements

In the event that a surplus of excavation material is present on site, this, in most cases, will be deemed to be a waste in accordance with the Waste Framework Directive (Article 3(1) Waste Framework Directive 2008/98/EE). The waste producer – but ultimately, the landowner – is responsible for the compliant disposal of such materials.

A formal waste classification assessment must be undertaken, irrespective of any future options or considerations for those materials that will be removed from site. Waste classification should only be made following the Environment Agency *Technical Guidance WM3 – Guidance on the Classification and Assessment of Waste*.

To remove the surplus material from site it will either need to be sent to a disposal site (landfill), to a permitted treatment facility or, dependent on the waste classification assessment, it may be suitable for use on a permitted land improvement or restoration operation.

Subject to suitability, these soils can be transferred to the receiving site, subject to an approved permit or materials management plan following guidance in the CL:AIRE *Definition of Waste: Code of Practice*.



RE-24 – Validation of Materials for Potable Water Supply Infrastructure

Barrier pipe is likely to be required, however, this will need to be confirmed following the completion of a UKWIR risk assessment.

Post remediation and enabling works ground conditions may be different from those identified during the ground investigation.

Where imported material is required to construct the potable water infrastructure pipework, this material will need to comply the requirements of UKWIR pipework thresholds for the specified pipework.

For the avoidance of doubt, the PE thresholds are presented in Section 8.3. Failure to meet the required specification may necessitate further remedial works.

RE-25 – Remedial Verification Report

Collation of information relating to site clearance, chemical testing, remedial works, remedial verification, material movements and waste transfer documentation is required, where appropriate.

Complete remedial validation is to be reported in line with regulatory guidance. This will include a detailed risk assessment. The report will be submitted to the local authority for approval following completion.

3.8. VALIDATION SAMPLING PROTOCOL

In accordance with the current requirements of the regulatory authorities, validation samples will be collected from all materials that are to be subject to movement under the protocols outlined within this Remediation Strategy, or for materials to be imported onto site to facilitate the proposed residential development.

Soil samples destined for chemical analysis will be collected at regular intervals in appropriate sampling containers. All samples will subsequently be stored in cooled boxes prior to submission to a UKAS/MCERTS accredited laboratory.

All samples will be collected using appropriate personal protective equipment (PPE) and sampling equipment, which will be cleaned at each sampling location.

A detailed copy of E3P Ltd sampling methodology, QA procedures and laboratory chain of custody forms will be documented within the site records and presented with the final validation report for the site.

Where material is found to contain concentrations of potential contaminants at levels in excess of the site-specific screening criteria (as detailed within Appendix III), E3P will undertake further assessment and recommendations on the appropriate use for the material in question, which may involve the disposal of such materials off site to a suitable waste management facility.

The sampling frequency for materials to be managed under the remediation strategy is presented within Table 3.5.



TABLE 3.5 SPECIFICATION OF CHEMICAL VALIDATION LABORATORY ANALYSIS

MATERIAL USE	TESTING FREQUENCY	SUITE OF ANALYSIS
Site-Generated		
Site-Generated 6F2	1 Sample per 1000 m ³	A/B/C/D
Site-Won MADE GROUND General Backfill	1 Sample per 250 m ³ where visual and/or olfactory impact is identified	G
Site-Won MADE GROUND General Backfill	1 Sample per 2000 m ³	A/B/C/D/I
Site-Won MADE GROUND General Backfill	1 Sample per 1000 m ³	J
Site-Won Natural Backfill	1 Sample per 2000 m ³	A/B/C/D
Site-Generated Subsoil (450 mm Garden Cover)	1 Sample per 250 m ³	A/B/C/D
Site-Generated Topsoil (150 mm Garden Cover)	1 Sample per 50 m ³	A/B/C/D
Hotspot Validation Samples	1 Sample per 10 m of linear excavation to base and sidewall	E/G
Imported		
6F2	1 Sample per 1000 m ³	A/B/C/D
Subsoil Greenfield Source (450 mm Garden Cover)	1 Sample per 250 m ³	A/B/C/D
Subsoil Brownfield Source (450 mm Garden Cover)	1 Sample per 250 m ³	A/B/C/D
Topsoil Greenfield Source (150 mm Garden Cover)	1 Sample per 250 m ³	A/B/C/D
Topsoil Brownfield Source (150 mm Garden Cover)	1 Sample per 50 m ³	A/B/C/D
General Engineering Fill (Class 1 and 2 Soil)	1 Sample per 1000 m ³	A/B/C/D

Notes

Sampling should be carried out in accordance with the above frequencies or minimum 3 samples per source, whichever is the greater.

Suites of Analysis:

- A. Speciated PAH.
- B. Speciated TPH (C5-C35).
- C. Asbestos (ID).
- D. CLEA Inorganic Heavy Metals.
- E. Speciated PAH, Banded TPH and VOCs.
- F. SVOC/Speciated TPH.
- G. On-Site Screening for VOC Using Calibrated PID.
- H. Leachate 2:1 Speciated PAH and Banded TPH.
- I. Leachate Analysis of Inorganic Heavy Metals, TPH, Sulphate and PAH.
- J. Total Mercury, with speciation where identified >1.2 mg/kg

All analysis prescribed above to be completed by UKAS-accredited laboratory.



3.9. REMEDIATION CONTRACTORS SITE MANAGEMENT AND RESPONSIBILITY

The appointed remediation contractor will take full and overarching responsibility for all methods of work required to complete the site remediation and enabling operations to ensure the delivery of the site and the completion of the objectives in a safe, legislatively compliant manner that ensures no pollution to the subject site or the wider environs.

For individual remediation operations as set out within this performance specification, the contractor will provide site-specific methods of work for individual operations pertaining to the removal and treatment of contaminated liquids and soils. For each and every operation as set out herein, the contractor will provide a written methodology of works to be supplied to the supervising geoenvironmental engineer prior to the instigation of operations on site.

The site manager will be responsible for documentation of each day's activities with a full recorded schedule of works completed and corresponding site-specific method statements that have been utilised to ensure the completion of the task to the required standard.



4. MATERIALS MANAGEMENT AND LEGISLATIVE COMPLIANCE

The processing of recycled aggregates will be completed using LAPC Part B licensed plant with the appropriate deployment notification to the local authority prior to commencement of works. All materials that are recovered as recycled aggregate will be compliant with the requirements of the WRAP protocol and the E3P validation testing requirements and as such would not be deemed to be a waste material.

A U1 Exemption will be registered for the site, which allows the re-use of up to 5000 T of prescribed material within construction, with up to 25,000 T of material permissible to be re-used in the construction of roads. It should be noted that only 1000 T of material described as sand, stones or clay soil classified as waste can be re-used with a U1.

A T5 Exemption, allowing for the screening and recovery of up to 5000 T of permissible material for subsequent re-use in construction will also be registered.

All materials that are recovered under the WRAP protocol, U1 or T5 exemptions must be analysed to demonstrate that they are both chemically and structurally suitable for use within the context of the development.

The relevant LAPC, U1, T5 and WRAP licences, exemptions and protocols provide the legislative framework for material compliance during the site remediation and enabling works to be completed by the specialist contractor under the supervision or E3P.

Where necessary, operations as outlined within the remediation enabling works rationale summarised in this report may be subject to regulation using the appropriate environmental permit, standard rules exemption and materials management plan, to be created in accordance with version 2 of the CL:AIRE *Definition of Waste: Code of Practice (DoW CoP)*.

It is noted that if material is to be imported utilising the CL:AIRE DoW CoP from an alternative development site, then only chemically certified, clean, naturally occurring material can be transferred.

If required, the MMP will be created with due consideration of all proposed remediation and enabling works operations prescribed within this document and will be undertaken by a qualified person with a signed declaration submitted to the EA prior to re-use of materials on the site.

The importation of material for use within the proposed construction of a development platform will be subject to the compliance with the E3P protocol for the importation of materials as set out within the specification for material import included within Appendix IV of this report.



5. ENVIRONMENTAL MONITORING AND VALIDATION

5.1. SITE MANAGEMENT

The tracking of materials will be based on the following hierarchy:

- ✿ The principal contractor will have the responsibility for setting out areas of the site on the basis of the contract specification.
- ✿ Operatives will have instructions only to excavate and to emplace materials in specified areas as assigned by the site manager/foreman.
- ✿ The site manager (employed by the principal contractor) will issue daily instructions to drivers regarding the placement of materials sourced from specific stockpiles or areas, ensuring that appropriate documentary evidence is collected that details which materials are going where and why.
- ✿ An E3P consultant, who will be in attendance as required, will:
 - Inspect the excavation areas and certify that the correct materials are being excavated;
 - Conduct spot checks on loaded vehicles to ensure compliance with this remediation strategy; and
 - Ensure that any loads that fail visual, olfactory or spot checks either remain on the vehicle or, if unloaded, are excavated and set aside. This material will be treated according to the recommendations of the E3P site engineer.
- ✿ E3P will conduct an audit of waste consignment notes. All material imported and removed from site will have duty of care/consignment notes, copies of which will be retained on site by the site manager.
- ✿ Materials directly reusable will be incorporated into the earthworks, subject to operational conditions and phasing of excavations, in which case they will be stockpiled prior to final placement.

5.2. COMPLETION

Following the completion of the remediation works, a report will be compiled by the environmental consultant detailing all site enabling works undertaken, waste consignment notes, and all site investigations, laboratory test certificates and validation testing undertaken.

A certificate of completion of earthworks should be included within the report which should then be issued to the local authority for their approval.

E3P considers that with the adoption of the above best practices the site can be safely redeveloped. The site enabling works process and presence of any residual contamination (if this is the case) should be recorded for future reference by landowners/occupiers. Future development at the site where this may result in penetration of new areas of hardstanding should be subject to no-less-stringent measures with respect to assessment and, where appropriate, monitoring, than those set out herein.



5.3. MITIGATION OF RISK FROM SOILS WITH ASBESTOS FIBRES

5.3.1. PRE-COMMENCEMENT WORKS

Prior to the commencement of works the following requirements must be satisfied:

-  Induction of all people that will be involved with the proposed site works; and
-  All methodologies must be agreed upon by all parties involved.

5.3.2. CONTROL, MONITORING AND REPORTING OF GENERAL AERIAL EMISSIONS FROM DUSTS AND PARTICULATES

DAMPING DOWN OF SOILS – MITIGATE PARTICULATE (DUST) EMISSION

During excavation, as outlined within the detailed working methodologies, soils will be regularly damped down using water to control the generation of dust (this may also comprise precipitation). The contractor will determine the best form of dust suppression to be used when a detailed programme has been issued.

If any previously unidentified asbestos-containing materials are identified, these should be dealt with in strict accordance with the *Control of Asbestos Regulations* (2012) and industry best practice as detailed in CIRIA 733.

GENERAL CONTROL OF DUST

The following control measures should be utilised to ensure that dust levels are kept to a minimum at all times:

-  Where necessary, haul road, work areas and stockpiles will be damped down with water spray.
-  The application of water to haul roads, work areas and stockpiles should be closely monitored by the resident engineer to ensure that soils are not saturated and, therefore, that the potential for water run-off is appropriately mitigated.
-  Once completed, any stockpiles will be sealed by compacting at the surface.
-  Vehicle speeds and movements on site will be kept to a minimum (< 5 mph) during civil excavation works to reduce the potential to generate dust.



PERSONAL PROTECTIVE EQUIPMENT (PPE)

In accordance with the HSE *Guidance Note em6: Asbestos Essentials, Personal protective equipment (including RPE)*, E3P recommend that all site operatives present within the work area where potential asbestos-impacted soils are being excavated are supplied with the following personal protective equipment:

Overalls:

- ✿ Disposable overalls.
 - Type 5 (BS EN ISO 13982-1) are suitable.
 - Cotton overalls hold dust and need specialist laundering.
- ✿ Waterproof overalls for outdoor work.
- ✿ Use oversized overalls - this will help to prevent ripping at the seams.
- ✿ If the cuffs are loose, seal them with tape.
- ✿ Avoid wearing a long-sleeved shirt as these are difficult to cover properly.
- ✿ Wear the overall legs over footwear as tucking them in lets dust into footwear.
- ✿ Wear the hood over the RPE straps.

Failure to utilise and correctly employ PPE will result in immediate cessation of works. Works will not be permitted to recommence until the individual has undergone further training in the use of PPE or the individual is removed from the works area.

At this current time, with the levels of ACM identified within the soils, the above-listed PPE is not considered to be required for all site personnel during the entire management of these soils.

When handling asbestos-impacted soils during the enabling works, asbestos monitoring works should be conducted in accordance with, but not limited to, the following HSE legislation and guidance:

- ✿ *Health & Safety at Work Act 1974;*
- ✿ *The Control of Asbestos Regulations 2012;*
- ✿ CL:AIRE, 2016. *Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry guidance;*
- ✿ *Approved Code of Practice L143 Work with materials containing asbestos;*
- ✿ *Management of Health and Safety at Work Regulations 1999;*
- ✿ *HSE Guidance Note HSG248 Asbestos, the analysts guide to sampling and analysis;*
- ✿ *HSE Guidance Note HSG247 Asbestos: The licensed contractors' guide;* and
- ✿ *CIRIA 733 Asbestos in soil and made ground: a guide to understanding and managing risks.*



If required, air monitoring in accordance with HSG248 will be undertaken intermittently throughout the duration of the works at a frequency to be determined by the contractor, entirely dependent on whether asbestos-impacted soils are being handled at any given time. In general terms, during any one monitoring period, ten standard monitoring pumps will be run throughout the day, for the appropriate time period to achieve the required limit of detection. These slides will be analysed immediately by the on-site UKAS-accredited laboratory.

Once any monitoring has been analysed by the on-site UKAS-accredited laboratory, the results will be delivered to the resident engineer who will then follow the correct site procedure. The results will then be included within the verification report.



6. RECORD-KEEPING AND VERIFICATION

6.1. RECORD-KEEPING

During the course of the remediation and site enabling works, the on-site E3P consultant will undertake the following record-keeping protocols:

- ✳ Detailed daily site diary including material movements;
- ✳ Sampling register, testing results, photographs, details of locations of hydrocarbon-impacted soils (drawings), details of hotspot removals, details of consignment notes of any hydrocarbon-impacted material that is required to be disposed of off site; and
- ✳ Detailed surveys (volumes).

Record-keeping on site, in particular movements and analysis of specific material types, will be in the form of site diaries and a remediation excavation record. This record will remain on site and will be completed by the E3P on-site engineer during the course of the remediation and site enabling works.

6.2. VERIFICATION

The records listed above will then be compiled into a validation report produced by E3P on completion of the remediation and site enabling works, clearly referencing the origin of the materials used and testing carried out to confirm its suitability for use, where required. E3P will also prepare an as-built development drawing clearly detailing the materials present on site to be cross referenced with the supporting validation documentation.

The validation report will include the following:

- ✳ Remediation strategy (including copies of confirmation from regulatory authorities agreeing criteria);
- ✳ Detailed surveys of all excavations and production of as-built drawings for the earthworks;
- ✳ Copy of consignment notes relating to the movement of wastes to a licensed waste management facility;
- ✳ Detailed drawings showing all sampling locations for both chemical and geotechnical testing;
- ✳ Chemical test results;
- ✳ Geotechnical test results;
- ✳ Details of qualified persons signed declaration; and
- ✳ Monitoring results if undertaken (e.g. asbestos in air, gas water).



7. CONTINGENCY PLAN

7.1. PREVIOUSLY UNIDENTIFIED CONTAMINANTS

Should significantly impacted material be encountered during the development, then it will be excavated and stockpiled on an impermeable material and sampled and tested for an appropriate range of determinants.

Once the laboratory analysis of the material is available, an assessment will be undertaken to determine whether it can be retained on site as part of the material management plan or whether it should be disposed of off site.

Depending on the nature of any such impact, it may be necessary to undertake validation testing of the excavation faces in order to demonstrate that no such materials are left in situ.



8. BU PHASE MITIGATION AND MANAGEMENT

A separate document will be required to document the construction works that are required to ensure full compliance with the remediation strategy, Regulatory Authorities, Building Control & warranty providers;

The following will be included in the build phase strategy:

- ✿ Required laboratory testing of imported topsoil and subsoil (testing frequencies and anticipated volumes).
- ✿ Cover system requirements within all gardens and landscaped areas and validation procedure.
- ✿ Vapour protection strategy with verification plan detailing which plots will be required to be installed with VOC resistant membranes.
- ✿ Post remedial gas monitoring data and re-assessment of ground gas protection measures, with verification (zoning) plan, together with installation requirements and validation procedure.
- ✿ Assessment of ground conditions for potable water supply (UKWIR).

END OF REPORT



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 1.2.
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



Castleton Sidings, Rochdale

Remediation Strategy

March 2024

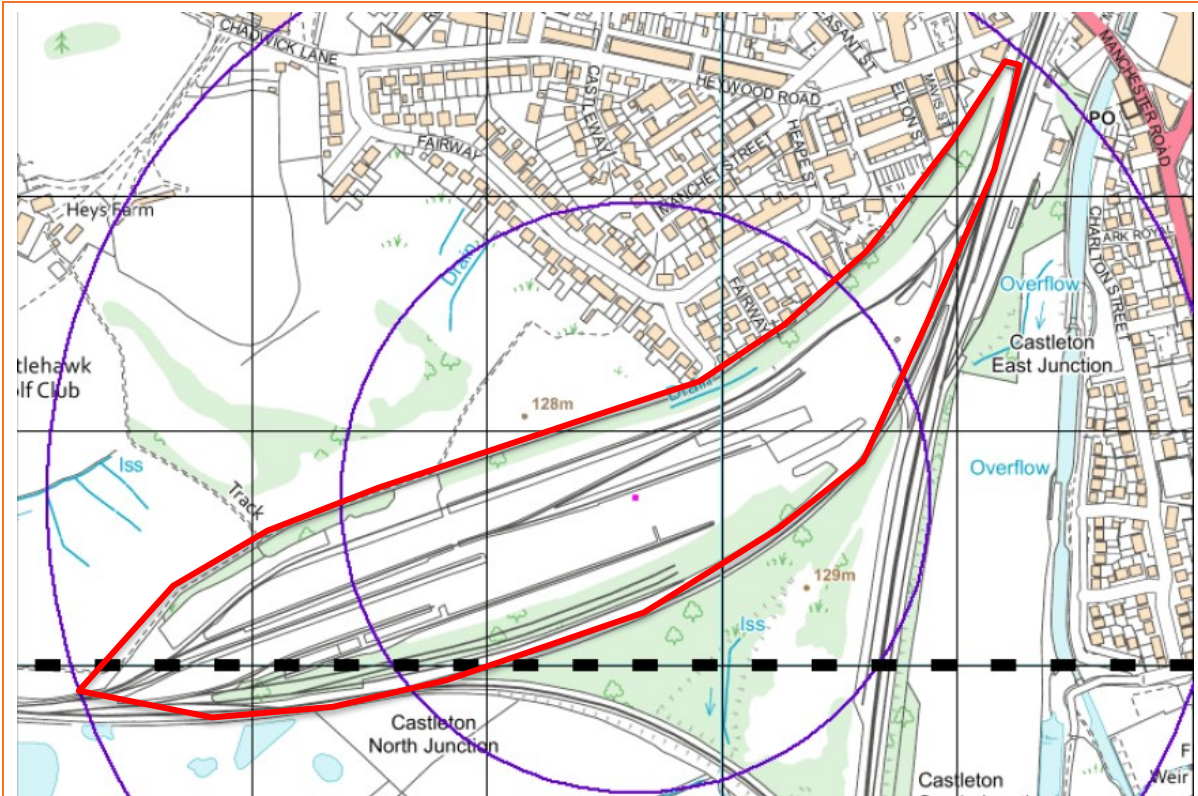
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts 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

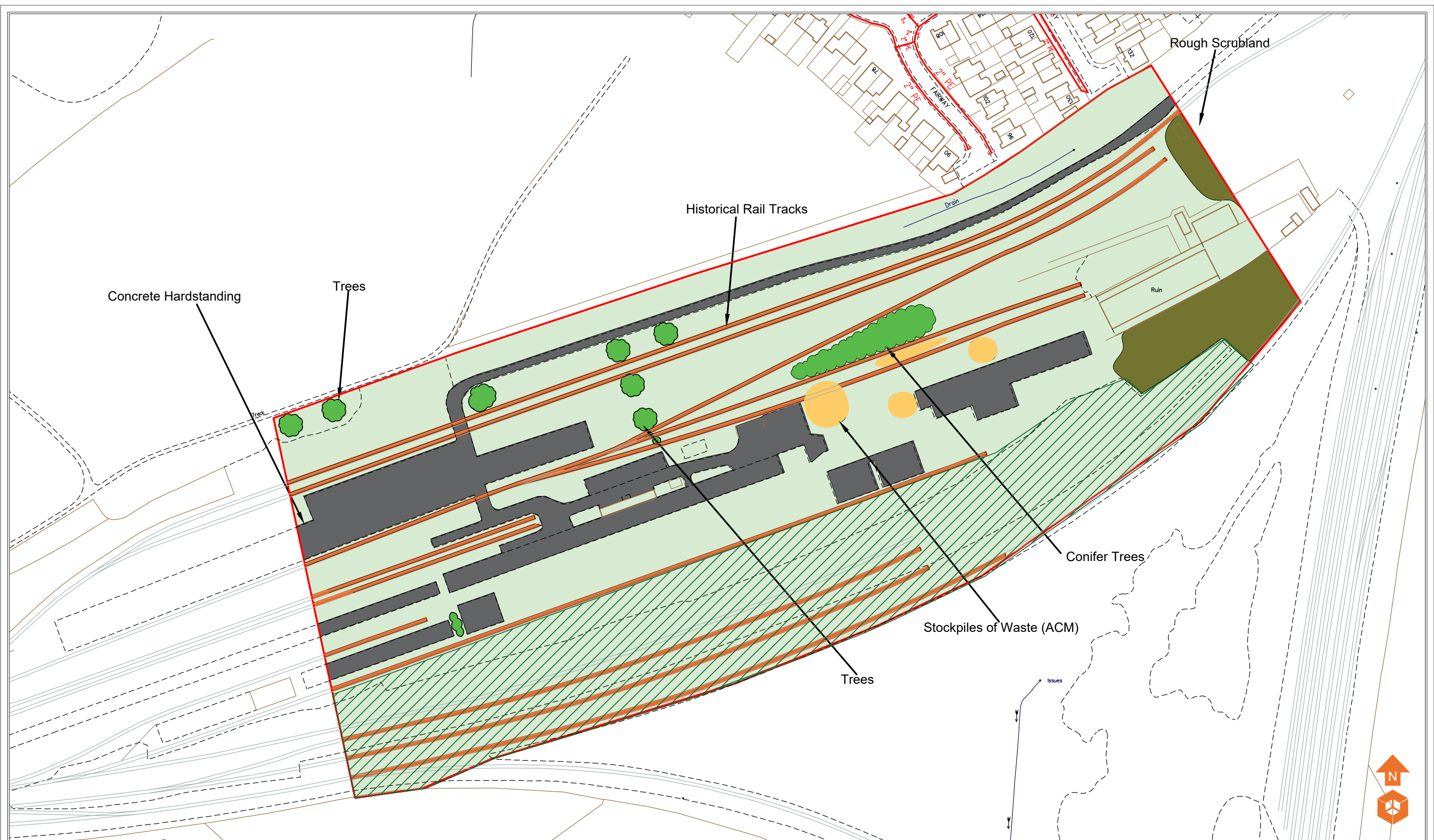


APPENDIX III

DRAWINGS

DRAWING 14-768-001 – SITE LOCATION PLAN





- Site Features
- Overgrown Trees
 - Concrete Hardstanding
 - Rough Scrubland
 - Trees
 - Stockpiles of Waste (Possible ACM)
 - Historical Rail Tracks

Notes:				
P1	REVC	12.12.2022	HM	EC
P1	REVB	11.03.2022	HM	JS
P1	REVA	15.04.2021	EB	EF
Phase	Issue	Date	Drawn	Checked

Client:	Kellen Homes
Job Title:	Heywood Road, Castleton

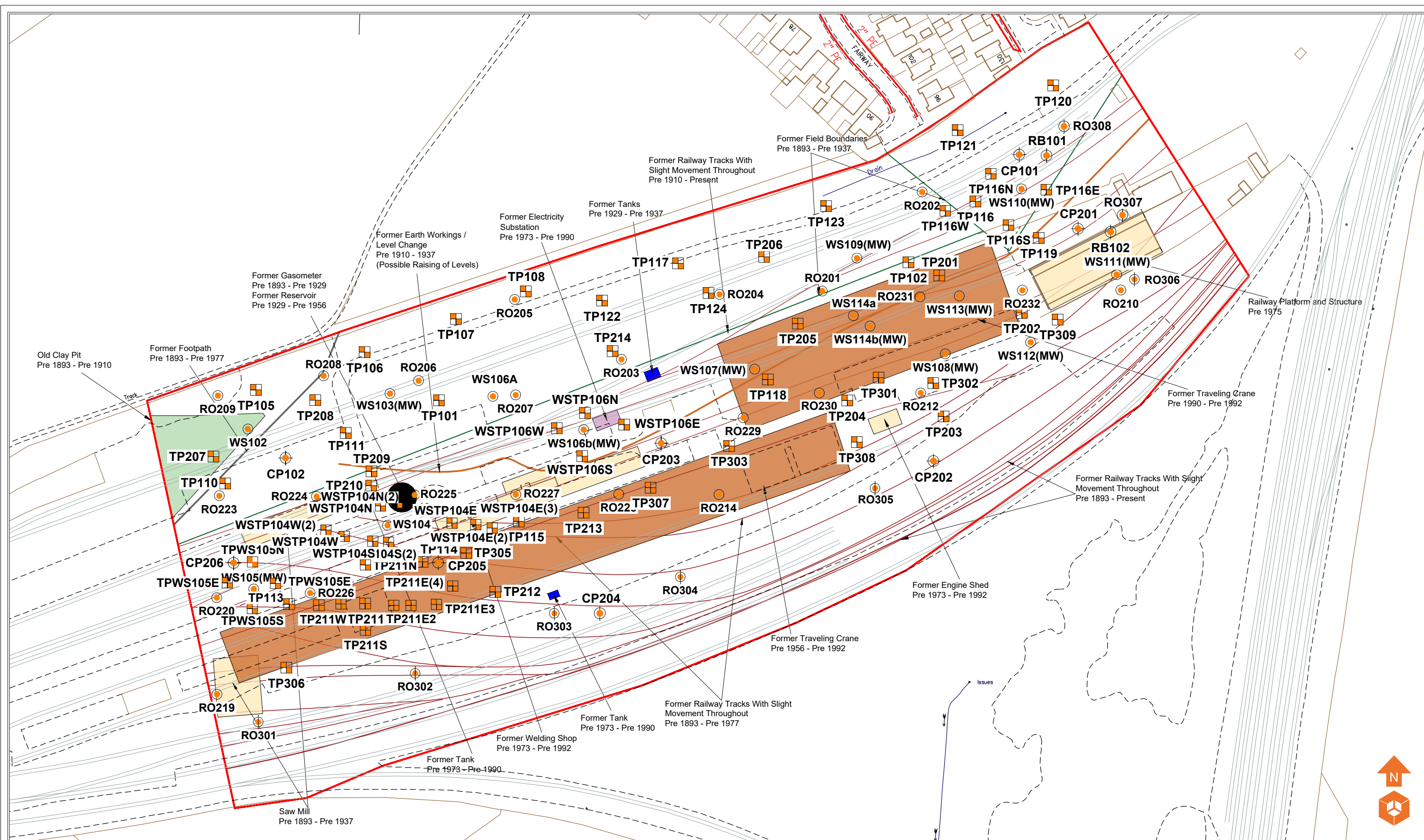
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Drawing No:	104

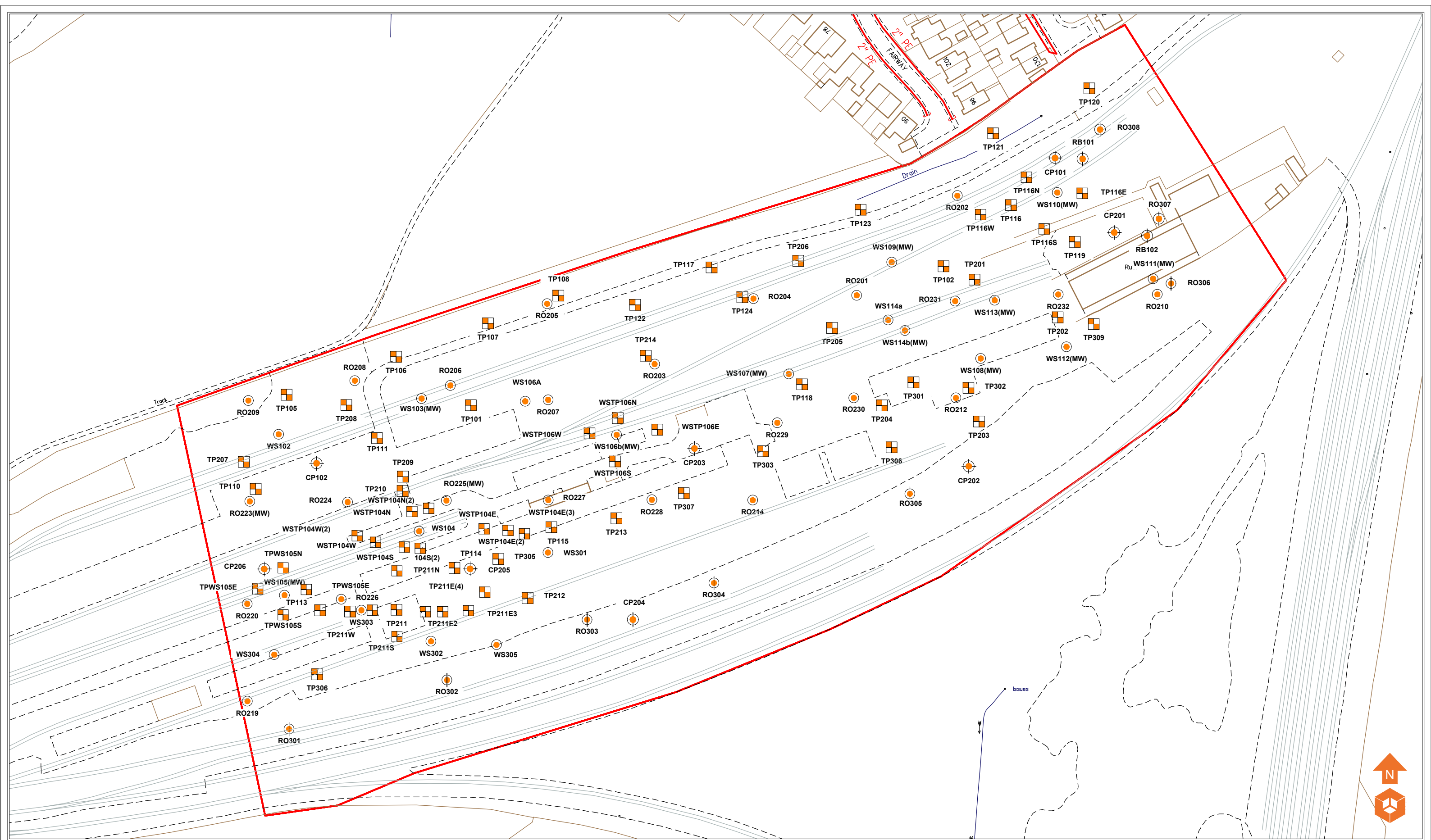
Date:	12.12.2022
Scale:	NTS @ A3
Drawing Title:	Site Features Plan



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Location Symbols			
	Approximate Window Sample Probehole Location (March 2021)		Approximate Cable Percussive Borehole Location (March 2021)
	Approximate Window Sample Probehole Location with Install (March 2021)		Approximate Cable Percussive Borehole Location (June 2023)
	Approximate Trial Pit Location (March 2021)		Approximate Window Sample Probehole Location (December 2023)
	Approximate Rotary Borehole Location (March 2021)		
	Approximate Trial Pit Location (June 2021)		
	Approximate Rotary Borehole Location (July 2021)		
	Approximate Hand Dug Pit Location (July 2021)		
	Approximate Stockpile Sample Location (July 2021)		
	Approximate Location of Rotary Borehole		

Notes:				
P1	REVI	14.12.2023	OW	JS
P1	REVG	29.08.2023	LM	JS
P1	REVG	30.01.2023	EB	JS
P1	REVI	16.01.2023	HM	JS
P1	REVE	12.12.2022	HM	EC
P1	REVD	19.10.2022	HM	EC
P1	REVC	30.03.2022	EB	JS
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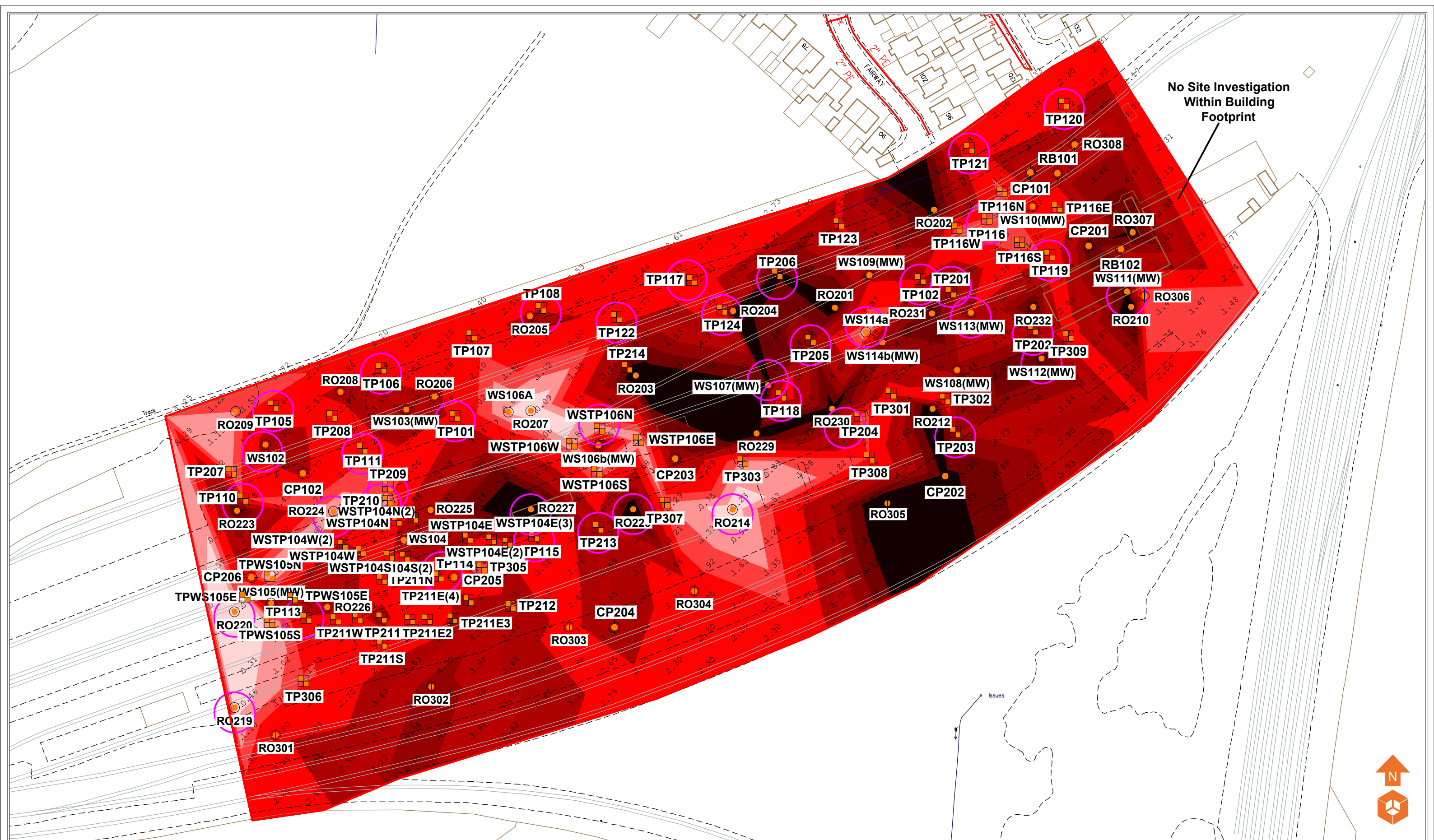
Client:	Kellen Homes
Job Title:	Heywood Road, Castleton

Job No:	14-768
Drawing No:	005

Date:	14.12.2023
Scale:	NTS @ A3

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No Site Investigation
Within Building
Footprint

Location Symbols			
	Approximate Window Sample Probehole Location (March 2021)		Approximate Cable Percussive Borehole Location (March 2021)
	Approximate Window Sample Probehole Location with Install (March 2021)		Approximate Cable Percussive Borehole Location (June 2023)
	Approximate Trial Pit Location (March 2021)		
	Approximate Rotary Borehole Location (March 2021)		
	Approximate Trial Pit Location (June 2021)		
	Approximate Rotary Borehole Location (July 2021)		
	Approximate Hand Dug Pit Location (July 2021)		
	Approximate Stockpile Sample Location (July 2021)		
	Approximate Location of Rotary Borehole		

Made Ground Depth (m)	
	Depth of Made Ground 0.00 - 0.49m
	Depth of Made Ground 0.50 - 0.99m
	Depth of Made Ground 1.00 - 1.49m
	Depth of Made Ground 2.00 - 2.49m
	Depth of Made Ground 2.50 - 2.99m
	Depth of Made Ground 3.00 - 3.49m
	Depth of Made Ground >3.50m
	Depth of Made Ground 2.50 - 2.99m
	Depth of Made Ground 3.00 - 3.49m
	Depth of Made Ground 3.00 - 3.49m

	Base of Made Ground Not Proven
--	--------------------------------

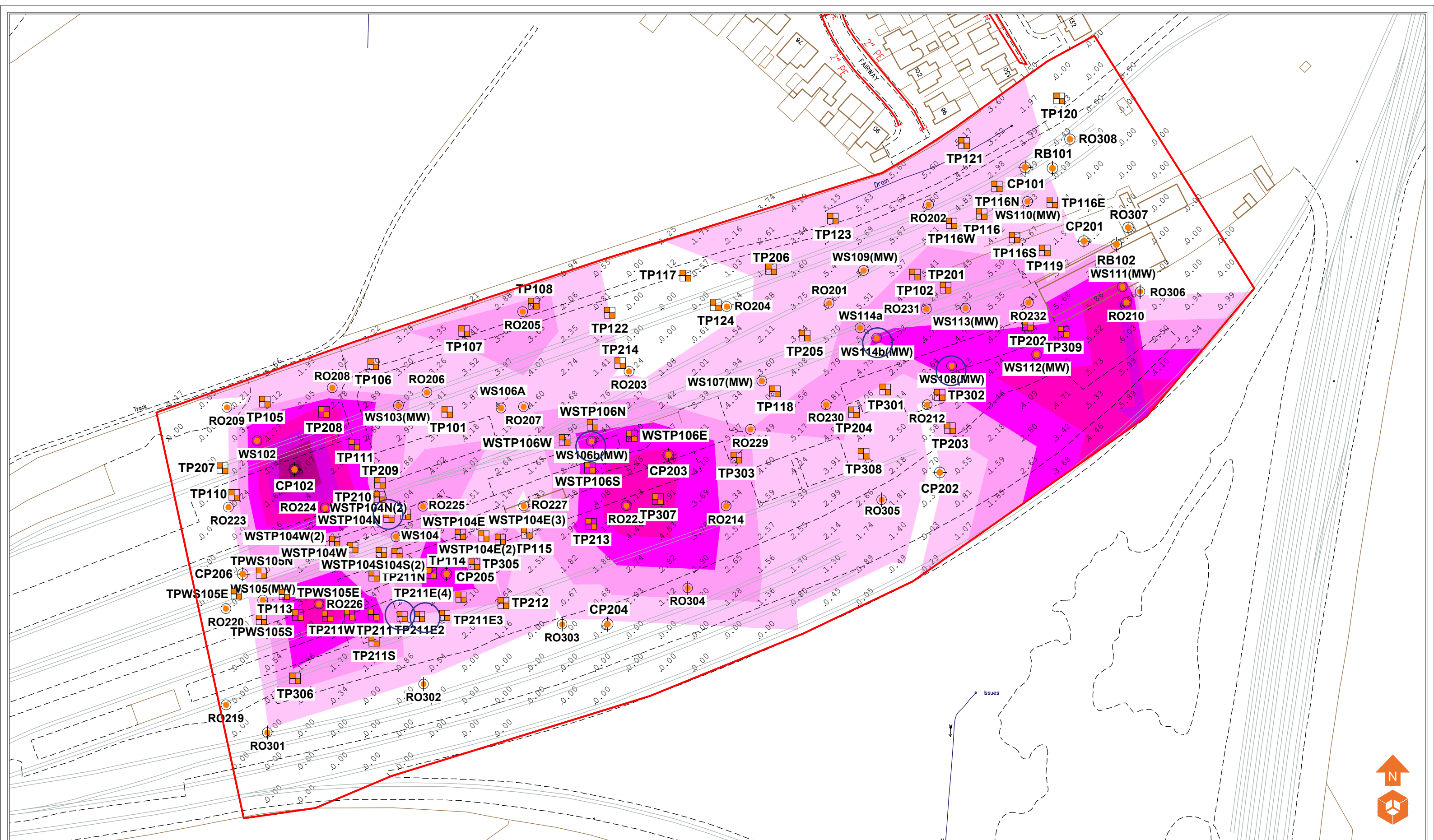
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P1	REVD	30.03.2022	EB	JS	
P1	REVC	11.03.2022	HM	JS	
P1	REVB	07.05.2021	EB	JS	
P1	REVA	31.03.2021	EB	EF	
Phase	Issue	Date	Drawn	Checked	

Client:	
Kellen Homes	
Job Title:	
Heywood Road, Castleton	

Job No:	14-768
Drawing No:	106
Date:	30.08.2023
Scale:	NTS @ A3
Drawing Title:	
Depth Of Made Ground Plan	

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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 Trial Pit Location (June 2021)
 - Approximate Rotary Borehole Location (March 2021)
 - Approximate Rotary Borehole Location (July 2021)
 - Approximate Hand Dug Pit Location (July 2021)
 - Approximate Stockpile Sample Location (July 2021)
 - Approximate Location of Rotary Borehole

- Approximate Cable Percussive Borehole Location (March 2021)
- Approximate Cable Percussive Borehole Location (June 2023)
- Full Thickness of Peat Not Proven

- Thickness of Peat (m)**
- Thickness of Peat 0.00 - 0.39m
 - Thickness of Peat 0.40 - 0.79m
 - Thickness of Peat 0.80 - 1.19m
 - Thickness of Peat 1.20 - 1.59m
 - Thickness of Peat 1.60 - 1.99m
 - Thickness of Peat 2.00 - 2.39m
 - Thickness of Peat >2.40m
 - Recorded Depth to Peat (m BGL)

Notes:					
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P1	REVE	01.02.2023	EB	JS	
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P1	REVC	13.12.2022	HM	EC	
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Phase	Issue	Date	Drawn	Checked	

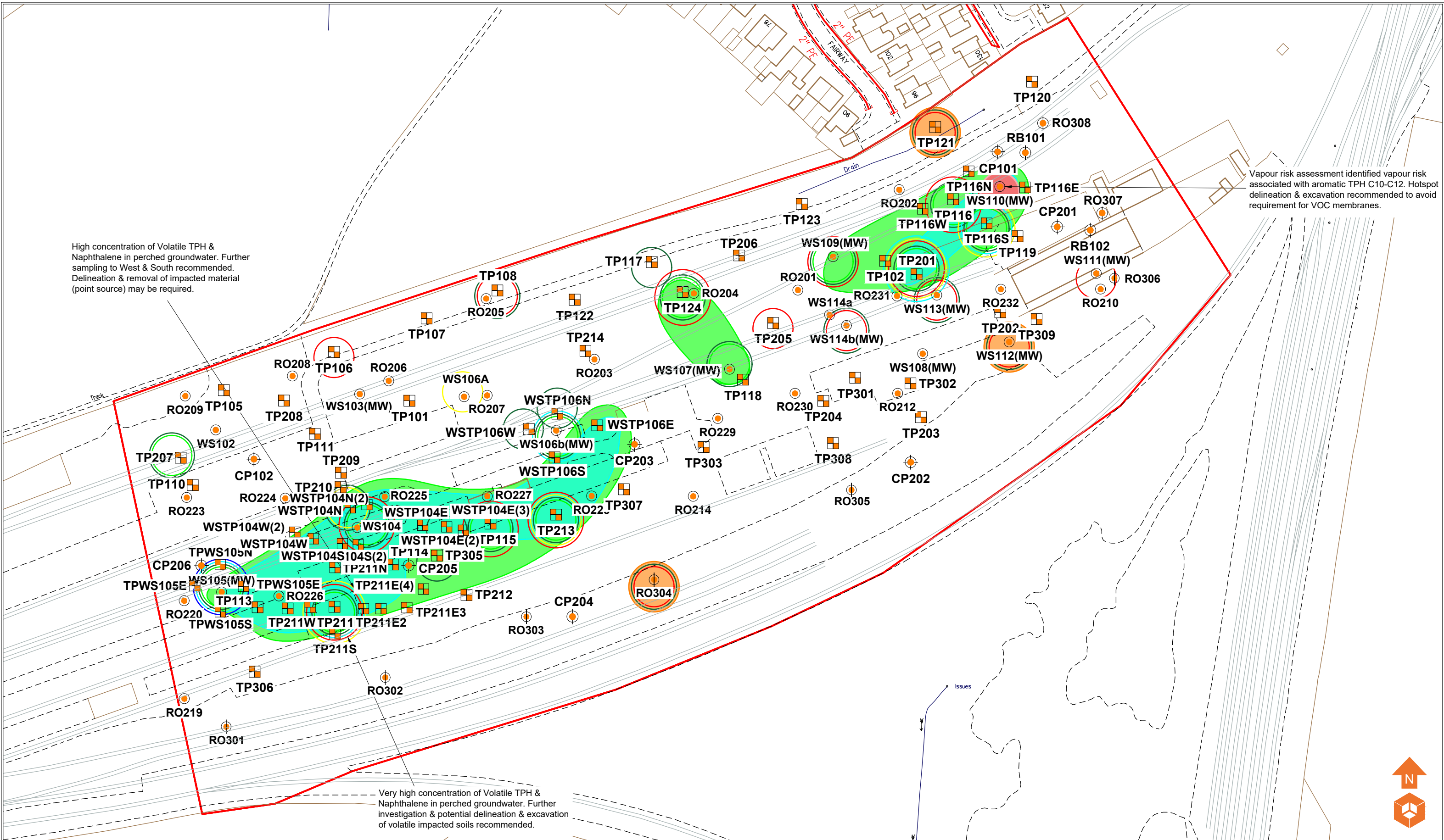
Client:	
Kellen Homes	
Job Title:	
Heywood Road, Castleton	

Job No:	14-768
Drawing No:	107
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Drawing Title:	
Depth and Thickness of Peat Plan	



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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 Trial Pit Location (June 2021)

Approximate Rotary Borehole Location (July 2021)

Approximate Hand Dug Pit Location (July 2021)

Approximate Stockpile Sample Location (July 2021)

Approximate Location of Rotary Borehole

Approximate Cable Percussive Borehole Location (March 2021)

Approximate Cable Percussive Borehole Location (June 2023)

Soil Contaminants

Heavy metals

Mercury (volatile)

Asbestos (chrysotile <0.001% wt/wt)

Napathalene (volatile)

Non-volatile PAH

TPH C10-C16 (volatile)

TPH C16-C21 (non-volatile)

Groundwater Contaminants

Volatile TPH & Naphthalene in Groundwater Sample.

Vapour Risk (TPH C10-C12 Aromatic)

Napathalene Impacted Soils

TPH Impacted Soils

Volatile Mercury

Notes:

P1	REVH	30.08.2023	LM	JS
P1	REVG	31.02.2023	EB	JS
P1	REVF	17.01.2023	HM	JS
P1	REVE	13.12.2022	HM	EC
P1	REVD	30.03.2022	EB	JS
P1	REVC	24.02.2022	LM	JS
P1	REVB	30.04.2021	EB	EF
P1	REVA	15.04.2021	EB	EF
Phase	Issue	Date	Drawn	Checked

Client:

Kellen Homes

Job No:

14-768

Date:

30.08.2023

Drawing No:

118

Scale:

NTS @ A3

Job Title:

Heywood Road, Castleton

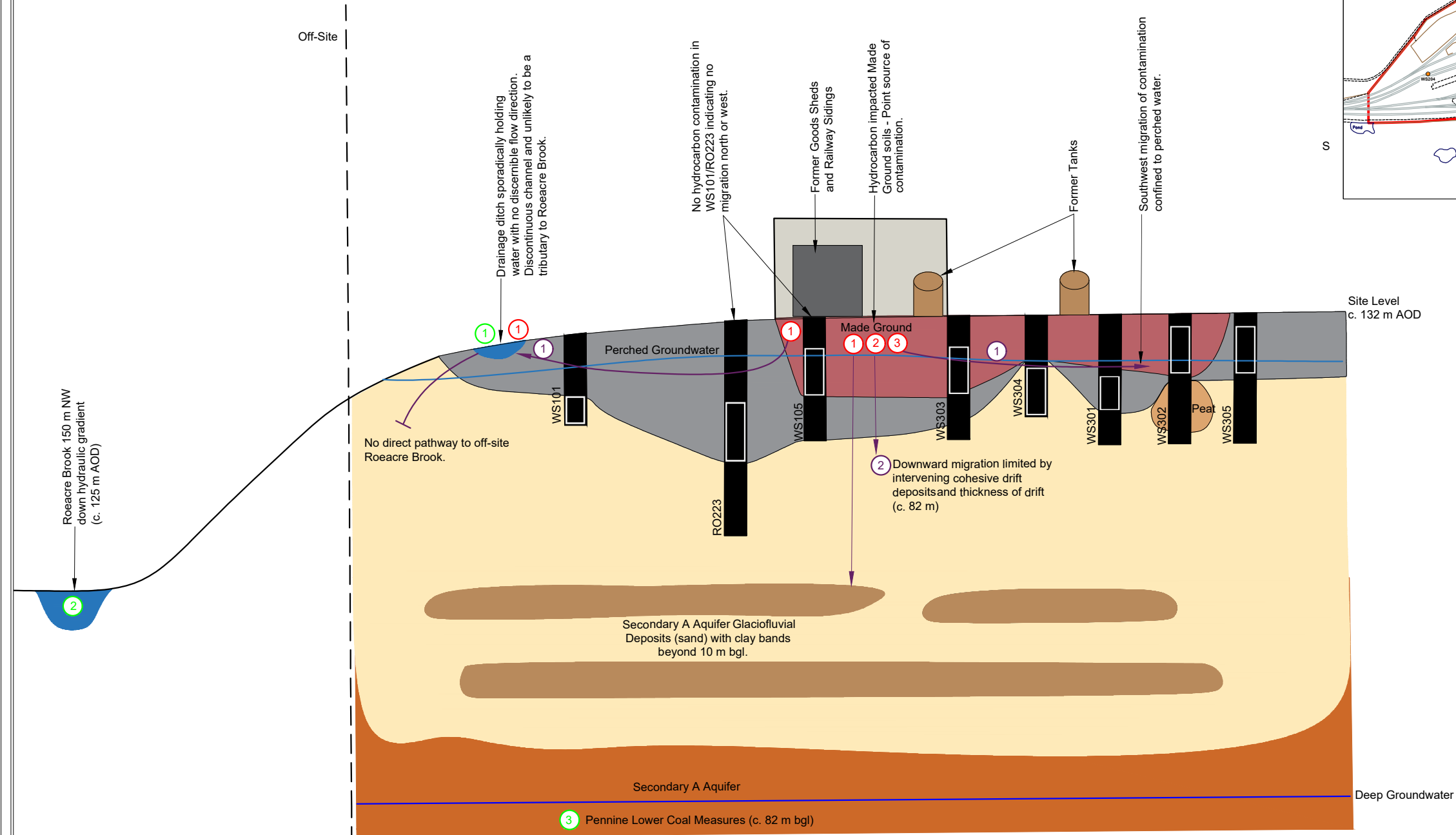
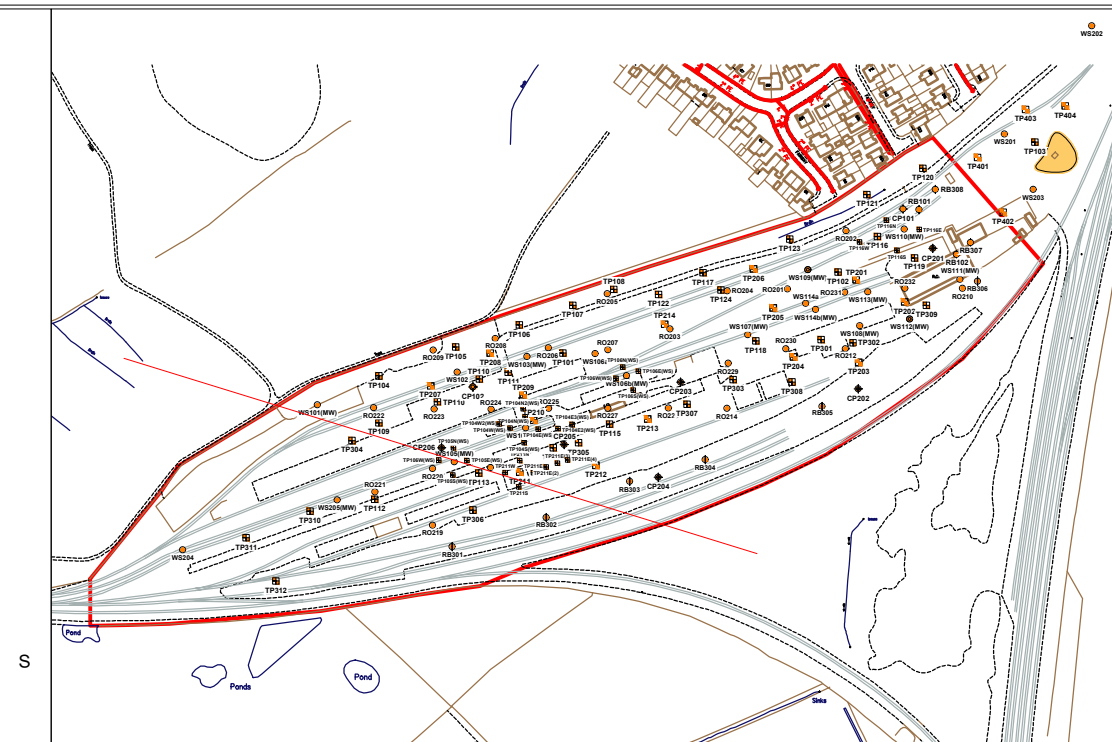
Drawing Title:

Contamination Issues Plan

e3p

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Geology Key Sandstone Sand Made Ground Peat	Sources/Contaminants 1 Heavy Metals 2 SVOCs 3 TPH	Receptors 1 Drainage Ditch (on-site) 2 Roeacre Brook (off-site) 3 Deep Groundwater / Secondary A Bedrock Aquifer	Pathways 1 Lateral Migration 2 Vertical Migration	Notes:					Client: Kellen Homes		Job No: 14-768		Date: 26.02.2024		e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JG Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk	
											Drawing No: 010		Scale: 1:1000 @ A3			
				P1 REVB 26.02.2024 OW JS P1 REVA 15.05.2020 CB MD					Job Title: Heywood Road, Castleton		Drawing Title: Conceptual Site Model - Controlled Waters		The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.			

STAGE 1

STAGE 1 VOLUMES : TOPO LEVELS DOWN TO BOTTOM OF PEAT LEVELS (MADE GROUND + PEAT)					
Group	Volumes (m³)			Cut / Fill Areas (m²)	
	Cut/Material	Fill/Void	Balance	Cut/Material	Fill/Void
Back Gardens	2221	1	2219	1281	26
Frontages	21484	3	21480	5752	22
Plots	24793	3	24791	10700	46
POS	4689	3	4686	1472	29
Roads	29856	0	29855	7220	18
Shared Driveways	7804	0	7804	1546	0
Total	90847	10	90836	27972	142

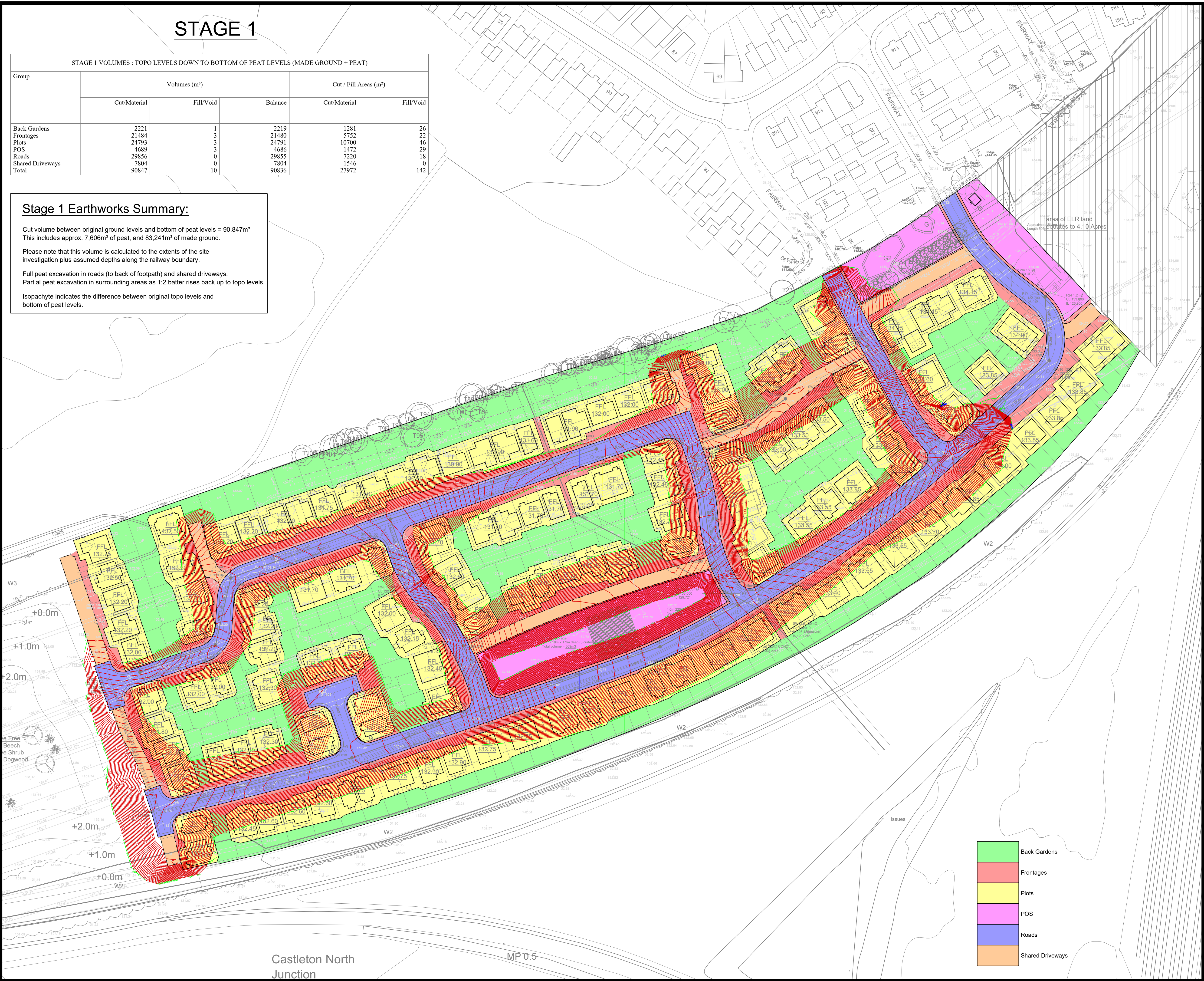
Stage 1 Earthworks Summary:

Cut volume between original ground levels and bottom of peat levels = 90,847m³
This includes approx. 7,606m³ of peat, and 83,241m³ of made ground.

Please note that this volume is calculated to the extents of the site investigation plus assumed depths along the railway boundary.

Full peat excavation in roads (to back of footpath) and shared driveways.
Partial peat excavation in surrounding areas as 1:2 batter rises back up to topo levels.

Isopachyte indicates the difference between original topo levels and bottom of peat levels.



N

North

Approx

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Legend

Cut

Fill

Zero

Planning levels

Topographic levels

12.345

12.345

Drawing Revisions:
+ Rev. 01 - 24/02/2022 - Updated layout, levels and SI information.
+ Rev. 02 - 31/03/2022 - Updated layout, levels and SI information.

Title	Revision	Consultant	Date	Notes
Revised Drainage Option 1.dwg	01	Kellen Holmes	11/03/2022	Engineering layout / levels
PS-2020-TS-02.dwg	02	Paragon Surveys	26/04/2021	Topographical Survey
KELLEN Depth to peat.dwg	-	Kellen Holmes	-	Point depth isopachyte
KELLEN Thickness to peat.dwg	-	Kellen Holmes	-	Point thickness isopachyte

JOB

CASTLETON SIDINGS

ROCHDALE

DRAWING

VOLUMETRIC APPRAISAL (REV 02)

SHEET 1/2

DATE: 31/03/2022

DRAWN: JY

CHECKED: PC

SCALE: N.T.S

www.mcauliffegroup.co.uk

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WA15 9NE
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DRAWING No: KELL 3703 VA 02 (1)

STAGE 2

STAGE 2 VOLUMES : BACKFILL PLUS SURROUNDING CUT/FILL TO REGRADE LEVELS			
Group	Volumes		
	Cut/Material	Fill/Void	Balance
Back Gardens	7707	3601	4105
Frontages	2240	18342	-16102
Plots	14286	19681	-5395
POS	572	5319	-4747
Roads	1827	24377	-22550
Shared Driveways	221	7444	-7223
Total	26853	78765	-51912

TRIANGLE AREAS		
Group	Plan Area	Slope Area
Back Gardens	14052	14070
Frontages	6979	7104
Plots	24247	24742
POS	3814	3816
Roads	8052	8053
Shared Driveways	2043	2050
Total	59186	59835

Stage 2 Earthworks Summary:

Roads (to back of footpath) and shared driveways have been excavated down to the underside of peat, leaving approx 1:2 batters up to surrounding topo. From here, the shortfall of material to achieve desired regrade levels (as per parameters) is now approx. 51,912m³.

Please note that some areas of the regrade model is derived from assumed finished levels due to lack of design information.

Isopachyte indicates the cut / fill required to get to regrade levels from this profile.

Earthworks Parameters:

- + Plots = -900mm FFL
- + Roads = -810mm FRL
- + Shared Driveways = -370mm FL (interpolated using nearby levels)
- + Back Gardens = -600mm FGL / -750mm nearest FFL
- + Frontages = graded between nearest features
- + POS = -300mm below nearest levels / graded to boundary

N

Approx North

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Surveying & Engineering Department

Legend

- Cut
- Fill
- Zero

Planning levels

Topographic levels

12.345

12.345

- Drawing Revisions:
- Rev. 01 - 24/02/2022 - Updated layout, levels and SI information.
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JOB

CASTLETON SIDINGS

ROCHDALE

DRAWING

VOLUMETRIC APPRAISAL (REV 02)

SHEET 2/2

DATE: 31/03/2022

DRAWN: JY

CHECKED: PC

SCALE: N.T.S

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DRAWING No:

KELL 3703 VA 02 (2)

APPENDIX IV E3P REMEDIATION/ VALIDATION CRITERIA

HUMAN HEALTH REMEDIATION TARGETS – LOW-RISE RESIDENTIAL END USE

DETERMINAND	UNITS	WITHIN 600 mm COVER SYSTEM (GARDEN)	HARD STANDING AND >600 mm OF COVER	PUBLIC OPEN SPACE 300 mm COVER	PUBLIC OPEN SPACE > 300 mm	PATH- WAY
Arsenic	mg/kg	37 ⁽ⁱ⁾	40 ⁽ⁱⁱ⁾	79 ⁽ⁱⁱⁱ⁾	170 ^(iv)	1
Cadmium	mg/kg	11 ⁽ⁱ⁾	85 ⁽ⁱⁱ⁾	120 ⁽ⁱⁱⁱ⁾	532 ^(iv)	1
Chromium (Hexavalent)	mg/kg	6 ⁽ⁱ⁾	6 ⁽ⁱⁱ⁾	7.7 ⁽ⁱⁱⁱ⁾	220 ^(iv)	1
Lead	mg/kg	200 ^(vi)	310 ^(vii)	630 ^(viii)	1300 ^(viii)	1
Elemental Mercury	mg/kg	1.2 ⁽ⁱ⁾	1.2 ⁽ⁱⁱ⁾	16 ⁽ⁱⁱⁱ⁾	30 ^(iv)	2
Nickel	mg/kg	130 ⁽ⁱ⁾	180 ⁽ⁱⁱ⁾	230 ⁽ⁱⁱⁱ⁾	800 ^(iv)	1
Selenium	mg/kg	250 ⁽ⁱ⁾	430 ⁽ⁱⁱ⁾	1100 ⁽ⁱⁱⁱ⁾	1800 ^(iv)	1
Copper	mg/kg	2400 ⁽ⁱ⁾	7100 ⁽ⁱⁱ⁾	12,000 ⁽ⁱⁱⁱ⁾	44,000 ^(iv)	1
Zinc	mg/kg	3700 ⁽ⁱ⁾	40,000 ⁽ⁱⁱ⁾	81,000 ⁽ⁱⁱⁱ⁾	170,000 ^(iv)	1
Phenol	mg/kg	120 ^{(i)(xi)}	440 ^{(xiv)(xi)}	440 ^{(iii)(xi)}	440 ^{(iv)(xi)}	2
Naphthalene	mg/kg	2.3 ^{(i)(xi)}	2.3 ^{(xiv)(xi)}	1200 ^{(iv)(xi)}	1200 ^{(iv)(xi)}	2
Acenaphthylene	mg/kg	170 ^{(i)(xi)}	500 ^(v)	15,000 ^{(iii)(xi)}	29,000 ^{(iv)(xi)}	3
Acenaphthene	mg/kg	210 ^{(i)(xi)}	500 ^(v)	15,000 ^{(iii)(xi)}	29,000 ^{(iv)(xi)}	1
Fluorene	mg/kg	170 ^{(i)(xi)}	500 ^(v)	9900 ^{(iii)(xi)}	20,000 ^{(iv)(xi)}	1
Phenanthrene	mg/kg	95 ^{(i)(xi)}	500 ^(v)	3100 ^{(iii)(xi)}	6200 ^{(iv)(xi)}	3
Anthracene	mg/kg	500 ^{(i)(xi)}	500 ^(v)	74,000 ^{(iii)(xi)}	150,000 ^{(iv)(xi)}	3
Fluoranthene	mg/kg	280 ^{(i)(xi)}	500 ^(v)	3100 ^{(iii)(xi)}	6300 ^{(iv)(xi)}	3
Pyrene	mg/kg	500 ^{(i)(xi)}	500 ^(v)	7400 ^{(iii)(xi)}	15,000 ^{(iv)(xi)}	3
Benzo(a)Anthracene	mg/kg	7.2 ^{(i)(xi)}	11 ^{(ii)(xi)}	29 ^{(iii)(xi)}	49 ^{(iv)(xi)}	3
Chrysene	mg/kg	15 ^{(i)(xi)}	30 ^{(ii)(xi)}	57 ^{(iii)(xi)}	93 ^{(iv)(xi)}	3
Benzo(b)Fluoranthene	mg/kg	2.6 ^{(i)(xi)}	3.9 ^{(ii)(xi)}	7.1 ^{(iii)(xi)}	13 ^{(iv)(xi)}	3
Benzo(k)Fluoranthene	mg/kg	77 ^{(i)(xi)}	110 ^{(ii)(xi)}	190 ^{(iii)(xi)}	370 ^{(iv)(xi)}	3
Benzo(a)Pyrene	mg/kg	2.2 ^{(i)(xi)}	3.2 ^{(ii)(xi)}	5.7 ^{(iii)(xi)}	11 ^{(iv)(xi)}	3
Indeno(123-cd)Pyrene	mg/kg	27 ^{(i)(xi)}	45 ^{(ii)(xi)}	82 ^{(iii)(xi)}	150 ^{(iv)(xi)}	3
Dibenzo(a,h)Anthracene	mg/kg	0.24 ^{(i)(xi)}	0.31 ^{(ii)(xi)}	0.57 ^{(iii)(xi)}	1.1 ^{(iv)(xi)}	3
Benzo(ghi)Perylene	mg/kg	320 ^{(i)(xi)}	360 ^{(ii)(xi)}	640 ^{(iii)(xi)}	1400 ^{(iv)(xi)}	3
TPH C ₅ -C ₆ (aliphatic)	mg/kg	42 ^{(i)(xi)}	42 ^{(ii)(xi)}	42 ^{(iii)(xi)}	10,000 ^{(xiv)(xi)}	2
TPH C ₆ -C ₈ (aliphatic)	mg/kg	100 ^{(i)(xi)}	100 ^{(ii)(xi)}	100 ^{(iii)(xi)}	10,000 ^{(xiv)(xi)}	2
TPH C ₈ -C ₁₀ (aliphatic)	mg/kg	27 ^{(i)(xi)}	27 ^{(ii)(xi)}	27 ^{(iii)(xi)}	10,000 ^{(xiv)(xi)}	2
TPH C ₁₀ -C ₁₂ (aliphatic)	mg/kg	130 ^{(i)(xi)}	130 ^{(ii)(xi)}	130 ^{(iii)(xi)}	10,000 ^{(xiv)(xi)}	2
TPH C ₁₂ -C ₁₆ (aliphatic)	mg/kg	1000 ^{(xiv)(xi)}	1000 ^{(xiv)(xi)}	1000 ^{(xiv)(xi)}	10,000 ^{(xiv)(xi)}	2
TPH C ₁₆ -C ₂₁ (aliphatic)	mg/kg	1000 ^{(xiv)(xi)}	1000 ^{(xiv)(xi)}	1000 ^{(xiv)(xi)}	10,000 ^{(xiv)(xi)}	1
TPH C ₂₁ -C ₃₅ (aliphatic)	mg/kg					1
TPH C ₅ -C ₇ (aromatic)	mg/kg	70 ^{(i)(xi)}	370 ^{(ii)(xi)}	370 ^{(iii)(xi)}	10,000 ^{(xiv)(xi)}	2
TPH C ₇ -C ₈ (aromatic)	mg/kg	130 ^{(i)(xi)}	860 ^{(ii)(xi)}	860 ^{(iii)(xi)}	10,000 ^{(xiv)(xi)}	2
TPH C ₈ -C ₁₀ (aromatic)	mg/kg	34 ^{(i)(xi)}	47 ^{(ii)(xi)}	47 ^{(iii)(xi)}	10,000 ^{(xiv)(xi)}	2
TPH C ₁₀ -C ₁₂ (aromatic)	mg/kg	74 ^{(i)(xi)}	250 ^{(ii)(xi)}	250 ^{(iii)(xi)}	10,000 ^{(xiv)(xi)}	2



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TPH C ₁₂ -C ₁₆ (aromatic)	mg/kg	140 ^{(i)(xi)}	1800 ^{(ii)(xi)}	1800 ^{(ii)(xi)}	10,000 ^{(xiv)(xi)}	1
TPH C ₁₆ -C ₂₁ (aromatic)	mg/kg	260 ^{(i)(xi)}	1900 ^{(ii)(xi)}	1900 ^{(ii)(xi)}	10,000 ^{(xiv)(xi)}	1
TPH C ₂₁ -C ₃₅ (aromatic)	mg/kg	1000 ^{(xiv)(xi)}	1900 ^{(ii)(xi)}	1900 ^{(ii)(xi)}	10,000 ^{(xiv)(xi)}	1
Asbestos	Fibres Volume Weight (%)	NFD	0.001%	NFD	0.001	4

Notes 1

NFD = No Fibres Detected

Asbestos will be screened visually on site by a qualified environmental consultant and where potential ACM is identified, representative samples will be subject to quantitative analysis of % volume by weight.

Should any ACM be identified within the soil matrices, further detailed % assessment would be required when the reported laboratory result exceeds the limit of detection for the analytical method at 0.01% by volume (weight).

Notes 2

Excludes matrices where free product is observed.

No viable exposure pathway beneath hardstanding and cover system.

Notes 3

Main exposure pathways: 1 = soil ingestion, 2 = vapour inhalation (indoor), 3 = dermal contact and ingestion, 4 = dust inhalation.

Abbreviations: GAC = general assessment criteria, n = number of samples, MC = maximum concentration, N/A = Not Applicable (no exceedance of assessment criteria), Loc of MC = location of exceedances.

- i. Value derived from LQM Sutable 4 Use Levels (S4ULs) for residential end use with plant uptake.
- ii. Value derived from LQM Sutable 4 Use Levels (S4ULs) for residential end use without plant uptake – these levels used below 600 mm cover system within residential gardens as soils will be present within a residential setting yet soils will not be disturbed and garden plants will not reach these soils.
- iii. Value derived from LQM Sutable 4 Use Levels (S4ULs) for public open space (POS) residential.
- iv. Value derived from LQM Sutable 4 Use Levels (S4ULs) for public open space (POS) park – these levels used below 300 mm POS cover system as soils will not be disturbed by any future site users and exposure to these soils will be similar to a park end use.
- v. Value derived from LQM Sutable 4 Use Levels (S4ULs) alongside assessment with WM3 to ensure that materials remaining on site do not exceed the WM3 toxicity criteria for hazardous waste.
- vi. Value derived from Category 4 Screening Levels (C4SL) for residential land use with homegrown produce.
- vii. Value derived from Category 4 Screening Levels (C4SL) for residential land use without homegrown produce.
- viii. Value derived from Category 4 Screening Levels (C4SL) for public open space (POS) residential.
- ix. Value derived from Category 4 Screening Levels (C4SL) for public open space (POS) park.
- x. Mercury – based on elemental mercury.
- xi. PAH and TPH levels used are for 1% SOM.
- xii. Xylenes based on p-xylene (o-xylene 2600 mg/kg, m-xylene 3500 mg/kg) and is capped by its solubility.
- xiii. Value derived from LQM Sutable 4 Use Levels (S4ULs) for residential end use with plant uptake due to the volatilisation risk.
- xiv. BTEX is not SOM-related due to inhalation pathway.



REMEDIATION TARGETS – COMPARISON OF GROUNDWATER / LEACHATE ANALYSIS WITH TIER 1 SCREENING LEVELS

DETERMINAND	UNIT	EQS SCREENING VALUE ^{1, 2, 3}		DWS ^{3,4,5}
		AA	MAC	
Arsenic	µg/l	50	–	10
Cadmium	µg/l	0.08-0.25	0.45-1.5	5
Chromium (VI)	µg/l	3.4	–	–
Chromium (III)	µg/l	4.7	–	50
Copper	µg/l	1	–	2000
Total Cyanide	µg/l	1	–	50
Lead	µg/l	1.2	14	10
Mercury	µg/l	–	0.07	1.0
Nickel	µg/l	4	34	20
Selenium	µg/l	–	–	10
Zinc	µg/l	10.9	–	–
pH		6–9		
Naphthalene	µg/l	2	130	10*
Anthracene	µg/l	0.1	0.1	
Benzo[b]fluoranthene	µg/l	0.00017*	0.017	
Benzo[k]fluoranthene	µg/l	0.00017*	0.017	
Benzo(a)pyrene	µg/l	0.00017*	0.27	
Indeno(123-cd)pyrene	µg/l	0.00017*	5*	
Benzo(ghi)pyrene	µg/l	0.00017*	5*	
Fluoranthene	µg/l	0.0063	0.12	
Benzo(ghi)perylene	µg/l	1.7–4	8.2–3	
TPH C5-C6 (benzene)	µg/l	10	50	1
TPH C6-C8 (toluene)	µg/l	74	–	700
TPH C8-C10 (ethyl benzene)	µg/l	20	–	300
TPH C10-C12 (xylene)	µg/l	30	–	500
TPH C12-C16	µg/l	2	130	90 ⁵
TPH C16-C35	µg/l	50#	50#	90 ⁵
TPH C5-C6	µg/l	–	–	15000
TPH C6-C8	µg/l	–	–	15000
TPH C8-C10	µg/l	–	–	300
TPH C10-C12	µg/l	–	–	300
TPH C12-C16	µg/l	–	–	300



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Remediation Strategy

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DETERMINAND	UNIT	EQS SCREENING VALUE ^{1, 2, 3}		DWS ^{3,4,5}
		AA	MAC	
TPH C16 – C21	µg/l	–	–	300**
TPH C21-C35	µg/l	–	–	300**
Tetrachloroethylene	µg/l	0.4	–	10
Trichloroethylene	µg/l	10	–	10
Trichlorobenzene	µg/l	0.4	–	–
Trichloromethane	µg/l	2.5	–	–
Dichloromethane	µg/l	20	–	200
Carbon Tetrachloride	µg/l	12	–	3
Vinyl Chloride	µg/l	–	–	0.3

Notes

Solubility <0.01µg/l

AA – Annual Average

MAC- Maximum Admissible Concentration

* Polyaromatic hydrocarbons (PAH) - Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA-EQS in water

** There are no WHO Guideline Values for aliphatic fractions C16-C21 and C21-C35, therefore the guideline value for aliphatic fractions inclusive of C8-C16 (300µg/l) has been applied.

1. The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations (2015)
2. Directive establishing a framework for Community action in the field of water policy (Water Framework Directive)
3. Council Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Dangerous Substances Directive) - List II substances
4. Council Directive on the quality of water intended for human consumption (Drinking Water Directive)
5. WHO Guidelines for Drinking Water Quality. Third edition (2004)



APPENDIX V

E3P MATERIAL IMPORT CRITERIA

SITE OF IMPORTATION ADDRESS		E3P +44 (0) 161 707 9612 info@e3p.co.uk 
Client		
Main Contractor		
Earthworks Contractor		
Haulier		
Date of Planned Import		
Overview of Planned Material Import		
Material Source (Site of Origin) and Postcode		
Site Investigation Report	Report Title and Reference: Date: Information Supplied By:	
Reason for Generation of Excess Material at Site of Origin		
Chemical Test Results for Stockpile at Site of Origin	Date: Laboratory Certificate Ref: Organisation Responsible for Stockpile Sampling:	
Geotechnical Material Classification and Testing	Delete as Appropriate: Class 1 / Class 2 / Class 6 / Topsoil	
Pictures of Material Stockpile Pending Transportation	Delete as Appropriate: Yes / No	
Person or Organisation Responsible for Ensuring Quality Control at Site of Origin		
Quantity of Material to Be Imported (m³)		
Proposed Area of Deposition (Site of Re-use)		
Waste Exemption/Permit or CL:AIRE MMP	Delete as Appropriate: U1 Standard Rules / CL:AIRE MMP (Direct Transfer) / Bespoke	



APPENDIX VI CONTRACTOR PRE- COMMENCEMENT CHECK SHEET

GEOTECHNICAL ENABLING WORKS PRE-START FORM

Prior to the commencement of any site remediation or enabling works, this form will be completed by E3P, in the presence of the appointed contractor, to ensure that all pertinent remediation and enabling works activities are fully discussed and understood.

Activity	Testing Responsibility	Contractors Method Statement Required (Y/N)	Comment/Action
Deployment of Environmental Permit			Ref No:
Deployment of LAPC Part B – Mobile Plant Permit			Ref No:
CL:AIRE MMP and Qualified Person Declaration			Ref No:
Identification of All Invasive Plant Species and Production of Eradication Plan with Appropriate Supervision by Specialist			Appointed specialist:
Removal of All Vegetation			Note disposal location:
Removal of All Root Bulbs and Root Networks			Note disposal location:
Identification of Contamination Hotspots, Removal of Material and Stockpile			Rationale:
Legislatively Compliant Procedure to Deal with Contamination Excavated from Hotspot			Rationale:
Processing and Recycling of Aggregate with Geotechnical and Chemical Validation Testing			Note stockpile location and anticipated volume:
Stockpiling of Subsoil and Certification of Suitability for Re-use			Stockpile location:
Decommission of All Redundant Drainage Infrastructure			
Decommission of All Former Interceptors			
Decommission of All Former Above- and Below-Ground Tanks			
Removal of All Asbestos to a Licensed Facility			
Engineering of Plots for Shallow Spread Foundation in Accordance with E3P Geotechnical Specification			Plot Numbers



Castleton Sidings, Rochdale

Remediation Strategy

November 2023

Activity	Testing Responsibility	Contractors Method Statement Required (Y/N)	Comment/Action
Engineering of Plots for VSC in Accordance with E3P Geotechnical Specification			Plot Numbers.
Engineering of Plots for Pile Foundation in Accordance with E3P Geotechnical Specification			Plot Numbers
Engineering of Plots for Raft Foundation in Accordance with E3P Geotechnical Specification			Plot Numbers
Stockpiling of Topsoil and Certification of Suitability for Re-use			Stockpile location
Engineering of Highways Bulk Upfill in Accordance with E3P Specification with Compliant Validation Testing			Upfill specification
Engineering of Highways Subgrade in Accordance with E3P Specification with Compliant Validation Testing			Upfill specification
Engineering of Highways Capping in Accordance with E3P Specification with Compliant Validation Testing			Upfill specification
Cut-and-Fill the Development Site to Clients' Required Elevation with As-Built Survey			Required formation elevations



APPENDIX VII CONTRACTOR COMPLETION CHECK SHEET

GEOTECHNICAL ENABLING WORKS COMPLETION FORM

Upon completion of all site remediation and enabling works, this form will be completed by E3P, in the presence of the appointed contractor, to ensure that all pertinent geotechnical enabling works activities are complete or, where a deviation from the specification has occurred, all future limitations and issues are documented for the client's records.

Activity	Complete			Signature
	Yes	No	N/A	(initial)
Eradication of all invasive plant species				
Removal of all vegetation				
Removal of all root bulbs and root networks				
Stockpiling of topsoil and certification of suitability for re-use				
Stockpiling of subsoil and certification of suitability for re-use				
Stockpile all recycled aggregate with geotechnical and chemical validation testing				
Removal of all relict foundations and infrastructure in their entirety				
Decommission of all redundant drainage infrastructure				
Decommission of all former interceptors				
Decommission of all former above- and below-ground tanks				
Removal of all waste materials to a licensed facility				
Removal of all asbestos to a licensed facility				
Engineering of all plots for shallow spread foundation in accordance with E3P Geotechnical Specification				
Engineering of all plots for VSC in accordance with E3P Geotechnical Specification				
Engineering of all plots for pile foundation in accordance with E3P Geotechnical Specification				
Engineering of all plots for raft foundation in accordance with E3P Geotechnical Specification				
Engineering of highways bulk upfill in accordance with E3P Specification with compliant validation testing				
Engineering of highways subgrade in accordance with E3P Specification with compliant validation testing				
Engineering of highways capping in accordance with E3P Specification with compliant validation testing				
Cut-and-fill the development site to client's required elevation with as-built survey				



POST-REMEDATION AND ENABLING LIMITATIONS

All and every deviation from the approved specification for works should be documented by the remediation and enabling works contractor below.



