Carley Daines and Partners Limited

Consulting Civil and Structural Engineers

DOWNLEY DRIVE

MANCHESTER

M4 7JU

PHASE 2 GEO-ENVIRONMENTAL INVESTIGATION AND ASSESSMENT

UNDERTAKEN FOR

GREAT PLACES HOUSING ASSOCIATION

Ref: 19-B-12490/Downley Drive **Revision '0'** **25th January 2021**

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Report Title:	**Downley Drive, Manchester M4 7JU**
Report Reference:	**19-B-12490**
Client:	**Great Places Housing Association**
Issue Date:	**25th January 2021**
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EXECUTIVE SUMMARY

Site Location	The site is located at the west end of Downley Drive in the New Islington area of Manchester approximately 1km east of the city centre at NGR 385345,398731 and at postcode M4 7JU.
Development Proposals	Planning stage drawings that have been made available to us indicate that the site is proposed to be redeveloped with houses and apartments and associated landscaping and car parking.
Site History	The site has had an industrial past with a steel works and wire works from the 19th century until the 1960's. Housing (recently demolished) was added to the north part of the site in the 1960's. The site is presently undeveloped, however classified as brownfield due to former use.
Foundations & Floor Slabs	The site is covered with made ground varying between 1.3m and 4.2m depth overlying a firm/stiff clay. Piling is recommended as an appropriate foundation solution though the nature of the made ground would suggest that vibro improvement may also be suitable. Ground floors should be suspended.
Pavements	New pavements should be designed on a CBR value for formation soils of 2.5% for made ground, and 3.0% for glacial till. Any buried structures in proposed pavement areas will need to be broken down to a depth of at least 0.6m below formation level to prevent unacceptable surface differential settlement. It is recommended that CBR testing should be undertaken in accordance with established procedure at formation level
Concrete Classification	On the basis of the chemical test results, the typical Design Sulphate (DS) Class, and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1S.
Soakaways	In view of the cohesive nature of the underlying drift geology, soakaways are not considered to be a viable drainage solution, due to impermeability.

Ground Gas	Ground gas monitoring is presently ongoing and will be subject to an Addendum Report and provided for review in due course.
Contamination Assessment	Chemical testing has been undertaken on soil samples, which revealed moderately elevated levels of metals and PAH contamination, together with asbestos traces. As a consequence, a design capping layer to soft landscaping is recommended.
Waste Disposal	On the basis of the current information, it is probable that surplus made ground will be classified as hazardous for off-site disposal particularly due to the detected presence of asbestos traces.

CONTENTS

1.0 INTRODUCTION
Appointment
Proposed Development
Objective
Scope
2.0 SITE LOCATION & DESCRIPTION
Site Location
Site Description
3.0 SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING
4.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT
5.0 SITE INVESTIGATION
Rationale
Intrusive Works
Monitoring Standpipe
Geotechnical & Chemical Testing
6.0 GROUND CONDITIONS
Stratigraphy
Made Ground
Glacial Till
Visual/Olfactory Evidence of Contamination
Existing Foundations
Groundwater
7.0 GEOTECHNICAL APPRAISAL
Site Preparation and Earthworks
Foundations
Floor Slabs
Excavations & Groundwater
Pavement Design
Concrete Design
Drainage & Soakaways
8.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)
General
Human Health
Soil Test Results
Conclusions
9.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS
Waste Soils Characterisation
Water Supplies
10.0 GROUND GAS ASSESSMENT

APPENDICES

Appendix 1	-	Site Location Plan
Appendix 2	-	Geotechnical Logs
Appendix 3	-	Chemical Test Results
Appendix 4	-	Tier 1 Assessment Criteria for Soil Contamination
Appendix 5	-	Historical Plans and Environmental Data

1.0 INTRODUCTION

Appointment

1.1 Carley Daines and Partners Limited has been commissioned by Great Places Housing Association to undertake a Phase 2 Geo-Environmental investigation and assessment of the proposed development of land at Downley Drive, Manchester M4 7JU.

Proposed Development

1.2 Planning stage drawings that have been made available to us indicate that the site has the potential to be redeveloped with new housing and apartments with associated access road, drainage, parking infrastructure and landscaping.

1.3 Development plans have been prepared by Buttress Architects of Manchester.

Objectives

1.4 The objective of the Ground Investigation and Assessment is to provide geotechnical recommendations for construction design purposes, together with a geo-environmental risk assessment in terms of potential ground contamination.

1.5 To achieve the objective, the following tasks were undertaken:

- Confirm, through undertaking a review of the existing Phase 1 PRA, the Geological, Hydro-Geological and Environmental context of the site, so as to identify any potential ground constraints to development through a site specific conceptual model and to design an appropriate Phase 2 Ground Investigation in accordance with the Environment Agency (2004) Model Procedures for the Management of Land Contamination, CLR11.
- Characterise the ground conditions in terms of geology, soil geotechnical parameters, and ground contamination from information provided by an appropriate ground investigation.

- Provide recommendations regarding suitable foundations, floor slabs and new pavement construction, together with any geotechnical considerations that could affect possible future development.
- Determine a ground conceptual model for the site in order to undertake an appropriate Phase 2 Generic Quantitative Risk Assessment (GQRA).

Scope

1.6 The Phase 1 PRA has been undertaken and is presented in the following Carley Daines & Partners Limited Report.

- Phase 1 Preliminary Risk Assessment, reference 19-B-12490, dated October 2019.

1.7 This report includes the findings of an appropriate Phase 2 Site Investigation designed on conclusions and recommendations provided in the Phase 1 Report. For ease of reference, the findings of the Phase 1 PRA are summarised in the following sections. The two reports are not exclusive and should be read in conjunction with one another.

1.8 The investigation comprised the sinking of eight boreholes & excavation of four trial pits, the location of which took into consideration the proposed development and the presence of existing buildings and possible existing services.

1.9 The Ground Investigation has been undertaken in general accordance with BS5930:1999 *Code of Practice for Ground Investigation* and BS10175:2011 and A1:2013 *Investigation of Potentially Contaminated Sites - Code of Practice* except where superseded by EN ISO 22475-1 "*Geotechnical Investigation and Assessment - Sampling by Drilling and Excavation and Groundwater Measurements*"

1.10 Geotechnical soil testing has been undertaken in accordance with guidelines provided in BS1377:1990 - Parts 1-9 *"Method of Test for Soils for Civil Engineering Purposes"*. Samples for chemical analysis were obtained and handled generally in accordance with the current guidelines (BS10175:2011 and A1:2013) relating to the anticipated nature of possible contamination and the intended end use.

2.0 SITE LOCATION AND DESCRIPTION

Site Location

2.1 The site is located at the west end of Downley Drive in Manchester, at approximate National Grid Reference 385345, 398731 and at post code M4 7JU.

2.2 The surrounding area is predominantly residential, with a northern boundary formed by the Rochdale Canal .

2.3 A Location Plan is presented in Appendix 01.

Site Description

2.4 The site is irregular in shape, with maximum dimensions of approximately 150m in the northeast – southwest direction, and 50m in the northwest-southeast direction. The site is bounded by low-rise housing to the east and south, medium rise apartments to the west and the Rochdale Canal and unmaintained grassland to the north.

2.5 The site is presently designated as brownfield due to its historic uses.

2.6 The site is reasonably level at an elevation of around 49m AOD.

2.7 There is no present access for vehicles but there are numerous positions for pedestrian access to the site.

2.8 The site is situated within East Manchester and the surrounding area is primarily residential in a mix of low, medium and high rise housing units. To the west of the site and across the canal, current development is largely retail and commercial.

2.9 There are no obvious natural watercourses on/near site. The Rochdale Canal is contiguous to the northern boundary.

3.0 SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING

3.1 The following paragraphs summarise the most relevant findings of the Phase 1 PRA.

3.2 There is no obvious made ground on site shown on currently available environmental plans. However, there are large areas of made/infilled ground around the site but beyond a 350m distance. The site has had significant past industrial usage shown from earliest plans with a steel works, wire works and sawmill all indicated between the 19th century and the 1960's.

3.3 Drift deposits on and off site are indicated as Devensian Till (Diamicton clay).

3.4 Solid geology is indicated as Collyhurst Sandstone to the east and Manchester Marl to the west.

3.5 The Coal Authority Report indicates that the site has been undermined at depths of 330m to 1090m in the past. The site is not affected by historical shallow workings.

3.6 There are no fault lines affecting the site. The nearest fault line is discontinuous to the north of the site.

3.7 There are no natural surface watercourses on or close to the site.

3.8 In terms of hydrogeology the site is indicated as being above a secondary aquifer.

3.9 The site is not within a currently designated Environment Agency Source Protection Zone.

3.10 The site is not within a known brine compensation area.

3.11 The site is in a low probability radon area.

3.12 There are no known or obvious hazardous installations within 500m of the site.

3.13 The Phase 1 PRA indicates that there are 4 historical landfill sites over 500m distant.

4.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

4.1 Based on the above findings, the table on page 6 summarises the Preliminary Conceptual Model and Risk Assessment for development of the site for new residential structures with landscaped garden areas.

4.2 Under the proposed development scenario, several pollutant linkages are considered possible, and the overall preliminary risk is assessed as being generally moderate to high.

4.3 The approach of the Phase 1 Desk Study stage is, however, precautionary, until such time as uncertainties in the conceptual model can be verified by appropriate site investigation.

4.4 It is not known at Phase 1 stage if there is any significant historical contamination on site.

4.5 Therefore, uncertainties relate, in the main, to the potential presence of residual contaminants on the site from previous industrial activities.

Table 5 - Conceptual Site Model				
Potential Source	Potential Pathways	Potential Receptor	Comments	Risk
On-site contamination (Heavy Metals, PAHs, TPH, Asbestos & pH)	Ingestion Dermal Contact Inhalation	Human Health - Site Users, Maintenance Staff, Contractors	Possible risk of residual ground contamination due to previous industrial usage of site.	Moderate to High
	Direct Contact	On-site structures, Water pipes		
	Migration of contamination to groundwater	Local Water Courses, Underlying Aquifer	Minor risk as aquifer protected by impermeable clay strata.	Low
Off-site contamination	Ingestion Dermal Contact Inhalation	Human Health - Site Users Maintenance Staff Contractors	Possible risk of residual ground contamination as there has been significant industry historically in the area.	Moderate to High
	Direct Contact	On-site Structures Water Pipes		
	Migration of contamination to groundwater	Underlying Aquifer	Minor risk as aquifer protected by impermeable clay strata.	Low
Ground gas from nearby landfill sites	Migration through permeable strata	Human Health, On-site Structures	There are areas of landfill around the site within 500m.	Moderate
Coal Mining	Workings close to surface	Buildings, roads & services	No recorded shallow workings affecting the site	Very Low

5.0 SITE INVESTIGATION

Rationale

5.1 Intrusive investigations were undertaken primarily to provide geotechnical parameters for structural design purposes, and also to verify the preliminary site conceptual model and confirm the anticipated environmental risk.

5.2 Eight boreholes were sunk to provide geotechnical information on near surface deposits and to provide samples for chemical and geotechnical analysis.

5.3 Four trial pits were excavated to provide further soil samples & also visual and olfactory assessment.

5.4 A general suite of contaminant testing was undertaken on selected samples of soil to confirm the contamination levels, and where applicable to establish the chemical suitability of soils for possible re-use within the development.

Intrusive Works

5.5 Ground investigation work was undertaken by Mini Soil Surveys, acting under our direct control and supervision. The work comprised the sinking of eight boreholes to a maximum depth of 6.0m, and the excavation of four trial pits to a depth of 1m. Work was undertaken on 15th and 16th December 2020.

5.6 The borehole and trial pit records are presented in Appendix 02 of this report.

Geotechnical and Chemical Testing

5.7 In-situ geotechnical testing was undertaken at regular intervals during the formation of the boreholes in the form of SPT tests, and also shear vane tests. Results of this testing are presented on the Descriptive Logs in Appendix 02.

5.8 The results of the soil sample chemical testing are presented in Appendix 03.

5.9 Chemical analysis was undertaken on selected soil samples for the following contaminants of concern:

- Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium and Zinc).
- PAH (USEPA16)
- TPH
- Asbestos screening and identification
- pH and Sulphate concentration

6.0 GROUND CONDITIONS

Stratigraphy

6.1 Ground conditions encountered during the intrusive investigation generally confirmed those identified in the published geological plans and in summary comprise topsoil, ash, gravel, brick and cinders Made Ground overlying firm becoming stiff cohesive Glacial Till (clay with some mixed gravel).

Made Ground

6.2 Made Ground was encountered in the boreholes from ground level to depths ranging from 1.3m – 4.2m. The Made Ground generally comprises topsoil, ash, cinder, gravel and brick fragments.

6.3 Made Ground was generally found to be weak and poorly compacted.

6.4 The horizon between Made Ground and Glacial Till is clearly defined.

6.5 The Made Ground has not been subject to geotechnical testing, as it is unsuitable for use as a foundation bearing strata.

Glacial Till (Clay & Sand)

6.6 The Made Ground is underlain mainly by cohesive Glacial Till, being described as firm, becoming very stiff sandy Clay, with some gravel. BH 5 also identifies a thin band of Sand overlying Clay.

6.7 SPT N values in the Glacial Till range from N=15 to N=53. The SPT N values generally confirm a stiff/very stiff consistency for the Clay.

6.8 Shear vane values in the range of C_U = 120kN/m^2 to C_U = 140 kN/m^2 were encountered. This provides further confirmation of the stiff consistency of the local Clay.

6.9 SPT values in the Sand within BH 5 yielded N=6, defining the strata as “loose”.

Visual/Olfactory Evidence of Contamination

6.10 No visual or olfactory evidence of significant ground contamination was identified during the investigation.

Existing Foundations

6.11 The trial pits did not expose any existing structural foundations.

Groundwater

6.12 Standing water was encountered in the boreholes on completion at depths ranging from 2.2m to 4.0m.

6.13 Variations could potentially occur in the long-term water regime due to seasonal and temperature differences.

General

6.14 It should be appreciated that ground conditions could vary between and away from the exploratory borehole positions, and due allowance should be made in this respect.

7.0 GEOTECHNICAL APPRAISAL

Site Preparation and Earthworks

7.1 At commencement, appropriate soil stripping and stock piling should be undertaken. A further visual check should be carried out for any evidence of significant contamination away from areas previously examined and tested.

7.2 Due to previous significant historical development, the possibility of foundations and/or basements from previous development remains. Such buried structures, if encountered, would need to be removed to facilitate excavations for new foundations and drainage. It is assumed that as part of the site stripping a check would be undertaken to determine the existence and extent of any remaining relic foundations.

7.3 Any such hardstanding encountered below existing ground level could be appropriately crushed and may be suitable for re-use as infill beneath hard cover areas.

7.4 Appropriate sorting and segregating of such excavated materials will ensure that selected material is suitable for use as bulk fill in remaining areas.

7.5 It is not anticipated that significant earthworks are envisaged due to the generally level nature of the site.

7.6 Any existing trees that are to remain will need to be protected from the effects of site preparation and construction activities. In particular, tree roots may need to be protected during excavations for foundations and drainage, and specialist advice, if required, should be sought in this respect.

Foundations

7.7 Made Ground and underlying incompetent natural strata should be considered unsuitable for the direct support of structural loads, as it may be loose and soft, which could result in unacceptable and differential settlements.

7.8 Significant depths of Made Ground exist across the site up to a recorded depth of 4.2m. This depth is too great for the construction of traditional concrete strip foundations and therefore a piled solution supporting reinforced concrete ground beams is proposed. The choice of pile type would be made following consultations with experienced piling contractors.

7.9 Due to the generally granular nature of the Made Ground an alternative of vibro improvement supporting reinforced shallow concrete strip foundations is also considered a suitable alternative.

7.10 Where foundations are to be constructed in close proximity to existing and/or removed trees, identification of the tree species will determine its water demand as provided in Appendix 4.2 - A of NHBC Standards 2010, Foundations, Chapter 4.2, Building near Trees. Assessment of the effects (if any) of tree influence on pile heads & ground beams should be considered.

Floor Slabs

7.11 It is recommended that floor slabs should be suspended, either precast beam and block or suspended cast in-situ.

Excavations and Ground Water

7.12 The presence of significant volumes of groundwater inflow into excavations is not anticipated. Conventional 'sump and pump' dewatering measures will be adequate to keep excavations dry.

7.13 Excavations will be possible with the use of conventional hydraulic plant and will need to be appropriately supported for safe man entry, and if they occur in proximity to existing site boundaries and the highway.

Pavement Design

7.14 In consideration of the ground conditions encountered in relation to the proposed development at the site, it is likely that Made Ground and cohesive Glacial Till will be exposed at formation level beneath areas of hardstanding.

7.15 It is recommended that new pavement design should be based on a CBR value of no more than 2.5% for the Made Ground, and 3.0% for the Glacial Till, with any soft, loose, or otherwise incompetent material being removed and replaced with a suitable thickness of capping, comprising well compacted granular fill.

7.16 The design CBR's should be confirmed by in-situ testing at formation levels prior to construction. In addition, where the formation is left exposed for any appreciable time, particularly during inclement weather, the CBR should be checked by further testing and, where required, adjusted to take account of any softening effects resulting from moisture change.

7.17 If buried structures are to remain beneath proposed pavement areas, they should be broken down to a depth of at least 0.6m beneath the proposed formation to prevent the possibility of 'hard spots' leading to unacceptable differential settlement at the surface.

Concrete Design

7.18 Design/mix of concrete should be undertaken in accordance with the "Aggressive Chemical Environment for Concrete" (ACEC) classification, of BRE Special Digest 1:2005 (Concrete in Aggressive Ground). With reference to the site history, it is deemed necessary to classify the site as "Brownfield", with respect to the BRE Special Digest.

7.19 The results of 2:1 soluble sulphate extract analysis are no greater than 0.24g/l. Values of pH range from 8.0 to 9.3.

7.20 On the basis of the chemical test results, the design sulphate (DS) and "Aggressive Chemical for Concrete" (ACEC) class for the site are DS-1 and AC-1s respectively.

Drainage and Soakaways

7.21 Consideration has been given to the feasibility of on-site soakaways for surface water drainage. Due to the cohesive strata encountered, and therefore impermeable nature of the underlying natural soils, soakaways are not considered to be viable for the new development.

8.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

General

8.1 A review of the PRA information has concluded that due to previous site usage, the potential for a significant pollution linkage should be considered to be Moderate to High.

8.2 Further to this, no visual or olfactory evidence of significant ground contamination was recorded during the ground investigation.

8.3 However, it has been considered prudent to adopt a precautionary principle and undertake chemical analysis on the sub-surface soils to confirm the human health risk status of the site.

Human Health

8.4 Selected samples have been analysed for a general suite of contaminants of concern and compared against Generic Assessment Criteria (GAC) for human health to determine the significance of the measured concentrations in relation to the site conceptual model. Thus, a Generic Quantitative Risk Assessment has been undertaken in line with guidelines provided in CLR11, Model Procedures for the Management of Land Contamination.2004. GQRA.

8.5 The GAC used in the assessment primarily comprised published Soil Guideline Values (SGV) and values that have been derived using Contaminated Land Exposure Assessment (CLEA) guidance as provided by CEFRA and the EA. In the latter case, values derived by Land Quality Management Ltd (LQM) on behalf of the Chartered Institute of Environmental Health (CIEH) and presented in their publication 'Generic Assessment Criteria for Human Health Risk Assessment' (2nd Edition) have been used. Where contaminants are not covered by the above guidelines, GAC have been sourced from previously published but withdrawn SGV's.

8.6 A conservative approach has been adopted in the first instance by assuming a worst case "Residential" land-use scenario as defined by the guidance.

Soil Test Results

8.7 A total of twelve soil samples were analysed for a suite of Metals, Semi-Metals, PAH and TPH as well as asbestos screening. The overwhelming majority of results fall below the defined GAC.

8.8 Asbestos fibres (Chrysotile & Amosite) were detected in four of the samples analysed.

8.9 Some exceedances have been encountered in respect of metals & PAH, and these are set out in the table below.

Contaminant	Number of Exceedances	SGV (mg/kg)	Maximum Recorded Concentrations (mg/kg)	Sample
Lead	1	450	530	TPC
Benzo(a)Anthracene	5	3.1	10	BH1, BH3, BH5, TPB, TPC
Benzo(a)Pyrene	3	5	7.4	BH1, BH2, TPA
Asbestos	4	detection		BH2, BH3, BH4, TPC

Conclusions

8.10 The elevated levels of contamination are considered to arise due to the nature of the infilled Made Ground on site and the previous industrial use.

8.11 Where the site is to be covered by hard surfacing & buildings, there will be no mechanism for a direct contact pollutant linkage. Therefore, the risk to end-users of the site will be negligible in these areas.

8.12 Elsewhere, where Made Ground is exposed within garden & soft landscaped areas, a direct contact linkage can be envisaged.

8.13 Therefore, to these areas it is recommended that a clean capping layer is provided of inert material 600mm thick.

8.14 It is further recommended that these proposals be formalised within a Remediation Strategy to be agreed with the regulating authorities.

8.15 The potential for higher or differing levels of contamination exists on site away from sample positions and therefore a watching brief should be maintained to record any unexpected or obviously elevated levels of additional contamination.

8.16 If any material is imported to site for soft landscaping and gardens, then appropriate testing to verify cleanliness and suitability would need to be undertaken.

8.17 The nature of the ground conditions encountered are such that they are not considered to be volatile and are not considered to be a potential risk to human health through inhalation of indoor or outdoor air. No special requirements are therefore considered in this respect.

8.18 In view of the detection of asbestos traces in the Made Ground, construction operatives working in open excavations should wear appropriate PPE.

9.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS

Waste Soil Characterisation

9.1 Excavation works undertaken during the development will produce waste soils for which appropriate waste management will be required. In line with current principles, any waste soils should be considered for re-use where possible by incorporation into the development.

9.2 Site-won granular Made Ground may be re-used as bulk fill, subject to engineering suitability, under proposed hardstanding and capped off using compacted granular fill.

9.3 Waste arisings comprising uncontaminated natural soil would be suitable, subject to confirmation of suitability for re-use as sub-soil with any planned landscaped areas.

9.4 On the basis of current information, it is likely that some of the Made Ground would be classified as hazardous.

9.5 Elevated levels of metals and PAH have been encountered, and these need to be compared against appropriate values for Waste Acceptance Criteria, which can differ from SGV's for residential gardens.

9.6 Traces of Chrysotile and Amosite asbestos fibres have also been identified within the Made Ground.

9.7 Any imported fill such as topsoil, will be subject to specific quality requirements. Allowance should be made for testing imported fill materials prior to emplacement to ensure suitability.

Water Supply Pipes

9.8 United Utilities will need to be consulted with regards to the selection of suitable water supply pipe materials for the development.

10.0 GROUND GAS ASSESSMENT

10.1 Ground gas monitoring has been undertaken, and the full results of which can be found in Carley Daines and Partners Ground Gas Addendum report.

SIGNED (electronically)

C. R. Carley JP MSc CEng MICE - Consultant

APPROVED (electronically)

D. J. Middleton BEng (Hons) CEng MIStructE - Principal

A P P E N D I X 1

SITE LOCATION PLAN

Note:
Do not scale from this drawing.
Dimensions are to be checked on site.
If in doubt please ask.

Rev	Date	Intls	Details
11	31/03/21	OM	STAGE 3 DRAFT
10	22/03/21	OM	Presentation
9	19/03/21	OM	Landscape Updates
8	10/03/21	OM	Gate position and curb
7	04/03/21	OM	Landscape Updated includng GMP alleyways comments
6	16/12/20	IB	STAGE 2 Report
5	08/12/20		WIP Landscaping to apartments update. Issue for review
4	07/12/20	MG	WIP issue for review
3	04/12/2020	IB	WIP issue for review
2	12/11/20	IB	DRAFT
1	11/10/20		Preliminary Issue

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Project Title Downley Drive
Client Manchester Life | Great Places
Location Ancoat - Manchester

Drawing Title Site Plan_Proposed

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Job No: **8801** **Status** **WIP**

Project: Origin: Zone: Level: Type: Disc: Number: Rev:

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A P P E N D I X 2

GEOTECHNICAL LOGS

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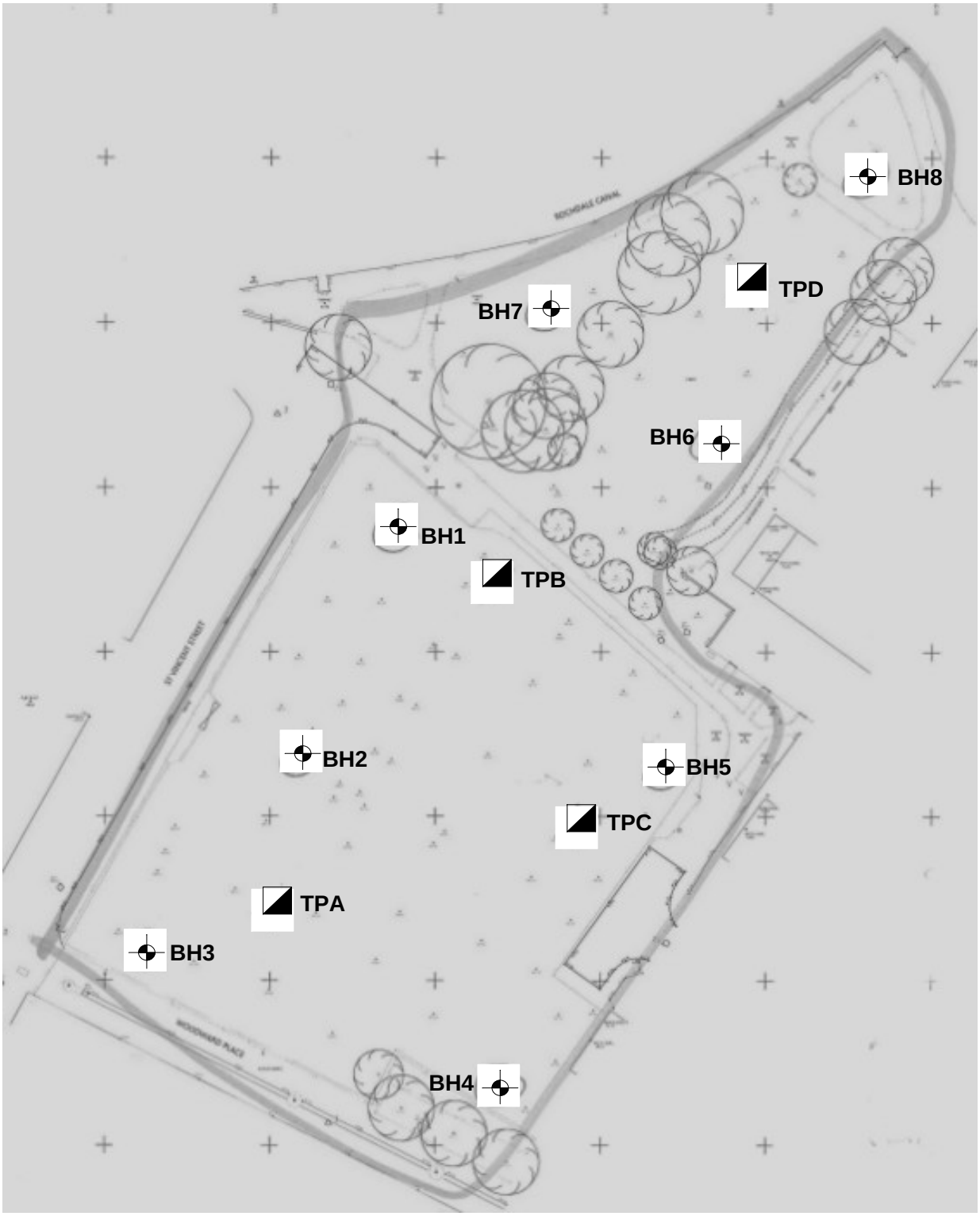

KEY PLAN

SITE: DOWNLEY DRIVE MANCHESTER

Not to Scale : diagrammatic only: all dimensions are in metres (BH. = Borehole TP. = Trial Pit)

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000

Vegetation over dark grey/brown sandy very clayey gravel with brick and sandstone cobbles

420

Dark brown/grey sandy clay with bricks, gravel and cinder.

Disturbed sample 0.2 - 0.8m

1000

TRIAL PIT A

000

90

Turf over dark brown ashy topsoil

Dark brown/grey ashy sandy clay and topsoil with cinder, brick, cobbles and gravel.

Disturbed sample 0.2 - 0.8m

1000

TRIAL PIT B

TRIAL PITS

SITE: DOWNLEY DRIVE MANCHESTER

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000

Vegetation over dark brown sandy slightly clayey topsoil with cinder, gravel and brick.

350

Dark brown/black sand and ash with brick and concrete rubble, cinder and some gravel.

Disturbed sample 0.2 - 0.8m

1000

TRIAL PIT C

000

Dark brown sandy clayey topsoil with gravel, brick fragments, cinder, sandstone cobbles, some concrete fragments and firm clay inclusions.

Disturbed sample 0.2 - 0.8m

1000

TRIAL PIT D

TRIAL PITS

SITE: DOWNLEY DRIVE MANCHESTER

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Site:- DOWNLEY DRIVE MANCHESTER

Job No. NTH 2799 Date:- 15/12/20 **BH No.1**

Description	Depth	Leg	Test/ Depth	Value
Vegetation on 150mm sand and limestone cobble over dark brown/grey sand, ash, brick, concrete, gravel and cinder. MADE GROUND.			0.2 DS	
			1.0 DS	
Medium dense black sand and ash with some cinder and fine brick fragments MADE GROUND.	1.10		1.2 SPT	N = 16
			1.8 SPT	N = 21
			2.4 SPT	N = 11
Firm occasionally stiff occasionally soft brown/grey sandy clay with brick fragments and gravel. MADE GROUND. Wet sand band at 3.2m.	2.50		2.5 DS	
			3.6 SPT	N = 8
Firm becoming stiff light grey sandy slightly organic CLAY with some fine gravel and occasional wet sand inclusions.	3.80		4.0 DS	
Very stiff brown/grey sandy CLAY with gravel and occasional black coal shale fragments.	4.30		4.8 SPT	N = 26
Borehole converted to gas well.	6.00			

SPT @ 1.2m 4/3/3,5,4,4 @ 1.8m 5/4/5,6,5,5 @ 2.4m 5/6/4,3,2,2 @ 3.6m 2/3/2,2,2,2 @ 4.8m 5/5/6,6,7,7
Water encountered and standing on completion at 3.2m.

Key: SPT (standard penetration test). SV (shear vane). DS (disturbed sample). U38 (38mm undisturbed sample).

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Site:- DOWNLEY DRIVE MANCHESTER

Job No. NTH 2799 Date:- 15/12/20 **BH No.2**

Description	Depth	Leg	Test/ Depth	Value
Vegetation over dark brown clayey ashy topsoil with gravel MADE GROUND				
Firm dark grey sandy ashy clay with much gravel and brick fragments. MADE GROUND.	0.15		0.2 DS	
			1.0 DS	
			1.2 SPT	N = 9
Stiff becoming very stiff brown/grey sandy CLAY with some gravel.	2.40		2.4 SPT	N = 15
			2.5 DS	
			3.5 SV	Cu = 140+kN/m2
			4.2 SPT	N = 30
	4.60			

SPT @ 1.2m 3/6/3,2,2,2 @ 2.4m 3/3/3,3,4,5 @ 4.2m 7/8/7,8,7,8
Water encountered and standing on completion at 2.2m.

Key: SPT (standard penetration test). SV (shear vane). DS (disturbed sample). U38 (38mm undisturbed sample).

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Site:- DOWNLEY DRIVE MANCHESTER

Job No. NTH 2799 Date:- 15/12/20 **BH No.3**

Description	Depth	Leg	Test/ Depth	Value
Vegetation over dark grey sandy, gravelly, ashy clay with cinder and sandstone fragments. MADE GROUND.			0.2 DS	
			0.8 DS	
			1.2 SPT	N = 13
Stiff becoming very stiff brown/grey sandy CLAY with rare gravel.	1.30		1.5 DS	
			1.7 SV	Cu = 120kN/m2
			2.4 SPT	N = 31
			3.6 SPT	N = 36
	4.00			

SPT @ 1.2m 2/3/2,3,4,4 @ 2.4m 6/7/7,7,8,9 @ 3.6m 8/9/8,9,9,10
Water encountered and standing on completion at 0.3m. (Perched surface water.)

Key: SPT (standard penetration test). SV (shear vane). DS (disturbed sample). U38 (38mm undisturbed sample).

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Site:- DOWNLEY DRIVE MANCHESTER

Job No. NTH 2799 Date:- 15/12/20 **BH No.4**

Description	Depth	Leg	Test/ Depth	Value
Vegetation over firm dark grey/brown sandy, gravelly, ashy clay with cinder, brick and sandstone fragments. MADE GROUND.			0.2 DS	
			1.0 DS	
			1.2 SPT	N = 6
			2.4 SPT	N = 7
			3.6 SPT	N = 11
Firm becoming very stiff grey/brown turning brown/grey sandy CLAY with some mixed gravel.	3.80		4.0 DS	
			4.2 SPT	N = 26
			4.8 SPT	N = 33
Borehole converted to gas well.	5.20			

SPT @ 1.2m 3/2/1,2,2,1 @ 2.4m 2/1/2,2,2,1 @ 3.6m 3/3/4,2,2,3 @ 4.2m 5/6/6,6,7,7
@ 4.8m 7/7/8,8,8,9
Water encountered and standing on completion at 3.6m.

Key: SPT (standard penetration test). SV (shear vane). DS (disturbed sample). U38 (38mm undisturbed sample).

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Site:- DOWNLEY DRIVE MANCHESTER

Job No. NTH 2799 Date:- 15/12/20 **BH No.5**

Description	Depth	Leg	Test/ Depth	Value
Vegetation over dark brown sandy clayey topsoil with sandstone fragments, cinder, brick fragments and firm clay inclusions. MADE GROUND.			0.2 DS	
Loose dark brown/black sandy ash with frequent firm clay bands, some gravel and some fine brick fragments. MADE GROUND.	0.80		1.0 DS 1.2 SPT 1.8 SPT 2.4 SPT	 N = 7 N = 10 N = 9
Loose moist brown/dark brown fine to medium clayey sand with bands of ash, firm organic clay inclusions, occasional cinder and some gravel. MADE GROUND.	3.20		3.2 DS 3.6 SPT	 N = 5
Loose wet brown fine to medium SAND with firm grey organic clay inclusions.	4.00		4.8 SPT	N = 6
Stiff becoming very stiff brown/grey sandy CLAY with some gravel.	5.10		6.0 SPT	N = 37
	6.40			

SPT + 1.2m 3/3/2,1,2,2 @ 1.8m 2/3/2,4,2,2 @ 2.4m 2/3/3,2,2,2 @ 3.6m 2/1/1,2,1,1
@ 4.8m 1/2/1,1,2,2 @ 6.0m 8/9/9,9,9,10
Water encountered and standing on completion at 4.0m.

Key: SPT (standard penetration test). SV (shear vane). DS (disturbed sample). U38 (38mm undisturbed sample).

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Site:- DOWNLEY DRIVE MANCHESTER

Job No. NTH 2799 Date:- 16/12/20 **BH No.6**

Description	Depth	Leg	Test/ Depth	Value
Vegettion over dark brown sandy clayey topsoil with brick and sandstone rubble, gravel and some cinder. MADE GROUND.			0.2 DS	
Very compact light grey/white sandy limestone fragments (fragmented by sampler) MADE GROUND.	0.65		1.0 DS 1.2 SPT 1.8 SPT 2.4 SPT	 N = 46 N = 32 N = 17
Stiff/very stiff becoming firm/stiff brown turning grey sandy clay with some gravel, organic clay bands and rare fine brick fragments. Angular stone fragments below 3.5m. MADE GROUND.	2.90		3.0 DS 3.6 SPT	 N = 14
No sample recovery due to stone obstructions. Suspect change to very stiff clay at 4.2m	4.00		4.2 SPT	N = 43 *
	4.60			

SPT @ 1.2m 18/10/9,11,13,13 @ 1.8m 10/12/20,8,7,7 @ 2.4m 7/6/7,4,3,2 @ 3.6m 3/3/3,4,3,4
@ 4.2m 4/6/10/12/13 * Affected by stone obstruction.
Water encountered and standing on completion at 2.5m.

Key: SPT (standard penetration test). SV (shear vane). DS (disturbed sample). U38 (38mm undisturbed sample).

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Site:- DOWNLEY DRIVE MANCHESTER

Job No. NTH 2799 Date:- 16/12/20 **BH No.7**

Description	Depth	Leg	Test/ Depth	Value
Vegetation over dark brown sandy topsoil with some gravel, cinder and roots. MADE GROUND			0.2 DS	
Compact red/brown sandy soil and brick rubble with some concrete fragments MADE GROUND.	0.35			
Stiff becoming soft/firm brown/grey sandy clay with some gravel and fine brick fragments. MADE GROUND	0.75		1.0 DS 1.2 SPT 1.6 DS 1.8 SPT 2.4 SPT	 N = 17 N = 13 N = 11
Stiff grey/dark grey very sandy organic clay with some gravel and occasional ash inclusions. MADE GROUND.	3.20		3.4 DS	
Very stiff brown/grey sandy CLAY with some gravel.	3.50		3.6 SPT 4.2 SPT	N = 27 N = 37
	4.60			

SPT @ 1.2m 3/4/4,4,4,5 @ 1.8m 5/4/4,3,3,3 @ 2.4m 3/3/3,3,3,2 @ 3.6m 5/6/6,6,7,8 @ 4.2m 8/9/9,9,9,10
Water encountered at 0.7m. No standing water on completion.

Key: SPT (standard penetration test). SV (shear vane). DS (disturbed sample). U38 (38mm undisturbed sample).

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Site:- DOWNLEY DRIVE MANCHESTER

Job No. NTH 2799 Date:- 16/12/20 **BH No.8**

Description	Depth	Leg	Test/ Depth	Value
Vegetation over dark brown sandy clayey topsoil with gravel, some cinder and some brick rubble, MADE GROUND.			0.2 DS	
Stiff becoming firm/stiff brown sandy clay with some gravel, fine brick fragments, wet sand bands, bands of ash and angular stone fragments. MADE GROUND.	0.40		1.0 DS 1.2 SPT 1.8 SPT 2.4 SPT 3.6 SPT	 N = 17 N = 12 N = 9 N = 17
Very stiff brown sandy gravelly CLAY. Poor sample recovery	4.20		4.8 SPT	N = 53
Borehole converted to gas well.	5.20			

SPT @ 1.2m 3/4/4,4,4,5 @ 1.8m 5/4/4,3,3,2 @ 2.4m 2/3/2,3,2,2 @ 3.6m 4/5/4,5,5,3
@ 4.8m 12/12/13,14,13,13,
Water encountered at 0.3m. Standing on completion at 2.2m.

Key: SPT (standard penetration test). SV (shear vane). DS (disturbed sample). U38 (38mm undisturbed sample).

A P P E N D I X 3

CHEMICAL TEST RESULTS

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Analytical Report Number : 21-49955

Project / Site name:	Carley Daires. Downley Drive, Manchester	**Samples received on:**	07/01/2021
Your job number:		**Samples instructed on/ Analysis started on:**	07/01/2021
Your order number:	KM	**Analysis completed by:**	12/01/2021
Report Issue Number:	1	**Report issued on:**	12/01/2021
Samples Analysed:	12 soil samples		

Signed:

Joanna Wawrzeczko
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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

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The results included within the report are representative of the samples submitted for analysis.

Analytical Report Number: 21-49955
Project / Site name: Carley Daires. Downley Drive, Manchester
Your Order No: KM

Lab Sample Number				1732080	1732081	1732082	1732083	1732084
Sample Reference				BH1	BH2	BH3	BH4	BH5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20-0.80	0.20-0.80	0.20-0.80	0.20-0.80	0.20-1.00
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	18	17	19	9.3
Total mass of sample received	kg	0.001	NONE	1	1	1	1	1

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	Chrysotile- Loose Fibres	Chrysotile, Amosite- Loose Fibres	Chrysotile- Loose Fibres	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Detected	Detected	Detected	Not-detected

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.9	8.5	8.8	8.0	8.5
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.034	0.035	0.15	0.081	0.24

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.13	< 0.05	0.15	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	1.0	0.29	0.72	0.23	0.99
Fluorene	mg/kg	0.05	MCERTS	0.76	0.39	0.58	0.18	0.68
Phenanthrene	mg/kg	0.05	MCERTS	6.7	4.1	5.6	1.7	6.9
Anthracene	mg/kg	0.05	MCERTS	1.3	1.0	1.0	0.4	1.5
Fluoranthene	mg/kg	0.05	MCERTS	9.5	6.7	10	3.2	9.2
Pyrene	mg/kg	0.05	MCERTS	11	6.6	11	3.3	8.8
Benzo(a)anthracene	mg/kg	0.05	MCERTS	4.2	2.8	5.1	1.8	4.0
Chrysene	mg/kg	0.05	MCERTS	3.5	2.3	4.2	1.5	2.9
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	2.9	1.9	4.0	1.2	2.8
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	2.5	1.6	2.5	1.1	1.9
Benzo(a)pyrene	mg/kg	0.05	MCERTS	3.8	2.4	4.2	1.4	3.2
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.6	1.0	2.1	0.68	1.4
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.0	1.4	2.5	0.91	1.8

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	50.2	32.6	53.1	17.6	45.9

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	21	19	18	23	18
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	1.9	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	28	30	22	39	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	86	63	130	83	76
Lead (aqua regia extractable)	mg/kg	1	MCERTS	210	110	220	190	210
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.8	0.5	0.9	0.7	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22	25	28	28	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	130	120	170	180	120

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	350	210	370	190	310

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

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 21-49955
Project / Site name: Carley Daires. Downley Drive, Manchester
Your Order No: KM

Lab Sample Number				1732085	1732086	1732087	1732088	1732089
Sample Reference				BH6	BH7	BH8	TP A	TP B
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20-1.00	0.20-1.00	0.20-0.80	0.20-0.80	0.20-0.80
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	11	19	18	11	14
Total mass of sample received	kg	0.001	NONE	1.2	1.2	1.2	1.2	1.2

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.7	8.5	8.6	9.3	8.5
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.069	0.078	0.062	0.16	0.02

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.26
Acenaphthene	mg/kg	0.05	MCERTS	0.34	0.22	0.21	0.43	1.0
Fluorene	mg/kg	0.05	MCERTS	0.24	0.21	0.14	0.45	1.2
Phenanthrene	mg/kg	0.05	MCERTS	2.8	1.9	1.4	3.4	10
Anthracene	mg/kg	0.05	MCERTS	0.61	0.36	0.33	0.82	1.8
Fluoranthene	mg/kg	0.05	MCERTS	4.7	2.3	3.0	4.1	14
Pyrene	mg/kg	0.05	MCERTS	4.7	2.5	3.0	4.0	13
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.1	1.0	1.3	1.7	6.6
Chrysene	mg/kg	0.05	MCERTS	1.9	0.99	1.1	1.7	4.7
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.8	0.68	1.0	1.3	4.4
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.96	0.65	0.81	0.79	3.1
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.8	0.85	1.2	1.3	5.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.84	0.43	0.57	0.62	2.1
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.51
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.1	0.46	0.63	0.79	2.7

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	23.8	12.6	14.6	21.4	70.8

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13	14	8.2	6.8	22
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	< 0.2	< 0.2	0.4	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	19	24	20	16	22
Copper (aqua regia extractable)	mg/kg	1	MCERTS	66	46	28	37	120
Lead (aqua regia extractable)	mg/kg	1	MCERTS	180	95	38	57	190
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.4	0.4	0.3	0.4	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	24	26	19	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	100	89	65	75	140

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	190	110	220	99	180

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

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Analytical Report Number: 21-49955
Project / Site name: Carley Daires. Downley Drive, Manchester
Your Order No: KM

Lab Sample Number				1732090	1732091
Sample Reference				TP C	TP D
Sample Number				None Supplied	None Supplied
Depth (m)				0.20-0.80	0.20-0.80
Date Sampled				Deviating	Deviating
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	16	10
Total mass of sample received	kg	0.001	NONE	1.2	1.2

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	Chrysotile-Sheeting/Board Debris	-
Asbestos in Soil	Type	N/A	ISO 17025	Detected	Not-detected

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.5	8.6
Water Soluble SO4 (2:1 Leach. Equiv.) 1hr extraction	g/l	0.00125	MCERTS	0.045	0.063

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.3	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	2.1	1.0
Fluorene	mg/kg	0.05	MCERTS	1.9	0.96
Phenanthrene	mg/kg	0.05	MCERTS	18	9.5
Anthracene	mg/kg	0.05	MCERTS	3.1	2.1
Fluoranthene	mg/kg	0.05	MCERTS	22	14
Pyrene	mg/kg	0.05	MCERTS	22	12
Benzo(a)anthracene	mg/kg	0.05	MCERTS	10	5.2
Chrysene	mg/kg	0.05	MCERTS	7.3	4.0
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	6.5	3.3
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	4.4	2.5
Benzo(a)pyrene	mg/kg	0.05	MCERTS	7.4	3.8
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	3.1	1.7
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.75	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	4.0	2.2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	112	62.5

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	30	13
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	30	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	160	69
Lead (aqua regia extractable)	mg/kg	1	MCERTS	530	260
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	2.1	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	33	28
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	230	97

Petroleum Hydrocarbons

TPH C10 - C40	mg/kg	10	MCERTS	220	220

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

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The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 21-49955
Project / Site name: Carley Daires. Downley Drive, Manchester

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1732080	BH1	None Supplied	0.20-0.80	Brown loam and clay with gravel and vegetation.
1732081	BH2	None Supplied	0.20-0.80	Brown clay and loam with vegetation and brick.
1732082	BH3	None Supplied	0.20-0.80	Brown clay and loam with vegetation and gravel
1732083	BH4	None Supplied	0.20-0.80	Brown clay and loam with vegetation and gravel
1732084	BH5	None Supplied	0.20-1.00	Brown clay and loam with gravel and vegetation.
1732085	BH6	None Supplied	0.20-1.00	Brown clay and loam with chalk and gravel
1732086	BH7	None Supplied	0.20-1.00	Brown clay and loam with vegetation and gravel
1732087	BH8	None Supplied	0.20-0.80	Brown clay and sand.
1732088	TP A	None Supplied	0.20-0.80	Brown clay and sand with vegetation and gravel
1732089	TP B	None Supplied	0.20-0.80	Brown loam and clay with vegetation and gravel
1732090	TP C	None Supplied	0.20-0.80	Brown loam and clay with vegetation and brick.
1732091	TP D	None Supplied	0.20-0.80	Brown clay and sand with gravel and brick.

Analytical Report Number : 21-49955
Project / Site name: Carley Daires. Downley Drive, Manchester

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	W	MCERTS
Sulphate, water soluble, in soil (1hr extraction)	Sulphate, water soluble, in soil (1hr extraction)	In-house method	L038-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Sample Deviation Report

Analytical Report Number : 21-49955
Project / Site name: Carley Daires. Downley Drive, Manchester

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH1	None Supplied	S	1732080	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
BH2	None Supplied	S	1732081	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
BH3	None Supplied	S	1732082	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
BH4	None Supplied	S	1732083	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
BH5	None Supplied	S	1732084	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
BH6	None Supplied	S	1732085	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
BH7	None Supplied	S	1732086	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
BH8	None Supplied	S	1732087	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
TP A	None Supplied	S	1732088	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
TP B	None Supplied	S	1732089	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
TP C	None Supplied	S	1732090	ab	Speciated EPA-16 PAHs in soil	L064-PL	b
TP D	None Supplied	S	1732091	ab	Speciated EPA-16 PAHs in soil	L064-PL	b

Key: **a** - No sampling date **b** - Incorrect container
c - Holding time **d** - Headspace **e** - Temperature

A P P E N D I X 4

TIER 1 ASSESSMENT CRITERIA FOR SOIL CONTAMINATION

	CARLEY DAINES & PARTNERS TIER 1 ASSESSMENT CRITERIA		
LAND USE	**Residential with Plant Uptake**		
CONTAMINANT	**1%**	**2.50%**	**6%**
a Arsenic	32	32	32
a Cadmium	10	10	10
b Chromium III	614	614	614
o Chromium VI	4.15	4.15	4.15
cd Lead	450	450	450
d Mercury	170	170	170
a Selenium	350	350	350
a Nickel	130	130	130
b Phenols	184	290	415
b Copper	2330	2330	2330
b Zinc	3750	3750	3750
o Cyanide	34	34	34
b Benzene	0.08	0.157	0.332
b Toluene	119	270	611
b Ethylbenzene	65	154	354
b *o* -xylene	45	106	246
b *m* - xylene	44	103	240
b *p* - xylene	42	98.2	228
b /l Acenaphthene	210(326)	480	1000
b /l Acenphthylene	168	400	850
b /l Anthracene	2300	4900	9200
b Benzo(a)anthracene	3.1	4.7	5.9
b Benzo(a)pyrene	0.83	0.94	1
b Benzo(b)flouranthene	5.6	6.5	7
o Benzo(ghi)perylene	40	46	47
b Benzo(k)fluoranthene	8.5	9.6	10
o Chrysene	6	8	9.3
b DiBenzo(ah)anthracene	0.76	0.86	0.9
o Fluoranthene	260	460	670
o/l Fluorene	160	380	780
b Ideno(1,2,3-cd)pyrene	3.2	3.9	4.2
b Napthalene	1.5	3.7	8.7
b /l Phenanthrene	92	200	380
b Pyrene	560	1000	1600
ALIPHATIC HYDROCARBONS			
b /l C5-C6	30	55	110
b /l C6-C8	73	160	370
b /l C8-C10	19	46	110
b /l C10-C12	93(48)	230(118)	540(283)
b /l C12-C16	740(24)	1700(59)	3000(142)
? C16-C35	45000	64000	76000
AROMATIC HYDROCARBONS			
b /l C5-7 (benzene)	65	130	280
b /l C7-8 (toluene)	120	270	611
b /l C8-C10	27	65	151
b /l C10-C12	69	160	346
b /l C12-C16	140	310	593
C16-C21	250	480	770
C21-C35	890	1110	1230

Notes

a SGV (2009)
b LQM/CIEH values or derived using CLEAv1.06 with LQM/CIEH Data
c 2002 SGV values used until further guidance is published
d SGV for inorganic Hg used (ref.2009 SGV, Pg5, Para.4)
e Atkins ATRISKsoil Value
f Oral, dermal and inhalation exposure compared with Oral HCV
Values in brackets present TAC exceeding solubility and vapour saturation limits

Table 1a

UKDWS			EQS (µg/l)*
Parameter	**Concentration**	**Units**	
Acrylamide	0.1	µg/l	-
Aluminium	200	µgAl/l	-
Ammonium	0.5	mgNH4/l	0.2
Anlimony	5	µgSb/l	-
Arsenic	10	µgAs/l	50 (dissolved)
Benzene	1	µg/l	10
Boron	1	mgB/1	2000
Bromale	10	µgBr03/l	-
Cadmium	5	µgCd/l	See Table 2b
Chromium	50	µgCr/l	-
Chromium (III)		µg/l	4.7
Chromium (VI)		µg/l	3.4
Chloride (i)	250	mgCl/l	250
Conductivity (i)	2500	µS/cm at 20°C	-
Copper (ii)	2	mg/l	See Table 2a
Cyanide	50	µgCNI/l	1
1, 2 dichloroethane	3	µg/l	10
Dichloromethane		µg/l	20
Epichlorohydrin	0.1	µg/l	-
Flouride	1.5	mgF/l	1 (Hardness 50mg/l $CaCO_3$) 2 (Hardness 50mg/l $CaCO_3$)
Hydrogen ion	10	pH value	-
Iron	200	µgFe/l	1000 (dissolved)
Lead (ii)	25	µgpb/l	1.2 (dissolved & bioavailable)
Manganese	50	µgMn/l	30
Mercury	1	µgHg/l	0.07 (dissolved)
Mineral Oil (TPH)	10	µg/l	5000 (total) ****
Nickel (ii)	20	µgNi/l	4 (dissolved & bioavailabe)
Nitrate (iii)	50	mgNO3/l	-
Nitrite (iii)	0.5	mgNO2/l	-
Phenol	0.5	µg/l	7.7
Polycyclic Aromatic Hydrocarbons (vii)*	0.1	µg/l	-
Fluoranthene		µg/l	0.0063
Naphihalene		µg/l	2
Benzo(a)pyrene	0.01	µg/l	0.00017
Benzo(b)fluoranthene		µg/l	-
Benzo(k)fluoranthene		µg/l	-
Benzo(g.h.i)perylene		µg/l	-
Indeno(1,2,3co)pyrene		µg/l	-
Anthracene		µg/l	0.1
Selenium	10	µgSe/l	-
Sodium	200	mgNa/l	-
Sulphate (i)	250	mgSO4/l	-
Tetrachloroethane & Trichloroethene (viii)	10	µg/l	10
Tetrachloromethane	3	µg/l	12
Toluene	700***	µg/l	50
Xylene	500***	µg/l	30
Ethylbenzene	300***	µg/l	20**
1.1.1-Trichloroethane		µg/l	400
Trichlorobenzenes		µg/l	0.4
Trichloromethane		µg/l	2.5
Vinyl chloride	0.5	µg/l	N/A
Carbon Tetrachloride		µg/l	12
Zinc	5000	µg/l	See Table 2a

Table 1b

Pesticides			EQS (µg/l)*
Aldrin	0.03	µg/l	
Dieldrin	0.03	µg/l	
Heplachlor	0.03	µg/l	
Heplachlor epoxide	0.03	µg/l	
other pesticides	0.1	µg/l	
Cyclodiene pesticides		µg/l	0.01 (sum)
Pesticides Total (vi)	0.5	µg/l	

Table 2a

EQS for Hardness Related Substances*							
Substance	**EQS Type**	**EQS (ug/l) for Hardness bands (mg/lCaCo$_2$)**					
		0-50	>50-100	>100-150	>150-200	>200-250	>260
Freshwaters, suitable for all fish life							
Copper (dissolved)	Annual average	1	6	10	10	10	28
Zinc (total)	Annual average	8	50	75	75	75	125

Table 2b

Substance	**EQS Type**	**EQS for Hardness Related Substances***				
		<40	40-50	50-100	100-200	>200
Cadmium (dissolved)	Annual average	<0.08	0.08	0.09	0.15	0.25

<u>Reference</u>

* The River Basin District Typology . Standards & Groundwatger Threshold Values (Water Framework Directive) (England & Wales) Direction 2010
** Provisional EQS Value
*** WHO Drinking Water Standard
** EA PPG3

A P P E N D I X 5

HISTORICAL PLANS & ENVIRONMENTAL DATA

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GAS MONITORING

SITE:- Downley Drive Manchester

Date	BH No	CH4%	CO2%	O2%	l.e.l. %	Press mb	Flow l/hr	Weather/Temp
06/01/21	1	0.0	2.3	17.5	0.0	1018	0.2	Dry, clear 1deg.
	4	0.0	0.3	20.5	0.0	1018	0.2	Pressure rising
	6	0.0	3.7	15.3	0.0	1018	0.2	
	8	0.0	2.9	16.1	0.0	1018	0.3	
21/01/21	1	0.0	0.2	21.4	0.0	974	0.4	Overcast 2deg
	4	0.0	1.3	20.0	0.0	974	0.4	Pressure rising
	6	0.0	2.8	17.1	0.0	974	0.3	
	8	0.0	3.0	16.3	0.0	974	0.4	
04/02/21	1	0.0	0.6	20.8	0.0	988	0.3	Dry, clear 2deg
	4	0.0	1.1	20.5	0.0	988	0.3	Pressure steady
	6	0.0	2.9	16.8	0.0	988	0.3	
	8	0.0	2.7	16.2	0.0	988	0.2	
19/02/21	1	0.0	0.4	21.1	0.0	996	0.2	Overcast 8deg.
	4	0.0	2.2	18.4	0.0	996	0.2	Pressure rising
	6	0.0	2.4	18.9	0.0	996	0.3	
	8	0.0	2.6	16.1	0.0	996	0.2	
05/03/21	1	0.0	1.1		0.0	1029	0.3	Dry, clear 5deg
	4	0.0	0.4		0.0	1029	0.2	Pressure rising
	6	0.0	2.6		0.0	1029	0.3	
	8	0.0	2.4		0.0	1029	0.3	
19/03/21	1	0.0	1.5	19.0	0.0	1027	0.2	Light rain 8deg
	4	0.0	0.3	20.9	0.0	1027	0.2	Pressure rising
	6	0.0	2.8	15.8	0.0	1027	0.2	
	8	0.0	2.1	18.0	0.0	1027	0.2	

Instrument GA5000