

Elizabeth Street, Cheetham Hill

Remediation Strategy

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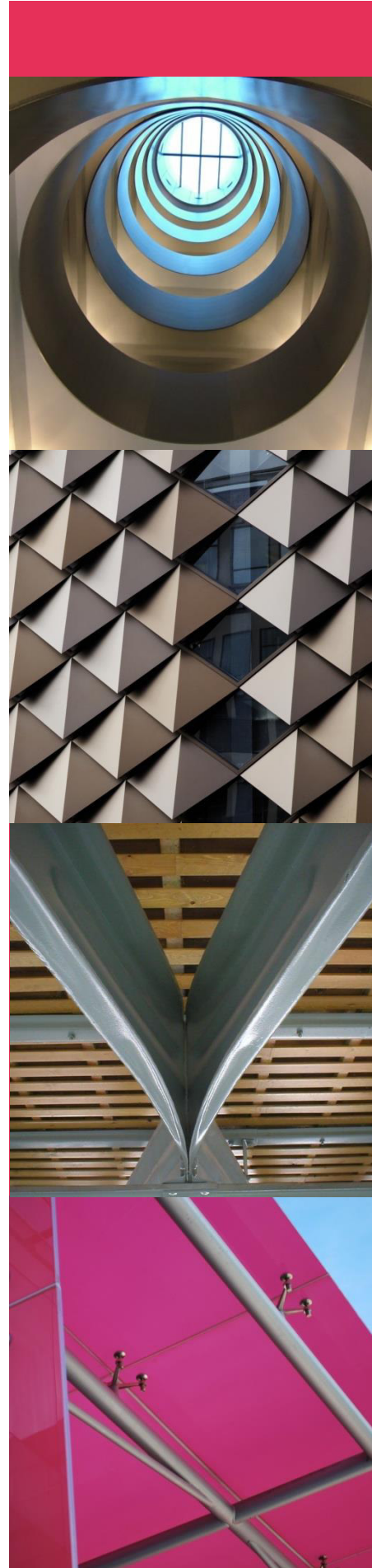
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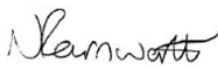


Remediation Strategy

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1.0 Introduction

This Remediation Strategy has been prepared by Curtins for Kier Trade City LLP (the Client) to provide guidance with respect to remedial requirements for the proposed development site off Elizabeth Street, Cheetham Hill, M8 8BB.

Development proposals comprise redevelopment of the site for a commercial/light industrial end use with nine units proposed of varying size. External areas are predominantly hardstanding comprising concrete yard areas, a tarmac access road and flexible paving for car parking areas. Some small areas of soft landscaping are proposed, primarily located at the north west of the site around Unit 9 as well as at the north east of site close to an electrical sub-station. Mature Poplar/Eucalyptus trees are to be retained in both of these areas which are protected under a root protection zone.

Fletcher Rae's proposed site plan is enclosed in Appendix A.

The site has been characterised through site investigation undertaken by Curtins (Ref. 1) with further investigation undertaken beneath the north of the site as detailed in this report.

The majority of the site comprises backfilled clay pits with up to 20m of made ground and is identified as an 'historical landfill site' although waste types and dates aren't supplied. The site is not a registered landfill site. The northern section of the site where Unit 1 is proposed is outside of the historic clay pits/landfill area.

Proposals for earthworks comprise a cut & fill across the site with exact volumes still being determined. Ground improvement is currently proposed across the site likely comprising Vibro Stone Columns or Controlled Modulus Columns to improve ground beneath spread foundations, a ground bearing floor slab and below external yards and roads.

1.1 Requirements of the Remediation Strategy

The Remediation Statement is to account for the following;

- A description of the materials likely to be encountered by the developer and their sub-contractors;
- Proposals for excavations with respect to the materials likely to be encountered;
- Findings of additional investigation undertaken at the north of the site in areas that were previously inaccessible;
- Revised risk ratings associated with ground contamination and primary pollutant linkages remaining;
- Recommendations for the specification of the cover of Made Ground soils in proposed soft landscaped areas;
- Recommendations for appropriate PPE and managing asbestos appropriately during construction;

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- Recommendations for installing appropriate ground gas protection measures in proposed buildings to comply with Characteristic Situation CS2 across the site;
- Recommendations for contaminant resistant water supply pipes;
- Recommendations for re-use of materials and use of a Materials Management Plan (MMP);
- A strategy a watching brief during earthworks and for handling potentially contaminative incidents.
- Proposals for the verification of remedial measures, including a regime for verification and chemical analysis of the cover layer material;

1.2 Definitions

In this document the following definitions apply,

- Contractor** Refers to the appointed contractor responsible for undertaking the remediation works.
- Site Manager** Refers to a representative of the appointed contractor resident on site.
- Engineer** Refers to a suitably qualified representative from Curtins, who would not normally be resident on site.

1.3 References

The Remediation Strategy has been prepared with reference to the following existing reports;

- **Reference 1:** Curtins (2021) Elizabeth Street, Cheetham Hill combined Phase 1 Preliminary Risk Assessment (PRA) and Phase 2 Ground Investigation Report Ref. 078695-CUR-00-XX-RP-GE-001-V03.
- **Reference 2:** Curtins (2022) Elizabeth Street, Cheetham Hill, Earthworks Specification Ref. 080139-CUR-00-XX-SP-GE-001-V01.
- **Reference 3:** Curtins (2022) Elizabeth Street, Cheetham Hill, Ground Treatment Specification Ref. 08139-CUR-XX-XX-SP-GE-002-T1.
- **Reference 4:** Curtins (2022) Elizabeth Street, Cheetham Hill, Waste Classification Memo Ref. 080139-CUR-00-XX-RP-GE-004-V03.

2.0 Ground Conditions

The following ground conditions section has been summarised, based on the Curtins Phase 2 Report (Ref. 1).

Curtins plans showing the locations of the exploratory holes undertaken during the investigation works are contained with Appendix A for ease of reference.

2.1 Made Ground

The surface covering across the site varied. Concrete was identified in BH01, BH02, TP02, TP04, TP06, TP09, and BH102 with a thickness of 0.10m to 0.30m. Tarmacadam was identified in WS102, WS103 and WS104 with a thickness of 0.10m and a paving slab was noted in WS101 with a 0.05m thickness. A variable gravel/ sandy surfacing in BH04, BH05, TP01, TP03, TP05, TP07 and TP10. A limited thickness of Topsoil/ grass covered Made Ground was encountered in TP08, BH103, BH104 and BH105.

Beneath surface coverings of topsoil or asphalt, made ground was encountered in all exploratory holes. The depth of made ground varied across the site but the depth of made ground within the north was significantly shallower. The east of the site recorded made ground to a maximum depth of 18.00m bgl and 14.90m bgl in the west. The maximum made ground depth was recorded at 1.90m bgl however recommendations suggested further investigation within the Unit 1 located within the north of the site to ensure the made ground does not encroach within the north of the site.

Made ground within the east of the site was described as dark brown sandy slightly clayey gravel with a medium to high cobble content. The gravel includes a high ash content, also including brick, sandstone, concrete, glass, tarmac, plastics and possible Asbestos Containing Materials (ACM) debris. Cobbles include bricks, concrete and sandstone. Frequent metal pieces were also noted as well occasional rubber pieces. It is assumed this material is associated with the historic landfill on site and the breakers yard more recently on site. A blackish brown slightly sandy gravelly to very gravelly clay was also noted with cobbles and boulders present. The gravel comprised glass, plastic, porcelain, brick and concrete, and cobbles and boulders of concrete and brick.

Made ground within the west of the site was described as brown silty sandy gravel with medium cobble content. The gravel fraction typically included less ash than the east as well as brick and sandstone. Cobbles typically included clinker, brick, concrete. Occasional timber was noted. A brown slightly sandy gravelly to very gravelly clay was also noted with a medium cobble and low boulder content. The gravel included concrete, brick and sandstone, and the cobbles/boulders comprised concrete and brick.

The north of the site is thought to be outside the backfilled clay pits. Made ground encountered in the north was generally described as sandy gravel of brick, tarmac, concrete and ash, and a sandy gravelly clay with gravel of brick, concrete, glass, mudstone and sandstone.

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Visual and olfactory signs of contamination was noted across the site in the form of hydrocarbon odours in TP01, TP03, and BH04. A sulphur odour was noted in BH04. Black tar type material was found in TP09. Asbestos Containing Material (ACM) was found in TP01, TP04 and TP05.

The following obstructions were encountered within made ground soils during site works detailed in *Table 2.1* below.

Table 2.1 – Obstructions Encountered

Site Works Phase	Exploratory Hole Location	Obstruction	Depth (m bgl)
May 2021	BH02	Unknown obstruction	8.80
	TP01	Possible concrete	1.50
	TP08	Cast iron piece	1.60m
	TP10	Brick structure	1.80
December 2021	WS101	Stiff stratum	4.45
	WS102	Stiff stratum	4.45
	WS104	Stiff stratum	3.45
	CPT102	Unknown obstruction	0.34
	CPT104	Unknown obstruction	0.48
	CPT104A	Unknown obstruction	0.35
	CPT109	Unknown obstruction	0.12
	CPT109A	Unknown obstruction	0.16
	CPT113	Unknown obstruction	6.71
	CPT119	Unknown obstruction	0.16
	CPT120	Unknown obstruction	0.96

2.2 Glacial Till Deposits

Where natural soils were encountered following progression through made ground, deposits indicative of glacial till deposits were recorded.

The glacial till deposits were cohesive and typically recorded as a firm to stiff, becoming very stiff with depth, brown mottled grey slightly sandy slightly gravelly (occasionally silty) Clay. The sand is fine to coarse, and the gravel is angular to subangular fine to medium of mudstone, sandstone and coal. In

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WS102 and WS104 a soft brown mottled grey slightly sandy slightly gravelly Clay was noted between depths of 1.00m and 1.60m bgl. The sand is fine to coarse, and gravel is angular to subrounded fine to coarse of mudstone, sandstone and coal.

Granular Glacial Till deposits were not encountered on site in boreholes.

2.3 Ground & Groundwater Contamination

As part of the Phase 2 Ground Investigation, a Generic Quantitative Risk Assessment (GQRA) was undertaken against *Commercial* Tier 1 thresholds protective of human health.

With respect to the proposed end-use of the site, one exceedance was reported above the GAC thresholds within the 16 samples of Made Ground tested, detailed in *Table 2.3A*.

Table 2.3A – Exceedances of contaminants

Borehole Ref.	Depth m bgl	Determinant	Conc. (mg/kg)	Commercial GAC (mg/kg)
BH103	0.20	Lead	2460	2300

All were scheduled for asbestos identification, Asbestos Containing Materials (ACM's) were identified in four samples (two soil samples and two bulk fragments) during the first stage of GI, as summarised in *Table 2.3B*.

Table 2.3B – Asbestos Identified Through Laboratory Screening

Borehole Ref.	Depth (m bgl)	Asbestos Type	Quantification (% w/w)
TP01	0.40	Solid fragment- Chrysotile cement (ACM)	-
TP01	0.30	Loose fibres – chrysotile cement	0.194
TP04	2.00	Solid fragment- Chrysotile cement (ACM)	-
TP05	0.90	Loose fibres – chrysotile cement	<0.001%

The two soil samples which identified loose Asbestos fibres underwent quantification to determine percentage unit weight of Asbestos in the samples. The results recorded <0.001% and 0.194%, with the latter above the hazardous waste threshold (>0.1%) for Asbestos in soils. Given the above, it is evident that the historical landfill material on-site is likely to contain former building materials with Asbestos.

A **Moderate/Low** risk rating was identified to end-users, construction workers and adjacent residents from inhalation or direct contact with contaminants within shallow site soils, this is owing to the presence asbestos in shallow soils as well as an exceedance for lead. The installation of an appropriate cover

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system was recommended for proposed soft landscaping areas to mitigate risk to end users. An appropriate asbestos management measures should be put in place during construction which should include the provision of an asbestos management plan to mitigate risk to construction workers and adjacent residents.

A **Low** risk rating was identified to the nearest surface water feature and groundwater receptors considering the distance to the nearest surface water feature, the predominance of cohesive superficial soils beneath made ground on site acting to limit migration of contamination and accounting for the betterment to site conditions development will present as proposed hardstanding cover across majority of the site will act to limit any leaching of contamination.

2.4 Ground Gas

To characterise the site's ground gas regime four gas monitoring visits were undertaken between 17th May and 17th June 2021, following the May 2021 site works. A further four gas monitoring visits were undertaken between 22nd December 2021 and 31st January 2022, following the December 2021. May 2021 installations was also undertaken in these visits.

Gas flow was recorded at a maximum peak flow rate of -15.3l/hr in WS104 on the second visit. The greatest steady state gas flow of -2.6/hr was recorded in the same borehole and same visit.

Elevated methane concentrations of 2.2%_{v/v} were recorded in one location, BH05 located on the western side of the site in the footprint of the infilled clay pit/historical landfill. Similarly, BH05 recorded concentrations of 2.0%_{v/v} during the subsequent rounds of gas monitoring.

Maximum steady state carbon dioxide concentrations of between 1.4% _{v/v} and 9.4% _{v/v} were recorded across both sets of gas monitoring. The highest peak concentration was 9.4% _{v/v} in BH02 on the second visit after the December 2021 site works, located in the northeast of the site.

Considering the varying ground conditions between the majority of the site (deep fill) and the far north (limited made ground and shallow natural soils) the gas risk assessments was separated and zoned.

For Units 2-9 evaluation of the 'borehole' scenario (highest hazardous gas flow rate that is realistically possible i.e. in a single borehole) recorded a maximum Q_{hg} of 0.144 l/hr for carbon dioxide with the highest steady state flow rate of -1.6 l/hr in BH02 on 06/01/2022. This was taken as the Gas Screening Value indicating a Characteristic Situation 2 gas regime, requiring gas protection measures. This is further supported by the recorded peak concentrations of methane above 1% and carbon dioxide concentrations recorded above 5%.

For Unit 1 on the north evaluation of the 'borehole' scenario (highest hazardous gas flow rate that is realistically possible i.e. in a single borehole) recorded a maximum Q_{hg} of 0.1456 l/hr for carbon dioxide with the steady state flow rate of -2.6 l/hr used in WS104 on 06/01/2022. This was taken as the Gas Screening Value indicating a Characteristic Situation 2 gas regime, requiring gas protection measures.

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This is further supported by the recorded peak concentrations of carbon dioxide recorded above 5% on two occasions and given the areas proximity to the deep fill/landfill.

A **Moderate** risk rating was identified to site end users from ground gas across the site, this is based on the presence of Made Ground present across the majority of the site and elevated methane and carbon dioxide recorded. This corresponds with Characteristic Situation 2 (CS2) classification requiring gas protection measures in all new buildings.

2.5 Water Supply Pipe Risk Assessment

A United Utilities water supply pipe risk assessment has been undertaken using the results of the ground investigations undertaken which is enclosed in Appendix D for reference.

Contaminant resistant water supply pipes are recommended (barrier pipe) across the site due to the concentrations of Total Petroleum Hydrocarbons recorded in soils.

A **Moderate** risk rating is identified to site end users through degradation of PE water supply pipes and migration of contamination into water supply followed by ingestion. Contaminant resistant water supply pipes should be adopted.

It is recommended that this completed risk assessment is submitted to United Utilities and their exact requirements confirmed.

3.0 Additional Ground Investigation Under the Existing Units at the North of Site

3.1 Scope of Works

Additional window sample boreholes were undertaken in July 2022 beneath the existing warehouse unit at the north of the site scheduled for demolition (identified as Warehouse 3&4). Curtins previous investigations Phase 2 investigation had recommended post demolition investigation in this area however as the Units are now vacant it was possible to access at this time for investigation.

Investigation was undertaken on 20th and 21st July 2022 and comprised six hand dug trial pits/window sample boreholes (Ref.WS201-WS206) to max depth 3.75m bgl. Handheld window sample equipment was used where access with a drilling rig was not possible. Curtins borehole location plan (Ref.078695-CUR-00-XX-DR-GE-005_V01) is enclosed in Appendix A whilst borehole logs and environmental chemistry analysis results are enclosed in Appendix C.

Boreholes were undertaken with the aim of further characterising ground conditions in this area where access had been limited previously, allow further chemical analysis of soils and to identify the depth of made ground in this area to confirm it sits outside of the historic landfill area.

Five made ground samples were obtained from the boreholes and tested for a broad suite of contamination in line with samples obtained during the Phase 2 Ground Investigation.

3.2 Ground Conditions

3.2.1 Made Ground

Made ground was encountered to a maximum depth of 2.10m bgl (WS205) however, the base of made ground was not encountered in WS201, advanced to 1.95m bgl, WS203 advanced to 0.55m bgl and WS206 advanced to 0.85m bgl due to termination on obstructions and due to limitations with using hand-held window sample equipment.

The surface covering internally comprised a concrete slab of up to 0.42m thickness. Externally (WS205 only) asphalt was recorded.

Soils underlying hardstanding was variable, comprising cohesive and granular soils.

Granular soils typically comprised dark grey/brown sandy gravel with variable clay/silt content. Light brown and grey gravelly fine to medium sand was identified in WS203. An orange brown brick fill was identified in WS205.

Cohesive made ground generally comprised dark brown silty very gravelly clay.

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The gravel fraction typically included fine to coarse of brick, ash, mudstone, siltstone, slate, concrete, plastics. Cobbles of brick, concrete and sandstone were also noted.

The thickness of made ground encountered (where the base was encountered) indicate section of the site is outside of the historic clay pit/landfill area.

No evidence of gross/mobile phase contamination was identified.

3.2.2 Glacial Till

Cohesive glacial till was encountered underlying the made ground in WS202 at 0.85m bgl, WS204 at 1.32m bgl and WS205 at 2.10m bgl.

Cohesive glacial till comprised stiff light brown mottled grey becoming stiff to very stiff dark brown with occasional grey mottling slightly gravelly silty clay. The gravel fraction included fine to medium siltstone and sandstone and cobbles of sandstone.

Ground conditions were in line with those recorded on this section of the site within the previous, main ground investigation works.

3.2.3 Groundwater

No groundwater was recorded in any borehole location.

3.3 Ground & Groundwater Contamination

A Generic Quantitative Risk Assessment (GQRA) was undertaken against *Commercial* Generic Assessment Criteria thresholds protective of human health. Of the five additional made ground soil samples tested, no exceedances recorded against conservative “*Commercial*” end use thresholds.

No asbestos containing materials were identified during the investigation works, however laboratory screening identified asbestos during Curtins additional Site investigation, as detailed in Table 3.3.

Table 3.3. – Asbestos Identified During Laboratory Screening by Curtins

Investigation Stage	Exploratory Hole ID (Location on Site)	Sample Depth (m bgl)	Asbestos Identification	Quantification Analysis
				Asbestos in Soil (% w/w)
July 2022	WS204	0.45	Crocidolite (loose fibres)	<0.001

With consideration of the findings of the additional investigation at the north of site a risk to end users and construction workers from asbestos fibres is also noted in this area. The risk rating applied to the wider site following the main ground investigation are therefore still valid as further summarised in the current Conceptual Site Model below.

A **Low** risk rating is still identified to the nearest surface water feature and groundwater receptors across the site considering the distance to the nearest surface water feature, the predominance of cohesive

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superficial soils beneath made ground on site acting to limit migration of contamination and accounting for the betterment to site conditions development will present as proposed hardstanding cover across majority of the site will act to limit any leaching of contamination.

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4.0 Conceptual Site Model

A conceptual site model (CSM) for the site has been developed as part of the site investigation that was undertaken at the site and considered based on the current enabling works proposed.

The CSM details a number of pollutant linkages at the site, however, based on the risk assessments undertaken, the potential contaminant linkages (PCLs) listed in *Table 4.1* were identified as requiring remediation to enable the safe re-development of the site.

Table 4.1 – Potential Contaminant Linkages

PCL	Sources	Receptor	Potential Pathway	Remediation Recommended
1	Made Ground soils containing elevated concentrations of asbestos fibres/containing materials.	On-site Construction workers Off-site Residents Passers-by	Direct contact, dermal uptake, soil and dust ingestion and inhalation. Inhalation of dust and fibres (off-site)	Appropriate PPE for construction staff and suitable asbestos management measures during construction.
2	Made Ground soils containing elevated concentrations of asbestos fibres/containing materials and lead in one location.	On-site End Users Future Staff/ Maintenance Workers	Direct contact, dermal uptake, soil and dust ingestion and inhalation.	Minimum of 450mm Clean capping within new soft landscaped areas, comprising topsoil/subsoil and a granular break layer or geotextile underlying. New tree will require enhanced thickness to support root growth (minimum of 900mm recommended) In root protection zones for existing trees soils should be carefully scraped and removed (circa 75mm) followed by deposition of circa 150mm clean topsoil. In area where development is not possible due to on-going Japanese Knotweed treatment is restrictions must be put in place as part of management operations to prevent access to site personnel

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PCL	Sources	Receptor	Potential Pathway	Remediation Recommended
3	Elevated concentrations of soil gas (CH ₄ and CO ₂) identified in site soils underlying all new buildings.	On-Site End Users Staff Construction Workers	Vertical and horizontal migration through the superficial and bedrock deposits.	Characteristic Situation 2 Gas Protection Measures.
4	Elevated Aliphatic and aromatic hydrocarbons in site soils.	On-Site End Users Staff Construction Workers	Degradation of water supply pipes followed by migration of hydrocarbon contamination into water supply followed by ingestion.	Contaminant resistant water supply pipes to be incorporated in the development in line with United Utilities requirements.

Section 8.0 presents a strategy for handling unexpected contamination or contaminative incidents. It is further recommended that watching brief/periodic site visits are undertaken by a Geo-Environmental Engineer to record any unexpected contamination as outlined in Section 8.3.

5.0 Remedial Works

In this document the term 'remediation' is used to define specific works required to address potential issues arising from contamination in site soils and ground gases, with due account taken of the known history of the site and the proposed end-user.

With reference to the Conceptual Site Model and the potential contaminant linkages detailed in *Table 3.1* three remedial actions are recommended in order for the site to be brought up to a condition that is deemed 'suitable for use';

- **Remedial Action 1:** Appropriate PPE for all construction workers and suitable asbestos management measures.; and
- **Remedial Action 2:** Engineered capping to serve as physical barrier between Made Ground and site surface in soft landscaped areas preventing direct contact, dermal uptake and limiting the derivation of dust. Prohibitive access restrictions to be in place in areas which cannot be remediated to the specification outlined.
- **Remedial Action 3:** Provision of gas protection measures within specific proposed buildings on site.
- **Remedial Action 4:** Contaminant Resistant Water Supply Pipes to be utilised where buried in site soils.

Measures for dealing appropriately to unexpected contamination encountered on site and the recommendation for a watching brief (part time) by an Environmental Engineer during earthworks are outlined within Section 7.0.

5.1 Remedial Action 1 – Contamination and Asbestos Management During Construction

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk.

It has been assumed that any future construction works on site will be undertaken in compliance with these requirements to address PCL1 (*Table 4.1*).

CL:AIRE have published guidance to aid in the classification of remediation works on Asbestos Containing Soils (ACS) compliant with Control of Asbestos Regulations 2012 (CAR). This is detailed in CL:AIRE (2016) "Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry Guidance.

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Any works with asbestos containing soils are required to determine their classification in accordance with Control of Asbestos Regulations 2012. The specialist groundworks contractor is therefore to designate the works based on the investigation results but utilising their own additional testing and delineation if they deem it to be required. Subsequently the specialist groundworks contractor is to compile a method statement to establish an appropriate management, monitoring and supervisory procedure for the movement of soils as part of the required cut and fill (earthworks) operations. The specialist remediation contractor is to be responsible for management and record keeping as detailed in their method statement document.

Where, from the site investigations, materials are known to contain asbestos fibres good practice (JIWG CAR-Soil and CAR 2012) prescribes such material to be segregated to ensure materials would not cross-contaminate other soils and to reduce the risk of further fibre release to site workers.

Table 2.3B in *Section 2.3* and *Table 3.3* in *Section 3.3* above should be consulted together with Curtins Exploratory Hole Plan Drawings in *Appendix A* (Ref. 078695-CUR-00-XX-DR-GE-005-V01) for the locations, depths and concentrations asbestos was identified during Curtins Ground Investigations (Ref. 1).

Concentrations of asbestos fibres encountered within the Made Ground soils by Curtins were generally relatively low (<0.01% w/w). In TP01 where loose fibres chrysotile cement asbestos containing material was encountered, a concentration of 0.194% w/w asbestos was recorded.

Materials containing asbestos >0.1% w/w would be classed as hazardous waste.

Further soil testing and assessment has also been undertaken by Curtins & Ebsford Environmental to inform waste classification of soils for off-site disposal. Asbestos was also identified in these investigations at comparable concentrations. It is recommended that the contractor also consults these reports.

Good practice prescribes that any fragments or asbestos containing materials where identified should be picked where possible and to be kept separated in line with those from any soil arisings. This is typically carried out by picking visible fragments at the point of excavation. Such operations are carried out by suitably qualified staff, wearing disposal overalls (type 5/6), gloves and fine dust (FPP3) masks in combination with adoption of dust suppression techniques and monitoring or other applicable methods as recommended by the Asbestos Management Specialist. The qualified staff are to be trained in the identification of asbestos at source. The qualification and competencies of all operatives undertaking monitoring and calibration documentation of equipment should be provided to the Engineer.

Existing Made Ground should not be crushed or in any way treated due to risk of asbestos fibre release. It may be possible to use Made Ground soils as general fill subject to in situ trial tests and where managed appropriately by the Method Statement compiled by the Asbestos Management Specialist.

5.2 Remedial Action 2 – Engineered Capping

The primary PCL identified at the site relates to the direct contact, dermal uptake, soil and dust ingestion and inhalation of heavy metals and asbestos fibres in soil and soils and soil derived dust (PCL 2, *Table 4.1*).

The potential for exposure to asbestos fibres is highest within proposed soft landscaped areas where receptors (maintenance staff and public) at the site are most likely to come in contact with the contaminated Made Ground soils. Landscape drawings are included within *Appendix A*.

Hardstanding, including building footprint, vehicular tarmac, pedestrian tarmac and concrete and block paving are considered sufficient to break the potential contaminant linkage, PPL 2, detailed in *Table 4.1* and therefore no specific remediation measures, above activities required for construction, are considered necessary if and where these are installed at the site.

For all soft landscaped areas a clean cover layer is recommended. It is therefore recommended that verified clean capping, comprising a minimum total thickness of 450mm is incorporated in general soft landscaping areas. This may be made up of (450mm) imported soils with a high visibility warning geotextile or granular break layer below.

Where tree pits are to be planted, excavation of 900mm is likely to be required for a sufficient depth to support the shrubs and trees respectively, where capping of this thickness is incorporated a break layer is not considered to required due to the additional depth of clean cover.

This is anticipated to provide adequate protection of human health with consideration of likely exposure and is in accordance with Manchester City Councils Planning & Contaminated Land Technical Guidance Document (2021) and should be incorporated in all proposed soft landscaped areas and proposed tree pits as asbestos has been identified across the site.

The presence of the root protection zones around mature trees north of Unit 02 means significant excavation of soils around the roots for disposal off-site or building up levels in this area with a significant capping thickness present the risk of damaging the tree. Instead it is recommended that existing soils are scraped back (circa 75mm) and a nominal thickness of clean topsoil is placed of circa 150mm thickness, this is subject to agreement with the landscape architect, arboriculturist and MCC's contaminated land officer. The approximate area requiring this bespoke capping is shown in Curtins Engineered Capping to Soft Landscaping in Tree Root Protection Zones Drawing Ref. 078695-CUR-00-XX-DR-GE-009-V01 enclosed in *Appendix A*.

Mature Poplars are also present along the western site boundary, west of Unit 9 which are also under a root protection zone. This area (circa 75m x 6m) is currently 'undevelopable' due to ongoing Japanese Knotweed treatment (spraying). A root barrier currently underlies this area and landscape proposals for this area are to cover with nominal thickness of barkwood mulch to allow treatment to continue. It is recommended that restrictions are to be put in place as part of management operations to permanently

Remediation Strategy

prohibit access to this area by site personnel. A record that this area has not been developed/remediated must be included in operations and maintenance manual for site to inform any future maintenance requirements. Where this area is to be developed or used in the future it must be remediated in accordance with the specification herein. The approximate 'undevelopable' area requiring access prohibitive restrictions regarding access is shown in Curtins Engineered Capping to Soft Landscaping in Tree Root Protection Zones Drawing Ref. 078695-CUR-00-XX-DR-GE-009-V01 enclosed in *Appendix A*.

The above requirements for soft landscaping and requirements in existing tree root protection zones are summarised in Table 5.2.

Table 5.2 Proposed Engineered Capping/ Access Restrictions for Proposed Soft Landscaping Areas

Location	Remedial Measures Required	Rationale
Typical New Soft Landscaped Areas (Where no New Trees are Proposed)	Provision of a minimum 450mm clean capping with underlying high visibility geotextile or 100mm granular break layer. The capping layer may comprise of a combination of suitable subsoil and topsoil but topsoil should be of a minimum 150mm thickness. The underlying geotextile should be high visibility to act as a warning to future ground workers. Alternatively, an aggregate break layer (of c.100mm thickness) can be used to act as an anti-dig layer instead of the geotextile. Capping depth may need to be extended accordingly to support root growth, subject to landscape architects requirements.	Remove potential for exposure of on-site receptors via direct contact, dermal uptake and soil and dust ingestion and inhalation. Geotextile/break layer to prevent soil mixing and obstruct future excavation to made ground soils.
Where New Trees are Proposed	Provision of a minimum of 900mm clean capping comprised a minimum of 150mm topsoil over subsoil. No break layer or geotextile needed.	Remove potential for exposure of on-site receptors via direct contact, dermal uptake and soil and dust ingestion and inhalation. Depth sufficient to support tree growth.

Remediation Strategy

Location	Remedial Measures Required	Rationale
Within Root Protection Zones for Trees to be maintained North of Unit 02	Thickness of capping to be reduced to allow for a scrape off and existing soils and placement of nominal thickness of around 150mm topsoil.	A root protection zone applies to the existing trees, capping in line with other areas may cause damage to the trees.
Within Root Protection Zone for Trees to be maintained west of Unit 09	Restrictions are to be put in place as part of management operations to permanently prohibit access to this area by site personnel. A record that this area has not been developed/remediated must be included in operations and maintenance manual for site to inform any future maintenance requirements.	This area (circa 75m x 6m) is currently 'undevelopable' due to ongoing Japanese Knotweed treatment (spraying).

The engineered capping must meet the specification outlined in *Section 6.0*.

Where landscaping proposals change and any further new areas of planting or soft landscaping are proposed then capping should be extended as necessary.

5.3 Remedial Action 3 – Ground Gas Protection Measures

The primary Potential Pollutant Linkage (PPL) identified at the site relates to the acute risk of explosion and/or asphyxiation of property and end-users through the vertical and horizontal migration of hazardous gases (asphyxiating) from soil gas sources as identified in PPL 3 (*Table 4.1*) into proposed buildings on site. This concluded that all new buildings onsite require CS2 ground gas protection.

In this case, carbon dioxide was identified as the primary hazardous gas and therefore, gas protection measures are to be implemented during the development of the site to mitigate the risk to the property and end-users.

It is recommended that the building type is classified as *Type D Industrial Style* building, in accordance with BS;8485:2015 +A1:2019 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

On this basis, a **minimum protection score of 1.5 points** should be achieved in non-ventilated areas as a minimum, in accordance with BS 8485. A minimum of two types of protection are required from i) a structural barrier, ii) ventilation measures, iii) gas membrane.

The chosen protection elements at the time of writing were understood to include a i) structural barrier-cast in situ ground bearing floor slab (0.5 points) and ii) gas resistant membrane (2 points).

5.3.1 Gas Membrane Specification

Where a gas resistant membrane is adopted, it must meet all the following criteria:

- i) Sufficiently impervious to methane and carbon dioxide with a methane gas transmission rate $<40.0 \text{ ml/day/m}^2/\text{atm}$ (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method);
- ii) Capable after installation of providing a complete barrier to the entry of the relevant gas;
- iii) Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;
- iv) Sufficiently strong to withstand in service stresses (e.g. due to ground settlement if placed below a floor slab);
- v) Sufficiently strong to withstand the installation process and following construction activities until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, and dropping tools);
- vi) Chemically resistant to degradation by other contaminants that might be present; and
- vii) Verified in accordance with CIRIA C735.

If the above criteria are met (as set out within BS8485) then a gas resistant membrane, that is correctly installed and verified, can achieve *2 points*.

It is recommended that an appropriately experienced and qualified workforce is employed to install gas protection systems. Installers should hold relevant qualifications such as Cskills Awards L2 NVQ diploma for the installation of gas membranes.

5.4 Remedial Action 4 – Contaminant Resistant Water Supply Pipes

The primary Potential Pollutant Linkage PPL 4 relates to the possible degradation of polyethylene water supply pipes caused by contamination on site, specifically elevated concentrations of EC5-EC10, EC10-EC16 and EC16-EC40 aliphatic and aromatic hydrocarbons. Where such contamination migrates into the water supply it could be ingested by site users. Contaminant resistant water supply pipes should be adopted such as barrier pipe.

It is recommended that the completed United Utilities (UU) risk assessment enclosed in Appendix D is submitted to UU and their exact requirements confirmed for the site.

6.0 Specification for Site Won and Imported Material

This section outlines the required chemical testing specification that the proposed engineered capping must meet to satisfy Remedial Action 2 along with a chemical testing specification for imported general fill materials. The Earthworks Specification (Reference 2) should be consulted for details of the required geotechnical specification for general fill materials.

6.1 Sourcing of Materials

6.1.1 Off-Site Sources

It is anticipated that materials may be imported to the site for use in constructing the clean engineered capping across the site's soft landscaping areas. It is strongly recommended that materials are sourced from reputable suppliers and comprise materials that have been suitably processed to produce standardised materials.

It is not recommended that materials are imported directly from 'donor' development sites. Imported material will also require verification testing to ensure suitability for reuse, and it is strongly advised that the Contractor undertake their own independent verification testing if accepting material from a third party, rather than relying on supplier reports.

It is anticipated that crushed hardcore stone and brick may be imported for use in earthworks such as in construction of piling mat.

6.1.2 On-Site Sources

Based on the findings of the Site Investigation, it is considered highly unlikely that the general shallow Made Ground could be considered 'uncontaminated', 'clean' or 'suitable' material for re-use as a subsoil or topsoil in soft landscaped areas due to the presence of asbestos fibres at a number of locations across the site as well as due to the physical natures of the existing site soils.

6.2 Imported Topsoil

Imported Topsoil will invariably be required and should be supplied and placed in accordance with the Architects' specification but generally it is anticipated that all topsoil will be a minimum of 150mm thick in proposed soft landscaped areas (as part of the 450mm overall layer thicknesses as detailed in *Section 4.0, or 150mm cover thickness in tree root protection zones*). Where topsoil is imported, it is to be 'Multipurpose' in accordance with BS 3882:2015 'Specification for Topsoil and Requirements for Use'.

The topsoil should also be confirmed to be 'suitable for use' as per the analysis outlined in *Section 6.5*.

6.3 Imported Subsoil

Where imported subsoil is required as part of the growing medium this can be cohesive or granular but should be free-draining and confirmed to be 'suitable for use' as per the analysis outlined in *Section 6.5* and compliant with BS 8601:2013 'Specification for subsoil and requirements for use'.

6.4 Physical Composition of Granular Capping in Soft Landscaped Areas

It is anticipated granular capping used as a granular break layer (minimum 100mm thickness recommended) it will meet the requirements of 'Selected granular material (coarse grading)' as a 6F2/6F5 material, meeting the requirements of Table 6/1 of 'Series 600 of the Specification for Highways Work' (2016).

6.5 Chemical Composition of Materials

All materials used in earthworks or capping should not contain concentrations of contaminants that present an unacceptable risk to the health of future site occupants or off-site receptors.

The Contractor shall be responsible for demonstrating that imported material is 'clean' and therefore suitable for use as part of the engineered capping or else as fill material. This will include the recovery of samples for laboratory testing from both the material source and verification testing of material following delivery to site. The required testing frequencies for materials source types are detailed below. Other sources may be applicable, however testing frequencies shall be confirmed with the Engineer prior to acceptance.

Table 6.5.1 – Environmental chemistry testing frequency for imported aggregate and soils

Source	Testing Frequency
Virgin Quarried Material	On-site Validation: 1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.
Imported or Site Won Crushed Hardcore Stone & Brick	On-site Validation: one sample every 500m ³ used (or a minimum of 4 No. samples whichever is greater).
Imported Topsoil/Subsoil (Greenfield/Manufactured)	On Site Verification: One sample every 200m ³ used (or a minimum of 3 No. samples whichever is greater), testing to be undertaken once material is imported to site.
Imported Topsoil/Subsoil (Remediated/Brownfield/Unknown)	On Site Verification: One sample every 150m ³ used (or a minimum of 3 No. samples whichever is greater), testing to be undertaken once material is imported to site.

Remediation Strategy

The environmental chemistry testing requirements are as *Table 6.5.2*. Additions to the suite and frequency of sampling may be required based on the source of the imported materials. For example, if the imported Topsoil is not naturally sourced, e.g. recycled soil, further chemical determinants may be added to the chemical analysis suite at the discretion of the Engineer.

Table 6.5.2 – *Environmental chemistry analysis suite for imported soils.*

Suite Reference	Environmental Chemistry Analysis
Virgin Quarried Material	Total metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron.
Crushed Hardcore, Stone, Brick	Total metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron; pH Soil Organic Matter Asbestos Screening Polycyclic Aromatic Hydrocarbons by GC-MS (Detection Limit 0.1mg/kg for each compound) Total Petrol Hydrocarbons (Full TPHCWG analysis – aromatic/aliphatic split, Detection Limit 0.01mg/kg for each banding C5 to C10 and 1mg/kg for bandings above C10)
Greenfield, Brownfield or Manufactured Soils	Total metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron; pH Soil Organic Matter Asbestos Screening Polycyclic Aromatic Hydrocarbons by GC-MS (Detection Limit 0.1mg/kg for each compound) Total Petrol Hydrocarbons (Full TPHCWG analysis – aromatic/aliphatic split, Detection Limit 0.01mg/kg for each banding C5 to C10 and 1mg/kg for bandings above C10)

Assessment criteria: Concentrations of the above determinants shall not exceed the ‘*Residential without plant uptake*’ screening criteria (contained within Appendix B).

Definition of ‘clean’: Where ALL concentrations are less than these values the soils shall be defined as ‘clean’.

Soil organic matter (SOM): A review of the thresholds may be made for specific soil sources whereby the Soil Organic Matter is proving to be routinely above 6%.

6.6 Validation of Capping Thickness in Soft Landscaped Areas

Confirmatory analysis outlined previously is required to confirm the suitability of the capping layer.

Evidence that the specified depth of capping has been provided will be required.

Evidence could either be in the form of topographic surveys at the base of excavations together with material order sheets (for break layers or geo-textiles) and the final finish levels or hand excavated trial pits advanced in areas where material has been placed.

The pits shall be excavated to the base of the interface between the existing Made Ground and the engineered capping layer with the granular break layer clearly visible.

Remediation Strategy

A photographic record of the hand excavated trial pits would also be required in accordance with the best practice examples.

7.0 Re-use of Site Soils

It is understood that there is currently the intention to re-use site won made ground materials during the cut & fill to achieve desired site levels. Volumes and exact locations where soils are to be re-used are still being determined. Curtins Earthworks Specification (Reference 2) should be referred to for further detail together with Curtins Cut & Fill drawings.

Based on the geochemical testing results presented as part of this Remediation Strategy it is considered that in the majority there is no specific requirement to remove soils from site because of them presenting an unacceptable risk to human health or the environment, where beneath hardstanding or engineered capping. They should however be suitably managed due to the presence of Asbestos Containing Material (ACM) debris as outlined in Section 4.0.

The re-use of site-won soils may therefore be undertaken if the following principles are met:

- i. The geotechnical suitability of the material needs to be confirmed;
- ii. The re-use of the material needs to be covered as part of the planning approval, e.g. site levels maintained within agreed limits;
- iii. The volume of the material being re-used needs to be confirmed and traceable; and
- iv. Regulatory approval from the relevant authorities has been sought.

These principles are outlined within the CL:AIRE Definition of Waste Code of Practice (version 2) and if and where the re-use of site-won soils is proposed as part of the development works it is recommended that a Materials Management Plan is produced in line with the Definition of Waste Code of Practice to detail and document the process, following a 'Use on the Site of Origin' scenario. Although the site is made up of deep infilled ground it is not a registered landfill site and as such re-use of soils under this mechanism is likely be permitted by the Environment Agency, subject to written their approval.

8.0 Strategy for Handling Potentially Contaminated Soils and Contaminative Incidents on Site

8.1 Contaminated Soils

Surplus soils to be removed from site, which have been identified as unsuitable for re-use should be loaded onto a lorry, covered securely and transported directly to the landfill facility.

Where stockpiling is unavoidable, the stockpile should be located on an impermeable membrane and be covered also with a low permeability membrane at the end of each working day. Where soils are wet when excavated, measures should be taken to ensure there is no runoff from the soils onto the surrounding soils.

Duty of Care: Under his duty of care, the Principal Contractor shall ensure the proper and safe disposal of waste from each site after it has been passed on to another party. In this respect details of the landfill facility to be used and the company disposing of the waste with regard to hazardous and non-hazardous waste shall be provided to the Site Manager. Copies of Consignment Notices for special waste and Waste Transfer Notes for hazardous and non-hazardous waste shall be kept on site for review by Curtins Consulting.

Curtins waste classification report (Reference 4) should be referred to for indicative classifications of materials for off-site disposal.

8.2 Contaminative Incidents

It is possible that some below ground features / structures exist that have not been recorded on plans and have not been encountered during the ground investigation works or demolition works. It is possible that further unknown/unrecorded substructures (e.g. fuel tanks) may exist which if ruptured may release materials that could contaminate the surrounding soils and groundwater (petroleum hydrocarbons, solvents, for example). In the unlikely event that this occurs an outline strategy is detailed below.

Where such a tank/pipework is damaged during excavation and the contents are released into the surrounding soil, the tank/pipework should be immediately pumped dry into another suitable container and a trench with a low permeability base formed around the tank/pipework to prevent seepage laterally and to collect the contaminant. Where groundwater is encountered in the trench, it should be pumped into a suitable container and tested for the contaminant. All soils affected shall then be tested and removed from site as appropriate.

Where the damage is caused to the underside of a tank and seepage is vertical, the contaminants may present a risk of polluting the groundwater. In this instance and subject to the findings of a risk assessment boreholes may be required to probe and intercept the contaminant. The contaminant will then be pumped into suitable containers.

Remediation Strategy

The procedure outlined in *Section 8.3* should also be adhered too and the Engineer shall approve all proposals for such remediation.

8.3 Unexpected Contamination & Watching Brief

In the event that material is revealed on the site of a nature that does not accord with the previously observed and recorded descriptions the following procedure is to be complied with.

- a) Cease and make safe all excavations in this location and report observations to the Site Manager.
- b) The Site Manager is to notify the Engineer.
- c) Under guidance of the Engineer take representative samples of the suspect materials and forward to a suitably accredited laboratory for analysis.
- d) Manchester City Council and if relevant the Environment Agency are to be kept fully informed of any site such occurrences. Manchester City Council must agree the strategy for dealing with unexpected contamination before works continue in that area.
- e) Await Engineers instructions with respect to re-commencement of the works and or removal from of suspect material to a suitably licensed disposal facility (following guidance outlined in Section 8.1 above).

It is recommended that in addition to the above a 'watching brief' for unexpected contamination is undertaken. It is recommended that this includes periodic site visits undertaken by the engineer during the groundworks phase such as during cut & fill and site preparation as well as visiting site as soon as potential contamination is observed by the contractor. Records of any unexpected contamination must be included within the Remediation Completion Report.

9.0 Verification

Validation visits shall be undertaken by an appropriately qualified environmental engineer throughout the construction phase to ensure that the requirements of the Remediation Strategy have been implemented at the site. This includes periodic visits/watching brief during earthworks. It is anticipated records of the following will be taken during the below phases of work:

- Placement of the requisite depths of clean capping material in required areas of proposed soft landscaping and in existing tree root protection zones;
- Documentation of general works including records from watching brief, asbestos management procedures during the works and records of contaminative incidents and any unexpected contamination; and
- On installation of gas protection measures (gas resistant membrane & ground bearing floor slab).
- On installation of contaminant resistant water supply pipes.
- On removal of soils from site for off-site disposal.
- On inclusion of measures to prohibit access to the 'undevelopable area'.

All associated documentation pertaining to the above will be supplied to the Engineer and incorporated within a Completion Report.

Confirmatory analysis is required to confirm the suitability of any imported material, the results of which will be included within the Completion Report. Any additional, confirmatory testing will also be included herein.

Verification through either hand excavated trial pits or comparison of reduced and final level surveys will all be included within the Completion Report to confirm the provision of a requisite depth of clean capping.

Verification of all implemented gas protection measures will be required to ensure remediation has been undertaken as specified herein and demonstrate the effectiveness of the remediation (gas protection measures).

To verify the gas protection measures, it is assumed that the following will be undertaken:

- An appropriately experienced and qualified workforce is employed to install gas protection systems. Installers should hold relevant qualifications such as Cskills Awards L2 NVQ diploma for the installation of gas membranes.

The Characteristic Situation 2 protection measures installed within any new building onsite should be in accordance with CIRIA C735 much of the verification may be carried out by on site staff (appropriately trained and experienced) with independent inspection from a third party/Curtins to review and compile all records.

The following verification records should therefore be obtained by the specialist installer contractor/on site staff:

Remediation Strategy

- Photographic log of installation and testing if undertaken, of gas protection measures (ventilation/gas membrane).
- Internal inspection and verification records including any discrepancies and non-conformities in accordance with CIRIA C735.

The above records should be reviewed by an independent third party/Curtins which should include visits to site to provide a secondary visual verification.

The frequency and timing of visits by Curtins shall be determined following confirmation of the construction phase programme and the chosen protection elements.

Where specialised installation staff are not used a revision to this plan/schedule will likely be required and validation visits potentially increased.

10.0 Reporting

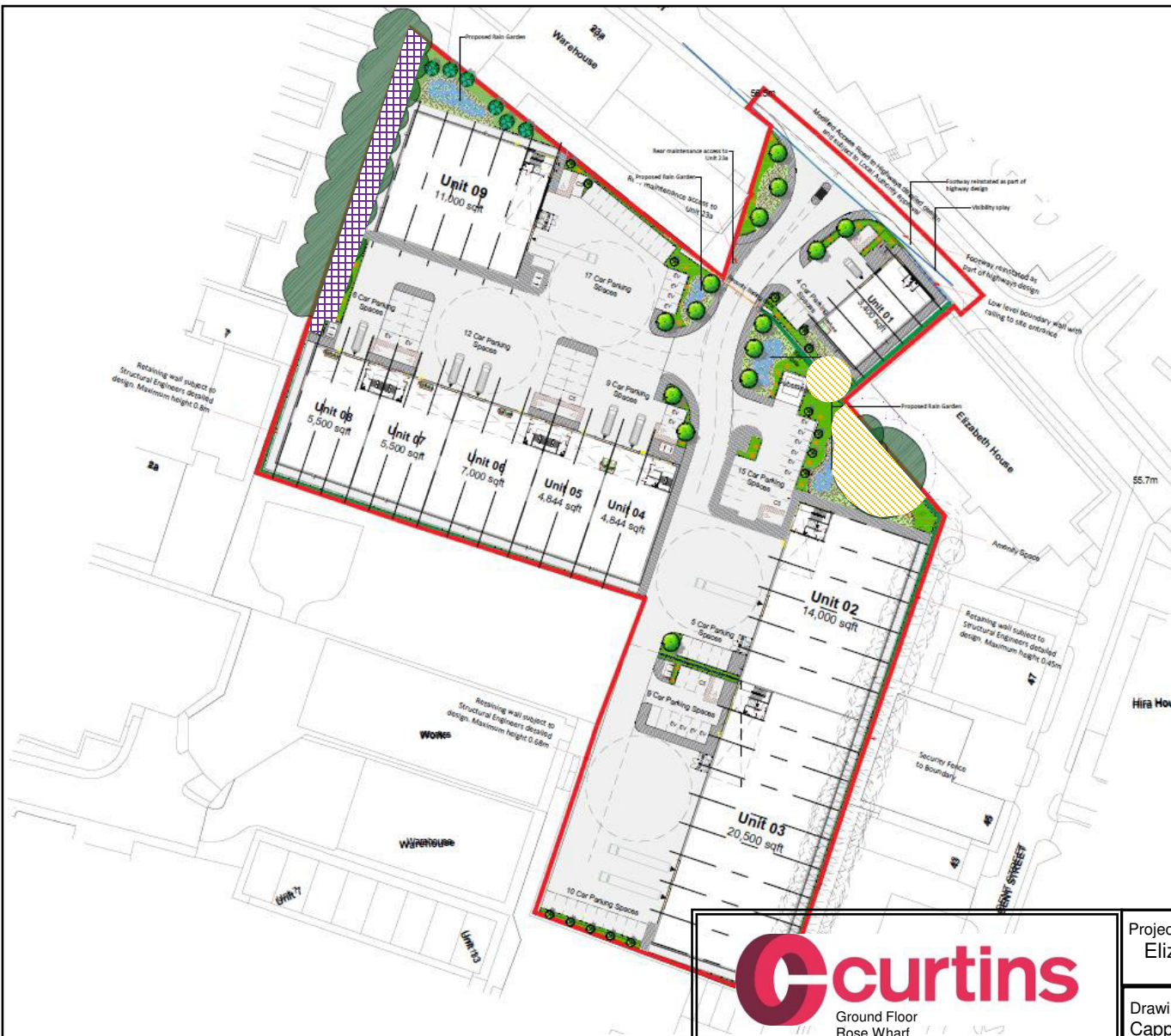
A Completion Report will be required on completion of the works confirming that the remedial works have been completed satisfactorily. The report will contain information including the following:

- Confirmation that the gas protection system has been installed as specified and the required points of protection are met, verified through a visual inspection with associated photographic record. This should include inspection and review of site records on the ventilation measures and or gas membrane.
- Specification and details of the gas membrane used where applicable;
- Confirmation that the capping has been installed as specified within the various proposed soft landscaped areas, including capping thickness validation records and photographs;
- Confirmation that access is prohibited for site users to 'undevelopable' area where no remediation has taken place, along with confirmation that this is included in the sites operations and maintenance manual;
- Confirmation of imported capping materials suitability for soft landscaped areas and confirmation of chemical suitability of imported materials used in earthworks (i.e. as general fill) including environmental chemistry testing results;
- Details and documentation of asbestos management measures utilised during the works;
- Details and documentation of contaminant resistant water supply pipes used;
- Confirmation that the remediation has been undertaken satisfactorily and in accordance with the Remediation Statement;
- Confirmation that the remediation objective has been achieved (see *Section 5.0*);
- Details of any unexpected contamination encountered on site and appropriate measures taken to respond; and
- Revised conceptual model showing no potentially significant contaminant linkages remain at the site.

It should be noted that the above list does not include the requirements of an Earthworks Completion report and Materials Management Completion report (where soils are re-used under an MMP) which are also likely to be required, in addition to the above remediation completion report.

Appendix A – Drawings & Specifications

- *Curtins Exploratory Hole Location Plan, Elizabeth Street, Cheetham Hill, Ref. 078695-CUR-00-XX-DR-GE-005-V01*
- *Curtins Engineered Capping to Soft Landscaping in Tree Root Protection Zones Drawing Ref. 078695-CUR-00-XX-DR-GE-009-V01*
- *TPM Landscape Architects Limited, Landscape Layout, Elisabeth Street Cheetham Hill, Ref. 4018 101, Rev C dated 29.11.21*



Key:



Engineered capping in this area to comprise strip and removal of existing soils followed by placement of circa 150mm clean soils.



Area not currently developable due to on going Japanese Knotweed treatment/spraying. Barkwood mulch to be placed at surface and restrictions to be put in place as part of management operations to permanently prohibit access by site personnel.

Notes:

- For further detail on proposals for tree root protection zones consult Curtins Remediation Strategy report.
- All other soft landscaped areas should include engineered capping layer in compliance with Curtins Remediation Strategy.



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Project:
Elizabeth Street, Cheetham Hill

Status:
DRAFT

Drawing Title: Proposals for Engineered
Capping & Access Restrictions in
Existing Tree Root Protection Zones

Drawn By: NF	Checked By: RA
Designed By: NF	Date: 27/09/2022
Scale: NTS	

Project No: Originator: Zone: Level: Type: Discipline: Category/Number: Rev:

078695-CUR-00-XX-DR-GE-009-P01

GENERAL NOTES:

Rev:	Description:	Date:	By:
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LEGEND	
	Site Boundary
	Existing Trees to be Removed
	Existing Trees to be Retained
	Proposed Large Trees (set in soft landscaping) Trees to be planted as 16-18cm girth, Extra Heavy Standard, 4-6m high with 2.5m clear stem. Trees to be staked with suitable rubber ties
	Proposed Native Trees Trees to be planted as 14-16cm girth, Extra Heavy Standard, 4.5-5m high with 2.5m clear stem. Trees to be staked with suitable rubber ties
	Proposed Small Ornamental Trees To be multi-stem specimen, 200-250cm high.
	Proposed Ornamental Shrubs Proposed shrubs and flowering herbaceous plants to be planted as 3-SL pots at 3-5 per sq.m. planted with individual specimen shrubs.
	Proposed Native Shrub Mix To be planted as bareroot stock, 60-80cm, at 2 p/m², and protect with spiral guards
	Proposed Hedgerow To be planted as 100-120cm SL pots, at 3 plants per linear m.
	Proposed Amenity Grass
	Proposed Wildflower Meadow To be Emorsgate EM2 Standard General Purpose Meadow Mix, supplied by Emorsgate or similar approved. Including 80% of ornamental grasses and 20% of wildflowers. Sowing rate 4/gm2.
	Proposed Wet-tolerant Plants Proposed mix of shrubs and perennial flowers able to withstand short periods of inundation.
	Proposed Linear Flag Paving Manhattan flag paving, in various plan sizes, 80mm deep, in Silver colour, by Tobermore or similar approved.
	Proposed Tarmac/ Concrete To Engineers details
	Proposed Fence To Engineers details
	Picnic Bench Seating Picnic bench style tables and benches, by Streetlife or similar approved.

- GENERAL NOTES**
- This drawing is the copyright of tpm landscape Ltd and cannot be reproduced in any form without the consent of the company.
 - This drawing is to be read in conjunction with detail landscape drawings, details and specification.
 - This drawing is to be read in conjunction with all relevant Architects', Engineer's, Specialists, Bills of Quantities and Specifications.
 - The insertion of any firm or proprietary brand on this drawing is an indication of the class or quality required and does not exclude the use of alternative materials that are equal in performance, quality and appearance, provided that they have been approved in writing by the Landscape Architect.
 - The Contractor is responsible for accurately ascertaining the position of underground services and responding to all relevant service easement requirements.
 - All dimensions are in millimetres unless stated otherwise, for the purposes of construction this drawing must not be scaled and only written dimensions used. Written and scaled dimensions to be checked on site, any discrepancies reported prior to work commencing. IF IN DOUBT PLEASE ASK.
 - All work and materials are to be in accordance with the relevant British Standards and Code of Practice.
 - All Proprietary products are to be used strictly in accordance with the manufacturer's instructions and details.

REVISION NOTES			
Rev	By	Description	Date
c	ct	tree root zones added	22-9-22
B	ct	new layout hard areas	16-6-22
A	TJ	Seating area added adjacent to Unit 2 & tree removed from vis splay	27.01.22

Client
Kier Property

Project
Elisabeth St, Cheetham Hill

Description
Landscape Layout

Status
For Approval

Scale @ A1 1:500	Drawn JS	Checked CT	Date 29.11.21
Job number 4018	Drawing number 101	Revision C	

Appendix B – ‘Residential Without Plant Uptake’ Screening Criteria for Imported Materials

Adopted Soil Generic Assessment Criteria
Sandy loam with 6% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130⁽¹⁰⁾	180⁽¹⁰⁾	53⁽¹¹⁾	980⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₆	160	160	3900	12000	600000	180000
EC ₅₋₆ - EC ₈	530	530	13000	40000	620000	320000
EC ₅₋₈ - EC ₁₀	150	150	1700	11000	13000	21000
EC ₁₀₋₁₀ - EC ₁₂	760	770	7300	47000	13000	24000
EC ₁₂₋₁₂ - EC ₁₆	4300	4400	13000	90000	13000	26000
EC ₅₋₁₆ - EC ₃₅	110000	110000	270000	1800000	250000	490000
EC ₃₅₋₃₅ - EC ₄₄	110000	110000	270000	1800000	250000	490000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅₋₅ - EC ₇	300	1400	57	86000	56000	92000
EC ₅₋₇ - EC ₈	660	3900	120	180000	56000	100000
EC ₅₋₈ - EC ₁₀	190	270	51	17000	5000	9300
EC ₁₀₋₁₀ - EC ₁₂	380	1200	74	34000	5000	10000
EC ₁₂₋₁₂ - EC ₁₆	660	2500	130	38000	5000	10000
EC ₅₋₁₆ - EC ₂₁	930	1900	260	28000	3800	7800
EC ₂₁₋₂₁ - EC ₃₅	1700	1900	1600	28000	3800	7900
EC ₃₅₋₃₅ - EC ₄₄	1700	1900	1600	28000	3800	7900
Aliph + Arom EC >44-70	1900	1900	3000	28000	3800	7900
Aromatic						
Benzene	0.33 0.87	1.0 3.3	0.07 0.18	95 98	73 140	110 230
Ethyl benzene	350	840	90	2800⁽⁸⁾ [66000]	2800⁽⁸⁾ [25000]	2800⁽⁸⁾ [27000]
Toluene	610	2700	120	4400⁽⁸⁾ [190000]	4400⁽⁸⁾ [56000]	4400⁽⁸⁾ [100000]
Xylene ⁽⁹⁾	230	290	160	2600⁽⁸⁾ [32000]	2600⁽⁸⁾ [43000]	2600⁽⁸⁾ [31000]
Phenol	420	520	280	3200⁽¹⁴⁾ (38000)	3200⁽¹⁴⁾ (10000)	3200⁽¹⁴⁾ (9300)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	13	13	24	1100	4900	3000
Acenaphthylene	920	6000	160	100000	15000	30000
Acenaphthene	1100	6000	200	100000	15000	30000
Fluorene	860	4500	160	71000	9900	20000
Phenanthrene	440	1500	90	23000	3100	6300
Anthracene	11000	37000	2200	540000	74000	150000
Fluoranthene	890	1600	290	23000	3100	6400
Pyrene	2000	3800	620	54000	7400	15000
Benz(a)anthracene	13	15	13	180	29	62
Chrysene	27	32	19	350	57	120
Benzo(b)fluoranthene	3.7	4.0	3.9	45	7.2	16.0
Benzo(k)fluoranthene	100	110	130	1200	190	440
Benzo(a)pyrene	3.0 5.0	3.2 5.3	3.5 5.7	36 77	5.7 10	13 21
Indeno(123cd)pyrene	41	46	39	510	82	180
Dibenzo(ah)anthracene	0.3	0.32	0.43	3.6	0.58	1.4
Benzo(ghi)perylene	350	360	640	4000	640	1600
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.0014	0.0015	0.0018	0.12	3.5	5.4
Trichloroethene (TCE)	0.075	0.08	0.21	5.7	120	120
1,1,1,2 Tetrachlorethane	6.4	8.2	4.4	560	1400	2100
Tetrachlorethane (PCE)	0.90	0.92	3.6	95	1400	1500
1,1,1 Trichlorethane	39	40	240	3000	140000	100000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs**
- Soil organic matter (SOM) is assumed to be 6% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 2.5% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 <u>21</u>	6 <u>21</u>	1.8 <u>170</u>	33 <u>49</u>	7.7 <u>21</u>	220 <u>250</u>
Lead	<u>200</u>	<u>310</u>	<u>80</u>	<u>2,300</u>	<u>630</u>	<u>1,300</u>
Mercury (elemental)	1	1	26	26	16	26 ⁽⁸⁾ [30]
Mercury (inorganic)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 <u>79</u>	170 <u>170</u>
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
<i>Aliphatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₆	78	78	1700	5900	590000	130000
EC ₆ - EC ₈	230	230	5600	17000	610000	220000
EC ₈ - EC ₁₀	65	65	770	4800	13000	18000
EC ₁₀ - EC ₁₂	330	330	4400	23000	13000	23000
EC ₁₂ - EC ₁₆	2400	2400	13000	82000	13000	25000
EC ₁₆ - EC ₃₅	92000	92000	270000	1700000	250000	480000
EC ₃₅ - EC ₄₄	92000	92000	270000	1700000	250000	480000
<i>Aromatic risk banded hydrocarbons - TPHCWG method</i>						
EC ₅ - EC ₇	140	690	27	46000	56000	84000
EC ₇ - EC ₈	290	1800	51	110000	56000	95000
EC ₈ - EC ₁₀	83	110	21	8100	5000	8500
EC ₁₀ - EC ₁₂	180	590	31	28000	5000	9700
EC ₁₂ - EC ₁₆	330	2300	57	37000	5100	10000
EC ₁₆ - EC ₂₁	540	1900	110	28000	3800	7700
EC ₂₁ - EC ₃₅	1500	1900	820	28000	3800	7800
EC ₃₅ - EC ₄₄	1500	1900	820	28000	3800	7800
Aliph + Arom EC >44-70	1800	1900	2100	28000	3800	7800
<i>Aromatic</i>						
Benzene	0.16	0.49	0.035	50	72	100
Ethyl benzene	150	380	39	1200⁽⁸⁾ [35000]	1200⁽⁸⁾ [24000]	1200⁽⁸⁾ [22000]
Toluene	270	1300	51	1900⁽⁸⁾ [110000]	1900⁽⁸⁾ [56000]	1900⁽⁸⁾ [95000]
Xylene ⁽⁹⁾	98	120	70	1200⁽⁸⁾ [14000]	1200⁽⁸⁾ [42000]	1200⁽⁸⁾ [23000]
Phenol	290	420	140	1500⁽¹⁴⁾ (35000)	1500⁽¹⁴⁾ (10000)	1500⁽¹⁴⁾ (8300)
<i>Polycyclic Aromatic Hydrocarbons (PAH)</i>						
Naphthalene	5.6	5.6	10	460	4900	1900
Acenaphthylene	420	4600	69	97000	15000	30000
Acenaphthene	510	4700	85	97000	15000	30000
Fluorene	400	3800	67	68000	9900	20000
Phenanthrene	220	1500	38	22000	3100	6200
Anthracene	5400	35000	950	540000	74000	150000
Fluoranthene	560	1600	130	23000	3100	6300
Pyrene	1200	3800	270	54000	7400	15000
Benz(a)anthracene	11	14	6.5	170	29	56
Chrysene	22	31	9.4	350	57	110
Benzo(b)fluoranthene	3.3	4.0	2.1	44	7.2	15
Benzo(k)fluoranthene	93	110	75	1200	190	410
Benzo(a)pyrene	2.7	3.2	2	35	5.7	12
Indeno(123cd)pyrene	36	46	21	510	82	170
Dibenzo(ah)anthracene	0.28	0.32	0.27	3.6	0.57	1.3
Benzo(ghi)perylene	340	360	470	4000	640	1500
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00087	0.001	0.001	0.077	3.5	5
Trichloroethene (TCE)	0.034	0.036	0.091	2.6	120	91
1,1,1,2 Tetrachlorethane	2.8	3.5	1.9	250	1400	1800
Tetrachlorethane (PCE)	0.39	0.4	1.5	42	1400	1100
1,1,1 Trichlorethane	18	18	110	1300	140000	76000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs
- Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Adopted Soil Generic Assessment Criteria
Sandy loam with 1% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
Aliphatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₆	42	42	730	3200	570000	95000
EC ₆₋₆ - EC ₈	100	100	2300	7800	600000	150000
EC ₈₋₈ - EC ₁₀	27	27	320	2000	13000	14000
EC ₁₀₋₁₀ - EC ₁₂	130	130	2200	9700	13000	21000
EC ₁₂₋₁₂ - EC ₁₆	1100	1100	11000	59000	13000	25000
EC ₁₆₋₁₆ - EC ₃₅	65000	65000	260000	1600000	250000	450000
EC ₃₅₋₃₅ - EC ₄₄	65000	65000	260000	1600000	250000	450000
Aromatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₇	70	370	13	26000	56000	76000
EC ₇₋₇ - EC ₈	130	860	22	56000	56000	87000
EC ₈₋₈ - EC ₁₀	34	47	8.6	3500	5000	7200
EC ₁₀₋₁₀ - EC ₁₂	74	250	13	16000	5000	9200
EC ₁₂₋₁₂ - EC ₁₆	140	1800	23	36000	5100	10000
EC ₁₆₋₁₆ - EC ₂₁	260	1900	46	28000	3800	7600
EC ₂₁₋₂₁ - EC ₃₅	1100	1900	370	28000	3800	7800
EC ₃₅₋₃₅ - EC ₄₄	1100	1900	370	28000	3800	7800
Aliph + Arom EC >44-70	1600	1900	1200	28000	3800	7800
Aromatic						
Benzene	0.08	0.3	0.017	28	72	90
Ethyl benzene	65	170	16	520⁽⁸⁾ [17000]	520⁽⁸⁾ [24000]	520⁽⁸⁾ [17000]
Toluene	120	610	22	860⁽⁸⁾ [59000]	860⁽⁸⁾ [56000]	860⁽⁸⁾ [87000]
Xylene ⁽⁹⁾	41	53	28	480⁽⁸⁾ [69000]	480⁽⁸⁾ [41000]	480⁽⁸⁾ [17000]
Phenol	180	310	66	760⁽¹⁴⁾ (31000)	760⁽¹⁴⁾ (10000)	760⁽¹⁴⁾ (7600)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	2.3	2.3	4.1	190	4900	1200
Acenaphthylene	170	2900	28	83000	15000	29000
Acenaphthene	210	3000	34	84000	15000	29000
Fluorene	170	2800	27	63000	9900	20000
Phenanthrene	95	1300	15	22000	3100	6200
Anthracene	2400	31000	380	520000	74000	150000
Fluoranthene	280	1500	52	23000	3100	6300
Pyrene	620	3700	110	54000	7400	15000
Benz(a)anthracene	7.2	11	2.9	170	29	49
Chrysene	15	30	4.1	350	57	93
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1	13
Benzo(k)fluoranthene	77	110	37	1200	190	370
Benzo(a)pyrene	2.2	3.2	0.97	35	5.7	11
Indeno(123cd)pyrene	27	45	9.5	500	82	150
Dibenzo(ah)anthracene	0.24	0.31	0.14	3.5	0.57	1.1
Benzo(ghi)perylene	320	360	290	3900	640	1400
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00064	0.00077	0.00055	0.059	3.5	4.8
Trichloroethene (TCE)	0.016	0.017	0.041	1.2	120	70
1,1,1,2 Tetrachlorethane	1.2	1.5	0.79	110	1400	1500
Tetrachlorethane (PCE)	0.18	0.18	0.65	19	1400	810
1,1,1 Trichlorethane	8.8	9	48	660	140000	57000

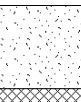
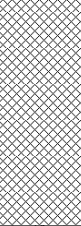
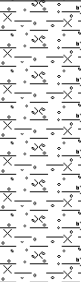
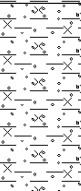
Notes

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- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs**
- Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Appendix C – Additional Site Investigation Information Under Existing Units

- *Curtins Borehole Logs WS201-WS206*
- *Environmental Chemistry Analysis for Soils, Envirolab Testing Certificate 22-07235-1*

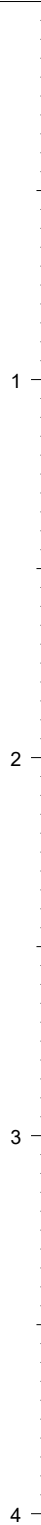
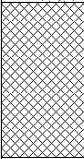
					Borehole Log			Borehole No. WS201 Sheet 1 of 1		
Project Name: Elizabeth St, Cheetham Hill					Project No. 080139		Co-ords: -		Hole Type WS	
Location: Cheetham Hill					Level:		Scale 1:20		Logged By RBJ	
Client: Kier Property					Dates: 20/07/2022 - 20/07/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.15			MADE GROUND: Grey Concrete.	1	
		0.30	ES		0.30			MAGE GROUND: Dark grey slightly clayey, sandy gravel with rare cobbles. Gravel is fine to coarse and angular to sub-angular of concrete, brick, slate, mudstone, siltstone and sandstone. Cobbles are angular to sub-rounded of mudstone and sandstone.		
					0.40			Plastic membrane 0.05m thick beneath concrete slab.		
								MADE GROUND: Grey asphalt.		
		0.85	ES					MADE GROUND: Dark brown silty very gravelly clay. Gravel is fine to coarse and angular to sub-rounded of ash, clinker, brick, concrete, sandstone and rare timber.		
		1.10	D						2	
					1.95			End of borehole at 1.95 m	3	
									4	
Remarks Location cleared with GPR and Cat. Hand dug service clearance pit excavated to 1.00m bgl. No groundwater encountered. Handheld Windowless Sampler used and maximum depth achieved at 1.95m bgl.										

					Borehole Log		Borehole No. WS202 Sheet 1 of 1	
Project Name: Elizabeth St, Cheetham Hill					Project No. 080139		Co-ords: -	
Location: Cheetham Hill					Level:		Hole Type WS	
Client: Kier Property					Dates: 20/07/2022 - 20/07/2022		Scale 1:20	
Client: Kier Property					Dates: 20/07/2022 - 20/07/2022		Logged By RBJ	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.22			MADE GROUND: Grey Concrete. <i>Plastic membrane 0.05m thick at 0.15m bgl inbetween concrete slabs.</i>
		0.70	ES		0.85			MADE GROUND: Dark brown slightly sandy gravel with rare cobbles. Gravel is fine to coarse and angular to sub-rounded of brick, ash, mudstone, siltstone, slate and concrete. Cobbles are angular to sub-rounded of concrete and sandstone.
		1.10 - 1.20	D		1.60			Stiff light brown mottled grey slightly gravelly silty CLAY. Gravel is fine and sub-angular of rare coal.
		2.00 - 2.10	D		2.10			Very stiff dark brown with occasional grey mottling slightly gravelly silty CLAY. Gravel is medium and rounded of siltstone.
								End of borehole at 2.10 m

Remarks

Location cleared with GPR and Cat. Hand dug service clearance pit excavated to 1.00m bgl. No groundwater encountered. Handheld Windowless Sampler used and maximum depth achieved at 2.10m bgl.



					Borehole Log			Borehole No. WS203 Sheet 1 of 1		
Project Name: Elizabeth St, Cheetham Hill					Project No. 080139		Co-ords: -		Hole Type WS	
Location: Cheetham Hill					Level:			Scale 1:20		
Client: Kier Property					Dates: 20/07/2022 - 20/07/2022			Logged By RBJ		
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.14			MADE GROUND: Grey Concrete.		
		0.28	ES					MADE GROUND: Light brown and grey very gravelly medium to coarse sand with occasional cobbles and boulders. Gravel is fine to coarse and angular to sub-rounded of brick, concrete, sandstone and siltstone. Cobbles and boulders of angular brick and concrete.		
		0.40	D							
					0.55			End of borehole at 0.55 m		
Remarks Location cleared with GPR and Cat. Hand dug service clearance pit excavated to 0.55m bgl. No groundwater encountered. Borehole terminated at 0.55m bgl within handpit due to large concrete cobbles unable to get out of the handpit.										
										

					Borehole Log		Borehole No. WS204 Sheet 1 of 1	
Project Name: Elizabeth St, Cheetham Hill					Project No. 080139		Co-ords: -	
Location: Cheetham Hill					Level:		Hole Type WS	
Client: Kier Property					Dates: 21/07/2022 - 21/07/2022		Scale 1:20	
Client: Kier Property					Dates: 21/07/2022 - 21/07/2022		Logged By RBJ	
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.45	ES		0.17			MADE GROUND: Grey Concrete.
					0.22			MADE GROUND: Light brown very sandy gravel. Gravel is fine to coarse and angular to sub-rounded of concrete and dolomite.
								<i>Plastic membrane 0.05m thick beneath concrete slab.</i>
					0.70			MADE GROUND: Dark brown very sandy gravel with occasional cobbles. Gravel is fine to coarse and angular to sub-angular of ash, brick, metal, plastic, sandstone and rare coal. Cobbles of angular brick.
					1.32			MADE GROUND: Firm dark brown and black slightly sandy silty very gravelly clay with occasional cobbles. Gravel is fine to coarse and angular to sub-angular of ash, brick, metal, plastic, sandstone and rare coal. Cobbles of angular siltstone.
		1.50	D		1.80		Stiff light brown mottled grey slightly gravelly silty CLAY. Gravel is coarse and sub-rounded of sandstone.	
					2.20		Stiff dark brown with occasional grey mottling slightly gravelly silty CLAY with rare cobbles. Gravel is fine to medium and rounded of siltstone and sandstone. Cobbles are sub-rounded of sandstone.	
					2.40		<i>Very stiff clay from 2.10m bgl.</i>	
							End of borehole at 2.40 m	

1

2

3

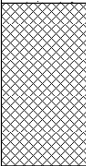
4

Remarks

Location cleared with GPR and Cat. Hand dug service clearance pit excavated to 1.00m bgl. No groundwater encountered. Handheld Windowless Sampler used and maximum depth achieved at 2.40m bgl.

						Borehole Log		Borehole No. WS205 Sheet 1 of 1	
Project Name: Elizabeth St, Cheetham Hill				Project No. 080139		Co-ords: 384228.65 - 400227.29		Hole Type WS	
Location: Cheetham Hill				Level: 57.07		Scale 1:20		Logged By RBJ	
Client: Kier Property				Dates: 21/07/2022 - 21/07/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15	56.92		MADE GROUND: Grey asphalt.	1
					0.22	56.85			
		0.50	ES						
		1.20		N=20 (3,5/5,4,5,6)					
		2.00		N=24 (6,5/5,5,6,8)	2.10	54.97			
							Stiff dark brown with occasional grey mottling slightly gravelly silty CLAY with rare cobbles. Gravel is fine to medium and rounded of siltstone and sandstone. Cobbles are sub-rounded of sandstone.	2	
							Very stiff clay from 2.50-3.00m bgl.		
		3.00 3.00 - 3.45	D	N=37 (7,7/8,11,9,9)			Stiff clay from 3.00m bgl.		
								3	
		3.50		N=50 (11,12/50 for 250mm)					
					3.75	53.32		End of borehole at 3.75 m	4

Remarks
Location cleared with GPR and Cat. Hand dug service clearance pit excavated to 1.00m bgl. No groundwater encountered. Terminated at 3.75m bgl due to SPT refusal.

					Borehole Log			Borehole No. WS206 Sheet 1 of 1		
Project Name: Elizabeth St, Cheetham Hill					Project No. 080139		Co-ords: -		Hole Type WS	
Location: Cheetham Hill					Level:		Scale 1:20		Logged By RBJ	
Client: Kier Property					Dates: 20/07/2022 - 20/07/2022					
Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
					0.42			MADE GROUND: Grey Concrete.	1	
					0.85		MADE GROUND: Dark brown silty very gravelly clay. Gravel is fine to coarse and angular to sub-rounded of ash, brick, concrete and sandstone. <i>Plastic membrane 0.05m thick beneath concrete slab.</i>			
								End of borehole at 0.85 m	2	
									3	
									4	
Remarks Location cleared with GPR and Cat. Hand dug service clearance pit excavated to 0.85m bgl. No groundwater encountered.										

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 22/07235
Issue Number: 1
Date: 01 August, 2022

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: Niall Farnworth/Rebecca Baksh-Jones
Project Name: Elizabeth Street, Cheetham Hill
Project Ref: 080139
Order No: EBMA3456
Date Samples Received: 25/07/22
Date Instructions Received: 25/07/22
Date Analysis Completed: 01/08/22

Approved by:



Holly Neary-King
Client Services Supervisor

Envirolab Job Number: 22/07235

Client Project Name: Elizabeth Street, Cheetham Hill

Client Project Ref: 080139

Lab Sample ID	22/07235/1	22/07235/2	22/07235/3	22/07235/4	22/07235/5			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS201	WS202	WS203	WS204	WS205					
Depth to Top	0.80	0.70	0.28	0.45	0.50					
Depth To Bottom										
Date Sampled	21-Jul-22	20-Jul-22	20-Jul-22	21-Jul-22	21-Jul-22					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	6ABE	4AB	4AB	4AB	4AB					
% Stones >10mm _A	11.1	22.9	42.1	<0.1	8.6			% w/w	0.1	A-T-044
pH _D ^{M#}	8.01	8.32	9.69	8.28	8.65			pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.34	0.05	0.02	0.12	0.04			g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	3	<1	2	<1			mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2			mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	6.5	5.4	1.0	11.6	2.8			% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	47	8	<1	39	7			mg/kg	1	A-T-024s
Boron (water soluble) _D	<1.0	<1.0	<1.0	<1.0	1.1			mg/kg	1	A-T-027s
Cadmium _D ^{M#}	1.6	1.7	0.8	3.3	0.9			mg/kg	0.5	A-T-024s
Copper _D ^{M#}	56	82	6	104	33			mg/kg	1	A-T-024s
Chromium _D ^{M#}	28	31	5	32	453			mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1			mg/kg	1	A-T-040s
Lead _D ^{M#}	126	291	19	313	1260			mg/kg	1	A-T-024s
Mercury _D	1.37	0.89	3.55	<0.17	2.88			mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	30	23	6	26	48			mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1			mg/kg	1	A-T-024s
Zinc _D ^{M#}	85	432	21	351	127			mg/kg	5	A-T-024s

Envirolab Job Number: 22/07235

Client Project Name: Elizabeth Street, Cheetham Hill

Client Project Ref: 080139

Lab Sample ID	22/07235/1	22/07235/2	22/07235/3	22/07235/4	22/07235/5			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS201	WS202	WS203	WS204	WS205					
Depth to Top	0.80	0.70	0.28	0.45	0.50					
Depth To Bottom										
Date Sampled	21-Jul-22	20-Jul-22	20-Jul-22	21-Jul-22	21-Jul-22					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	6ABE	4AB	4AB	4AB	4AB					
Asbestos in Soil (inc. matrix)										
Asbestos in soil _D [#]	NAD	NAD	NAD	Crocidolite	NAD					A-T-045
Asbestos Matrix (visual) _D	-	-	-	-	-					A-T-045
Asbestos Matrix (microscope) _D	-	-	-	Loose fibres	-					A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A					A-T-045
Asbestos in Soil Quantification % (Hand Picking & Weighing)										
Asbestos in soil % composition (hand picking and weighing) _D	-	-	-	<0.001	-			% w/w	0.001	A-T-054

Envirolab Job Number: 22/07235

Client Project Name: Elizabeth Street, Cheetham Hill

Client Project Ref: 080139

Lab Sample ID	22/07235/1	22/07235/2	22/07235/3	22/07235/4	22/07235/5			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS201	WS202	WS203	WS204	WS205					
Depth to Top	0.80	0.70	0.28	0.45	0.50					
Depth To Bottom										
Date Sampled	21-Jul-22	20-Jul-22	20-Jul-22	21-Jul-22	21-Jul-22					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	6ABE	4AB	4AB	4AB	4AB					
PAH-16MS										
Acenaphthene _A ^{M#}	0.27	0.37	0.96	0.80	0.14			mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.01	0.08	<0.01	0.08	0.06			mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.25	0.71	0.99	1.47	0.34			mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.58	2.32	1.33	3.19	1.19			mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.47	2.33	1.06	2.70	1.03			mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.55	2.43	1.04	2.93	1.13			mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.21	1.13	0.44	1.12	0.48			mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.16	0.72	0.35	0.88	0.33			mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.59	2.34	1.20	3.02	1.23			mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.04	0.24	0.09	0.23	0.10			mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	1.49	5.34	4.05	7.98	2.82			mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.15	0.36	0.68	0.74	0.13			mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.27	1.33	0.57	1.37	0.60			mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.06	0.14	1.10	1.05	<0.03			mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	1.26	3.43	4.41	6.66	1.76			mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	1.25	5.38	3.30	7.36	2.66			mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	7.61	28.6	21.6	41.6	14			mg/kg	0.01	A-T-019s

Envirolab Job Number: 22/07235

Client Project Name: Elizabeth Street, Cheetham Hill

Client Project Ref: 080139

Lab Sample ID	22/07235/1	22/07235/2	22/07235/3	22/07235/4	22/07235/5			Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS201	WS202	WS203	WS204	WS205					
Depth to Top	0.80	0.70	0.28	0.45	0.50					
Depth To Bottom										
Date Sampled	21-Jul-22	20-Jul-22	20-Jul-22	21-Jul-22	21-Jul-22					
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES					
Sample Matrix Code	6ABE	4AB	4AB	4AB	4AB					
TPH CWG with Clean Up										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	<1	<1	<1			mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	<1	<1			mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	3	1	3	2			mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	1	4	1	5	3			mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	4	20	4	57	9			mg/kg	1	A-T-055s
Total Aliphatics _A	5	27	6	66	15			mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	<1	<1	1	<1			mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	3	18	3	<1			mg/kg	1	A-T-055s
Aro >C12-C16 _A	3	27	52	20	5			mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	8	115	133	87	28			mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	18	270	230	227	83			mg/kg	1	A-T-055s
Total Aromatics _A	29	415	432	338	115			mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	35	443	439	404	130			mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01			mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Subscript "A" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these

humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	22/07235
Project:	Elizabeth Street, Cheetham Hill	Date Received:	25/07/2022 (am)
Clients Project No:	080139	Cool Box Temperatures (°C):	15.9

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/07235/1	22/07235/2	22/07235/3	22/07235/4	22/07235/5
Client Sample No					
Client Sample ID/Depth	WS201 0.80m	WS202 0.70m	WS203 0.28m	WS204 0.45m	WS205 0.50m
Date Sampled	21/07/22	20/07/22	20/07/22	21/07/22	21/07/22
A-T-019s	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
A-T-022s	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
A-T-024s	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
A-T-026s	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
A-T-027s	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
A-T-031s	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
A-T-032 OM	01/08/2022	01/08/2022	01/08/2022	28/07/2022	01/08/2022
A-T-040s	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
A-T-042sTCN	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022
A-T-044	27/07/2022	27/07/2022	27/07/2022	27/07/2022	27/07/2022
A-T-045	26/07/2022	26/07/2022	26/07/2022	26/07/2022	26/07/2022
A-T-050s	28/07/2022	28/07/2022	28/07/2022	28/07/2022	28/07/2022
A-T-054				01/08/2022	
A-T-055s	29/07/2022	29/07/2022	29/07/2022	29/07/2022	29/07/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Appendix D – United Utilities Water Supply Pipe Assessment

Supplementary guidance for the selection of water pipes in land potentially affected by contamination

Introduction

In January 2011, UK Water Industry Research (UKWIR) published “Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites” (Ref 10/WM/03/21; the ‘UKWIR Guidance’). Its aim is to ensure that the correct materials are selected for water pipes and components to be used below ground in brownfield sites to protect the quality of drinking water whilst taking into account the service life of the water distribution system. It supersedes the Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03 “Laying Pipes in Contaminated Land” which has been withdrawn.

The UKWIR Guidance is for use by developers, self-lay organisations, water companies and consultants when planning, designing and constructing water mains and/or services in brownfield sites. It defines brownfield sites as “land or premises that have previously been used or developed. They may also be vacant or derelict. However, they are not necessarily contaminated.” The UKWIR Guidance states that it does not apply to greenfield sites; however, we consider this supplementary guidance and the relevant sections of the UKWIR guidance as being equally suitable for application to those greenfield sites considered to be potentially affected by contamination. Where greenfield sites are not affected by contamination a preliminary risk assessment (see below) will suffice.

The UKWIR Guidance also states that there should be no departure from its provisions “*except where formally approved by the Water Company, such departure being technically justifiable or representing advances in knowledge or product development*”.

We have adopted the UKWIR Guidance in principle and produced this company specific supplementary guidance (the ‘UUW Guidance’) which includes the Risk Assessment for Water Pipes (the ‘RA’).

This guidance does not cover operative safety, health exposure modelling or accidental pipe damage.

Risk Assessment for Water Pipes in Land Potentially Affected by Contamination

Any application for new water supplies to a development (construction of new properties, or renovation or conversion of existing buildings) in land potentially affected by contamination shall include a completed RA.

As a minimum a desk study (preliminary risk assessment) shall be provided with the RA in accordance with the framework in Environment Agency publication “Model Procedures for the Management of Land Contamination” (ref: CLR11) that sets out whether the land through

which the pipes are to be laid may be affected by contamination. The application of the source, pathway, receptor concept will be an integral part of any pipeline risk assessment. For each potential source (the contamination) and each potential receptor (the water pipe), consideration shall be given to whether a potential pathway between source and receptor exists, or may exist in the future, linking the two. There are normally only three pathways by which contamination may come into contact with water pipes. These are direct contact with the soil or backfill, an excessive vapour phase or a contaminated groundwater regime. If none of these conditions exist on site (adopting the source, pathway, receptor concept) then it is likely that extended and/or targeted soil testing will not be required and a simple risk assessment will suffice. For those sites where land may be affected by contamination appropriate testing shall be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. The testing requirements are as described in the following section.

The signatories of the Water Supply Application Form and the RA must ensure that all assessments of land condition have been carried out in accordance with applicable current standards and guidelines by or under the direction of a suitably qualified competent person.

We require the competent person to be a) a chartered member of an appropriate professional body (such as the Institution of Civil Engineers, the Geological Society of London or the Royal Institution of Chartered Surveyors) with relevant experience of investigating contaminated sites or b) a Specialist in Land Condition (SiLC) with appropriate geo-environmental experience.

How to contact us about the information in this leaflet



DeveloperServicesWater@uuplc.co.uk



0345 072 6067

Opening hours:
8am-5pm Mon to Thurs
8am-4.30pm Fri

Testing Requirements

The soil, rock and if appropriate groundwater tests that are required on all sites where the potential for organic contamination has been identified in the desk study and where water pipes are proposed to be laid must be accredited by United Kingdom Accreditation Service (UKAS) as a minimum and where commercially available the Environment Agency's Monitoring Certification Service (MCERTS). These accredited tests should be undertaken for:

Banded hydrocarbons EC5-EC10, EC10-EC16, EC16-EC40 (Total aliphatic and aromatic hydrocarbons for each banding may be summed). Aliphatic/aromatic fractionation and subsequent banding may be required should a more detailed site specific risk assessment be undertaken. The bandings have been amended to take into account readily available laboratory tests. The equivalent carbon number (EC) is used to assess petroleum hydrocarbon mixtures rather than the actual number of carbon atoms in the molecule in line with guidance issued by the Environment Agency (2005).

Volatile organic compounds (VOCs) (method by head space or purge & trap GCMS) with tentative identification of compounds greater than 20µg/kg. The method used should be capable of detecting a wide range of compounds listed in US EPA Method 8260C or similar. The method should include analysis of naphthalene.

BTEX (Benzene, toluene, ethyl benzene and xylenes) plus MTBE (Methyl-tertiary butyl ether) (by head space GCMS)

Semi-Volatile Organic Compounds (SVOCs) (method by GCMS) with tentative identification of compounds greater than 20µg/kg The method used should be capable of detecting the compounds listed in US EPA Method 8270D or similar. The total concentration of SVOCs excludes polycyclic aromatic hydrocarbons, ethers, nitrobenzene, ketones, aldehydes, phenols, cresols and chlorinated phenols. Phenols, cresols and chlorinated phenols which are detected by the SVOC analysis are given their own assessment criteria.

We do not consider Table G1 and Table 3.1 of the UKWIR Guidance to be a definitive guide for assessing total concentrations. Table 1 in the RA below replaces Table 3.1 of the UKWIR Guidance.

Where previous site uses include the use, storage, treatment, disposal or manufacture of any of the following, appropriate testing for these substances will be required:

- Ethers, nitrobenzene, ketones, aldehydes and amines. Note that the presence of amines on any site at the proposed pipe depth +/- 1.0m precludes the use of polyethylene. The methods of analysis and method of calculation of total concentrations of these compounds will need to be agreed with UUW.

To comply with the testing requirements, the suites of tests that are required on all brownfield sites where wrapped steel, wrapped ductile iron or copper pipes are to be laid as minimum must include:

- pH, Conductivity and redox potential

Sufficiency of Testing

Water pipes are normally laid at between 0.75 and 1.35m from finished ground level to crown of pipe. Samples taken and tested must represent both a) the soil in which the water pipes are to be laid and b) the soil down to at least 500mm below the underside of the proposed pipe. Where the proposed depth of the pipes is unknown at the time of application, soil samples representative of the ground condition between surface level and 1.5m below finished ground level shall be taken as a minimum. Where appropriate (see UKWIR Guidance) groundwater sampling and groundwater monitoring will also be necessary. Photo-ionisation detection (PID) monitoring along the proposed route of the pipeline may be employed, though this does not provide a definitive guide to the suitability of water pipe materials.

Where required a sufficient number of test results should be obtained from the material in which the pipes are to be laid. CLAIRE/CIEH 2008 "Guidance on comparing soil contamination data with a critical concentration" may be used, where appropriate, to justify the number of soil samples tested; however, this statistical model should not be used on heterogeneous materials or used to average test results from different types of materials.

Further guidance on representative sampling is contained within BS10175:2011 Code of Practice for the Investigation of Potentially Contaminated Sites, the Department of the Environment's Contaminated Land Research Report "Sampling strategies for contaminated land" prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4; 1994) and the Environment Agency's "Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination" (ref: R&D Technical Report P5-066/TR; 2000).

Where remediation has been carried out on the site, the test results obtained from validation samples will be used in the assessment. Where a horizontal capping system has been or will be employed using materials spread across a site, sufficient samples will need to be taken to characterise the capping material used and the results presented to UUW. However, the sufficiency of sampling on the horizontal capping system, in which the pipeline will be placed, may be assessed on the basis of the source, quantity and type of materials used.

Detection Limits

Only positive concentrations, ie those above the limit of detection should be used in summation of VOC and SVOC (or other test groups of compounds ie phenols, cresols and chlorinated phenols). Laboratory methods shall provide a minimum limit of detection of 10µg/kg for each individual VOC or SVOC (or other test groups of compounds) quantitatively detected in accordance with the methods described above. For tentatively identified compounds (TICs), only those compounds with a concentration of 20µg/kg or greater shall be used in the summation of VOC and SVOC (or other test groups of compounds).

Protective Measures

Where polyethylene, ductile iron, steel or copper pipes are to be laid on a brownfield site or other land potentially affected by contamination (whether or not it has been remediated) and where the concentrations exceed the generic guideline values set out in Table 1 of the RA, the developer shall provide either:

- a) a robust risk assessment to show how any contaminants will not significantly impact on proposed water supplies or buried assets over the lifetime of the assets; or
- b) more suitable pipe materials; or
- c) an engineering solution to protect the pipe work backed up by an adequate assessment of the risk.

Liquid free phase product (e.g. oil or free solvent layers) shall not remain in the ground or groundwater in the vicinity of water pipes, whether barrier pipe or any other pipe materials are used.

When designing pipe routes on land potentially affected by contamination, new preferential contamination pathways along the route of new water pipes shall not be created. Particular measures may be required to prevent the possible migration of contamination through pipe bedding and into controlled waters.

References

BS10175: 2011

“Investigation of Potentially Contaminated Sites Code of Practice”

CLAIRE/CIEH

“Guidance on comparing soil contamination data with a critical concentration” 2008

Department of the Environment Contaminated Land Research Report

“Sampling strategies for contaminated land”

prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4) 1994

Environment Agency

“Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination”

(ref: R&D Technical Report P5-066/TR) 2000

Environment Agency

“Model Procedures for the Management of Land Contamination” (ref: CLR11), 2004

Environment Agency P5-080/TR3

“The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils”, 2005

UK Water Industry Research (UKWIR)

“Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites” (Ref 10/WM/03/21) January 2011

Water Regulations Advisory Scheme (WRAS)

Information and Guidance Note 9-04-03

“Laying Pipes in Contaminated Land” 2002

Frequently asked questions

Why has UUW published supplementary guidance to the 'UKWIR Guidance for the Selection of Water Pipes to be used in Brownfield Sites'?

UUW agrees with the UKWIR Guidance in principle; we have published supplementary guidance to clarify some of the areas in which it will operate.

Does the UKWIR Guidance only apply to 'brownfield sites'?

Yes, the UKWIR Guidance does apply to brownfield sites; in addition United Utilities Water will apply this guidance and the UUW supplementary guidance to any greenfield sites which are potentially affected by contamination.

Who is responsible for completing/ signing the Risk Assessment for Water Pipes (RA)?

This may be the Developer, the Developers representative, or the competent person directing the land assessment. The signatory of the Risk Assessment for Water Pipes (RA) must ensure that all land assessments have been carried out in accordance with current standards and guidelines by or under the direction of a suitably qualified competent person. For water supply applications on land potentially affected by contamination, UUW requires the competent person to be either a chartered member of an appropriate professional body (such as the Institution of Civil Engineers, the Geological Society of London or the Royal Institution of Chartered Surveyors) with relevant experience of investigating contaminated sites or a Specialist in Land Condition (SiLC). This level of competency is intended to promote good practice and high professional standards and is no greater than that required for planning purposes by Local Authorities.

Do we need to agree the number and location of soil samples with the Water Company as indicated by the UKWIR guidance following the Preliminary Risk Assessment (PRA)?

Where a preliminary risk assessment (PRA) highlights the need for a site investigation UUW considers it is a responsibility of the qualified competent person directing the land assessment to determine the location and frequency of sampling. UUW's role would be to confirm that the appropriate

choice of pipe material has been made on the basis of the information provided.

What do we do if the pipe route is not known when the Site Investigation report is commissioned?

Where the route of the pipe is not known at the site investigation stage, then any resultant pipe selection needs to take account of any contamination found on the site. Consideration should be given to identifying the route and depth of the pipeline at the site investigation stage to avoid unnecessary testing.

Is it acceptable not to undertake a site investigation and specify the use of barrier pipe which seems to be suitable for all conditions?

Not all brownfield land is contaminated, and because of that a default to barrier pipe is not an acceptable approach to UUW, due to the possibility of higher installation and future maintenance costs. The approach as to whether a site investigation is needed should be risk based. For those sites where land may be affected by contamination appropriate testing shall be undertaken on the ground materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials.

Examples where defaulting to barrier pipe would not be acceptable:

- Where a capping layer (non-contaminated) is introduced within which the pipes will be installed.
- Sites with a potential low risk for contamination.
- Where liquid free phase product (e.g. oil or free solvent layers) is in the ground or groundwater in the vicinity of water pipes.
- Where the route of the pipe could be diverted to another suitable location free from contamination.

Are UUW employees who will assess the Design Proposals for contaminated sites suitably qualified?

It is the role of the Developer's suitably qualified competent person to deal with or direct the assessment of land. UUW's role is to assess the Risk Assessment for Water

Pipes and supporting Site Assessment Report (SAR) which is provided with any new water supply application (ie. it has been provided in the correct format, proposals for pipe selection are included, the methodology is in line with the UKWIR Guidance and UUW Supplementary Guidance, it has been directed by a suitably qualified competent person etc.). If UUW do need to provide assistance or information in deciding pipe materials then the assessment would be carried out under the direction of a suitably qualified competent person.

What happens to existing PE that is in the ground under the "old" guidelines?

The latest UKWIR guidance and UUW's supplementary guidance are intended to be used to decide what pipe materials will be used for new water mains and services. It will have no effect for developers with regard to any parts of UUW's existing network.

Will the Developer be required to submit a fully completed Risk Assessment for Water Pipes (RA) and supporting Site Assessment Report (SAR), including pipe material recommendation, for both the option of a mains requisition application and the option of a self-lay application?

Yes, UUW expect the 'Developer', as defined in UUW Supplementary Guidance, to submit a Risk Assessment for Water Pipes (RA) and supporting Site Assessment Report (SAR), including pipe material recommendation, in respect of any water pipes being installed on the development irrespective of who is to install them.

Does Table 1 in UUW's Risk Assessment for Water Pipes (RA) replace any of the tables to be completed in the Site Assessment Report (SAR) as required in the UKWIR Guidance?

UUW does not consider Table G1 and Table 3.1 of the UKWIR Guidance to be a definitive guide for assessing total concentrations. Table 1 in UUW's RA replaces Table 3.1 of the UKWIR Guidance.

Have any other Water Companies adopted the UKWIR Guidance yet?

You will need to contact the water company concerned if you are intending to install water pipes outside UUW's licensed area.

About us

United Utilities is the North West's water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

Risk assessment for water pipes (RA)

The risk assessment for water pipes will help you choose appropriate materials for your development. We are happy to deal with a risk assessment for water pipes in advance of any formal application for a new water supply.

If you need any help completing the form please call us on **0345 072 6067**.

Section 1: Development details	
Development name (if it has one)	Elizabeth Street, Cheetham Hill
Development address	Elizabeth Street Cheetham Hill Manchester, M8 8BB
OS Grid reference (mid point)	SD 84170 00160
Developer's name	Kier Trade City LLP
UUW reference number (for UU use only)	
Please provide details below of the current and historical use of the site and adjacent sites. If your supporting information has details of the current and historical site use, please reference below the relevant sections of your report.	
The earliest available historical mapping (1850s) indicates the site was used as agricultural fields. On mapping dated 1892-93 and 1890-1891 residential properties are present on the northwest part of the site, two clay pits are located on the site in the east and an unlabelled pit is located in the west of the site. Offsite clay pits are located to the south and west of the site. By 1908 further development had occurred surrounding the site including a hospital located 100m to the northwest. By 1922 the claypit on the southwest of the site extends on to the site. The 1948 -1952 mapping shows a refuse heap located on the east and west of site, a pond on the south of the site and a pump house located on the southwest of the site. By 1951 a depot was located on the northwest of the site, eight small structures (assumed to be associated with the depot) are present on site and off site a shaft is located approximately 100m to the south of the site in relation to off-site brickworks. The clay pit and pond are no longer showing, it is assumed these have been infilled. By 1959 the site was labelled as a car breakers yard, a travelling crane is located on the eastern site boundary. Further development surrounding the site included printing works located in the south. 2021 mapping shows the site as a recycling centre. The site now comprises vacant land with areas of concrete hardstanding and areas of vegetation.	
Section 2: Preliminary risk assessment	
Has your desk study and site walkover identified any land potentially affected by contamination?	☒ Yes ☐ No
If the site is potentially affected by contamination but you have not completed any intrusive site investigation please provide details below of the rationale behind the intended pipe selection. If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.	
N/A	

Section 3: Intrusive site investigation																									
Have you completed any intrusive site investigation?	☒ Yes ☐ No																								
Have you completed any none intrusive site investigation?	☐ Yes ☒ No																								
Date(s) when the site investigation(s) undertaken	<table border="1"> <tr> <td>0</td><td>4</td> <td>0</td><td>5</td> <td>2</td><td>0</td><td>2</td><td>1</td> </tr> <tr> <td>0</td><td>7</td> <td>0</td><td>5</td> <td>2</td><td>0</td><td>2</td><td>1</td> </tr> <tr> <td>1</td><td>3</td> <td>1</td><td>2</td> <td>2</td><td>0</td><td>2</td><td>1</td> </tr> </table>	0	4	0	5	2	0	2	1	0	7	0	5	2	0	2	1	1	3	1	2	2	0	2	1
0	4	0	5	2	0	2	1																		
0	7	0	5	2	0	2	1																		
1	3	1	2	2	0	2	1																		
At what level has groundwater been encountered?	0.74 - 2.97 metres below ground level or ☐ Not encountered																								
Table 1 (Pipeline Selection Risk Assessment Summary (PSRAS)) below classifies testing required where the preliminary risk assessment has identified land potentially affected by contamination. Please provide details below of any test groups which have not been tested and the rationale for not testing. <i>If your supporting information has details of the rationale behind not testing any particular test groups, please reference below the relevant sections of your report.</i>																									
Please refer to the Phase 2 site investigation report for Elizabeth Street dated 17th March 2022, report ref.078695-CUR-00-XX-RP-GE-001 V03. Section 4.1 Soil Analysis during two separate investigations comprised; 2 Made Ground samples were obtained from cable percussion boreholes between 0.20m and 0.40m bgl, and 11 Made Ground samples from trial pits between 0.30 and 2.00m bgl during the March 2021 investigation. Three Made Ground samples were obtained from the window sample boreholes between 0.40m and 1.20m bgl, and three Made Ground samples were obtained from rotary open hole boreholes between 0.20 and 0.60m bgl in December 2021. Any group not tested were determined unnecessary as these were not considered potential contaminants of concern. This includes Ethers,Nitrobenzene, Ketones, Aldehyde,Amines, SVOCs and VOCs.																									
If the intrusive site investigation has identified concentrations above the PE threshold (see PSRAS) and your intended pipe selection is PE. Please provide details below of the rationale behind the intended pipe selection. <i>If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.</i>																									
N/A																									
Section 4: Site remediation																									
Please provide details below of any site remediation (which may include a change in site levels) already completed. <i>If your supporting information has details of the site remediation already completed, please reference below the relevant sections of your report.</i>																									
N/A																									
Has the PSRAS (Table 1) been completed using appropriate data after remediation?	☐ Yes ☐ No ☒ N/A																								
Please provide details below of any proposed site remediation and an analysis of whether this will affect your intended pipe selection. <i>If your supporting information has details of any proposed site remediation and whether this will affect your intended pipe selection, please reference below the relevant sections of your report.</i>																									
Current recommendations based on geo-environmental assessment of the site in Section 12 of the Ground Investigation Report are as such; Due to the presence of asbestos and elevated lead in one location, the installation of an appropriate cover system is recommended for proposed soft landscaping areas. If encountered, it is recommended any visual gross contamination is removed from the site. Cut and fill earthworks is proposed across areas of the site and as such re-use of site won soils should be detailed in a remediation strategy. It is recommended that in external hard standing areas a reduced level dig is carried out, to a suitable depth of 2.0m bgl, to enable removal of obstructions with subsequent replacement and compaction with suitable material to an engineering specification.																									

Section 5: Final use of site

Please provide details below of any chemicals (including fuel) to be stored on site and any other future contamination risks which may affect your intended pipe selection.

If your supporting information has details of potential contamination risks which may affect your intended pipe selection, please reference below the relevant sections of your report.

Given the proposed redevelopment of the site for commercial/light industrial end use comprising up to circa 8 units across the site with amenity for access roads, car parking and HGV loading areas. It is considered likely that chemicals and fuels may be stored on site, likely to be stored in plant areas.

What water pipe materials are intended to be used on site?

☐ PE ☒ PE Barrier Pipe Type A ☐ PE Barrier Pipe Type B
Other (please specify): x

Section 6: Additional information

Please use the section below to provide any additional details to support your intended pipe selection.

Although a level of site remediation is proposed there is no requirement to remove soils with elevated TPH's unless exhibiting gross/free phase contamination. TPH concentrations remaining on site after remediation are likely to still exceed PE thresholds. Barrier pipe recommended.

Section 7: Risk assessor

Name and relevant qualifications of person directing the risk assessment for water pipes

R Allen BSc (Hons) MSc FGS MCIWEM C.WEM CEng

Name and address of risk assessor's company

Curtins, 17-19 Whitworth St W, Manchester M1 5WG

Date risk assessment performed

0 3 0 8 2 0 2 2

Section 8: Declaration

I confirm I have completed this form and provided supporting information in accordance with 'UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' and UUW's Supplementary Guidance. I also confirm that if any further site investigation is needed and carried out, I will be required to submit an additional Risk Assessment for Water Pipes with the relevant supporting information. I understand that failure to supply any of the required information may delay my application being processed.

Name	Rob Allen	Company	Curtins
Telephone	0161 236 2394	Date	0 3 M M Y Y Y Y

Please email the completed form and supporting information to **DeveloperServicesWater@uuplc.co.uk** or post to us at United Utilities Water, Developer Services, Second floor Grasmere House, Lingley Mere, Warrington WA5 3LP.



About us

United Utilities is the North West's water company. We keep the taps flowing and toilets flushing for seven million customers every day. From Crewe to Carlisle, we work hard behind the scenes to help your life flow smoothly.

United Utilities Water Limited, Haweswater House, Lingley Mere Business Park, Lingley Green Avenue, Warrington WA5 3LP.
Registered in England and Wales. Registered Number 2366678.

Table 1 - Pipe selection risk assessment summary (PSRAS)

1. Testing must be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. Please use the appropriate testing data to complete Table 1 below.

2. If more than one pipe selection is being made, for example, for pipes in different areas of a large site, a completed PSRAS is required for each selection.

What materials have been tested to populate Table 1 below?

☒ Existing ground materials ☐ Remediated materials ☐ Imported capping materials

All concentrations in mg/kg								
Test Group	Testing Required?	PE threshold	Metal Pipes/ Barrier Pipe	Laboratory Detection Limit	Testing UKAS accredited Y/N	Maximum concentration at proposed pipeline depth See Note [2]	Maximum site concentration See Note [3]	Locations and depths where concentrations exceed proposed pipeline threshold
Total VOCs	Where Preliminary Risk Assessment (PRA) has identified land potentially affected by contamination	0.5	Pass					
Total BTEX & MTBE		0.1	Pass	<0.01	Y	<0.01	<0.01	
Total SVOCs (excluding PAHs and those substances marked with an *)		2	Pass					
EC5-EC10 aliphatic and aromatic hydrocarbons		2	Pass	<0.01 and 1	Y	10	36	BH104 at 0.6m, BH103 at 0.2m,
EC10-EC16 aliphatic and aromatic hydrocarbons		10	Pass	1	Y	21	47	BH104 at 0.6m, BH103 at 0.2m,
EC16-EC40 aliphatic and aromatic hydrocarbons		500	Pass	1	Y	4180	4180	BH103 at 0.2m, TP01 at 0.3m,
Phenols* (from SVOC analysis)		2	Pass					
Cresols and chlorinated phenols* (from SVOC analysis)		2	Pass					
Ethers*	Only where identified	0.5	Pass					
Nitrobenzene*		0.5	Pass					
Ketones*		0.5	Pass					
Aldehydes*		0.5	Pass					
Amines		Fail	Pass					
Corrosive	Conductivity, Redox and pH	Pass	See Note [1]	0.01	Y	6.40-8.07		

Note [1] Threshold: For wrapped steel, corrosive if pH<7 and conductivity > 400µS/cm. For wrapped ductile iron corrosive if pH<5, Eh not neutral and conductivity > 400µS/cm. For copper, corrosive if pH<5 or >8 and Eh positive.

Note [2] Water pipes are normally laid at 0.75-1.35m below finished ground level.

Note [3] Also state if liquid free product is present in soil or groundwater.

Our Locations

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