

SPARKLE STREET REMEDIATION STRATEGY

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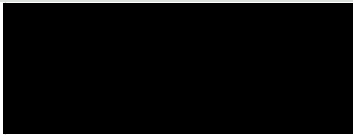
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1 INTRODUCTION

This Remediation Strategy has been prepared by Curtins for Foras (Sparkle Street) Limited to provide guidance with respect to remedial requirements for the proposed development site at Sparkle Street, Manchester, M1 2NA.

The site hereby known as 'Sparkle Street', is located south of Store Street, east of Sparkle Street, west of 'Thomas Telford Basin' residential properties and north of 'Home Apartments' residential properties. A site location plan is presented in Appendix A.

The site is currently occupied by the Gateway Industrial Estate comprising two buildings with several large brick/concrete plinths. A sub-station is present in the southwest corner of the western warehouse. The external areas are occupied by hardstanding tarmac.

A large retaining wall is present at the southeast of the site, retaining ground to the south. A vegetated slope is present in the southwest, rising to the residential apartments and car park immediately adjacent to the site.

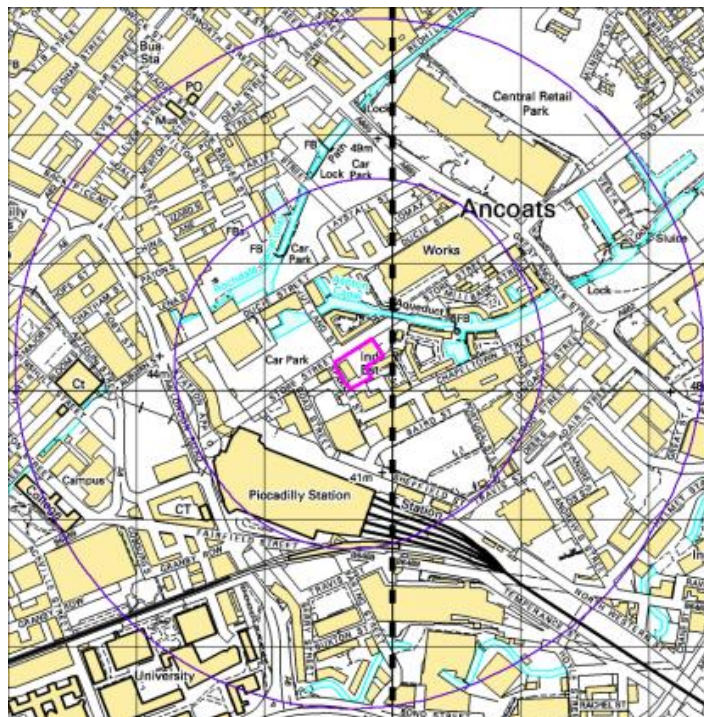


Figure 1 – Site Location Plan (Site boundary shown in pink). Crown Copyright. License Number 100022432.

It is understood that the proposed site development includes the demolition of the two existing buildings on site and the development of a multistorey residential scheme. The proposed development plans are presented in Appendix A.

The site has been characterised through a desk-based Phase 1 Preliminary Risk Assessment (Ref. 1) and two stages of Phase 2 Geo-Environmental Investigation and Risk Assessment undertaken by Curtins, in 2023 and 2025 (Ref. 2), A Piling Risk Assessment (Ref. 3) has also been undertaken.

1.1 Requirements of the Remediation Strategy

The Remediation Strategy is to account for the following;

- A description of the materials likely to be encountered by the developer and their contractor/sub-contractors;
- Proposals for excavations with respect to the materials likely to be encountered;
- 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;

- 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 (2023) Sparkle Street, Phase 1 Preliminary Risk Assessment, Ref. 082142-CUR-00-XX-T-GE-00001-P02, dated July 2023
- **Reference 2:** Curtins (2025) Sparkle Street, Phase 2 Ground Investigation, Ref. 082142-CUR-00-XX-T-GE-00003-P05, dated December 2025
- **Reference 3:** Curtins (2025) Sparkle Street, Piling Risk Assessment, Ref. 082142-CUR-XX-XX-T-GE-00004-P01, dated December 2025

2 GROUND CONDITIONS

Table 1 summarises the exploratory holes were undertaken by Curtins during two phases of ground investigation. The first stage was undertaken between 24th April and 11th May 2023 and the second stage of investigations were undertaken between 3rd and 5th November 2025.

Table 1 – Scope of Works and Rationale

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Exploratory Hole Type	Exploratory Hole Reference	Ground Level (m AOD)	Exploratory Hole Depth (m bgl)	Rationale
2023 Ground Investigation				
Window Sample Boreholes	WS01	-	1.32	- Confirm shallow ground and groundwater conditions. - Collect soils samples for chemical analysis. - Collect samples for geotechnical soil testing; - Gas and groundwater level monitoring.
	WS02	-	5.00	
	WS03	37.78	3.00	
	WS04	-	3.00	
	WS05	-	5.00	
	WS05b	-	5.00	
Window Sample with Rotary (Geobore S) Follow On	BH01	37.77	35.00	- Confirm shallow and deep ground and groundwater conditions. - Collect soils samples for chemical analysis. - Collect samples for geotechnical soil/rock testing; - Gas and groundwater level monitoring.
	BH02	37.91	35.00	
	BH03	-	35.00	
Hand Excavated Foundation Pits	HP01	-	0.35	Confirm foundation presence and depth beneath the exterior retaining walls.
	HP02	-	0.46	
	HP04	-	0.93	
	HP06	-	0.88	
2025 Ground Investigation				
Window Sample Borehole		-		- Confirm shallow ground and groundwater conditions. - Collect soils samples for chemical analysis. - Attempt to delineate the extent of hydrocarbon contaminated soils recorded in BH01 during the 2023 investigation. - Delineate the area of deep Made Ground around WS05 identified within the 2023 investigation
	WS101	-	3.45	
	WS102	-	6.45	
	WS103	-	2.00	
	WS104	-	4.15	
	WS106	37.80	0.60	
	WS106A	-	3.10	
WS107	-	2.30		
Machine Excavated Trial Pits	TP101	-	3.60	- Delineate the extent of hydrocarbon contaminated soils recorded in BH01 during the 2023 investigation. - Delineate the extent of organic rich soils encountered in BH03 during the 2023 investigation. - Collect soils samples for chemical analysis.
	TP102	-	3.35	
	TP103	-	4.40	
	TP104	-	2.50	
	TP105	37.70	2.80	
Machine Excavated Foundation Pit	FP101	-	0.70	Confirm foundation presence and depth beneath the eastern warehouse building.

It was not possible to undertake HP03 or HP05 due to presence of live services in the immediate vicinity of the excavation location.

For the location of the exploratory holes refer to Curtins drawing reference. 082142-CUR-00-XX-DR-GE-002-P02.

Ground level and GPS coordinates were recorded for external exploratory hole locations and are recorded on the exploratory hole logs.

Exploratory hole logs can be referred to in Appendix B.

2.1 Made Ground

Beneath a surface covering of concrete (internal) or tarmac (External), variable Made Ground was encountered. The deepest Made Ground was recorded within the assumed footprint of the former Shooters Brook, and was shallower in other areas of the site.

Granular Made Ground was recorded in all exploratory holes directly beneath the hardstanding concrete/tarmac to maximum observed depths between 0.41m and 6.45m bgl. The composition of the granular Made Ground varied across the site, though was described as:

- Grey sandy gravel, with gravels comprising subangular sandstone.
- Grey/black very sandy very gravelly silty fine to coarse sand, with gravels comprising fine to coarse subangular brick, concrete and slate fragments.
- Black silty gravelly fine to coarse sand with gravels comprised of fine to coarse subangular brick, coal and glass fragments.
- Dark brown gravelly fine to coarse sand with cobbles, with gravels and cobbles comprising of brick and sandstone.
- Dark greyish brown silty gravelly fine to coarse sand with a medium cobble content. Gravel and cobbles comprise pottery, brick, and wood.
- TP104 observed Made Ground strata comprising, dark grey and brown sandy gravel with a medium cobble content and a low boulder content. Gravel comprised of brick, sandstone, ash, clinker, wood, pottery and limestone. Cobbles and boulders comprised of brick and wood. Large beams of timber were noted during excavation.
- TP105 encountered a grey silty slightly gravelly fine to coarse sand with a contamination odour and pockets of sandy clay from 2.10 to 2.50m bgl.
- WS102 encountered deep Made Ground deposits with granular Made Ground encountered from 5.60 to 6.45m bgl, where the position was terminated. The granular Made Ground was described as Dark grey clayey fine to coarse sand with a chemical odour.

Cohesive Made Ground was recorded in the following locations:

- BH03, comprising very soft brown gravelly organic rich silt between 1.26m and 2.00m bgl,
- WS03 comprising light brown very sandy gravelly clay, with fragments of brick, ash, concrete, coal, mudstone and sandstone (1.13m to 2.53m bgl) and light greyish brown very sandy gravelly clay with fragments of brick and concrete (2.53m to 2.75m bgl).
- WS04 comprising dark brown and black sandy gravelly clay with fragments of brick, concrete, clinker and coal (1.90m to 2.00m bgl) and dark brown very gravelly very sandy cobbly clay with fragments of brick and concrete (2.25m to 2.60m bgl).
- WS05 comprising Soft brown very sandy gravelly clay, with fragments of ash, brick, concrete, coal and clinker (1.20m to 1.70m bgl) and fragments of brick, mudstone, siltstone, sandstone and quartzite (1.70m to 3.00m bgl). This is underlain by very soft brown and grey sandy slightly gravelly clay with fragments of coal (3.00m to 4.90m bgl).
- In BH01 between 1.50m and 2.58m bgl a stratum of black very silty wood chippings was encountered.

- WS102, comprising reddish brown gravelly sandy clay, with fragments of brick, sandstone, ceramic and limestone (2.15m to 5.60m bgl).
- WS103, comprising greyish brown gravelly sandy clay, with fragments of brick (0.80m to 2.00m).
- WS104, comprising brown sandy slightly gravelly clay, with fragments of brick (3.20m to 4.00m bgl).
- WS106A, comprising brown mottled dark grey sandy gravelly clay with cobbles, with fragments of brick and sandstone (0.80m to 1.30m bgl), and brown very sandy clay (1.30m to 2.20m bgl).
- WS107, comprising brown gravelly sandy clay with cobbles, with fragments of brick (0.70m to 1.25m bgl).

Organic rich Made Ground deposits were encountered within TP102 and TP103 during the 2025 Curtins Ground Investigation. The deposits were encountered between 2.40m to 3.30m bgl within TP102 and 2.50m to 3.20m bgl within TP103. These deposits were described as Dark grey very silty slightly gravelly fine to coarse sand with an organic odour and a low cobble content. Gravels and cobbles comprised brick and pottery.

Greater thicknesses of Made Ground were recorded in the west of the site (up to 6.45m bgl), surrounding WS05.

2.1.1 Hydrocarbon Contamination Delineation Trial Pits

The 2023 ground investigation identified hydrocarbon contamination within BH01 from 1.65m to 2.58m bgl. Exploratory hole locations WS106A, WS107, TP104 and TP105 were undertaken in 2025 to delineate the observed contamination, within the confines of the current site setting, as shown in Figure 2. A photographic log of observed contamination is included in Appendix C.

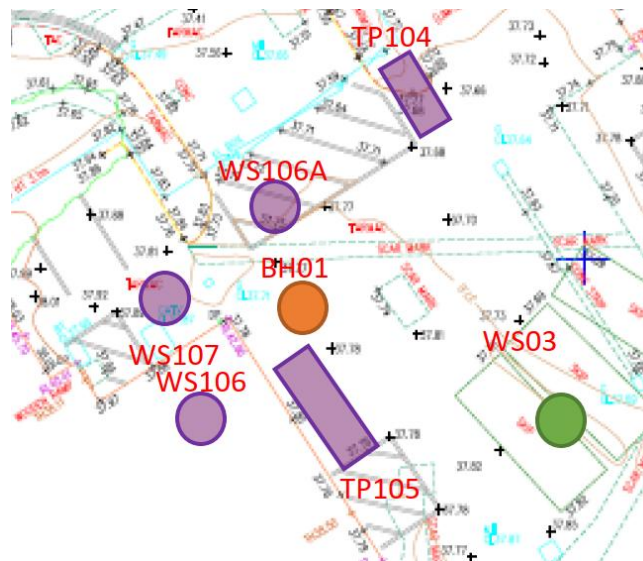


Figure 2 - Extract of Drawing 0-82142-CUR-00-XX-DR-GE-80003-P01, showing the BH01 delineation positions.

Visual and olfactory evidence of contamination was observed within WS106A and TP105 only, at depths of 2.20m to 2.50m and 1.80 to 2.10m bgl respectively (Section 2.4). The contamination within TP105 was no longer observed 5.2m from the original BH01 position.

No visual or olfactory evidence of hydrocarbon contamination was identified within WS107 or TP104.

2.2 Organic Rich Soils

Very soft organic silt deposits were encountered in WS05, BH03 and TP101 underlying Made Ground Deposits. Soils are typically described as very soft black very sandy organic silt or dark grey silty fine to medium sand. Soils were

recorded between 4.90m and 5.00m bgl in WS05, 2.38m to 4.72m bgl (with soft reddish brown very sandy gravelly silt between 2.76m and 3.69m bgl) in BH03, and between 3.40m to an observed depth of 3.60m bgl in TP101.

Organic deposits located around WS05, BH03 and TP101 are likely to be associated with the historic Shooters Brook, shown in the 1787-1794 historical maps. Shooters Brook was culverted after 1794, when it was no longer recorded on site.

2.3 Glacial Till

Cohesive Glacial Till deposits were encountered ten exploratory hole locations (BH01, BH02, BH03, WS02, WS03, WS05, TP101, WS101, WS106A and WS107), from depths of between 0.46m and 6.00m bgl. Soils are typically described as soft, firm or stiff brown, with some grey mottling, sandy to very sandy gravelly clay with gravels comprised of fine to coarse subrounded to subangular mudstone, siltstone, sandstone and quartzite fragments.

Granular Glacial Till deposits were encountered in six exploratory hole locations (BH01, BH02, WS02, WS04, WS05b, WS101 and TP105), from depths of between 0.41m and 4.80m bgl. Granular Glacial Till was typically described as a 'Medium dense or dense light brown or reddish-brown fine to coarse sand' and/or a 'reddish-brown very gravelly fine to coarse sand with gravels comprised of fine to coarse subrounded to subangular mudstone, siltstone and sandstone fragments or brown silty clayey fine to medium sand.

2.1 Coarse Glacial Deposits

Coarse Glacial Deposits were encountered in all BH01, and BH02 directly beneath the Glacial Till deposits. This deposit was typically described as very dense greyish brown very sandy gravel of mixed lithology. Soils were encountered from depths of 8.14m bgl (BH01) and 6.88m bgl (BH02). No recovery of soil was recorded in BH03 between 5.91m and 8.00m bgl. It is possible that Coarse Glacial Deposits were washed away during the drilling process with the use of water flush.

2.2 Chester Formation

Highly weathered sandstone was encountered in BH03 between 8.00m and 9.50m bgl, comprising very dense reddish brown very gravelly sand with gravels comprised of fine to coarse subangular sandstone fragments.

Competent bedrock of the Chester Formation was encountered at 10.33m bgl (BH01) 8.22m bgl (BH02) and 9.50m bgl (BH03). The Chester Formation is characterised by reddish brown very weak to weak medium to coarse grained sandstone.

Fractures are generally horizontal to sub-horizontal, very closely to closely spaced, locally widely spaced, planar, rough and clean. Fractures with sand or clay infill were also recorded. Vertical and inclined fractures were also recorded.

Where non-intact rock was recovered, this was typically recorded as reddish brown silty fine to coarse sand, reddish brown medium and coarse sand, reddish brown gravelly medium to coarse sand, with fine to coarse fragments of sandstone and mudstone, or reddish-brown gravel of sandstone and mudstone.

2.3 Existing Retaining Wall Foundations

Foundation pits were undertaken at the base of the retaining walls surrounding the western, eastern and southern boundaries of the development site.

HP01 and HP02 identified a concrete step overlying and into the underlying granular Glacial Till.

HP04 identified a possible concrete pad, it was not possible to determine the full extent of the concrete.

HP06 identified 2 No. brick steps at 0.12m increments to depths of 0.35m and 0.52m bgl. Overlying a thick layer of Made Ground and granular Glacial Till.

FP101 identified a concrete step, however it was not possible to determine the full depth of concrete due to proximity to services.

2.4 Observed Potential Contamination

Visual and olfactory evidence of contamination was observed within BH01, WS106A, and TP105 during the two Curtins ground investigations. These deposits were recorded between a minimum of 1.50m bgl and 2.58m bgl, described as: 'Black or greenish brown very sandy silty gravel of wood chippings with a strong hydrocarbon odour and iridescent sheen', 'Grey slightly gravelly silty sand with a contamination odour and pockets of sandy clay. Gravels comprise brick, wood and ceramic', and/or 'Dark grey clayey fine to coarse sand with a chemical odour'.

Contamination was also noted in WS102 from 5.60m to 6.45m bgl, noted as 'Dark grey clayey fine to coarse sand with a chemical odour'.

BH02 identified an Asbestos Containing Material (ACM) within the Made Ground from 0.08m to 0.46m bgl, identified as Chrysotile cement.

2.5 Obstructions Encountered

WS106 encountered concrete at 0.60m bgl which could not be excavated and was attempted three times which found the same obstruction.

TP102 encountered red brick at 3.35m bgl which could not be excavated.

No further obstructions were encountered as part of the site investigation works.

2.6 Groundwater

No groundwater was encountered during the initial site investigation works. It was not possible to determine groundwater strikes within the bedrock formation due to the use of water/air mist flush.

Perched water was recorded within TP101 at 2.20m bgl, at the base of the Made Ground. The strike recorded a fast infiltration rate.

Damp strata was noted within WS101 from 2.40m to 2.64m bgl within the natural granular deposits.

Notwithstanding, perched water may be encountered in other areas of the site, or during construction, accounting for variability beyond the findings of this investigation.

Six groundwater monitoring visits have been undertaken between the 25th May and 2nd August 2023, the results are presented in Table 2.

No groundwater monitoring was undertaken within the 2025 ground investigation.

Table 2 – Groundwater Monitoring Results (2023 Ground Investigation)

Strata	Installation Strata	Response Zone m bgl (m AOD)	Depth (m bgl)					
			25/05/23	12/06/23	05/07/23	14/07/23	18/07/23	02/08/23
WS01	0.50-1.20	Made Ground	Dry	Dry	Dry	Dry	Dry	Dry
WS03	1.50-2.50	Made Ground	(1)	(1)	(1)	(1)	(1)	(1)
WS05	4.00-5.00	Made Ground	Dry	Dry	Dry	5.00	4.98	4.97
BH01	20.00-30.00	Chester Formation	10.42	10.30	10.47	10.40	10.49	(2)
BH02	10.00-15.00	Chester Formation	10.31	10.26	10.34	10.36	10.39	10.24
BH03	15.00-25.00	Chester Formation	10.72	10.65	10.70	10.69	10.77	10.51

(1) Borehole damaged by warehouse vehicles unable to monitor groundwater level.

(2) Borehole tap was stuck within the pipe due to vehicle compaction, therefore unable to monitor groundwater level.

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Perched water may be present in Made Ground soils, and may be controlled by pumping from sumps.

Hydraulic head level within the Chester Formation is anticipated to be approximately 10.26 – 10.77m bgl.

3 GROUND & GROUNDWATER CONTAMINATION

3.1 Ground Contamination

3.1.1 Soil

Table 3 lists elevated concentrations of contaminants of concern, above the nominated GACs within each ground investigation report.

Table 3 - Summary of Elevated Concentrations of Contaminants of Concern With Respect to Nominated GACs

Location	Depth (m bgl)	Soil Type	Determinant	Recorded Concentration (mg/kg)	GAC (mg/kg)
BH01	0.40	Made Ground	Benzo(a)anthracene	15.7	11
			Benzo(a)pyrene	14.2	3.2
			Benzo(b)fluoranthene	14.2	3.9
			Dibenzo(ah)anthracene	1.35	0.31
BH01	1.40	Made Ground	TPH Aliphatic C8-C10	72	27
			TPH Aliphatic C10-C12	256	130
			TPH Aliphatic C12-C16	1150	1100
BH01	2.20	Made Ground	TPH Aliphatic C8-C10	729	27
			TPH Aliphatic C10-C12	1500	130
			TPH Aliphatic C12-C16	3670	1100
			TPH Aromatic C8-C10	375	47
			TPH Aromatic C10-C12	1030	250
			TPH Aromatic C12-C16	4190	1800
			1,2,4-Trimethylbenzene	0.763	0.41
WS01	0.60	Made Ground	Lead	444	310
			Dibenzo(ah)anthracene	0.33	0.31
BH03	0.40	Made Ground	Lead	565	310
			Benzo(a)pyrene	3.44	3.2
			Dibenzo(ah)anthracene	0.54	0.31
WS102	5.60	Made Ground	Benzo(b)fluoranthene	4.46	3.9
TP105	2.20	Made Ground	Lead	351	310

All soil samples were screened for asbestos. Asbestos was positively identified in three Made Ground soil samples, summarised in Table 4.

Table 4 - Summary of Asbestos Identified in Soil Samples

Location	Depth (m bgl)	Stratum	Asbestos in Soil	Quantification (% w/w)
BH02	0.08-0.46	MADE GROUND	Chrysotile Solid fragment/tile	15
BH01	0.40-0.50	MADE GROUND	Chrysotile loose fibres	<0.001
WS102	5.60-6.45	MADE GROUND	Chrysotile Cement	<0.001

Non-Volatile Contamination

Elevated concentrations of lead were recorded with respect to the nominated GACs in three locations, WS01 (0.60m bgl), BH03 (0.40m bgl), TP105 (2.20m bgl).

Elevated concentrations of non-volatile PAHs were recorded with respect to the nominated GACs in four locations, including BH01 (0.40m bgl), WS01 (0.60m bgl), BH03 (0.40m bgl) and WS102 (5.00m bgl).

It is recommended that a capping layer is installed in areas of soft landscaping, to mitigate against end user or maintenance exposure to soil contamination. Hardstanding surfaces (pavements etc.) will break the source-pathway-receptor linkage.

Volatile Contamination

Elevated concentrations of volatile contaminants were recorded in BH01 (1.40m) and BH01 (2.20m). Contaminants include:

- **<C16 Aliphatic TPHs:** BH01 (1.40m) and BH01 (2.20m).
- **<C16 Aromatic TPHs:** BH01 (2.20m).
- **Trimethylbenzene:** BH01 (2.20m bgl)

A series of delineation trial pits and window sample boreholes were undertaken during the 2025 ground investigation, including WS106A, WS107, TP104 and TP105. Visual and olfactory evidence of contamination was recorded in WS106A and TP105 only, at depths of between 2.20m and 2.50m bgl, and 1.80m and 2.10m bgl, respectively. The contamination within TP105 was no longer observed approximately 5.20m south of BH01.

The extent of volatile contamination identified during the ground investigation will be delineated during groundworks, through soil sampling and laboratory chemical analysis. These soils are to be removed from site to a suitable licenced waste disposal facility.

Construction and maintenance workers should be provided with appropriate PPE and sanitary facilities, with respect to the environmental chemical analysis results.

3.2 Groundwater

A summary of elevated concentrations of contaminants of concern within groundwater, with respect to UK DWS, on exceedance has been detected and three exceedances of WHO thresholds were recorded, as detailed in Table 5.

Table 5 - Summary of Groundwater Chemical Analysis Results

Location	Depth (m bgl)	Stratum	Determinant	Recorded Concentration (µg/l)	UK DWS (µg/l)	WHO Guideline Value (µg/l)
BH01	10.47 – 26.90	Chester Formation	Benzo(a)pyrene	0.02	0.01	0.01
BH02	10.34 – 12.72	Chester Formation	>C21-C35 Aliphatic Hydrocarbons	780	300	300
			>C21-C35 Aromatic Hydrocarbons	111	90	90
			Total Hydrocarbons	920	300	300

In absence of a likely groundwater receptor (The site is not situated in a Source Protection Zone and there are no

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potable groundwater abstractions within 1km of the site), and an aquitard of clay is present beneath the site limiting the downward migration of contamination to groundwater bodies, it is unlikely that groundwater receptors would be impacted by contamination beneath the site.

It is considered that the elevated concentrations identified are associated with the wider industrial land use of Manchester city centre and not indicative of site won contamination. No groundwater remediation is required.

A piling risk assessment has been prepared to manage risk to the aquifer during piling.

3.3 Ground Gas

Six ground gas monitoring visits have been undertaken between 25th May 2023 and 2nd August 2023, with barometric pressure recorded between 981mb and 1024mb. Steady barometric pressure was recorded on the first, second and sixth visit, a rising state was recorded on the third visit and a falling barometric pressures on the fourth and fifth visit.

The highest carbon dioxide concentration was recorded in WS03 on the third monitoring visit at 7.2% v/v. 2 visits in WS03 and 1 visit in WS01 recorded carbon dioxide concentrations >5% v/v.

Hydrogen sulphide was recorded below the instruments limit of detection throughout the monitoring programme.

Carbon monoxide concentrations were recorded between <0.1ppm and 10ppm.

Air flow rates were recorded at maximum values of between -28 l/hr (in BH01 on the fifth monitoring visit) and <0.1 l/hr, reducing to a steady state of <0.1 l/hr (below the limit of detection of the monitoring instrument) in all monitoring locations excepting BH02 on the sixth visit, where a steady state flow of 5.7 l/hr was recorded. The greatest peak air flow rates and negative air flow rates were typically recorded where the monitoring well was flooded.

It is considered that the high flow rates recorded in are likely to be linked to rising shallow groundwater in the solid section of the well installation causing an increase in internal pressure within the pipework, which is released, and subsequently equalised, when the valve tap is opened, resulting in the high observed peak flows preceding the considerably lower steady flow. Considering the above, and using professional judgement, the elevated peak flow readings from the affected boreholes, on visits where wells are noted to be flooded, have been omitted from the calculations used in assessment of gas risk.

4 CONCEPTUAL SITE MODEL

A Conceptual Site Model (CSM) for the site has been developed as part of the Curtins site investigations that were undertaken at the site and considered based on the current 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 6* were identified as requiring remediation to enable the safe re-development of the site.

Table 6 – Potential Contaminant Linkages

PCL	Sources	Receptor	Potential Pathway	Risk	Remediation Recommended
1	Made Ground Soils Asbestos identified in Made Ground soils, including solid chrysotile cement and loose fibres of chrysotile, as detailed in Table 4.	Construction Workers	Direct contact and dermal uptake, soil and dust ingestion and inhalation (indoor & outdoor air)	Moderate/Low	Asbestos control measures during construction works. Asbestos Management Plan to be put in place with input from a specialist. Above to be detailed within Contractor Risk Assessments.
2	Hydrocarbon Impacted Soils Visual and olfactory evidence of hydrocarbon contamination (Oil sheen and hydrocarbon odour), and elevated concentrations of aliphatic and aromatic hydrocarbons (EC8 – EC16) and 1,2,4-Trimethylbenzene were recorded in BH01 (1.40 – 2.58m bgl), as detailed in Table 3.	Residential end users of the site	Soil vapour migration and inhalation	Moderate/Low	Delineation, excavation and removal of hydrocarbon contaminated material consistent with materials identified within and in the vicinity of BH01 (1.40m and 2.58m bgl).
3	Made Ground Soils Elevated concentrations of lead, hydrocarbons, PAHs and asbestos within shallow Made Ground soils, as detailed in Table 3.	Residential end users of the site, site visitors and the public	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation (indoor & outdoor air)	Moderate/Low	Installation of a clean capping layer in areas of soft landscaping.
4		Construction and Maintenance workers	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation (indoor & outdoor air)	Moderate/Low	Construction and maintenance workers to be provided with appropriate PPE and sanitary facilities, with consideration of the soil environmental chemistry results. Should unexpected contamination be observed during demolition or construction, works should be stopped with advice obtained from an appropriate specialist.

Section 7 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.

5 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 potential contaminant linkages detailed in Table 13 remedial actions are recommended in order for the site to be brought up to a condition that is deemed 'suitable for use'. Recommendations are also made for further works:

- **Remedial Action 1:** Suitable contamination and asbestos control measures to be implemented by the Contractor during remediation, earthworks and construction phase.
- **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:** Delineation, excavation, and removal of VOC contaminated soils.

Notwithstanding, all site personnel, including site visitors, must be provided with appropriate PPE and sanitary facilities for their respective activities, in accordance with their working risk assessment and method statement.

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 and PCL4 (Table 6).

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.

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 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.

Asbestos Containing Material (ACM), including loose fibres were encountered during the ground investigations. It is possible that additional asbestos will be encountered during remediation and earthworks operations beyond the findings of previous ground investigation works. Asbestos containing materials are likely to remain present within re-engineered Made Ground soils during the construction stage. Materials containing asbestos >0.1% w/w would be classed as hazardous waste.

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.

Affected Made Ground should not be crushed or in any way treated due to risk of asbestos fibre release. It may be possible to use such 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.

The following steps should be taken;

- Asbestos Management Plan to be developed and actioned by the Contractor prior to and during works.
- All identified or suspected ACM to be submitted to a laboratory for testing, and/or removed from site to a suitable licensed waste disposal facility. **ACM, where observed, must be picked and removed**, it cannot be re-buried on the development site accounting for significant earthworks and disturbance which will be undertaken.
- The Contractor is responsible for providing appropriate records of ACM identified, and provision of disposal records.

5.2 Remedial Action 2 – Delineation, excavation, and removal of TPH and VOC impacted soils.

PCL3 relates to the inhalation exposure to site end users from elevated concentrations of the volatile contaminants in soils and soil derived vapours.

During the ground investigation volatile and semi-volatile hydrocarbons were recorded above 'Residential without Homegrown Produce' thresholds in BH01, at depths of between 1.40m and 2.40m bgl. The potential for exposure to vapours through the building footprint to site end users from volatilisation and inhalation if contaminated soils are not removed or a hydrocarbon-resistant membrane is not installed presents a risk to residential site end users.

Delineation, excavation and removal of the TPH and VOC impacted soils should be undertaken to the full extent of hydrocarbon impacted soils in the vicinity of BH01, such that the vapour risk to end users is reduced. A full time watching brief should be undertaken during excavation of hydrocarbon impacted soils by a qualified Geo-Environmental Engineer.

Remedial measures for the TPH and VOC impacted soils should be undertaken in exploratory hole locations with elevated TPHs and VOCs, requiring delineation and removal are detailed in Table 7.

Table 7 – Excavation and Removal of TPH, VOC and semi volatile Impacted Soils

Impacted Soils	Remedial Measures Required	Rationale
BH01 (1.40m – 1.50m bgl)	Delineation, excavation and removal of TPH and VOC impacted soils. A full time watching brief should be undertaken during excavation of hydrocarbon impacted soils by a qualified Geo-Environmental Engineer.	Remove potential for exposure to volatile contamination identified during the ground investigation to residential end users via inhalation of soil vapours sourced from contaminated Made Ground soils.
BH01 (2.20m – 2.40m bgl)	The material is to be removed from site to a suitably licenced waste disposal facility.	

The excavation of the TPH and VOC impacted soils is to be supervised by a qualified Geo-Environmental Engineer. Upon removal of the full extent of soil exhibiting visual and olfactory evidence of contamination, soil samples from the sides and base of the excavation are to be collected and sent to an MCERTs / UKAS accredited environmental

chemical analysis laboratory to confirm no elevated levels of TPHs (with specific consideration of aliphatic and aromatic hydrocarbons EC8-EC10, EC10-EC12, and EC12-EC16, and 1,2,4-Trimethylbenzene) remain in the soils in this area.

5.3 Remedial Action 3 – Installation of Engineered Capping

PCL3 identified at the site relates to the direct contact, dermal uptake, soil and dust ingestion and inhalation of heavy metals, TPHs, PAHs, VOC/SVOCs and asbestos fibres in soil and soils and soil derived dust.

The potential for exposure to asbestos fibres is highest within soft landscaped areas where receptors (maintenance staff and the site end users) at the site are most likely to come in contact with the contaminated Made Ground soils.

Where hardstanding has been placed or installed, including the building footprints, vehicular tarmac, pedestrian tarmac and concrete and block paving are considered sufficient to break the potential contaminant linkage, PCL 3, detailed in Table 6 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 is incorporated in general soft landscaping areas.

The following minimum depths of clean cover layers are proposed:

- 450mm depth – Soft landscaping, shrubs and herbaceous planted areas

Greater thicknesses may be specified by the Landscape Architect, especially in tree pits/shrub areas.

This is to be made up of a minimum 150mm imported topsoil, or deeper where specified by the Landscape Architect. Additionally, a high visibility warning geotextile, or clean and inert hardcore break layer is to be installed beneath the clean cover system.

This is anticipated to provide adequate protection of human health with consideration of likely exposure and is in accordance with Manchester City Council's Planning & Contaminated Land Technical Guidance (2021) and should be incorporated in all proposed soft landscaped areas.

6 SPECIFICATION FOR SITE WON AND IMPORTED SOILS

This section outlines the required chemical testing specification that the imported or re-used site soils used in soft landscaping areas must meet to satisfy Remedial Action 3, along with a chemical testing specification. This does not cover general fill materials.

6.1 Sourcing of Materials

6.1.1 Off-Site Sources

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 or haul roads.

6.1.2 On-site Sources

Based on the findings of the available ground investigation, there is no topsoil or subsoil that would be suitable for use in soft landscaping areas. Made Ground soils are unlikely to be considered suitable due to the presence of asbestos fibres, contamination concentration exceedance with respect to relevant generic assessment criteria, and 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. 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 6.4*.

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 6.4* and compliant with BS 8601:2013 'Specification for subsoil and requirements for use'.

6.4 Chemical Composition of Soils

All materials used in 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.

The environmental chemistry testing requirements and frequency are as Table 8 & Table 9. Additions to the suite and frequency of sampling may be required based on the source of 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 8 - Environmental Chemistry Testing Frequency for Soils and Imported Stone

Impacted Soils	Testing Frequency
Imported Topsoil/Subsoil (Greenfield)	At Source: It is recommended that one sample for every 200m³ imported is to be tested by the supplier in accordance with Clause 5 of BS 3882:2015 / BS8601:2013 or to the landscape architect's / architect's / client's specification. On-site Verification: One sample every 200m³ used (or a minimum of 3 No. samples, whichever is greater).
Imported Topsoil/Subsoil (Remediated/Manufactured/ Unknown Soil Source)	At Source: It is recommended that one sample for every 150m³ imported is to be tested by the supplier in accordance with Clause 5 of BS 3882:2015 or to the landscape architect's / architect's / client's specification. On-site Verification: One sample every 150m³ used (or a minimum of 3 No. samples, whichever is greater).
Imported Quarried Stone, (e.g. Break layer)	On-site Verification: One or two samples depending on the type of stone utilised, to confirm the inert nature of the material. One sample every 500m³ used (or a minimum of 3 No. samples, whichever is greater).
Imported or Site Won Crushed Hardcore Stone and Brick (e.g. Break Layer)	On-site Verification: One sample every 500m³ (or minimum of 4 No. samples, whichever is greater).

Table 9 - Environmental Chemistry Analysis Suite for Soils and Imported Stone

Suite Reference	Environmental Chemistry Analysis*
Greenfield, Brownfield or Manufactured Soils, Imported Quarried Stone and imported or site won hardcore stone and brick	Metals: Arsenic, cadmium, chromium, chromium VI, lead, mercury, selenium, copper, nickel, zinc, water soluble boron; pH Value 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)

*Depending on the source of imported materials, additional testing may be required to confirm suitability.

Assessment criteria: Concentrations of the above determinants shall not exceed the 'Residential without Home Grown Produce' screening criteria (contained within Appendix C).

Definition of 'clean': Where ALL concentrations are less than these values the soils shall be defined as 'clean'. No asbestos shall be detected in soils described as 'clean'.

Soil organic matter (SOM): A review of the thresholds may be made for specific soil sources whereby the Soil Organic Matter ranges.

7 STRATEGY FOR HANDLING POTENTIALLY CONTAMINATED SOILS AND CONTAMINATIVE INCIDENTS ON SITE

7.1 Contaminated Soils and Groundwater

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.

Unsuitable soils will likely contain high concentrations of potential contaminants of concern (e.g. hydrocarbons, asbestos), suitable warning signs or protection measures should be placed around stockpiles to inform site staff and visitors. Soil stockpiles must be placed in an arrangement that minimises potential for contamination of adjacent stockpiles or materials (i.e. do not place 'clean' imported soils next to contaminated arisings).

Where contaminated perched water is encountered, the water should be pumped into a suitable container, which may be a specifically constructed tank, where the water may be sampled for chemical assessment for potential contaminants of concern accounting for the sites historic land use, as identified in the ground investigation report.

Where contaminated perched water is encountered, the Contractor must cease works, and an assessment by the Contractor and Engineer must be undertaken to determine suitable methodologies for continuing works, where appropriate.

Free phase contamination was not identified within perched water or groundwater bodies, however if encountered during remediation works, with particularly reference to Made Ground soils or perched water, the products shall be removed and placed into a specific storage tank for assessment and removal from site.

Contaminated perched water or groundwater is unlikely to be disposable into a foul water sewer and will likely require disposal off-site. Contaminated perched water must not be allowed to flow directly into the underlying natural site soils or bedrock.

Guidance on managing contaminated water is given in the jointly issued document produced by Water UK, Environment Agency, NIEA, Natural Resources Wales, DWI, Fera, Defra's CBRN Recovery Team and NFCC National Resilience, titled Protocol for the disposal of contaminated water and associated waste incidents, broadly comprising a system of:

- i. Contain – Closed containers, contained at source.
- ii. Identify – Chemical analysis of water, seek specialist advice where required.
- iii. Treat – Is site treatment practicable to allow safe disposal?
- iv. Dispose – Remove from site by appropriate method, following all relevant guidance and regulation.

The following bodies must be contacted in the event of perched water contaminative incidents:

- Water/Waste Water Companies (United Utilities)
- Environment Agency

Duty of Care: Under their 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 the Verification Engineer.

7.2 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 previous ground investigation works. It is possible that unknown/unrecorded substructures

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(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 prove and intercept the contaminant. The contaminant will then be pumped into suitable containers.

The procedure outlined in *Section 8* should also be adhered too and the Engineer shall approve all proposals for such remediation.

7.3 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.

1. Cease works and make safe all excavations in this location and report observations to the Site Manager. A full time watching brief should be undertaken during excavation of hydrocarbon impacted soils by a qualified Geo-Environmental Engineer. Soils are to be monitored for visual, olfactory contamination and also monitored using a photoionization detector (PID).
2. The Site Manager is to notify the Engineer.
3. Under guidance of the qualified Engineer take representative samples of the suspect materials and forward to a suitably accredited laboratory for analysis.
4. The Newcastle-under-Lyme Council Contaminated Land Planning Officer and if relevant the Environment Agency are to be kept fully informed of any such occurrences. Contaminated Land Planning Officer must agree the strategy for dealing with unexpected contamination before works continue in that area.
5. 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 site preparation, removal of contaminated soils from site as well as visiting site as soon as potential contamination is observed by the contractor.

A Geo-Environmental Engineer must also be present on site during excavations and remedial treatment of hydrocarbon impacted soils in the east of the site. Records of any unexpected contamination must be included within the Remediation Completion Report.

7.4 Health & Safety

This section details health and safety requirements associated with contaminated land but does not seek to cover all aspects to be managed by the Contractor under CDM Regulations and detailed in Method Statements.

The works are likely to generate soils, dust, waste asbestos containing materials, groundwater, and other materials that may be a risk such as petroleum hydrocarbons and other related chemicals. The Contractor shall incorporate in its health and safety plan provisions for protecting personnel from physical and chemical hazards associated with these materials. The health and safety plan should also incorporate personnel decontamination requirements and facilities.

7.4.1 Contractor Method Statements

The Contractor is required to prepare method statements relating to the separate tasks highlighted and provide these to the client or Principal Designer along with the Engineer for review prior to the commencement of the related works.

The Contractor shall induct all its employees and subcontractors into the relevant aspects of their health and safety plan and method statements prior to each employee and/or subcontractor commencing works on site.

No works shall commence until the clients' nominated Principal Designer has approved the task specific method statement.

7.5 Environmental Controls

Environmental Controls are the responsibility of the Contractor. However, in general this section details specific requirements for potentially contaminated soils and is not intended to cover all aspects to be managed by the Contractor and detailed within their Method Statements.

Without limiting the Contractor's obligations, it shall be their responsibility to comply with all applicable laws, regulations and rules relating to potential contamination with regard to:

- Surface water run-off.
- Airborne particulates/vapours/odour; including asbestos materials and fibres, and,
- Control of spillages.

Method statements are to be provided to the Engineer and should incorporate the environmental management measures pertaining to the above factors, with further detail given below.

7.5.1 Surface Water Run-Off

The Contractor is responsible for ensuring that site surface water run-off does not leave the site.

The Contractor is to provide for necessary surface water diversion systems as required to keep the construction area free from excess surface or groundwater that may interfere with the works.

All personnel engaged by the Contractor should be trained in response techniques (e.g., use of absorbent materials, etc.) to ensure that any surface water run-off with fuel leakage impact or associated potentially contaminated soil is managed appropriately.

7.5.2 Airborne Particles/Vapour/Odour

The Contractor is responsible for the implementation of dust suppression in work areas, using water or other means of suppression that are not considered harmful to the environment. The Contractor should also set out procedures for the mitigation of any potential odours that may arise from exposed contaminated soils that could affect off-site users (adjacent residents).

An Asbestos Management Plan must be in place during demolition, earthworks and construction works, to inform procedures and mitigation measures to be implemented during excavation and removal of asbestos containing materials.

7.5.3 Control of Spillage

During the phase of works, any type of spillage (including fabricating, hydraulic oils, fuels and/or other materials) should be immediately contained, removed, and disposed of, with any further surrounding areas cleaned.

8 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 groundworks. It is anticipated records of the following will be taken during the below phases of work:

- Documentation of general works including records from watching brief, asbestos management procedures during the works and records of contaminative incidents and any unexpected contamination
- On delineation and removal of contaminated soils from site for off-site disposal, including:
 - A plan illustrating the extent of hydrocarbon impacted soils (including X, Y, Z co-ordinates of excavation extents).
 - A plan illustrating excavation side wall and base sample locations and elevation, including (X, Y, Z co-ordinates).
 - Soil chemical analysis results, demonstrating that hydrocarbon impacted soils have been removed.
 - Photographic record of delineation and excavation works.
 - Waste Transfer Notes for materials removed from site.
 - Details of materials used to infill excavation area.
- Details of materials removed from site, including:
 - Source location
 - Volume
 - Laboratory testing certificates, may include WAC testing
 - Waste Transfer Notes
- Placement of the requisite depth of clean capping material in areas of proposed soft landscaping, including:
 - Details of materials imported, including material types source details, volumes, chemical analysis results and imported material transfer tickets
 - Hand excavated trial pits to confirm sufficient thickness of clean capping has been installed, including high visibility layer or hardcore no dig layer, as detailed in Section 5.3.
 - Photographic record demonstrating that sufficient capping layer thickness has been placed in all soft landscaping areas.

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.

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

9 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:

- Details and documentation of asbestos management measures utilised during the works;
- Details of full extent of hydrocarbon impacted soils excavated and remediated, including:
 - A plan illustrating the extent of hydrocarbon impacted soils (including X, Y, Z co-ordinates of excavation extents).
 - A plan illustrating excavation side wall and base sample locations and elevation, including (X, Y, Z co-ordinates).
 - Soil chemical analysis results, demonstrating that hydrocarbon impacted soils have been removed.
 - Photographic record of delineation and excavation works.
 - Waste Transfer Notes for materials removed from site.
 - Details of materials used to infill excavation area.
- Details of any unexpected contamination encountered on site and appropriate measures taken to respond. If no unexpected contamination was encountered, a letter from the contractor confirming this should be included in the Verification Report ; and,
- Records of waste transfer notes and consignment notes for contaminated material disposed of off-site.
- Confirmation of imported capping materials suitability for soft landscaped areas including environmental chemistry testing results;
- Confirmation that the remediation has been undertaken satisfactorily and in accordance with the Remediation Strategy;
- Confirmation that the remediation objective has been achieved (see *Section 5.0*);
- 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/or 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.

APPENDICES

Appendix A – Drawings

Appendix B – Exploratory Hole Logs

Appendix C – Screening Criteria for Imported Materials

Appendix A – Drawings



- Key
For detailed description on below items refer to Outline Landscape Specification & Report SPS-RFM-XX-XX-SP-L-19-0001
- Site works boundary
 - Proposed building
 - Existing building
 - PCC Concrete flags to footpath **P1**
To adoptable standards. To be agreed with MCC.
Size: 450(W)x450(L)x50(D)mm
 - Small clay paving units **P2**
To private terraces and main entrance
Size: 200(W)x65(L)x50(D)mm
 - Macadam surfacing to service access route **P10**
Refer to engineers detail.
 - Natural stone tactile paving to entrance steps **P8**
Size: 400x400x50
 - Tactile paving to footpath crossing **P9**
Size: 400x400x50
Refer to approved S278 layout from engineers.
 - Proposed flat bar railing type-1 to townhouses **B1**
Height: 1100mm
 - Proposed flat bar railing fence type-2 to eastern boundary **B2**
Height: 2400mm
 - Curtilage paving band to building edge
Clay paving units **P2**
Size: 200(W)x65(L)x50(D)mm
 - Flush metal edging **E1**
Laid flush
 - Proposed PCC conservation road kerb **K1**
Laid to 100-125 upstand. As per approved S278 drawings.
Size: 145 x 915 x 255mm
 - Proposed PCC conservation x drop kerb **K1**
Transition kerb to both sides. Drop kerb laid flush. As per approved S278 drawings.
Size: 145 x 915 x 145mm
 - Proposed conservation play or drop kerb to service route **K1**. TBC.
75mm upstand. As per approved S278 drawings.
 - Proposed conservation x edging **K2**
Laid flush
Size: 63 x 915 x 150mm
 - Proposed slot drain
Refer to drainage layout from engineers
Drainage design to be further developed at stage-4.
 - Proposed freestanding raised metal planter with integrated seating on Store Street **F6**
Offset 500mm from the kerb edges. Subject to agreement with highways. Further details to be coordinated with fabricator.
Height: 800mm
 - Bespoke feature seat to entrance with engraved branding **F1**
Timber top on stone base.
Height: 500mm
 - Bespoke raised metal edge planter to townhouses **F7**
Height: 600mm. 200mm below FFL.
 - Bespoke metal post to townhouses with engraved house number **F13**
Height: 1500mm
Detail to be developed at stage-4
 - Proposed 2m-high screen for wind mitigation (50% perforation)
Detail by facade/wind consultants. Refer to consultants detail.
 - Proposed cycle stands **F9**
 - Granite step with timber handrail to entrance **P5**
Top steps to be feathered to tie in with levels. Detail design to be coordinated with manufacturer. For handrail refer **F15** in specification

- Proposed tree in soft landscape
Refer to SPS-RFM-XX-XX-DR-L-19-1006 Planting Plan and SPS-RFM-XX-XX-DR-L-19-8001 Soft Landscape Details
 - Proposed feature multi stem tree
Refer to SPS-RFM-XX-XX-DR-L-19-1006 Planting Plan and SPS-RFM-XX-XX-DR-L-19-8001 Soft Landscape Details
 - Proposed feature shrub
Refer to SPS-RFM-XX-XX-DR-L-19-1006 Planting Plan and SPS-RFM-XX-XX-DR-L-19-8001 Soft Landscape Details
 - Proposed shrub planting mix
Refer to SPS-RFM-XX-XX-DR-L-19-1006 Planting Plan and SPS-RFM-XX-XX-DR-L-19-8001 Soft Landscape Details
 - Proposed hedge planting to townhouses
Refer to SPS-RFM-XX-XX-DR-L-19-1006 Planting Plan and SPS-RFM-XX-XX-DR-L-19-8001 Soft Landscape Details
 - Gravel chipping layer to hedge planting and along the planting strip on Sparkle Street **S1**
Depth: Min 50mm to hedges. Min 300mm to planting.
- +2.200 Proposed levels
- +2.200(e) Existing levels
- Proposed manhole cover
Refer to drainage layout from engineers
 - Existing light posts/road sign to be retained
 - Proposed litter bins **F10**
 - Private ownership boundary shown indicatively

Notes

- All dimensions in mm, unless otherwise stated.
- Scaling from drawing if printed incorrectly may lead to errors.
- All information outside red line boundary shown for contextual purpose only.
- All hatch patterns are indicative only unless stated otherwise.
- This drawing is to be read in conjunction with the following re-form landscape architecture documentation:
SPS-RFM-XX-L01-DR-L-19-1002 Landscape GA Plan Podium Level
SPS-RFM-XX-L10-DR-L-19-1003-Landscape GA Plan Roof Terrace Level
AND all relevant documentation from the design team
- Levels information on this drawing illustrates the design intent only.

27.09.24	Stage-3 issue	SS	DL	DL	P02
Date	Description of revision	Drawn by	Checked by	Approved by	Revision

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Project
SPARKLE STREET, MANCHESTER
RF23-1006

Client
CENTRAL & URBAN - JRL

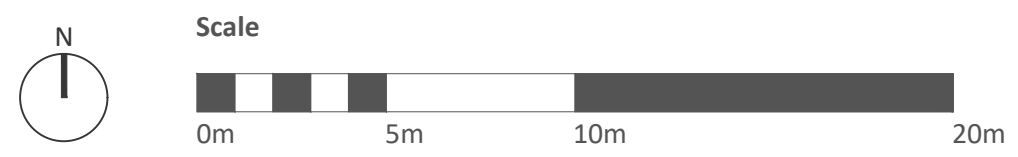
Document title
LANDSCAPE GENERAL ARRANGEMENT PLAN
GROUND LEVEL

Paper size
A1
Scale
1:200

Status
FOR STAGE APPROVAL
S4

Drawing number
SPS-RFM-XX-L00-DR-L-19-1001
Revision
P02

© re-form landscape architecture



Additional GI Exploratory Hole Location Plan

-  Window sample borehole Location (max depth 5m bgl).
-  Window sample boreholes to 5m with rotary core follow on to 35m.
-  Hand Excavated Trial Pit to maximum depth of 1.2m bgl.
-  Delineation Trial Pits
-  Delineation Window Sample boreholes
-  Foundation Trial Pit Location
-  Sub-station Window Sample Borehole

All proposed locations subject to GPR utility clearance.
It is assumed that free and unobstructed access is available to all proposed exploratory hole locations.

Project Name: Sparkle Street

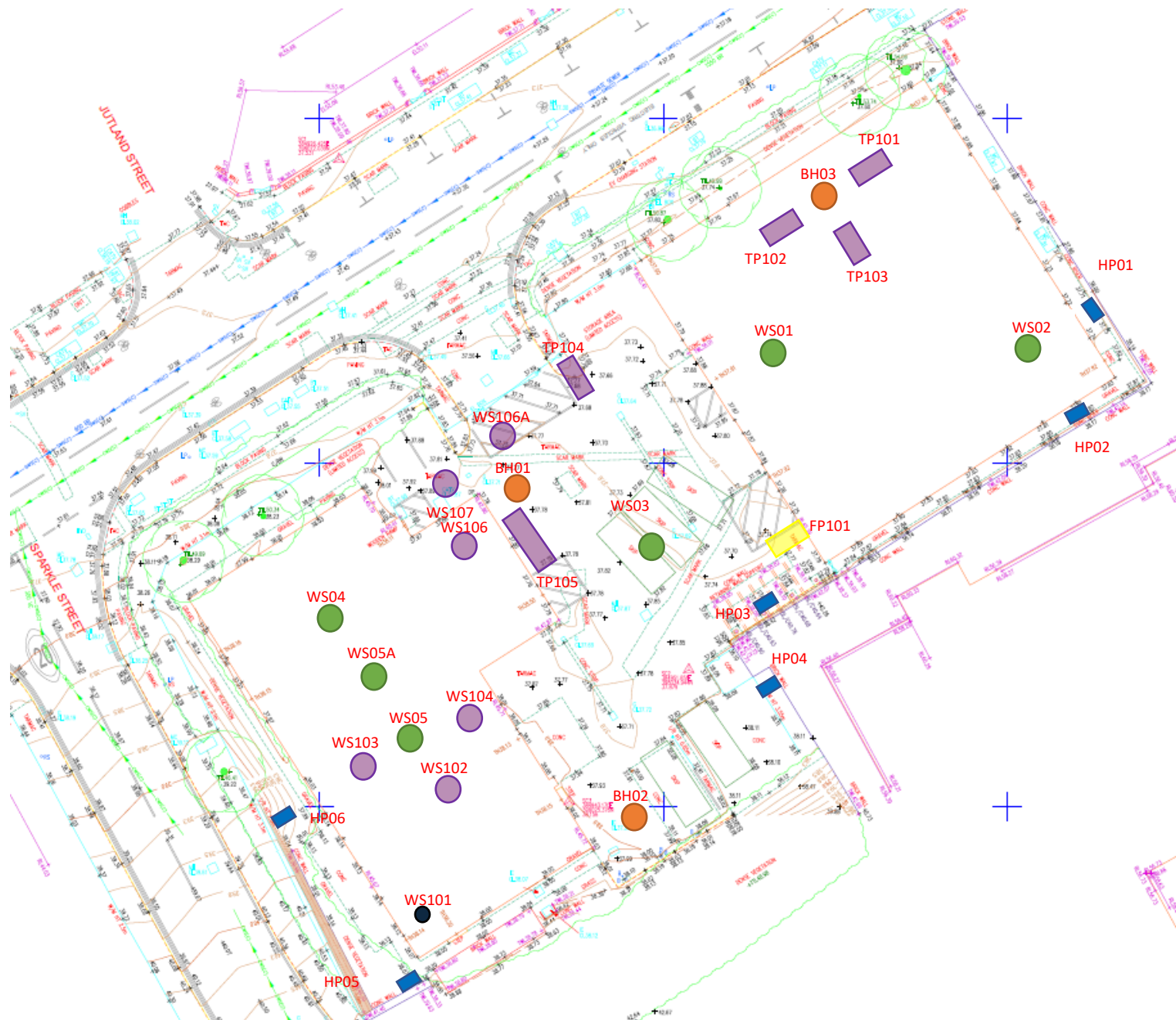
Project Number: B082142.301

Drawing Name: Additional Ground Investigation
Exploratory Hole Location Plan

Drawing No: 082142-CUR-00-XX-DR-GE-80003-P01

Produced by: J Provis

27/11/2025



Appendix B – Exploratory Hole Logs

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 28/04/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		0.40 - 0.50	ES				0.10 0.25 0.69			MADE GROUND: Black tarmac MADE GROUND: Grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse sub-angular brick, concrete and slate fragments. MADE GROUND: Black very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse subangular brick, concrete and clinker fragments. MADE GROUND: Reddish brown slightly silty gravelly cobbly sand. Sand is fine to coarse. Gravels are frequent fine to coarse subangular brick fragments. Cobbles are occasional subangular brick fragments. <i>N=5 (3,1/2,1,1,1)</i>	1
		1.40 - 1.50	ES				1.50 1.65			MADE GROUND: Black very sandy silty gravel. Sand is fine to coarse. Gravel is fine subangular wood. <i>From 1.50 to 2.58m material has a strong hydrocarbon odour and an iridescent sheen.</i> MADE GROUND: Greenish brown very sandy silty gravel. Sand is fine to coarse. Gravel is fine subangular wood. <i>N=28 (3,6/6,7,8,7)</i>	2
		2.20 - 2.40	ES				2.58 2.88			Medium dense black very silty SAND. Sand is fine to coarse. Dense light brown very silty gravelly SAND. Sand is fine to coarse. Gravels are frequent rounded to subangular mudstone, siltstone, sandstone and quartzite fragments. <i>N=44 (7,8/7,10,15,12)</i>	3
		3.00 - 3.30 3.00 - 3.50	B ES							<i>N=35 (7,8/9,9,7,10)</i>	4
										<i>N=35 (5,8/9,9,9,8)</i>	5
							5.27 5.50			Dense light brown and black mottled very silty gravelly SAND. Sand is fine to coarse. Gravels are frequent rounded to subangular mudstone, siltstone, sandstone and quartzite fragments. Very dense light brown very silty gravelly SAND. Sand is fine to coarse. Gravels are frequent rounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	6
		6.00 - 6.50	D				6.00 6.50			Firm greyish brown very sandy gravelly CLAY. Sand is fine to coarse. Gravels are frequent fine to coarse rounded to subangular mudstone, siltstone and sandstone fragments. <i>N=50 (7,8/50 for 255mm)</i> Very dense reddish brown gravelly Sand. Sand is medium to coarse. Gravels are fine to coarse rounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	7
		7.50 - 8.00	B								8

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

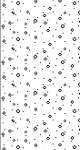
Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 28/04/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description		
				TCR	SCR	RQD						
							8.14			N=50 (25 for 125mm/50 for 110mm) Very dense greyish brown very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse sub-rounded to subangular of mixed lithologies.		
							8.66			No recovery (suspected very dense sandy gravel).		
											N=50 (25 for 50mm/50 for 70mm)	
		10.33 - 11.00	20	100	75	46					Very weak to weak, reddish brown medium to coarse grained SANDSTONE. Fractures are 0-10 degrees, close to medium spaced, planar, rough, clean. From 10.13 to 10.44m 1 No. 0-10 degrees, undulating, rough, clean fracture. From 10.63 to 10.66m 1 No. 45 degree, planar, rough, clean fracture. From 10.68 to 10.71m recovered as non-intact brown clayey medium to coarse sand. From 11.13 to 11.18m recovered as non-intact coarse sand. From 11.18 to 11.42m fractures are closely to very closely spaced. From 11.2 to 11.25m 1 No. vertical, rough, clean fracture.	9
			12									
		11.00 - 12.50	NI	100	97	59					Very weak to weak, reddish brown medium to coarse SANDSTONE. Fractures are 0-10 degrees, close to very close spaced, planar, rough, clean. From 12.9 to 13.05m recovered as non-intact medium to coarse sand. From 13.12 to 13.19m recovered as non-intact medium to coarse sand. From 13.39 to 13.46m recovered as non-intact medium to coarse sand. From 13.46 to 13.49m recovered as non-intact extremely weak coarse subangular gravel comprising mudstone. From 13.76 to 14.00m no recovery.	10
			38									
			7									
			AZCL									
		12.50 - 14.00	24	84	61	31					Very weak to weak, reddish brown medium to coarse SANDSTONE. Fractures are 0-10 degrees, close to very close spaced, planar, rough, clean. From 12.9 to 13.05m recovered as non-intact medium to coarse sand. From 13.12 to 13.19m recovered as non-intact medium to coarse sand. From 13.39 to 13.46m recovered as non-intact medium to coarse sand. From 13.46 to 13.49m recovered as non-intact extremely weak coarse subangular gravel comprising mudstone. From 13.76 to 14.00m no recovery.	11
			NI									
			29									
			NI									
			20									
			NI									
		14.00 - 15.50	11	100	99	52					From 14.46 to 14.52m sandstone is very weak.	12
			AZCL									
			12									
			11									
	NI							From 15.85 to 15.95m recovered as non-intact gravelly medium to coarse sand with gravels comprised of very weak fine to coarse subangular mudstone. From 15.95 to 16.08m 1 No. vertical, planar, rough, clean fracture.	13			
Continued on next sheet											14	

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 28/04/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description								
				TCR	SCR	RQD												
		15.50 - 17.00	16	100	76	38	18.50			From 16.18 to 16.38m recovered as non-intact gravelly medium to coarse sand with gravels comprised of very weak fin to coarse subangular mudstone.	17							
			NI															
			12															
		17.00 - 18.50		NI	100	80				37	From 17.54 to 17.63m recovered as non-intact fine to coarse sand.	18						
				9														
			18.50 - 20.00										100	100	69	Weak, reddish brown medium to coarse grained SANDSTONE. Fractures are 0-10 degrees, closely to medium spaced, planar, rough, clean.	19	
		10																
				20.00 - 21.50	95	95				84	From 20.53 to 20.69m 2 No. stepped, undulating, rough, clean closely spaced fractures.	20						
			AZCL															
		21.50 - 23.00	7										100	100	77	From 21.43 to 21.50m no recovery.	21	
				AZCL														
					23.00 - 24.50	93				85	85	From 23.00 to 23.10m no recovery. From 23.10 to 23.18m non-intact drilling induced fractures recovered as subangular gravel. From 23.19 to 23.31m 1 No. 45 degrees, planar, rough, clean fracture.						22
		From 23.88 to 24.00m 1 No. 45 degrees, planar, rough fracture with brown fine to coarse clayey sand infill.	23															
				Continued on next sheet														

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 28/04/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description		
				TCR	SCR	RQD						
			8								25	
		24.50 - 26.00		100	100	75				From 24.42 to 24.50m 1 No. 45 degrees, planar, rough, clean fracture.		
												From 25.07 to 25.08m 1 No. 0-10 degrees, undulating, rough, clean fracture.
										From 25.31 to 25.32m 1 No. 0-10 degrees, undulating, rough fracture with brown clay infill.		
		26.00 - 27.50	100	100	88	From 26.30 to 26.51m 1 No. 45 degrees, planar, smooth fracture with grey clay infill. From 26.30 to 26.54m sandstone is very weak.						
										From 26.98 to 27.04m 1 No. 45 to 50 degrees, planar, rough, clean fracture.		
		27.50 - 29.00	10	90	90	73				From 28.07 to 28.10m 2 No very closely spaced band of very weak reddish brown mudstone.		
			6									
			AZCL							From 28.45 to 29.00m no recovery.		
		29.00 - 30.50	NI	100	91	59				From 29.70 to 29.84m recovered as non-intact medium to coarse gravelly sand with gravels comprised if fine to coarse subangular sandstone.		
			7							From 2 No. 30.12 to 30.50m very weak closely to very closely spaced fractures.		
	21											
30.50 - 32.00	13	100	100	68	From 30.82 to 30.86m sandstone is very weak. From 31.04 to 31.16m 1 No. vertical, planar, rough, clean fracture. From 31.21 to 31.22m 1 No. 45 degrees, planar, rough, clean fracture.							
	9				From 31.57 to 31.59m 1 No. 45 degrees, planar, rough, clean fracture.							
</												

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 28/04/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		32.00 - 33.50	10	100	100	88	35.00		<		

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 03/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
							0.08			MADE GROUND: Black tarmac	
		0.40	ES				0.46			MADE GROUND: Grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse sub-angular brick, concrete, slate and asbestos cement fragments.	
		0.46	ES				0.91			Soft grey and brown mottled very sandy gravelly CLAY. Sand is fine to coarse. Gravel is frequent fine to coarse subangular to subrounded mustone and siltstone fragments.	1
		1.70 - 2.00	B				2.00			Dense reddish brown very clayey gravelly SAND. Sand is fine to coarse. Gravels are frequent fine to coarse subrounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	
							2.20			N=30 (1,2/6,10,8,6)	
							2.60			Medium dense light grey very silty SAND. Sand is fine to coarse.	2
							2.80			N=19 (4,5/4,4,5,6)	
		2.80 - 3.00	D				3.00			Stiff light grey sandy gravelly CLAY. Sand is fine to coarse. Gravels are frequent fine to coarse subrounded to subangular mudstone, siltstone and sandstone fragments.	
							3.18			Medium dense light grey very silty SAND. Sand is fine to medium.	3
							3.50			Stiff light grey sandy gravelly CLAY. Sand is fine to coarse. Gravels are frequent fine to coarse subrounded to subangular mudstone, siltstone and sandstone fragments.	
		4.00 - 4.45	D				3.71			Very dense light brown very gravelly SAND. Sand is fine to coarse. Gravels are fine to coarse subrounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	4
							5.00			N=50 (10,15/50 for 150mm)	
										Soft light brown sandy gravelly CLAY. Sand is fine to coarse. Gravels are frequent subrounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	
										Very dense light brown very gravelly SAND. Sand is fine to coarse. Gravels are fine to coarse subrounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	5
		5.50 - 6.50	B							Stiff brownish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse sub-rounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	
										Very dense reddish brown slightly gravelly SAND. Sand is fine to coarse. Gravels are frequent fine to coarse subrounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	6
										N=50 (25 for 85mm/50 for 75mm)	
										N=50 (11,13/50 for 125mm)	
		7.00 - 7.50	B				6.88			Very dense greyish brown very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse sub-rounded to subangular of mixed lithologies.	7
							8.00			From 7.79m to 8.00m No recovery.	8

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 03/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		8.00 - 9.50	11	100	88	50	8.22			Very dense greyish brown very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse sub-rounded to subangular of mixed lithologies. <i>N=50 (25 for 60mm/50 for 70mm)</i>	9 10 11 12 13 14 15 16
										Very weak to weak, reddish brown medium to coarse grained SANDSTONE. Fractures are 0-10 degrees, closely to very closely spaced, planar, rough, clean.	
										From 8.34 to 8.36m 1 No. 30 degrees, undulating, rough, clean fracture.	
										From 8.64 to 8.80m 1 No. vertical, rough, clean fracture.	
										From 8.83 to 8.84m 1 No. 45 degrees, planar, rough, clean fracture.	
										From 9.21 to 9.44m 1 No. vertical, planar, rough, clean fracture.	
		9.50 - 11.00	NI	100	85	28	10.22			From 10.00 to 10.22m recovered as non-intact gravelly medium to coarse sand with gravels comprised of fine to coarse sub-rounded to subangular mudstone and sandstone fragments.	
			15							Weak, reddish brown medium to coarse grained SANDSTONE. Fractures are 0-10 degrees, closely to very closely spaced, planar, rough, clean.	
										From 10.48 to 10.51m 1 No. stepped, undulating, rough, clean fracture.	
										From 11.00 to 12.33m fractures are very close to medium spaced.	
		11.00 - 12.50	10	89	87	47				From 11.59 to 11.61m 1 No. 0-10 degrees, undulating, rough fractures with medium to coarse sand infill.	
			10							From 11.90 to 11.93m recovered as non-intact recovered as silty fine to coarse sand.	
			AZCL							From 12.33 to 12.50m no recovery.	
		12.50 - 14.00	14	97	97	36				From 13.05 to 13.09m 4 No. 10-20 degrees, planar, rough fractures with fine to coarse sand infill.	
										From 13.54 to 13.55m 1 No. 45 degrees, undulating, rough, clean fracture.	
										From 13.66 to 13.67m 1 No. 45 degrees, undulating, rough fracture with medium to coarse sand infill.	
										From 13.95 to 14.00m no recovery.	
										From 14.15 to 14.18m 1 No. 45 degrees planar, rough, clean fracture.	
		14.00 - 15.50	12	100	100	65				From 14.49 to 14.51m 1 No. 45 degrees, planar, rough, clean fracture.	
										From 14.62 to 14.63m 1 No. 0-10 degrees, undulating, rough, clean fracture.	
										From 14.84 to 15.50m sandstone is coarse grained with frequent fine to coarse subrounded gravels comprising quartzite.	
										From 15.50 to 15.67m no recovery.	
			AZCL							Weak, reddish brown medium to coarse grained SANDSTONE. Fractures are 0-10 degrees, very closely to medium spaced, planar, rough, clean.	
			25				15.88			From 15.97 to 15.98m 1 No. 45 degrees, undulating, rough, clean fracture.	

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 03/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description						
				TCR	SCR	RQD										
		15.50 - 17.00	11	89	75	63				From 16.29 to 16.31m 1 No. 0-10 degrees, undulating, rough, clean fracture.	17					
		17.00 - 18.50	NI	100	89	76				From 16.71 to 16.72m 1 No. 0-10 degrees, undulating, rough, clean fracture.						
			8							From 17.00 to 17.08m recovered as non-intact medium to coarse sand.						
			NI							From 17.73 to 17.81m as non-intact medium to coarse sand.						
			7													
		18.50 - 20.00	12	78	78	37				From 18.50 to 18.76m sandstone is closely to very closely spaced.						
			AZCL							From 18.81 to 18.86m 1 No. 0-10 degrees, planar, rough fracture with brown clay infill.						
										From 18.93 to 18.98m 1 No. 50-60 degrees, planar, rough, clean fracture.						
		20.00 - 21.50	8	71	71	63				From 19.73 to 20.00m no recovery. (Drillers noted core lost to flush)						
			AZCL							From 20.80 to 20.82m 1 No. fracture 10-20 degrees, planar, rough fracture with brown clay infill.						
										From 20.97 to 20.98m 1 No. 10-20 degrees, undulating, rough fracture with fine to medium sand infill.						
		21.50 - 23.00	10	100	89	73				From 21.04 to 21.50m no recovery. (Drillers noted core damaged by drilling process)						
			NI							From 22.36 to 22.38m 1 No. 20-30 degrees, undulating , rough, clean fracture.						
			15							From 22.60 to 22.66m non-intact recovered as a medium to coarse sand.						
			NI							From 22.86 to 22.97m non-intact recovered as a medium to coarse gravelly sand with gravels comprised of fine to coarse subangular sandstone.						
		23.00 - 24.50	8	85	83	67				From 23.10 to 23.12m 1 No. 0-10 degrees, planar, rough fracture with fine to medium sand infill.						
			From 23.23 to 23.24m 1 No. 0-10 degrees planar, rough fracture with brown clay infill.													
			From 23.37 to 23.38m 1 No 20-30 degrees, planar, rough, clean fracture.													
															Continued on next sheet	24

Continued on next sheet

24

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 03/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description				
				TCR	SCR	RQD								
			AZCL							From 24.28 to 24.50m no recovery.				
										From 24.50 to 24.64m sandstone is very weak.				
		24.50 - 26.00	19	100	100	62				From 24.50 to 25.04m sandstone is closely to very closely spaced.				
			10							From 25.02 to 25.03m very weak reddish brown mudstone.				
		26.00 - 27.50		91	91	83				From 25.14 to 25.15m 1 No. vertical, planar, rough, clean fracture.				
										From 25.32 to 25.39m 1 No. 60-70 degrees, planar, rough, clean fractures.				
			5							From 25.65 to 25.66m 1 No. 10-20 degrees, undulating, rough, clean fracture.				
										From 25.72 to 25.74m 1 No. 0-10 degrees, undulating, rough, clean fracture.				
										From 25.87 to 25.88m 1 No. 0-10 degrees, planar, rough fractures with brown clay infill.				
		27.50 - 29.00	13	88	88	72				From 26.66 to 26.67m to 1 No. 45 degrees, planar, rough, clean fractures.				
			AZCL							From 26.97 to 27.02m 2 No. 0-10 degrees, undulating, rough closely to very closely spaced fractures with fine to coarse sand infill.				
										From 26.97 to 27.22m fractures are closely to very closely spaced.				
		29.00 - 30.50		93	93	67				From 27.36 to 27.68m no recovery.				
										From 27.68 to 27.78m 1 No. vertical, planar, rough, clean fractures.				
			24							From 28.12 to 28.14m 1 No. 0-10 degrees, planar, rough fracture with fine to medium clayey sand infill.				
										From 28.34 to 28.35m 1 No. 10-20 degrees, planar, rough fracture with fine to medium clayey sand infill.				
		30.50 - 32.00	6	100	100	85				From 28.61 to 28.62m 1 No. 10-20 degrees, planar, rough, clean fracture.				
										From 28.97 to 29.22m sandstone is closely to very closely spaced.				
			AZCL									From 30.20 to 30.25m 2 No. 10-20 degrees, undulating, rough, clean close to very closely spaced fractures.		
												From 30.39 to 30.50m no recovery.		
			5	100	100	85								
										From 31.39 to 32.02m 2 No. 0-10 degrees, undulating, rough, clean fractures.				
			21									From 31.81 to 32.00m fractures are close to very closely spaced.		
									Continued on next sheet					

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 03/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		32.00 - 33.50	6	90	90	83	35.00			From 32.59 to 32.95m 3 No. 45 degrees, planar, rough, clean closely spaced fractures.	33
			AZCL							From 33.35 to 33.50m no recovery.	34
		33.50 - 35.00	6	100	100	90				From 34.56 to 34.58m 1 No. 0-10 degrees, rough, clean fracture.	35
										End of borehole at 35.00 m	36
											37
											38
											39
											40

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 04/05/2023 - 11/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / Fl	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		0.40 - 0.50	ES				0.17 0.34			CONCRETE with subangular recycled concrete aggregate. MADE GROUND: Dark grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse subangular brick and concrete fragments. MADE GROUND: Black very gravelly cobbly sand. Sand is fine to coarse and contains ash. Gravel is frequent fine to coarse subangular brick, concrete and clinker fragments. Cobbles are occasional subangular brick fragments. <i>N=6 (1,0/0,1,2,3)</i>	1
							1.26			MADE GROUND: Very soft brown gravelly sandy organic silt. Sand is fine to medium. Gravel is frequent fine subangular brick fragments.	
		2.50 - 2.60	D				2.00 2.38			MADE GROUND: Dark brown to black very clayey gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse subangular brick and concrete fragments. <i>N=8 (1,1/2,2,2,2)</i>	2
		2.80 - 2.90 2.80 - 3.00 3.00 - 3.45	ES D D				2.76			Very soft black and brown mottled very sandy organic SILT. Sand is fine to medium. Slight organic odour. Soft reddish brown very sandy gravelly SILT. Sand is fine to coarse. Gravel is occasional subrounded mudstone fragments. <i>N=7 (1,1/1,2,2,2)</i>	3
		3.70 - 3.80	D				3.69			Very soft black sandy organic SILT. Sand is fine to coarse. Slight organic odour. <i>N=9 (1,1/2,2,2,3)</i>	4
		4.00 - 4.45	D				4.72			Dense greyish brown very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular of mixed lithologies. <i>From 4.72m to 5.00m No recovery. N=37 (13,9/7,7,10,13)</i>	5
		5.70 - 5.80	D				5.32 5.64 5.91			Reddish brown gravelly silty SAND. Sand is fine to coarse. Gravel occasional subangular to subrounded mudstone and sandstone fragments. Firm very sandy gravelly CLAY. Sand is fine to coarse. Gravel is occasional fine to medium subrounded to subangular mudstone fragments. No recovery (Drillers noted lost to flush - suspected very dense sandy gravel). <i>N=50 (5,5/50 for 245mm)</i>	6
		6.50 - 6.95	D				8.00				7
										Continued on next sheet	8

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

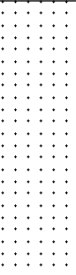
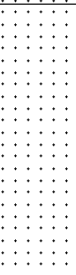
Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 04/05/2023 - 11/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description		
				TCR	SCR	RQD						
		8.50 - 8.80	B				9.50			Reddish brown slightly gravelly SAND. Sand is fine to coarse. Gravels are fine to coarse subangular sandstone fragments. (Highly weathered sandstone). <u>N=50 (4,4/50 for 275mm)</u>	9	
		9.50 - 11.00	13	75	75	37				Very weak to weak, reddish brown medium to coarse grained SANDSTONE. Fractures are 0-10 degrees, closely to very closely spaced, planar, rough, clean. <u>N=50 (25 for 30mm/50 for 50mm)</u> <u>From 10.01 to 10.03m 1 No. 0-10 degrees, undulating, rough fracture with fine to medium sand infill.</u> <u>From 10.32 to 10.35m 1 No. 30-40 degrees, planar, rough, clean fracture.</u> <u>From 10.62 to 11.00m bgl no recovery.</u>	10	
			AZCL									<u>From 11.19 to 11.25m recovered as non-intact medium to coarse sand.</u> <u>From 11.55 to 11.56m 1 No. 0-10 degrees, undulating, rough, clean fracture.</u> <u>From 12.04 to 12.76m no recovery.</u>
		11.00 - 12.50	NI	69	66	35				12		
			16									
			10									
		AZCL										
		12.50 - 14.00		84	84	64	12.76				Weak, reddish brown medium to coarse grained SANDSTONE. fractures are 0-10 degrees, closely to medium spaced, planar, rough, clean. <u>From 13.35 to 13.68m 4 No 0-10 degrees, undulating, rough closely to very closely spaced fractures with fine to medium sand infill.</u>	13
			9									
		14.00 - 15.50	16	74	42	20				<u>From 14.00 to 14.49m non-intact drilling induced fractures recovered as subangular gravel.</u> <u>From 15.11 to 15.50m no recovery.</u>	14	
			AZCL									
			11						<u>From 15.50 to 15.59m 2 No. 0-10 degrees, undulating, rough fractures with brown clayey fine to coarse sand infill.</u> <u>From 15.88 to 15.91m 1 No. 0-10 degrees, undulating, rough fractures with brown clay infill.</u>	15		
									Continued on next sheet	16		

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 04/05/2023 - 11/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description					
				TCR	SCR	RQD									
		15.50 - 17.00		100	100	59				<u>From 16.15 to 16.19m fractures are very closely spaced.</u>	17				
			5							<u>From 16.59 to 16.60m fractures are very closely spaced.</u>					
										<u>From 16.86 to 16.88m 1 No. 0-10 degrees, undulating, rough, clean fracture.</u>					
		17.00 - 18.50	9	95	95	79				<u>From 17.43 to 17.45m 1 No.45 degrees, planar, rough, clean fracture.</u>	18				
										<u>From 18.06 to 18.09m 2 No. undulating, rough, clean fractures.</u>					
			AZCL							<u>From 18.42 to 18.50m no recovery.</u>					
		18.50 - 20.00	10	100	96	69				<u>From 18.98 to 19.00m 1 No. 0-10 degrees, planar, rough fractures with fine to medium sand infill.</u>	19				
			NI							<u>From 19.12 to 19.14m 1 No. 45 degrees, planar, rough, clean fractures.</u>					
			10							<u>From 19.22 to 19.28m recovered as non intact very weak reddish brown coarse subangular mudstone gravel.</u>					
										<u>From 19.49 to 19.57m 1 No. vertical, undulating, rough, clean fracture.</u>					
		20.00 - 21.50		72	49	36				<u>From 20.32 to 20.39 non intact recovered as very weak mudstone.</u>	20				
			NI							<u>From 20.69 to 20.94m non-intact drilling induced fractures recovered as subrounded cobble.</u>					
			17							<u>From 21.08 to 21.50m no recovery.</u>					
			14							<u>From 21.66 to 21.68m 1 No. stepped, rough, clean fracture.</u>					
			AZCL									21			
			21.50 - 23.00	7	100	100				88	<u>From 22.89 to 22.91m 1 No.10-20 degrees, undulating, rough, clean fracture.</u>		22		
														<u>From 23.42 to 23.43m 1 No. 0-10 degrees, rough, clean fracture.</u>	
											<u>From 23.49 to 23.53m 1 No. 45 degree, undulating, rough, clean fracture.</u>				
		23.00 - 24.50		85	85	51					23				
														Continued on next sheet	24

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

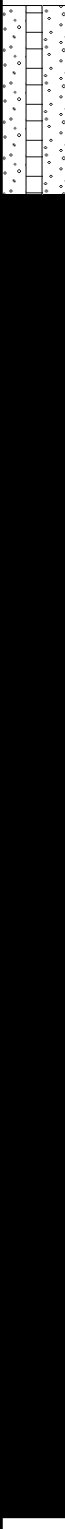
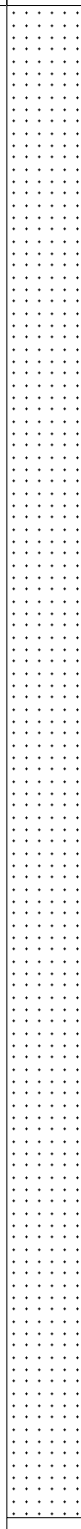
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Scale
1:40

Client: JRL Construction Management Limited

Dates: 04/05/2023 - 11/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		24.50 - 26.00	AZCL							From 24.26 to 24.50m no recovery.	25
			7							From 24.77 to 24.86m fractures are closely to very closely spaced.	
			44								
		26.00 - 27.50	9	100	100	85				From 25.20 to 25.25m 2 No. 0-10 degrees, undulating, rough, clean fractures. From 25.39 to 25.41m 1 No. 0-10 degrees, planar, rough fracture with brown fine to medium sand infill.	26
										From 25.90 to 26.00m very closely spaced fractures.	
		27.50 - 29.00	5	100	100	95				From 26.40 to 26.41m 1 No. 10-20 degrees, planar, rough, clean fracture.	27
										From 26.89 to 26.91m 1 No. 45 degrees, planar, rough, clean fracture.	
		29.00 - 30.50	AZCL							From 28.84 to 28.89m 1 No. 30-40 degrees, undulating, rough fractures with blue/grey clay infill. From 28.94 to 29.00m no recovery.	29
			9	94	94	67				From 29.43 to 29.44m 1 No. 0-10 degrees, undulating, rough, clean fracture. From 29.62 to 29.69m 1 No. 45 degrees, rough, clean fracture.	
		30.50 - 32.00	AZCL							From 30.41 to 30.50m no recovery.	31
				100	100	96				From 31.52 to 31.53m 1 No. 10-20 degrees, planar, rough, clean fracture.	
											32

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
RC

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 04/05/2023 - 11/05/2023

Logged By
RT

Well	Water Strikes	Depth (m)	Type / Fl	Coring			Depth (m)	Level (m)	Legend	Stratum Description	
				TCR	SCR	RQD					
		32.00 - 33.50	4	100	100	100	35.00			From 33.28 to 33.31m 1 No. 10-20 degrees, planar, rough, clean fracture.	33
		33.50 - 35.00	11	100	100	94				From 34.27 to 35.00m closely to very closely spaced. From 34.28 to 34.29m 1 No. 0-10 degrees, planar, rough fracture with fine to medium sand infill. From 34.64 to 34.67m 1 No. 45 degrees undulating, rough, clean fracture. From 34.97 to 34.98m 1 No. 0-10 degrees, undulating, rough, clean. End of borehole at 35.00 m	34 35 36 37 38 39 40

Remarks

Service inspection pit hand excavated from GL to 1.20m. Groundwater unable to be recorded due to flush.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
WS

Location: Sparkle Street, Manchester

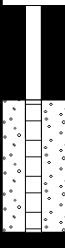
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Scale
1:40

Client: JRL Construction Management Limited

Dates: 04/05/2023 - 04/05/2023

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.18			CONCRETE with subangular recycled concrete aggregate.	
		0.60 - 0.70	ES		0.45			MADE GROUND: Grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse sub-angular brick, concrete and slate fragments.	
		1.20		50 (3,2/50 for 245mm)	1.32			MADE GROUND: Black very gravelly sand. Sand is fine to coarse and contains ash. Gravels are frequent fine to coarse sub-angular and sub-rounded	1
								End of borehole at 1.32 m	2
									3
									4
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. No Groundwater encountered.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
WS

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 04/05/2023 - 04/05/2023

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20 - 0.30	ES		0.17 0.41			CONCRETE with subangular recycled concrete aggregate. MADE GROUND: Grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse sub-angular brick, concrete and slate fragments. Dense reddish brown very clayey very gravelly SAND. Sand is fine to coarse. Gravels are frequent fine to coarse subangular to subrounded mudstone, siltstone and sandstone fragments.	1
		1.20 1.20 - 1.50	B	N=48 (5,8/9,12,13,14)					
		2.00 2.00	D	N=18 (3,3/3,4,5,6)	2.00			Firm grey very sandy gravelly CLAY. Sand is fine to coarse. Gravel is frequent fine to coarse subangular to subrounded mudstone, siltstone and sandstone fragments.	2
		3.00 3.00 - 3.45	D	N=30 (4,4/6,7,8,9)					3
					3.71 3.81			Dense reddish brown SAND. Sand is fine to coarse.	
		4.00		N=34 (13,10/7,9,8,10)	4.00 4.17			Firm grey very sandy gravelly CLAY. Sand is fine to coarse. Gravel is frequent fine to coarse subangular to subrounded mudstone, siltstone and sandstone fragments.	4
		4.60 - 4.80	B		4.56			Dense reddish brown SAND. Sand is fine to coarse.	
		5.00		50 (25 for 135mm/50 for 105mm)	4.87 5.00			Firm grey very sandy gravelly CLAY. Sand is fine to coarse. Gravel is frequent fine to coarse subangular to subrounded mudstone, siltstone and sandstone fragments.	5
								Dense reddish brown very clayey very gravelly SAND. Sand is fine to coarse. Gravels are frequent fine to coarse subangular sandstone fragments.	
								Dense greyish brown gravelly SAND. Sand is fine to coarse. Gravels are frequent fine to coarse sub-angular to subrounded mudstone, siltstone and sandstone fragments.	6
								End of borehole at 5.00 m	

Remarks

Service inspection pit hand excavated from GL to 1.20m. No Groundwater encountered.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
WS

Location: Sparkle Street, Manchester

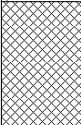
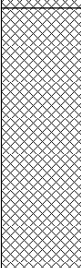
Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 25/04/2023

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
		Depth (m)	Type	Results							
		0.60 - 0.70	ES	N=5 (0,0/1,1,1,2)	0.19			CONCRETE with subangular recycled concrete aggregate.	1		
					0.44					MADE GROUND: Grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse sub-angular brick, concrete and slate fragments.	
		1.20		1.13		MADE GROUND: Black very gravelly sand. Sand is fine to coarse. Gravel is fine to coarse subangular brick, concrete, clinker and glass.					
		2.00		N=4 (0,0/1,1,1,1)			MADE GROUND: Light brown very sandy gravelly clay. Sand is fine to coarse and contains ash. Gravel is frequent subangular brick, concrete, coal, mudstone and sandstone fragements.	2			
		2.80 - 3.00	D	N=50 (0,1/50 for 285mm)	2.53				MADE GROUND: Light greyish brown very sandy gravelly clay. Sand is fine to coarse. Gravels are frequent fine to coarse subangular brick and concrete fragments.	3	
					2.75						
					3.00						Firm grey and brown mottled very sandy gravelly CLAY. Sand is fine to coarse. Gravels are frequent fine to coarse rounded to subangular mudstone, siltstone, sandstone and quartzite fragments.
		End of borehole at 3.00 m									4
											5
									6		
									7		
									8		

Remarks

Service inspection pit hand excavated from GL to 1.20m. No Groundwater encountered.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
WS

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 24/04/2023

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.17			CONCRETE with subangular recycled concrete aggregate.	
					0.54			MADE GROUND: Grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse sub-angular brick, concrete and slate fragments.	
		1.20		N=6 (1,1/1,1,2,2)				MADE GROUND: Dark brown to black very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse subangular brick and concrete fragments.	1
		1.70 - 1.80	ES		1.69			MADE GROUND: Light brown very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse subangular brick, concrete, clinker and coal fragments.	
		2.00		N=10 (3,5/3,2,2,3)	1.90			MADE GROUND: Dark brown and black mottled sandy gravelly clay. Sand is fine to coarse. Gravel is frequent fine to coarse subrounded to subangular brick, concrete, coal and mudstone fragments.	2
					2.00			MADE GROUND: Black silty gravelly sand. Sand is fine to coarse. Gravels are frequent fine to coarse subangular brick, coal and glass fragments.	
					2.25			MADE GROUND: Dark brown very gravelly sandy slightly cobbly clay. Sand is fine to coarse. Gravels are frequent fine to coarse subangular brick and concrete fragments. Cobbles are occasional subangular brick fragments.	
		2.70 - 3.00	B		2.60			Light brown gravelly SAND. Sand is fine to coarse. Gravels are frequent rounded to subangular mudstone and sandstone fragments.	
		3.00		50 (10,11/50 for 225mm)	3.00			End of borehole at 3.00 m	3
									4
									5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. No Groundwater encountered.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
WS

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 24/04/2023 - 24/04/2023

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15 0.23			0.15 0.23			CONCRETE with subangular recycled concrete aggregate.	
		1.20 1.30 - 1.50	ES	N=7 (1,1/1,1,2,3)	1.20			MADE GROUND: Reddish brown slightly silty gravelly sand. Sand is fine to coarse. Gravels are frequent fine to coarse subangular brick fragments.	1
					1.70			MADE GROUND: Grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse sub-angular brick, concrete and slate fragments.	
		2.00 2.00 - 2.45	D	N=5 (5,4/2,1,1,1)				MADE GROUND: Soft light brown very sandy gravelly clay. Sand is fine to coarse and contains ash. Gravels are frequent fine to coarse subangular brick, concrete, coal, clinker fragment.	2
								MADE GROUND: Soft light brown very sandy gravelly CLAY. Sand is fine to coarse. Gravel is frequent rounded to subangular brick, mudstone, siltstone, sandstone and quartzite fragments.	
		3.00		N=30 (1,2/4,13,11,2)	3.00			MADE GROUND: Very soft brown and grey mottled sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine sub-angular coal fragments.	3
		4.00		N=0 (0,0/0,0,0,0)					4
		4.80 - 5.00 5.00	D	N=0 (0,0/0,0,0,0)	4.90 5.00			Very soft black oranic sandy SILT. Sand is fine to medium. Strong organic odour. End of borehole at 5.00 m	5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. No Groundwater encountered.

Project Name: Sparkle Street

Project No.
B082142

Co-ords: -

Hole Type
WS

Location: Sparkle Street, Manchester

Level:

Scale
1:40

Client: JRL Construction Management Limited

Dates: 25/04/2023 - 25/04/2023

Logged By
RT

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.19			CONCRETE with subangular recycled concrete aggregate.	
					0.35			MADE GROUND: Grey very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse sub-angular brick, concrete and slate fragments.	
								MADE GROUND: Black very gravelly sand. Sand is fine to coarse. Gravels are fine to coarse subangular brick, concrete, clinker, coal and glass fragments.	
		1.20		N=2 (1,0/1,0,1,0)	1.00			MADE GROUND: Firm black very gravelly cobbly clay. Sand is fine to coarse and contains ash. Gravels are frequent fine to coarse subangular brick, concrete and coal fragments. Cobbles are occasional subangular brick fragments.	1
					1.59			MADE GROUND: Black gravelly sand. Sand is fine to coarse. Gravels are frequent fine to coarse subangular brick, concrete and coal fragments. Cobbles are occasional subangular brick fragments.	
		2.00		N=5 (2,1/2,1,1,1)	2.00			MADE GROUND: Dark brown to black very gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse subangular brick, concrete, clinker, coal and glass fragments.	2
					2.46			MADE GROUND: Soft brown and black mottled very sandy gravelly clay. Sand is fine to coarse. Gravel is frequent fine to coarse subangular brick, concrete, coal, ceramic and glass fragments.	
		3.00		N=4 (0,1/1,1,1,1)	3.00			MADE GROUND: Black and grey very silty gravelly sand. Sand is fine to coarse. Gravel is frequent fine to coarse subangular brick and coal fragments.	3
					3.76			No recovery. Drillers advised a cobble was being pushed down by the sampler.	
		4.00		N=11 (0,1/2,3,4,2)	4.00			Light brown slightly gravelly SAND. Sand is fine to coarse. Gravels are frequent rounded to subangular mudstone, siltstone, sandstone and quartzite fragments.	4
					4.80			End of borehole at 5.00 m	
		5.00		N=50 (9,9/50 for 285mm)	5.00				5
									6
									7
									8

Remarks

Service inspection pit hand excavated from GL to 1.20m. No Groundwater encountered.

Curtins				Trial Pit Log			Trialpit No HP01 Sheet 1 of 1		
Project Name: Sparkle Street				Project No. B082142		Co-ords: - Level:		Date 04/05/2023	
Location: Sparkle Street, Manchester				Dimensions (m):		0.55		Scale 1:40	
Client: JRL Construction Management Limited				Depth 0.35		0.39		Logged	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.11			MADE GROUND: Black very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded flint fragments. MADE GROUND: Grey very sandy gravel. Sand is fine to coarse. Gravel is medium to coarse subangular concrete fragments. Reddish brown clayey gravelly fine to coarse SAND. Gravel is frequent fine to coarse subrounded to subangular mudstone, siltstone and sandstone fragments. End of pit at 0.35 m		
				0.19					
				0.35					
									1
									2
									3
									4
									5
									6
									7
									8
Remarks: Foundation Pit to investigate foundations beneath existing retaining wall.								AGS	
Stability: Stable.									

Curtins				Trial Pit Log			Trialpit No HP02 Sheet 1 of 1		
Project Name: Sparkle Street				Project No. B082142		Co-ords: - Level:		Date 04/05/2023	
Location: Sparkle Street, Manchester				Dimensions (m):		0.5		Scale 1:40	
Client: JRL Construction Management Limited				Depth 0.46		0.41		Logged	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.13			MADE GROUND: Black very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded flint fragments. MADE GROUND: Grey very sandy gravel. Sand is fine to coarse. Gravel is medium to coarse subangular concrete fragments. Reddish brown clayey gravelly fine to coarse SAND. Gravel is frequent fine to coarse subrounded to subangular mudstone, siltstone and sandstone fragments. End of pit at 0.46 m		
				0.31					
				0.46					
									1
									2
									3
									4
									5
									6
									7
									8
Remarks: Foundation Pit to investigate foundations beneath existing retaining wall.								AGS	
Stability: Stable.									

Project Name:	Sparkle Street	Project No.	B082142	Co-ords:	-	Level:		Date	25/04/2023
Location:	Sparkle Street, Manchester			Dimensions (m):	0.48			Scale	1:40
Client:	JRL Construction Management Limited			Depth	0.93			Logged	

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.44			TOPSOIL: Friable black fine to coarse sand with frequent rootlets.	
				0.93			MADE GROUND: Reddish brown cobble comprising brick with poorly bonded mortar.	
							End of pit at 0.93 m	
								1
								2
								3
								4
								5
								6
								7
								8

Remarks:	Foundation Pit to investigate foundations beneath existing retaining wall.	
Stability:	+Stable.	

Curtins				Trial Pit Log			Trialpit No HP06 Sheet 1 of 1		
Project Name: Sparkle Street				Project No. B082142		Co-ords: - Level:		Date 25/04/2023	
Location: Sparkle Street, Manchester				Dimensions (m):		0.66		Scale 1:40	
Client: JRL Construction Management Limited				Depth 0.88		0.32		Logged	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.13			MADE GROUND: Black very sandy gravel. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded flint fragments. MADE GROUND: Reddish brown very gravelly very cobbly clayey fine to coarse sand. Gravels are frequent fine to coarse subangular brick and concrete fragments. Cobbles are frequent subangular brick fragments. End of pit at 0.88 m		
				0.88					
									1
									2
									3
									4
									5
									6
									7
									8
Remarks: Foundation Pit to investigate foundations beneath existing retaining wall.								AGS	
Stability: Stable.									



Project Name: Sparkle Street Additional Investigation

Project No.
082142.302

Co-ords: -
Level:

Date
05/11/2025

Location: Sparkle Street, Manchester

Dimensions
(m):

3.7

Scale
1:25

Client: Foras (Sparkle Street) Limited

Depth
3.60

1:3

Logged
JP

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼				0.20			Grey CONCRETE with a plastic membrane on the base.	
				0.55			MADE GROUND: Grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.	
							MADE GROUND: Dark brown gravelly fine to coarse sand with cobbles. Gravel is fine to coarse, angular to subangular of brick and sandstone. Cobbles are subangular of brick.	1
				2.20			Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded of sandstone and mudstone. <i>From 2.20m to 3.60m bgl: Trial pit collapsed from 3.6 to 2.2m bgl due to perched groundwater at 2.2m bgl.</i>	2
				3.40			Dark grey organic silty fine to medium SAND with an organic odour and pockets of sandy silt.	3
				3.60			End of pit at 3.60 m	4
								5

Remarks: Machine Excavated Trial Pit to 3.60m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. A perched groundwater strike was noted at 2.20m bgl with a fast infiltration rate and causing sidewall collapse of the trial pit. Trial pit was terminated due to an unstable side wall.

Stability: Unstable due to water ingress

Curtins				Trial Pit Log			Trialpit No TP102 Sheet 1 of 1			
Project Name: Sparkle Street Additional Investigation				Project No. 082142.302		Co-ords: - Level:		Date 05/11/2025		
Location: Sparkle Street, Manchester				Dimensions (m): Depth 3.35		4.2 1.2		Scale 1:25		
Client: Foras (Sparkle Street) Limited								Logged JP		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
				0.20			Grey CONCRETE with a plastic membrane on the base.			1 2 3 4 5
				0.40			MADE GROUND: Grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.			
				0.80			MADE GROUND: Dark brown gravelly fine to coarse sand with cobbles. Gravel is fine to coarse, angular to subangular of brick and sandstone. Cobbles are subangular of brick.			
				1.50			MADE GROUND: Light brown mottled reddish brown gravelly fine to coarse sand. Gravel is fine to coarse, angular to subangular of brick, pottery and concrete.			
				2.40			MADE GROUND: Dark greyish brown silty gravelly fine to coarse sand with a medium cobble content. Gravel is fine to coarse, angular to subangular of brick, pottery and wood. Cobbles are subangular of brick, pottery and wood.			
				3.30			MADE GROUND: Dark grey very silty slightly gravelly fine to coarse sand with an organic odour and a low cobble content. Gravel is fine to coarse, angular to subangular of brick and pottery. Cobbles are subangular of brick and pottery.			
				3.35			MADE GROUND: Red brick. End of pit at 3.35 m			
Remarks: Machine Excavated Trial Pit to 3.35m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during trial it progression. Trial pit terminated on a brick structure.										
Stability: Stable										





Project Name: Sparkle Street Additional Investigation

Project No.
082142.302

Co-ords: -
Level:

Date
05/11/2025

Location: Sparkle Street, Manchester

Dimensions (m):

3.1

Depth
2.50

1.7

Scale
1:25

Logged
JP

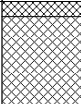
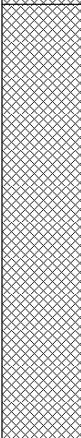
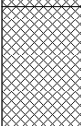
Client: Foras (Sparkle Street) Limited

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.05			Dark grey TARMACADAM.	
				0.40			MADE GROUND: Grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.	
							MADE GROUND: Dark grey and brown sandy gravel with a medium cobble content and a low boulder content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of brick, sandstone, wood, pottery and limestone. Cobbles and boulders are angular to subangular of brick and wood.	1
	1.80 - 1.90	ES		1.90			Brown very clayey slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular to subrounded of sandstone and mudstone.	2
				2.50			End of pit at 2.50 m	3
								4
								5

Remarks: Machine Excavated Trial Pit to 2.5m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during trial it progression. Trial pit reached target depth.

Stability: Stable



Curtins				Trial Pit Log			Trialpit No TP105 Sheet 1 of 1		
Project Name: Sparkle Street Additional Investigation				Project No. 082142.302		Co-ords: 384937.40 - 398048.29		Date 05/11/2025	
Location: Sparkle Street, Manchester				Dimensions (m):		4.2		Scale 1:25	
Client: Foras (Sparkle Street) Limited				Depth 2.80		1:1		Logged JP	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	2.20 - 2.40	ES		0.05	37.65		Dark grey TARMACADAM.		
				0.35	37.35		MADE GROUND: Grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.		
				1.80	35.90		MADE GROUND: Brown slightly gravelly silty fine to coarse sand. Gravel is fine to coarse, subangular of brick.		
				2.10	35.60		MADE GROUND: Grey silty slightly gravelly fine to coarse sand with a chemical odour and pockets of sandy clay. Gravel is fine to coarse, subangular of brick and ceramic.		
			2.50	35.20		At 2.1m bgl: Contamination observed within the trial trench was no longer observed 5.2m from the original delineation borehole. Brown silty clayey fine to medium SAND.			
			2.80	34.90		End of pit at 2.80 m			
Remarks: Machine Excavated Trial Pit to 2.8m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during trial it progression. Trial pit reached target depth.									
Stability: Stable				AGS					

Project Name: Sparkle Street Additional Investigation

Project No. 082142.302

Co-ords: -

Hole Type WS

Location: Sparkle Street, Manchester

Level:

Scale 1:25

Client: Foras (Sparkle Street) Limited

Dates: 03/11/2025 - 03/11/2025

Logged By JP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50 - 0.60	ES		0.15			Grey CONCRETE	1
					0.30			MADE GROUND: Reddish brown fine to medium sand.	
								MADE GROUND: Greyish brown mottled reddish brown clayey gravelly fine to coarse sand. Gravel is fine to coarse, angular to subangular of brick, limestone, sandstone and concrete.	
					0.80			Soft brown sandy CLAY. Sand is fine to coarse.	
		1.20		N=2 (1,1/0,1,0,1)					2
					2.10			Firm brown sandy CLAY. Sand is fine to coarse.	
		2.00		N=2 (1,0/1,0,1,0)	2.40			Loose slightly clayey fine to coarse SAND. <i>From 2.40m to 2.64m bgl: Strata is slightly damp.</i>	3
					2.64			Stiff brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subrounded of sandstone and mudstone.	
		3.00		N=50 (10,11/50 for 275mm)				<i>From 3.00m to 3.45m bgl: Strata is very stiff.</i>	
					3.45		End of borehole at 3.45 m		4
									5

Remarks

Window Sample Borehole to 3.45m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. Damp strata was noted from 2.40m to 2.64m bgl. Borehole terminated due to refusal in SPT.

Project Name: Sparkle Street Additional Investigation

Project No.
082142.302

Co-ords: -

Hole Type
WS

Location: Sparkle Street, Manchester

Level:

Scale
1:25

Client: Foras (Sparkle Street) Limited

Dates: 03/11/2025 - 04/11/2025

Logged By
JP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.14			Grey CONCRETE	
					0.45			MADE GROUND: Grey gravelly fine to coarse sand. Gravel is fine to coarse, subangular of brick and sandstone.	
		1.20		N=17 (4,4/5,5,4,3)				MADE GROUND: Reddish brown sand gravel. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of brick, and sandstone.	1
		2.00		N=5 (2,1/2,1,1,1)	2.15				2
		3.00		N=8 (2,2/2,2,2,2)				MADE GROUND: Reddish brown gravelly sandy clay. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of brick, sandstone, ceramic and limestone.	3
		4.00		N=10 (2,3/2,3,3,2)					4
		5.00		N=13 (3,2/3,4,3,3)					5

Continued on next sheet

Remarks

Window Sample Borehole to 6.45m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during drilling. Borehole reached the target depth.



Project Name: Sparkle Street Additional Investigation

Project No.
082142.302

Co-ords: -

Hole Type
WS

Location: Sparkle Street, Manchester

Level:

Scale
1:25

Client: Foras (Sparkle Street) Limited

Dates: 03/11/2025 - 04/11/2025

Logged By
JP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		6.00	ES	N=40 (3,3/5,8,12,15)	5.60			MADE GROUND: Dark grey clayey fine to coarse sand with a chemical odour.	6
		5.60 - 6.45			6.45				
								End of borehole at 6.45 m	7
									8
									9
									10

Remarks

Window Sample Borehole to 6.45m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during drilling. Borehole reached the target depth.

Hole Type	WS
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
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34	34
35	35
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38	38
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67	67
68	68
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70	70
71	71
72	72
73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

Scale
1:25

Logged By
JP

[illegible]

Window Sample Borehole to 2.00m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during drilling. Borehole terminated due to barrel misalignment.



Project Name: Sparkle Street Additional Investigation

Project No. 082142.302

Co-ords: -

Hole Type WS

Location: Sparkle Street, Manchester

Level:

Scale 1:25

Client: Foras (Sparkle Street) Limited

Dates: 03/11/2025 - 03/11/2025

Logged By JP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15			Grey CONCRETE	
					0.40			MADE GROUND: Grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.	
		1.20		N=26 (3,4/4,6,8,8)				MADE GROUND: Very dark grey gravelly fine to coarse sand. Gravel is fine to coarse, angular to subangular of brick, wood, sandstone and ceramic.	1
		2.00		N=8 (12,10/2,2,2,2)					2
		3.00		N=6 (1,2/2,1,2,1)	3.20			MADE GROUND: Brown sandy slightly gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of brick.	3
		3.80		50 (25 for 60mm/50 for 95mm)	4.00			MADE GROUND: Dark grey and reddish brown sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of brick.	4
					4.15			End of borehole at 4.15 m	5

Remarks

Window Sample Borehole to 4.15m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during drilling. Borehole terminated due to refusal in SPT.

Project Name: Sparkle Street Additional Investigation

Project No. 082142.302

Co-ords: 384934.02 - 398048.95

Hole Type WS

Location: Sparkle Street, Manchester

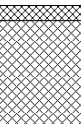
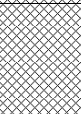
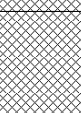
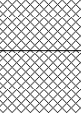
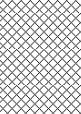
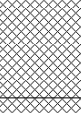
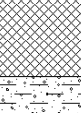
Level: 37.80

Scale 1:25

Client: Foras (Sparkle Street) Limited

Dates: 04/11/2025 - 04/11/2025

Logged By JP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.05			0.05	37.75		Dark grey TARMACADAM	1
		0.40			0.40	37.40		MADE GROUND: Grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.	
		0.80			0.80	37.00		MADE GROUND: Dark brown gravelly fine to coarse sand with cobbles. Gravel is fine to coarse, angular to subangular of brick and sandstone. Cobbles are subangular of brick.	
		1.20		N=5 (7,4/2,1,1,1)	1.30	36.50		MADE GROUND: Brown mottled dark grey sandy gravelly clay with cobbles. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of brick and sandstone. Cobbles are subangular of brick.	2
		2.00		N=15 (4,0/1,2,2,10)	2.20	35.60		MADE GROUND: Very sandy clay. Sand is fine to medium.	
		2.20 - 2.50	ES		2.50	35.30		MADE GROUND: Dark grey fine to medium sand with a chemical odour.	
		2.70		50 (25 for 125mm/50 for 180mm)	3.10	34.70		Stiff brown slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded of sandstone, mudstone and coal. <i>From 2.70 to 3.10m bgl: Strata is very stiff.</i>	3
								End of borehole at 3.10 m	4
									5

Remarks

Window Sample Borehole to 3.10m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during drilling. Borehole terminated due to refusal in SPT.

Project Name: Sparkle Street Additional Investigation

Project No. 082142.302

Co-ords: -

Hole Type WS

Location: Sparkle Street, Manchester

Level:

Scale 1:25

Client: Foras (Sparkle Street) Limited

Dates: 04/11/2025 - 04/11/2025

Logged By JP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.05			0.05			Dark grey TARMACADAM	1
					0.70			MADE GROUND: Grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.	
		1.20		N=28 (6,2/5,6,8,9)	1.25			Stiff brown slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded of sandstone, mudstone and coal.	2
		1.50 - 1.60	ES						
		2.00		N=50 (7,8/50 for 275mm)	2.30			End of borehole at 2.30 m	3
									4
									5

Remarks

Window Sample Borehole to 2.30m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were noted during drilling. Borehole terminated due to refusal in SPT.

Page Number:	1
Location:	BH01
Notes:	Hydrocarbon contamination encountered in BH01 at 1.50m to 2.58m bgl 1 – 1.20m to 2.0m bgl 2 – 2.0m to 3.0m bgl 3 – 3.0m to 4.0m bgl 4 – 4.0m to 5.0m bgl



Page Number:	2
Location:	WS106A
Notes:	Contamination encountered in WS106A at 2.20 to 2.50m bgl 1 – 1.20m to 2.00m bgl 2 – 2.0 to 2.35m SPT with contamination 3 – 2.0 to 2.70m bgl 4 – 3.70m to 3.10m bgl SPT

1



2



3



4



Page Number:	3
Location:	WS107
Notes:	Delineation borehole with no observable contamination 1 – Hand Pit 2 – Cobbles within hand pit 3 – Window sample boreholes from from 0.80m to 2.00m bgl 4 – Strata from 2.0m to 2.30m bgl



Page Number:	4
Location:	TP104
Notes:	Delineation Trial Pit showing no hydrocarbon contamination.# 1 – trial pit length 2 – trial pit width 3 – trial pit depth 4 – trial pit with large wood beam within pit

1



2



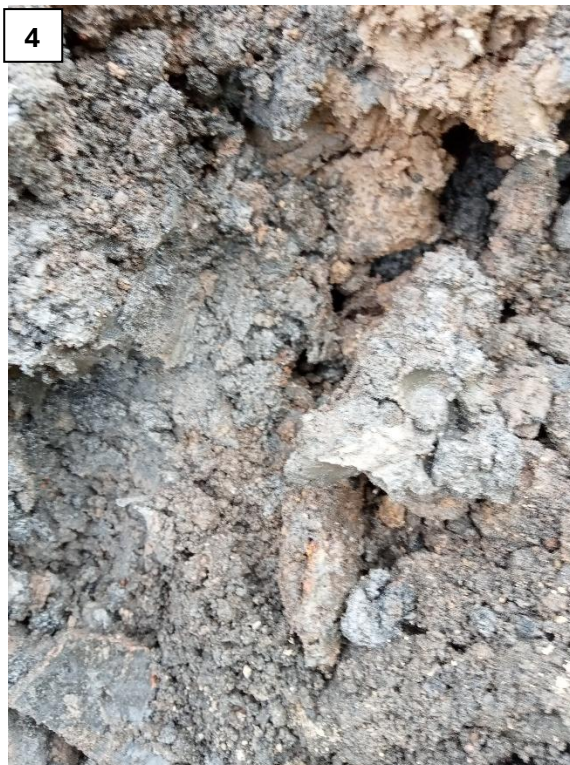
3



4



Page Number:	5
Location:	TP105
Notes:	Delineation Trial pit with contamination observed between 1.80m and 2.10m bgl. Contamination was no longer observed 5.2m from the original BH01 position, shown in pictures 2 and 3. 1 – Trial Pit Width 2 – Distance of contamination from BH01 3 – Trial Pit depth 4 – Contamination found within trial pit



Appendix C – Screening Criteria for Imported Materials

Human Health GQRA Rationale and Hierarchy

Background

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency, Defra, CL:AIRE, LQM/CIEH and Public Health England as referenced below (references a-h).

A Generic Quantitative Risk Assessment (GQRA) is carried out for the Potential Contaminant Linkages (PCLs) investigated by screening of soil contamination data against relevant Generic Assessment Criteria where available.

Generic Assessment Criteria are available for a range of different land use scenarios, soil organic matter (SOM) and soil types. Curtins have adopted available GACs for a sandy loam soil at 1%, 2.5% and 6% SOM using various sources.

GAC Hierarchy

A summary of and hierarchy for adopted GACs is identified below:

- i) **Category 4 Screening Levels (C4SLs):** In March 2014 Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium, and lead as part of the 'Phase 1 Project'. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). In 2018 the 'Phase 2 Project' commenced which aims to develop C4SLs for a range of further contaminants. Currently available Phase 2 C4SLs include vinyl chloride, trichloroethene, tetrachloroethene, naphthalene, cis-1,2 dichloroethene, trans 1, 2 dichloroethene and per / polyfluoroalkyl substances (PFAS) . Where contaminant concentrations do not exceed C4SLs, there is no risk that the land poses a significant possibility of significant harm (SPoSH) or the level of risk is low, as such land can be demonstrated to be in Category 4 and cannot be determined as contaminated land. The C4SLs are proposed to be more pragmatic (whilst still strongly precautionary) in comparison with SGVs and S4UL's outlined below.
- ii) **Suitable for Use Levels (S4ULs):** In 2015 LQM and the Chartered Institute of Environmental Health published generic assessment criteria for 89 substances including metals, BTEX, TPH, polycyclic aromatic hydrocarbons, phenols, chlorinated solvents and other volatile organic compounds. The S4ULs represent a minimal risk to long term human health, derived using health criteria values. The methodology for deriving the S4ULs is based on the Environment Agency CLEA model with consideration of developments in UK human health exposure assessment, in particular the additional land uses and exposure assumptions.
- iii) **Other Supplementary Screening Criteria:** In addition to those developed by LQM/CIEH (outlined above), other third party organisations have derived SSVs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including those developed EIC/AGS/CL:AIRE and SoBRA published thresholds.

Alternative Assessment Approaches

PAH – Benzo(a)pyrene Surrogate Marker Assessment

In September 2017 Public Health England (PHE) (Ref. h) published guidance for the use of a surrogate marker approach to assess the risk posed by soil contamination with the genotoxic polycyclic aromatic hydrocarbons (PAHs). The guidance indicates that the use of a marker compound, such as Benzo(a)pyrene, provides a consistent indicator of the amount of 7 other genotoxic PAHs commonly tested for in soil including benz(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, indeno(123cd)pyrene and benzo(ghi)perylene.

Where PAH concentrations of these 8 no. PAHs are present within pre-determined ratios in soil, provided in the guidance, this approach is used, comparing soil concentrations of the marker compound with a Category 4 Screening Level, or site specific assessment criteria. An individual compound assessment is carried out for other PAH compounds not considered in the PHE guidance.

An individual compound assessment is carried out for all PAH compounds where pre-determined ratios are not met for the surrogate marker approach.

Notes

Curtins Generic Assessment Criteria provide further information and notes to be read in conjunction with this assessment rationale.

Human Health GQRA Rationale and Hierarchy



References

- a) Environmental Agency. (2009) Contaminated Land Exposure Assessment (CLEA) v1.071 model.
- b) Environment Agency. (2009) Human Health Toxicological Assessment of Contaminants in Soil (report no. SC050021/SR2).
- c) Environment Agency. (2009) Updated Technical Background to the CLEA Model (report no.SC050021/SR3).
- d) Environment Agency (2005) The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils Science Report P5-080/TR3.
- e) Department of Environment Food and Rural Affairs (DEFRA). (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (report no. PB13735).
- f) CL:AIRE (2014) Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, SP1010 Rev 2.
- g) LQM & CIEH (2015) S4ULs for Human Health Risk Assessment.
- h) Public Health England (2017) Contaminated Land Information Sheet: Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)

Contaminants	Residential with Home Grown Produce	Residential Without Home Grown Produce	Allotments	Commercial	Public open space (Residential)	Public park POS _{park}	Solubility Saturation Limit (mg/kg)	Vapour Satuation Limit (mg/kg)
Metals, Semi-Metals & non-metals								
Antimony	-	550	-	7500	-	-		
Arsenic	37	40	49	640	79	170		
Beryllium	1.7	1.7	35	12	2.2	63		
Boron	290	11000	45	240000	21000	46000		
Cadmium	22	150	3.9	410	220	880		
Chromium III	910	910	18000	8600	1500	33000		
Chromium VI	21	21	170	49	21	250		
Copper	2400	7100	520	68000	12000	44000		
Lead	200	310	80	2300	630	1300		
Mercury (elemental)	1.2	1.2	21	58	16	30		25.8
Mercury (inorganic)	40	56	19	1100	120	240		
Methylmercury	11	15	6	320	40	68		
Nickel	130	180	53	980	230	800		
Selenium	250	430	88	12000	1100	1800		
Vanadium	410	1200	91	9000	2000	5000		
Zinc	3700	40000	620	730000	81000	170000		
Inorganic Compounds								
Cyanide	24	24	24	1400	24	24		
Organic contaminants								
Aliphatic Risk Banded Hydrocarbons - TPH CWG method								
Aliphatic EC5 - EC6 TPHs	42	42	730	3200	570000	95000	304	
Aliphatic EC>6 - EC8 TPHs	100	100	2300	7800	600000	150000	144	
Aliphatic EC>8 - EC10 TPHs	27	27	320	2000	13000	14000	78	
Aliphatic EC>10-EC12 TPHs	130	130	2200	9700	13000	21000	48	
Aliphatic EC>12-EC16 TPHs	1100	1100	11000	59000	13000	25000	24	
Aliphatic EC>16 - EC35 TPHs	65000	65000	260000	1600000	250000	450000	8.48	
Aliphatic EC>35 - EC44 TPHs	65000	65000	260000	1600000	250000	450000	8.48	
Aromatic Risk Banded Hydrocarbons - TPH CWG method								
Aromatic EC5 - EC7 TPHs	70	370	13	26000	56000	76000	1220	
Aromatic EC>7 - EC8 TPHs	130	860	22	56000	56000	87000		869
Aromatic EC>8 - EC10 TPHs	34	47	8.6	3500	5000	7200		613
Aromatic EC10 - EC12 TPHs	74	250	13	16000	5000	9200	364	
Aromatic EC12 - EC16 TPHs	140	1800	23	36000	5100	10000	169	
Aromatic EC>16 - EC21 TPHs	260	1900	46	28000	3800	7600		
Aromatic EC>21 - EC35 TPHs	1100	1900	370	28000	3800	7800		
Aromatic EC>35 - EC44 TPHs	1100	1900	370	28000	3800	7800		
Long Chain Aliphatic and Aromatic Hydrocarbons								
Aliphatic and Aromatic EC >44-70	1600	1900	1200	28000	3800	7800		
Aromatic Hydrocarbons								
Benzene	0.2	0.89	0.039	27	140	190		
Ethyl benzene	47	83	16	5700	24000	17000		518
Toluene	130	880	22	56000	56000	87000		869
Xylene	56	79	28	5900	41000	17000	478 (o-xylene) 576 (p-xylene)	625 (m-xylene)
MTBE	49	73	23	7900			20400	
Phenol	280	750	66	760	760	760		
Polycyclic Aromatic Hydrocarbons (PAH) - Benzo(a)pyrene Surrogate Marker Approach, with reference to C4SL PAH Surrogate Marker Check Sheet where appropriate								
Benzo(a)Pyrene (C4SL Surrogate Marker Approach)	5	5.3	5.7	77	10	21		
Naphthalene	15	15	65	1600	11000	800	76.4	
Acenaphthylene	170	2900	28	83000	15000	29000	86.1	
Acenaphthene	210	3000	34	84000	15000	29000	57	
Fluorene	170	2800	27	63000	9900	20000	30.9	
Phenanthrene	95	1300	15	22000	3100	6200	36	
Anthracene	2400	31000	380	520000	74000	150000		1.17
Fluoranthene	280	1500	52	23000	3100	6300		
Pyrene	620	3700	110	54000	7400	15000		
Polycyclic Aromatic Hydrocarbons (PAH) - Individual Compound Assessment								
Naphthalene	15	15	65	1600	11000	800	76.4	
Acenaphthylene	170	2900	28	83000	15000	29000	86.1	
Acenaphthene	210	3000	34	84000	15000	29000	57	
Fluorene	170	2800	27	63000	9900	20000	30.9	
Phenanthrene	95	1300	15	22000	3100	6200	36	
Anthracene	2400	31000	380	520000	74000	150000		1.17
Fluoranthene	280	1500	52	23000	3100	6300		
Pyrene	620	3700	110	54000	7400	15000		
Benzo(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 (only)	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								
Chloroethene (Vinyl chloride)	0.0064	0.015	0.0017	1.1	7.8	18		
1,1-Dichloroethene (DCE)	0.23	0.23	2.8	26			2230	
Cis 1,2, Dichloroethene (DCE)	0.46	0.5	0.89	38	3800	2800	3940	
Trans 1,2, Dichloroethene (DCE)	0.9	0.93	3.7	69	13000	5600	3420	
Trichloroethene (TCE)	0.0093	0.0097	0.032	0.73	76	41		
Tetrachloroethene (PCE)	0.31	0.32	2	24	3200	1400		
1,1,1,2 Tetrachloroethane	1.2	1.5	0.79	110	1400	1500		
1,1,1 Trichloroethane	8.8	9	48	660	140000	57000		1425
1,2-Dichloroethane (Ethylene Dichloride)	0.11	0.16	0.054	12	300	300		
Tetrachloromethane	0.026	0.026	0.45	2.9	890	190		
Trichloromethane (Chloroform)	0.91	1.2	0.42	99	2500	2600		
Per- and Polyfluoroalkyl Substances (PFAS)								
Perfluorooctanoic Acid (PFOA)	0.0076	0.041	0.0014	0.6	0.079	0.17		
Perfluorononanoic Acid (PFNA)	0.013	0.041	0.0027	0.6	0.079	0.17		
Perfluorohexane Sulfonic Acid (PFHxS)	0.0081	0.041	0.0015	0.6	0.079	0.17		
Perfluorooctane Sulfonic Acid (PFOS)	0.0073	0.041	0.0013	0.6	0.079	0.17		

Contaminants	Residential with Home Grown Produce	Residential Without Home Grown Produce	Allotments	Commercial	Public open space (Residential)	Public park POS _{park}	Solubility Saturation Limit (mg/kg)	Vapour Satuation Limit (mg/kg)
Metals, Semi-Metals & non-metals								
Antimony		550		7500				
Arsenic	37	40	49	640	79	170		
Beryllium	1.7	1.7	35	12	2.2	63		
Boron	290	11000	45	240000	21000	46000		
Cadmium	22	150	3.9	410	220	880		
Chromium III	910	910	18000	8600	1500	33000		
Chromium VI	21	21	170	49	21	250		
Copper	2400	7100	520	68000	12000	44000		
Lead	200	310	80	2300	630	1300		
Mercury (elemental)	1.2	1.2	21	58	16	30		25.8
Mercury (inorganic)	40	56	19	1100	120	240		
Methylmercury	11	15	6	320	40	68		
Nickel	130	180	53	980	230	800		
Selenium	250	430	88	12000	1100	1800		
Vanadium	410	1200	91	9000	2000	5000		
Zinc	3700	40000	620	730000	81000	170000		
Inorganic Compounds								
Cyanide	24	24	24	1400	24	24		
Organic contaminants								
Aliphatic Risk Banded Hydrocarbons - TPH CWG method								
Aliphatic EC5 - EC6 TPHs	78	78	1700	5900	590000	130000	558	
Aliphatic EC>6 - EC8 TPHs	230	230	5600	17000	610000	220000	322	
Aliphatic EC>8 - EC10 TPHs	65	65	770	4800	13000	18000		190
Aliphatic EC>10-EC12 TPHs	330	330	4400	23000	13000	23000		118
Aliphatic EC>12-EC16 TPHs	2400	2400	13000	82000	13000	25000	59	
Aliphatic EC>16 - EC35 TPHs	92000	92000	270000	1700000	250000	480000	21	
Aliphatic EC>35 - EC44 TPHs	92000	92000	270000	1700000	250000	480000	21	
Aromatic Risk Banded Hydrocarbons - TPH CWG method								
Aromatic EC5 - EC7 TPHs	140	690	27	46000	56000	84000	2260	
Aromatic EC>7 - EC8 TPHs	290	1800	51	110000	56000	95000	1920	
Aromatic EC>8 - EC10 TPHs	83	110	21	8100	5000	8500		1500
Aromatic EC10 - EC12 TPHs	180	590	31	28000	5000	9700	899	
Aromatic EC12 - EC16 TPHs	330	2300	57	37000	5100	10000	419	
Aromatic EC>16 - EC21 TPHs	540	1900	110	28000	3800	7700		
Aromatic EC>21 - EC35 TPHs	1500	1900	820	28000	3800	7800		
Aromatic EC>35 - EC44 TPHs	1500	1900	820	28000	3800	7800		
Long Chain Aliphatic and Aromatic Hydrocarbons								
Aliphatic and Aromatic EC >44-70	1800	1900	2100	28000	3800	7800		
Aromatic Hydrocarbons								
Benzene	0.17	0.7	0.034	47	72	100		
Ethyl benzene	110	190	39	13000	24000	22000		1220
Toluene	290	1900	51	110000	56000	95000		1920
Xylene	130	180	67	14000	42000	23000	1120	1470
MTBE	84	120	44	13000			33100	
Phenol	550	1300	140	1500	1500	1500		
Polycyclic Aromatic Hydrocarbons (PAH) - Benzo(a)pyrene Surrogate Marker Approach, with reference to C4SL PAH Surrogate Marker Check Sheet where appropriate								
Benzo(a)Pyrene (C4SL Surrogate Marker Approach)	5	5.3	5.7	77	10	21		
Naphthalene	36	36	130	3700	15000	1200	183	
Acenaphthylene	420	4600	69	97000	15000	30000	212	
Acenaphthene	510	4700	85	97000	15000	30000	141	
Fluorene	400	3800	67	68000	9900	20000	76.5	
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		
Polycyclic Aromatic Hydrocarbons (PAH) - Individual Compound Assessment								
Naphthalene	36	36	130	3700	15000	1200	183	
Acenaphthylene	420	4600	69	97000	15000	30000	212	
Acenaphthene	510	4700	85	97000	15000	30000	141	
Fluorene	400	3800	67	68000	9900	20000	76.5	
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		
Benzo(a)anthracene	11	14	6.5	170	29	56		
Chrysene	22	31	9.4	350	57	110		
Benzo(b)fluoranthene	3.3	4	2.1	44	7.2	15		
Benzo(k)fluoranthene	93	110	75	1200	190	410		
Benzo(a)pyrene (only)	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								
Chloroethene (Vinyl chloride)	0.01	0.019	0.0031	1.4	7.8	19		
1,1-Dichloroethene (DCE)	0.4	0.41	5.6	46			3940	
Cis 1,2, Dichloroethene (DCE)	0.78	0.84	1.7	64	3800	2400	6610	
Trans 1,2, Dichloroethene (DCE)	1.6	1.7	0.75	120	13000	7000	6170	
Trichloroethene (TCE)	0.02	0.02	0.072	1.5	78	54		
Tetrachlorethene (PCE)	0.7	0.71	4.8	55	3300	1900		
1,1,1,2 Tetrachlorethane	2.8	3.5	1.9	250	1400	1800		
1,1,1 Trichlorethane	18	18	110	1300	140000	76000		2915
1,2-Dichloroethane (Ethylene Dichloride)	0.18	0.24	0.1	17	210	330		
Tetrachloromethane	0.056	0.056	1	6.3	920	270		
Trichloromethane	1.7	2.1	0.83	170	2500	2800		
PFAS								
Perfluorooctanoic Acid (PFOA)	0.0076	0.041	0.0014	0.6	0.079	0.17		
Perfluorononanoic Acid (PFNA)	0.013	0.041	0.0027	0.6	0.079	0.17		
Perfluorohexane Sulfonic Acid (PFHxS)	0.0081	0.041	0.0015	0.6	0.079	0.17		
Perfluorooctane Sulfonic Acid (PFOS)	0.0073	0.041	0.0013	0.6	0.079	0.17		

Contaminants	Residential with Home Grown Produce	Residential Without Home Grown Produce	Allotments	Commercial	Public open space (Residential)	Public park POS _{park}	Solubility Saturation Limit (mg/kg)	Vapour Satuation Limit (mg/kg)
Metals, Semi-Metals & non-metals								
Antimony		550		7500				
Arsenic	37	40	49	640	79	170		
Beryllium	1.7	1.7	35	12	2.2	63		
Boron	290	11000	45	240000	21000	46000		
Cadmium	22	150	3.9	410	220	880		
Chromium III	910	910	18000	8600	1500	33000		
Chromium VI	21	21	170	49	21	250		
Copper	2400	7100	520	68000	12000	44000		
Lead	200	310	80	2300	630	1300		
Mercury (elemental)	1.2	1.2	21	58	16	30		25.8
Mercury (inorganic)	40	56	19	1100	120	240		
Methylmercury	11	15	6	320	40	68		
Nickel	130	180	53	980	230	800		
Selenium	250	430	88	12000	1100	1800		
Vanadium	410	1200	91	9000	2000	5000		
Zinc	3700	40000	620	730000	81000	170000		
Inorganic Compounds								
Cyanide	24	24	24	1400	24	24		
Organic Compounds								
Aliphatic Risk Banded Hydrocarbons - TPH CWG method								
Aliphatic EC5 - EC6 TPHs	160	160	3900	12000	600000	180000	1150	
Aliphatic EC>6 - EC8 TPHs	530	530	13000	40000	620000	320000	736	
Aliphatic EC>8 - EC10 TPHs	150	150	1700	11000	13000	21000		451
Aliphatic EC>10-EC12 TPHs	760	770	7300	47000	13000	24000		283
Aliphatic EC>12-EC16 TPHs	4300	4400	13000	90000	13000	26000	142	
Aliphatic EC>16 - EC35 TPHs	110000	110000	270000	1800000	250000	490000		
Aliphatic EC>35 - EC44 TPHs	110000	110000	270000	1800000	250000	490000		
Aromatic Risk Banded Hydrocarbons - TPH CWG method								
Aromatic EC5 - EC7 TPHs	300	1400	57	86000	56000	92000	4710	
Aromatic EC>7 - EC8 TPHs	660	3900	120	180000	56000	100000		4360
Aromatic EC>8 - EC10 TPHs	190	270	51	17000	5000	9300		3590
Aromatic EC10 - EC12 TPHs	380	1200	74	34000	5000	10000	2150	
Aromatic EC12 - EC16 TPHs	660	2500	130	38000	5000	10000		
Aromatic EC>16 - EC21 TPHs	930	1900	260	28000	3800	7800		
Aromatic EC>21 - EC35 TPHs	1700	1900	1600	28000	3800	7900		
Aromatic EC>35 - EC44 TPHs	1700	1900	1600	28000	3800	7900		
Long Chain Aliphatic and Aromatic Hydrocarbons								
Aliphatic and Aromatic EC >44-70	1900	1900	3000	28000	3800	7900		
Aromatic Hydrocarbons								
Benzene	0.87	3.3	0.18	98	140	230		
Ethyl benzene	260	440	91	27000	25000	27000		2840
Toluene	690	3900	120	180000	56000	100000		4360
Xylene	310	430	160	30000	43000	31000	2620	
MTBE	160	220	90	24000			62700	
Phenol	420	2300	280	3200	3200	3200		
Polycyclic Aromatic Hydrocarbons (PAH) - Benzo(a)pyrene Surrogate Marker Approach, with reference to C4SL PAH Surrogate Marker Check Sheet where appropriate								
Benzo(a)Pyrene (C4SL Surrogate Marker Approach)	5	5.3	5.7	77	10	21		
Naphthalene	85	85	200	8400	17000	1900	432	
Acenaphthylene	920	6000	160	100000	15000	30000	506	
Acenaphthene	1100	6000	200	100000	15000	30000	336	
Fluorene	860	4500	160	71000	9900	20000	183	
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		
Polycyclic Aromatic Hydrocarbons (PAH) - Individual Compound Assessment								
Naphthalene	85	85	200	8400	17000	1900	432	
Acenaphthylene	920	6000	160	100000	15000	30000	506	
Acenaphthene	1100	6000	200	100000	15000	30000	336	
Fluorene	860	4500	160	71000	9900	20000	183	
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		
Benzo(a)anthracene	13	15	13	180	29	62		
Chrysene	27	32	19	350	57	120		
Benzo(b)fluoranthene	3.7	4	3.9	45	7.2	16		
Benzo(k)fluoranthene	100	110	130	1200	190	440		
Benzo(a)pyrene (only)	3	3.2	3.5	36	5.7	13		
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								
Chloroethene (Vinyl chloride)	0.017	0.029	0.0058	2.2	7.8	19		
1,1-Dichloroethene (DCE)	0.82	0.82	12	92			7940	
Cis 1,2, Dichloroethene (DCE)	1.5	1.6	3.6	120	3900	3100	12900	
Trans 1,2, Dichloroethene (DCE)	3.3	3.4	16	260	13000	9100	12600	
Trichloroethene (TCE)	0.043	0.045	0.16	3.4	79	69		
Tetrachloroethene (PCE)	1.6	1.6	11	130	3400	2500		
1,1,1,2 Tetrachloroethane	6.4	8.2	4.4	560	1400	2100		
1,1,1 Trichloroethane	39	40	240	3000	140000	100000		6392
1,2-Dichloroethane (Ethylene Dichloride)	0.31	0.41	0.19	29	310	380		
Tetrachloromethane	0.13	0.13	2.4	14	950	400		
Trichloromethane	3.4	4.2	1.7	350	2500	3100		
PFAS								
Perfluorooctanoic Acid (PFOA)	0.0076	0.041	0.0014	0.6	0.079	0.17		
Perfluorononanoic Acid (PFNA)	0.013	0.041	0.0027	0.6	0.079	0.17		
Perfluorohexane Sulfonic Acid (PFHxS)	0.0081	0.041	0.0015	0.6	0.079	0.17		
Perfluorooctane Sulfonic Acid (PFOS)	0.0073	0.041	0.0013	0.6	0.079	0.17		

- 1) All Values are in mg/kg, reported to 2 significant figures.
- 2) Numbers in bold are C4SLs, Numbers in italics are S4ULs, Numbers underlined are EIC/AGS/CL:AIRE GACs, Numbers in red are SoBRA Acute Generic Assessment Criteria.
- 3) Assumptions and key notes made when deriving the Generic Assessment Criteria are contained within the relevant guidance documents, references:
 - a) Contaminated Land: Applications in Real Environments (2014) SP1010 - Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, Final Project Report (Revision 2b)
 - b) Land Quality Management Ltd. (2015) The LQM/CIEH S4ULs for Human Health Risk Assessment.
 - c) CL:AIRE, EIC, AGS (2010) Soil Generic Assessment Criteria for Human Health Risk Assessment.
 - d) Society of Brownfield Risk Assessment (2020) Development of Acute Generic Assessment Criteria for Assessing Risks to Human Health from Contaminants in Soil.
 - e) Environment Agency (2009) Human Health Toxicological Assessment of Contaminants in Soil, Science Report - SC050021/SR2.
- 4) Generic Assessment Criteria listed in the following order of preference: C4SLs, S4ULs, CL:AIRE/AGS/EIC Generic Assessment Criteria, Other relevant Generic Assessment Criteria where GACS associated with the prioritised GACs are not available as outlined further in Curtins Rationale and Hierarchy notes.
- 5) To use Benzo(a)pyrene as a surrogate marker for PAH contamination, the assumptions set out in the relevant C4SL documentation must be met. A C4SL PAH surrogate marker checklist is appended.
- 6) Naphthalene is a volatile PAH. The C4SL values are derived on the basis of chronic exposure and risks to human health, and do not explicitly account for acute risks (e.g. a one off ingestion of a significant amount of soil by a young child) where the inhalation pathway is the main risk driver. Further consideration of the acute risk may be required in external settings (POS_{park} and POS_{resi}) where the GAC is substantially greater than the residential equivalent, to account for the possibility of acute exposure to the ingestion of naphthalene. The theoretical solubility saturation limit of naphthalene in soil is substantially lower than the GAC value, and therefore it is likely that free phase contamination would be present where the GAC is exceeded. In such a situation, it is unlikely that the product would remain in-situ untreated, and consideration of remediation / mitigation methods would be required.
- 7) Where the C4SL surrogate marker checklist indicates the PAH ratios are not suitable, individual PAH compounds must be assessed individually against the relevant contaminant specific assessment criteria.
- 8) Risk associated with additive effects of TPH contamination needs to be assessed in addition to the individual bandings, using the following equation:

$$HI = \sum HQ_i = \sum \frac{\text{Measured concentration, } Fi \text{ (mg/kg)}}{\text{Relevant GAC (mg/kg)}} Fi$$

Where:

HI = Hazard Index

HQ = Hazard Quotient

Fi = Fraction i

Where the HI > 1, there may be a risk to human health.

- 9) Exposure to all xylene isomers to be considered together. Values detailed in this table are the lowest (most conservative) of o-, m- and p- xylene isomers.
- 10) PFAS assessment also uses a hazard index approach to ensure the total exposure from all four PFAS compounds combined does not exceed the LLTC_{oral}. Where the hazard index exceeds 1, further consideration or assessment of the risk is required, even where none of the individual C4SL values are exceeded.
- 11) PFAS C4SL values are interim. The C4SL has been derived using the sum of the four PFAS compounds as the basis of the low level of toxicological concern. The term interim reflects concerns raised by the Committee on Toxicity (COT) and the fact that further work by the COT and others may result in the need for the LLTC to be updated.
- 12) Generic Assessment Criteria assume no free phase contamination is present. Where free phase contamination is present, further assessment may be required.
- 13) Solubility Saturation Limit and Vapour Saturation Limit are provided in accordance with relevant guidance documents. Where these values are exceeded, and the vapour pathway is an important contributing pathway to exposure, then the following should be considered:
 - Free phase contamination may be present
 - Exposure from vapour pathways will be over predicted.
 - Where the vapour pathway is >90% of exposure then it is unlikely that the relevant HCV will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Additional assessment should be undertaken where this is the case, with consideration that:

- Exposure is unlikely to reach the relevant HCV and the risk based on the assumed conceptual model is likely to be negligible.
- Vapour pathway exposure should be calculated using algorithms suitable for free phase or NAPL sources
- Screening could be considered using the lower saturation limit, which is the approach adopted by the USEPA. However, this may not be practical in many cases because of very low limits and is in any case highly conservative.

Where the vapour pathway is the only exposure pathway considered then effective assessment criteria should be derived manually in accordance with guidance outlined in CLEA Science Report SC050021/SR4