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Site:	Block C, First Street, Manchester
Client:	Downing Living (Manchester South) Limited Partnership Incorporated
Ref:	GRM/P10418/RS.1
Date:	November 2023



BLOCK C, FIRST STREET, MANCHESTER

REMEDIAL STRATEGY
FOR
DOWNING LIVING (MANCHESTER SOUTH
LIMITED PARTNERSHIP INCORPORATED

Project Ref:
P10418

Date:
November 2023

Prepared for:
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This report has been prepared in accordance with GRM's Accredited Quality Procedures

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Issue	Description of Revision	Signature



Land Appraisal | Environmental | Geotechnical | Design | Mining | Inspections

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1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Ltd (GRM) was instructed by Alan Johnston Partnership LLP (Client's Agent) on behalf of Downing Living (Manchester South) Limited Partnership Incorporated (Client) to produce a Remedial Strategy for the Block C phase of development at First Street, Manchester. Blocks A, B and D are already under construction.

GRM standard limitations of reporting are provided in Appendix A of this report.

The following reports have been used in the preparation of this document:

- GRM Phase II Site Appraisal for Block C, First Street, Manchester. Report ref: GRM/P10418/SAR.1 dated November 2023.
- Geotechnical Engineering Ltd, 'Factual Report on Ground Investigation', dated 12/07/2016 (ref: 31847).
- Cundall Johnston and Partnerships LLP (Cundall), 'Geotechnical and Geoenvironmental Assessment', dated 30/06/2016 (ref: 1011906.RPT.GL.004).

A Site Location and Boundary Plan is included as Appendix B.

1.2 OBJECTIVES OF THE SITE APPRAISAL

The principal aims of this document are as follows:

- a) Assess the existing information relating to the soil and groundwater conditions within the area of the site.
- b) Determine a cost and time effective remedial strategy.
- c) Set out the remediation and validation processes to be followed on site to ensure the site developed does not pose a risk to human health and controlled waters.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 PHASE I DESK STUDY SUMMARY AND SITE OBSERVATIONS

A summary of the desk study information for the site, based on the information obtained from the relevant reports presented in Section 1, is presented below.

Project Name.	Block C, First Stret, Manchester.
Project Reference.	P10418.
Site Location (address).	Land west of Newcastle Street, Manchester, M15 6JE.
National Grid Reference.	SJ 8381 9714.
Site Area (Ha).	0.40.
Summary of Proposed Development.	Predominantly high-rise apartments with limited areas of soft landscaping.
Client Supplied Information.	Topographical Survey. Utility Survey. Existing ground investigation reports. Remediation Reports. Site Photographs.
Site Setting.	The site has previously comprised disused parcels of land west of Newcastle Street. At present the site comprises a compound and car parking associated with the wider construction site for Blocks A, B and D.
Site History.	The earliest map reviewed records terraced residential properties across the site, with post WW2 bomb damage evident from a significantly reduced amount of structures both on-site and in the local area. A 1968 fire insurance map indicates a small garage in the north of the Block C area, Chester Road in the centre of the site and remnants of residential properties in the south. Aerial photographs dated 2020 record the site to be derelict ground with asphalt surfacing.
Geology.	The BGS geological map records superficial deposits of Glaciofluvial Sheet Deposits (sand and gravel) underlain by Glacial Till (gravelly Clay), and Solid Geology of Chester Formation (sandstone). Made ground will be present from the previous development.
Hydrogeology.	Glaciofluvial Deposits – Secondary A Aquifer. Glacial Till – Secondary Undifferentiated Aquifer. Chester Formation – Principal Aquifer. The site is located in the northern extents of a Zone III total catchment groundwater source protection zone associated with an abstraction 1.20km south of the site.
Hydrology.	River Medlock located 250m north and is wholly culverted at the closest point to the site.
Flooding.	The Gov.uk internet base flood risk map for planning indicates the site is within 'Flood Zone 1' which has a low probability of flooding from rivers and the sea (less than 0.1% chance in any year).

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Mining and Quarrying.	The site is not within a Coal Authority reporting area and there is no evidence of mineral extraction having occurred within the site boundary.
Potential Soil Contamination Sources.	Potential contaminated made ground associated with the previous development of the site. Stockpiled arising from the wider development have previous been stored within this area of the site, but has been exported from site to accommodate the site compound.
Potential Ground Gas Sources (including Radon).	The existing ground investigation classified the site as Characteristic Situation 1 (CS1) for which no gas protection measures are required. The site does not lie within a radon affected area.
Other Hazards	Unexploded Ordnance risk. Obstructions in made ground.

3 PHASE II GROUND INVESTIGATION

3.1 FIELDWORK

The ground investigation has been designed in accordance with the general comments outlined in Appendix A (iv).

2016 Ground Investigation

The 2016 Geotechnical Engineering Ltd ground investigation progressed four exploratory holes within the Block C area (one cable-percussive borehole (CP102) to a depth of 6.65m below existing ground level (begl), one cable-percussive borehole with rotary coring follow on (CP/RC102A) to a depth of 27.70m begl and two mechanically excavated trial pits (TP108 and TP109) to depth of between 3.40m and 4.20m begl).

Downhole magnetometer surveying recorded a metallic feature in CP102 at a depth greater than 6.65m begl. The borehole was terminated before rotary coring could comment and redrilled as CP/ RC102A further south.

Hand-dug asbestos observation pits were also progressed across the site on an approximate 9.0m grid.

2023 GRM Ground Investigation

The GRM ground investigation fieldwork was conducted on 18th October 2023. A total of four windowless sample boreholes (WS01 to WS04) were progressed, to depths ranging between 1.00m and 4.00m begl. The borehole were positioned in areas which could be accessed around the existing site cabins and car parking, whilst avoiding buried utilities. Buried obstructions were encountered in three of the four locations, a total of two holes managed to penetrate the made ground and buried obstructions following re-drilling.

3.2 ENCOUNTERED GROUND CONDITIONS

The following is a summary of ground conditions encountered during both phases of fieldwork in the Block C area:

- Made Ground
- Glaciofluvial Deposits
- Glacial Till
- Chester Formation (Solid Strata)

3.2.1 Made Ground

Made ground was encountered across the entire site, from surface to depths ranging between 0.45m and 2.40m begl. The made ground was variable, but included the following materials:

- Surface layers of hardstanding of asphalt/tarmac or concrete.
- Localised relaid topsoil comprising brown clayey SAND with gravel of quartzite and brick.
- Medium dense brown sandy GRAVEL of sandstone and quartzite with localised brick fragments.
- Loose to medium dense brown clayey SAND with gravel of sandstone, quartzite, brick, concrete and rare fragments of tarmac and coal.
- Dark brown sandy organic SILT with gravel of sandstone, brick, ash, glass and ceramic.
- Medium dense whole bricks and brick fragments.
- Firm brown sandy CLAY with gravel of sandstone, quartzite and brick.

3.2.2 Glaciofluvial Deposits

Glaciofluvial Deposits were encountered in all exploratory holes which penetrated the made ground (WS02, WS04b, TP108, TP109, CP102 and CP/RC102A). The base of these deposits was only proven in CP102 and CP/RC102A at depths of between 4.95m and 5.45m begl. These deposits generally comprised:

- Loose to medium dense orangish brown slightly clayey fine and medium sand.
- Loose to medium dense orangish brown clayey fine to coarse SAND, with gravel of sandstone, quartzite and mudstone with a low sandstone cobble content.
- Medium dense orangish brown silty sandy GRAVEL of sandstone and siltstone.

3.2.3 Glacial Till

Glacial Till was encountered in all exploratory holes which penetrated the Glaciofluvial Deposits (CP102 and CP/RC102A). The base of these deposits was only proven in CP/RC102A at a depth of 11.65m begl. These deposits generally comprised stiff to very stiff sandy CLAY with gravel of siltstone, quartzite, sandstone and rare coal.

3.2.4 Chester Formation

Chester Formation strata were only encountered in CP/RC102A which full penetrated the superficial deposits at a depth of 11.65m begl and extended to a depth of at least 27.70m begl (base of borehole). These deposits generally comprised a more weathered horizon of very dense weakly cemented reddish brown medium SAND to a depth of 13.65m begl which were underlain by less weathered strata comprising extremely weak to medium strong reddish brown and orangish brown medium to coarse SANDSTONE.

3.3 GROUNDWATER OBSERVATIONS

Groundwater ingress was not observed during the GRM 2023 investigation. However, the exploratory techniques used were rapid and may have masked small water seepages.

The 2016 ground investigation noted damp horizons at the base of made ground, with a groundwater strike at the base of Glaciofluvial Deposits at approximately 5.0m begl, perched above the cohesive Glacial Till. A groundwater monitoring standpipe within CP/RC102A recorded groundwater at a depth of 3.95m begl.

There are considered to be two main groundwater bodies beneath the site. A shallow groundwater table at the base of the Glaciofluvial Deposits at approximately 31.5m AOD, and a second groundwater table within the within the solid strata (Chester Formation), the level of the deeper groundwater has not been fully established.

3.4 CONTAMINATION OBSERVATIONS

Contamination observations during fieldwork were generally limited to the presence of tarmac and ash fragments within the made ground, and the presence of deleterious materials including glass, ceramic and metal fragments.

Elevated concentrations of ground gas have not been recorded during the 2016 ground investigation. The previous site investigation has classified the wider site (including Block C) as Characteristic Situation 1 (CS1) for which no gas protection measures are required.

3.5 CHEMICAL ANALYSIS

The chemical analysis as part of all phases of investigation comprised:

- Eight samples (seven of made ground and one of natural strata) were analysed for a general suite of contaminants (metals, inorganics and speciated PAH).
- Eight samples (seven of made ground and one of natural strata) were analysed for banded aliphatic and aromatic hydrocarbons (TPHCWG).
- Five of made ground have been screened for the presence of asbestos.
- Two samples of made ground have been submitted for a GRM Water pipe suite.

3.6 RISK ASSESSMENT FOR SOILS CONTAMINATION

3.6.1 Human Health

End Users

The human health risk assessment undertaken within the Phase II Site Appraisal has indicated that there is a low risk to end users from lead, PAH and hydrocarbon contamination; however, the screening values used are considered to be highly conservative and this is likely to be significantly lower as the ground floor of the structure is generally communal areas and plant rooms. Despite this, the building will protect the end-users and for the landscaped areas there is a general absence of existing topsoil and subsoil, so soils for use as a growing medium will need to be imported.

Asbestos was identified across the wider site area as part of the 2016 investigation. An approximate 9.0m grid of hand-excavated asbestos inspection pits was progressed across the entire site, with samples submitted for laboratory analysis. None of the sampling points within the Block C area identified the presence of asbestos. Additionally, the samples tested as part of the 2023 investigation did not identify the presence of asbestos.

Site Workers

Asbestos containing materials (ACMs) have been identified across the wider site area within the previous investigation. Whilst asbestos has not been identified in the grid of shallow samples undertaken across the Block C area, there remains a risk of ACMs being uncovered during the site enabling works. The potential presence of asbestos will need to be considered during the production of any site specific risk assessments for site workers, and suitable PPE will need to be used if any identified ACMs are to be disturbed or moved. Similarly, the risk to nearby residents or customers within the surrounding commercial developments will need to be considered during site activities.

Based on the available and reported information, the risk to the aquifer below the site is considered to be very low and no specific remediation in respect to controlled waters is considered to be required. The risk to nearby surface waters is negligible given the distance between the site and River Medlock.

3.6.2 Water Supply Pipes

It is considered that, based on the UKWIR guidance, the concentrations of contaminants recorded to date (specifically the hydrocarbons and total VOC) are such that upgraded water pipes will be required for the site. It is recommended that the local water supply company for the site (United Utilities) be contacted to confirm their requirements with regard to pipe materials.

3.7 RISK ASSESSMENT FOR GROUND GAS

Ground gas monitoring was undertaken as part of the 2016 ground investigation across the entire site area including all Blocks of development. No significantly elevated concentrations of ground gas were recorded within the site or across the wider site area. The existing ground investigation concludes that:

- *Based on the results of the maximum gas screening value calculation the site will characterise as Characteristic Situation 1 (CS1) where no specific ground gas protection measures are required in new buildings in accordance with CIRIAC665 /BS8485. However, precautions will be required for any site staff undertaking works in deep excavations / confined spaces where air circulation is limited due to the localised presence of depleted oxygen.*
- *No significantly elevated levels of carbon dioxide or methane were noted during monitoring, and gas flow levels were also low. A Characteristic Situation 1 (CS-1) for the site is considered appropriate and therefore no specific ground gas measures are required.*

No additional potential sources of ground gas have been identified in the 2023 GRM ground investigation, therefore, no further gas monitoring was undertaken.

From the investigation works completed the following Phase II Conceptual Model has been produced:

3.8 PHASE II CONCEPTUAL MODEL

HUMAN HEALTH			
Source	Pathway	Receptor	Remedial Solution
Elevated levels metals, PAH and localised heavy end petroleum hydrocarbons within made ground.	Indoor and outdoor inhalation of soil/soil dust and asbestos fibres, ingestion of, and dermal contact with contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users.	Soil capping or removal of contaminated soils.
		Construction workers.	
Made Ground	Inhalation of ground gas.	End users.	Existing report concludes that no gas protection measures required.
Potential asbestos containing materials within made ground.	Inhalation.	Construction workers.	Use of suitable PPE and adoption of appropriate working protocols.
Elevated PAH, VOC and heavy end petroleum hydrocarbons within made ground.	Migration of contamination through leaks and joints, degradation of water pipe materials.	End Users.	Upgraded pipe materials in clean backfill required (specific requirements to be confirmed by water supply company).
CONTROLLED WATERS			
Elevated levels metals, PAH and localised heavy end petroleum hydrocarbons within made ground.	Leaching of contaminants and vertical migration to the groundwater restricted by the presence of cohesive Glacial Till.	Principal Aquifer and associated source protection zone.	Very low. No specific remediation considered to be necessary.

4 REMEDIAL STRATEGY FOR SOIL CONTAMINATION

The works outlined below are those considered necessary to commence the development of the site in accordance with the requirements of the Local Authority. It is the responsibility of the Client to ensure that the recommendations given, and the risk assessment on which they have been based, have been approved by the Local Authority prior to development taking place.

4.1 ENABLING WORKS

There are existing structures on the site including site cabins, storage containers and areas of car parking. Buried obstructions have been encountered across the entire site, including brick and concrete structures within the Block C area and buried basements across the wider site.

Site enabling works are required to remove existing hardstanding and buried obstructions and so as not to present an issue to the proposed construction works (including the progression of piled foundations). Hardstanding should be broken out and the made ground soils turned over to identify any remnant substructures and obstructions.

It is recommended that any buried concrete or masonry obstructions are separated from the made ground and stockpiled separately for processing. We would recommend segregating the made ground around WS02 and stockpiling it separately for further testing to confirm disposal rates.

Construction activities should consider the potential for dust generation and employ appropriate suppression measures.

4.2 HUMAN HEALTH

Remediation to protect End-Users

Following site enabling works, it is considered that the use of a minimum 450mm thick clean growth medium above a granular anti-dig layer or geotextile marker in all soft landscaped areas to break the source-pathway-receptor linkage would currently represent a suitable form of remediation. The thickness of the growth medium will need to be increased locally for specific plant or tree requirements.

Remediation to protect Site Workers

Whilst asbestos has not been identified in the Block C area, it has been encountered in the wider site area, and there remains a risk of asbestos containing materials (ACMs) being encountered during the enabling works. Specific remedial measures are not proposed at this stage; however, the presence of asbestos will need to be considered during the production of any site-specific risk assessments for site workers, and

suitable PPE will need to be used if any identified ACMs are encountered. Similarly, the risk to nearby residents or customers within the surrounding commercial developments will need to be considered during site activities.

4.3 CONTROLLED WATERS

The risk to controlled waters is very low and no specific remedial measures are required.

4.4 CONSTRUCTION MATERIALS

It is considered that, based on the United Utilities Risk Assessment guidance, the concentrations of contaminants recorded to date (specifically the hydrocarbons and total VOC) are such that upgraded water pipes will be required for the site. It is recommended that the local water supply company for the site (United Utilities) be contacted to confirm their requirements with regard to pipe materials.

4.5 UNEXPECTED CONTAMINATION

Should any material suspected of being significantly contaminated be encountered during the redevelopment of the site, GRM shall be contacted to undertake additional investigation, if necessary. The local Environmental Health Officer will be contacted and informed of any additional remedial work required.

5 DISPOSAL AND CLASSIFICATION

Based on the Waste Classification Report (Appendix L) it is considered that the majority of the made ground will be classed as Non-Hazardous Waste. However, it is considered that the made ground from around WS02 will be classed as Hazardous Waste due to the concentrations of TPH and PAH. The made ground from WS03 might be classed as hazardous waste due to a high (alkaline) pH, although it is likely this is due to the presence of concrete.

At this stage, we would recommend segregating the made ground around WS02 for disposal as Hazardous Waste, with the remainder of the made ground being suitable for disposal of as Non-Hazardous Waste. Early consultation with the relevant landfill sites over their particular acceptance criteria may produce cost savings. Reference should be made to the relevant notes presented in Appendix A (x).

The natural strata underlying the site is likely to be classified as Inert for disposal purposes, however, further testing will be required to confirm this. Natural soils may be suitable for re-use on-site as part of any growth medium (subject to chemical validation testing) and consideration should be given to retaining this material on-site.

Care should be taken to keep natural arisings separate from the made ground and free from construction materials, as natural soils mixed with made ground and construction materials may attract additional disposal costs.

It is recommended that any concrete or masonry buried obstructions are separated from the made ground and stockpiled separately for processing.

Visible asbestos containing materials (ACMs) within soils will result in the soils being classified as Hazardous Waste. Visible ACMs should be removed, employing appropriate health and safety protocols and where possible should be undertaken prior to disposal.

It is recommended that any materials to be exported are stockpiled and tested to confirm disposal rates, as this may be more cost effective than using the results contained within this report.

Where site-won materials (i.e. made ground or contaminated natural soils) are to be re-used on site, or materials are to be imported, it is recommended that this should be carried out under a Materials Management Plan produced in accordance with the CL:AIRE Definition of Waste Code of Practice. This document should be approved by a CL:AIRE-registered Qualified Person prior to excavation of materials, and be maintained throughout the duration of the project. A Verification Report should be produced on completion of the project in order to confirm the control and recording of material movements around or between sites in accordance with current waste management legislation and guidance.

6 POST REMEDIATION VALIDATION

There is no suitable topsoil at the site and so some will need to be imported for use as a clean growing medium in areas of soft landscaping. Any materials imported for use to construct the clean growth medium will require chemical validation to confirm that they are suitable for use. Samples of these materials will need to be analysed for a suite of contaminants including metals, inorganics, speciated PAHs and other contaminants such as, speciated hydrocarbons and asbestos depending on the source. The number of samples that require analysis will depend on the source of the materials. The recommended analysis rate is:

Material Type	No. of Samples	Testing
Virgin Quarries Material	2 per source	Metals suite
Crushed hardcore, stone, brick	Minimum 3 per source or 1 per 250 m ³ (whichever is greater)	Asbestos
Greenfield / manufactured soils	Minimum 3 per source or 1 per 200 m ³ (whichever is greater)	Metals suite, PAH suite and asbestos
Brownfield / screened soils	Minimum 6 per source or 1 per 50 m ³ (whichever is greater)	Metals suite, PAH suite and asbestos, plus additional analysis dependent on the source.

Imported soils should be tested in-situ in stockpiles, or once placed in soft landscaped areas. A copy of GRMs Tier 1 Assessment Criteria Values is presented in Appendix D.

The thickness of the capping layer should be confirmed by hand dug validation pits in the areas of soft landscaping.

7 REPORTING

A Remediation Validation Completion Report will be required by the Local Authority to confirm that the remedial strategy has been implemented appropriately. The report should include the following:

- Details of the source, chemical composition and thickness of the soils imported to form the clean growth medium in areas of soft landscaping, including confirmation that they are suitable for use.
- Details of any asbestos containing materials identified including, location of material and photographs confirming the removal and subsequent disposal.
- Details of any unexpected contamination (if encountered) and the remedial measures implemented.
- Additionally, copies of haulage notes confirming the import / export of any soils (including any contaminated arisings) will also be required.

The validation report confirming all the above measures have been undertaken should be submitted to the Local Authority.



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GENERAL APPRAISAL COMMENTS

i INFORMATION SOURCES

Where available the following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:10,000 for local area
- British Geological Survey (BGS) Geology Map Scale 1:50,000/1:63,320
- BGS Memoir
- BGS Borehole Records: <https://mapapps2.bgs.ac.uk/geoindex/home.html>
- BGS online viewer: <https://geologyviewer.bgs.ac.uk>
- Magic Groundwater Vulnerability Maps
- Historical Ordnance Survey (OS) Maps
- Environmental Data Report
- Environment Agency Website: <http://www.environment-agency.gov.uk/>
- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010.
- Coal Authority Records / Coal Mining Report
- DEFRA/Environment Agency Contaminated Land publications and DoE Industry Profiles
- BRE Guide BR211 (2023), 'Radon: Guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects)'
- UK HSA Radon Maps: <https://www.ukradon.org/information/ukmaps>
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- BS8485:2015 +A1: 2019, 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'
- Other technical references used throughout this document are detailed in the text.

ii CONTAMINANTS OF CONCERN

The DoE Industry Profiles are normally used to assess likely contaminants from past land use and potential nearby industrial sources. For land uses where no profile is available, likely contaminants of concern are selected by GRM based on past experience of similar sites, a general screening suite of contaminants covered by CLEA and common contaminants from the Industry Profiles.

- | | | |
|------------|-------------------|--|
| · Arsenic | · Copper | · Water soluble sulphate |
| · Cadmium | · Nickel | · PAH (polycyclic aromatic hydrocarbons) |
| · Chromium | · Zinc | |
| · Lead | · Phenols | |
| · Mercury | · cyanide (total) | |
| · Selenium | · pH | |

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. There is the potential for asbestos containing material to be mixed up with made ground, following any demolition works.

iii CONCEPTUAL MODEL METHODOLOGY

The consideration of contamination is based upon the principles of risk assessment, using the 'source-pathway-receptor' model in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied to form a pollutant linkage:

- The presence of substances that may cause harm (SOURCE).
- The presence of a target which may be harmed (RECEPTOR).
- The existence of a plausible migration route between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage there is no risk. Where a potential linkage is identified in order for it not to pose a risk to the identified receptor it must be broken.

iv INTRUSIVE INVESTIGATION SAMPLING METHODOLOGY

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. A general grid pattern has been adopted, where possible, to provide sufficient information based on the current proposed layout scheme. Some holes have been targeted at particular hazards identified in the Phase I assessment. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

v GROUND GAS RISK ASSESSMENT METHODOLOGY

Gas monitoring programmes undertaken by GRM are designed to broadly comply with the recommendations outlined in CIRIA Report C665 'Assessing risks posed by hazardous ground gas to buildings' (2007) and BS8576 'Guidance on Investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs) (2013).

To assess the risks posed by ground gases such as radon, carbon dioxide and methane, the relevant current guidance has been used. For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (including supplementary advice for extensions, conversions and refurbishment projects) (BR211: 2023)'. For methane and carbon dioxide the primary guidance document used to determine if protection measures are required is *BS8485:2015 Code of practice for the design of protective measures from methane and carbon dioxide ground gases for new buildings*. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Flow Rate (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors such as gas concentrations.

Where flow is not recorded during the monitoring a default flow rate of 0.1l/hr will be used in the assessment to produce a positive result.

vi HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

Guidance contained in the Environment Agency's CLEA Reports has been used to assess the risks posed to human health.

For residential developments that include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land with plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered including the consumption of home-grown vegetables.

For residential developments that do not include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land without plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered except the consumption of home-grown vegetables. For commercial/industrial developments the default Tier 1 Assessment Criteria (TAC) for 'commercial/industrial' are used, i.e. a female with a start age class of sixteen and an end age class of eighteen. All pathways are considered except the consumption of home-grown vegetables.

The TAC used by GRM include Category 4 Screening Levels (C4SLs) published by DEFRA, values calculated by GRM using the CLEA v1.071 risk assessment, and values and Suitable for Use Levels (S4UL) developed by LQM/CIEH. The TAC used in the assessment are selected based on the lowest site specific SOM values returned as part of the chemical analysis.

Where soil chemical analysis results are found to exceed the TAC, Site-Specific Risk Assessments may be undertaken using the CLEA v1.071 risk assessment software using the age classes and pathways described above.

vii RISK TO SITE WORKERS – GENERAL COMMENTS

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Demolition and dismantling of existing structures on the site must be carried out to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

viii CONTROLLED WATERS RISK ASSESSMENT METHODOLOGY

Where the desk study and fieldwork do not reveal a potential source of contamination no leachate or groundwater testing will be performed. Where a potential source is identified the testing will comprise leachate testing on the material considered most likely to pose a risk, groundwater testing will be undertaken if water is present at shallow depth.

The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate/groundwater test results. When the most sensitive receptor is considered to be the aquifer (groundwater) UKDWS will be adopted as the Initial Tier 1 screening values.

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Where the most sensitive receptor is a surface water feature the EQS values will be used as Initial Tier I Screening values.

ix CONSTRUCTION MATERIALS RISK ASSESSMENT METHODOLOGY

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- UK Water Industry Research (UKWIR) Contamination thresholds for sub-surface water pipes, for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

x WASTE DISPOSAL, SITE WASTE MANAGEMENT PLANS AND MATERIAL MANAGEMENT PLANS

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The chemical analysis results included in this report should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous, then the site will need to be registered with the Environment Agency prior to the movement of the waste. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. GRM can assist in the production of Material Management Plans under the CL:AIRE Definition of Waste: Code of Practice. The DoWCoP enables:

- The direct transfer and re-use of clean naturally occurring soil materials between sites, and
- The re-use of both contaminated and uncontaminated materials on their site of origin and between sites within defined Cluster projects.

GRM can also undertake the role of Qualified Person and submit the DoW CoP project Declaration.

Likewise making the site as volume neutral as possible will reduce the costs of development. Whilst not a statutory requirement, Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

xi GEOTECHNICAL ASSESSMENT GENERAL COMMENTS

Where finished floor levels of proposed structures have not been provided by the Client, then for the purposes of initial assessment, GRM will assume that finished levels will not vary appreciably from the existing ground levels. If the depths of any underground engineering works (i.e. sewers, pumping stations etc.) are unknown they will not be taken in to account in the assessment and it will be assumed that any such works will not compromise foundation or ground stability.

Should the development proposals or finished levels be different from these assumptions then the comments/recommendations in the Geotechnical Assessment may require revising.

It should be noted that the results of window sampling and/or cable percussive boreholes may not give a true indication of a soils actual engineering properties (i.e. stability, mass structure etc). GRM consider that that prior to development trial pitting should be undertaken to confirm the recommendations in the Geotechnical Assessment.

xii GEOTECHNICAL ASSESSMENT – ENGINEERING GROUND TREATMENT

Near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should always be taken to avoid this, as excessive disturbance may leads to more onerous floor slab designs, road cap thickness and increased amounts of off-site disposal etc.

Near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known.

xiii GEOTECHNICAL ASSESSMENT – EXCAVATIONS

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground, soft and very soft clays and granular soils. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

If contaminated water enters excavations it should be removed and transported to an appropriate treatment facility by a suitably licensed carrier before construction begins.

xiv GEOTECHNICAL ASSESSMENT – SUBSTRUCTURES

Where practicable, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There may be existing structures and/or infrastructure in close proximity to the proposed development. New build foundations may be constructed next to pavements with existing underground services beneath them, or excavations may be required near existing footings associated with adjacent properties. These potential hazards need to be taken into consideration when designing foundations and the groundworker needs to be made aware of their potential impact during the redevelopment works. Foundations close to existing underground services or buildings may require alternative foundation techniques (such as piling) to protect the integrity of these structures.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing buildings/roads/ services that are to be retained.

xv **GEOTECHNICAL ASSESSMENT – SOAKAWAYS**

Soakaway testing in trial pits by GRM is broadly carried out in accordance with BRE DG 365 (2016). The testing comprises the excavation of a test pit to a suitable depth, and the placement of water into the pit. The level of water present is then monitored over time. For borehole installations, the permeability testing (falling head/rising head) is undertaken in accordance with BS5930.

If it is decided to proceed with the use of soakaway drainage, then the following general points should be noted:

- Soakaways should not be placed so that water can be discharged through potentially contaminated made ground.
- The Environment Agency may require soakaways to be sealed systems such that only roof run off falls to soakaway.
- Interceptors are likely to be required for soakaways for highway drainage. The adopting authority for the highways should be consulted at the earliest opportunity regarding the use of soakaways for highways drainage.
- Consideration of site levels and slopes should be taken into account during the design.
- The construction of all soakaways should be in accordance with the current building regulations.
- Soakaways should not be placed within 5m of a proposed building.
- Placement of soakaways needs to be considered so as to avoid ponding of water down slope.
- The base of a soakaway should not be below the highest recorded water level.
- The Environment Agency prefer 1m of dry soil to be present between the base of a soakaway and the water table to provide attenuation for contamination.

xvi **GEOTECHNICAL ASSESSMENT – FOUNDATIONS**

If soft or hard spots are encountered during foundation excavation then they should be replaced with suitably compacted material or the footings deepened to suitable strata, to avoid differential settlement.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a single plot then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (e.g. piles or vibro-replacement).

NOTES ON LIMITATIONS

General

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

- a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and
- b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and as considered necessary and appropriate to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as provisional only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. Whilst exploratory testing is intended to gain an accurate representation of the site, the very nature of sampling and testing is such that it cannot ensure that all localised conditions are detected.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects. The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.



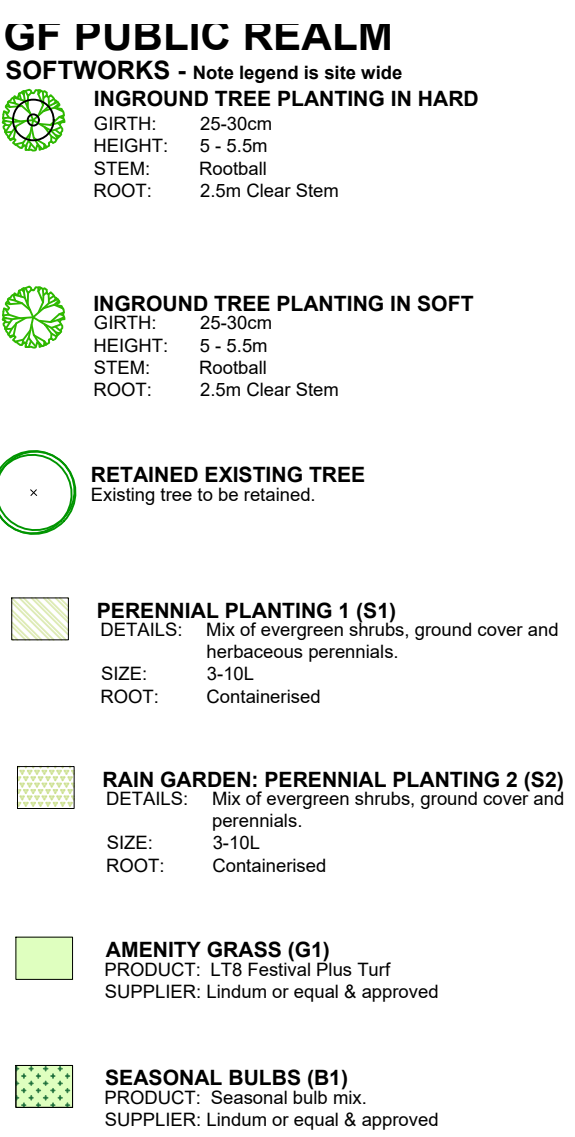
The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.



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CDM INFORMATION

1. To be completed

KEY PLAN



Issue	Revision	Initial	Date
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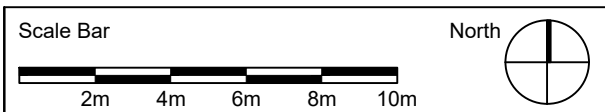
Client
Downing

Project
First Street: Block C
Manchester

Drawing Title

LANDSCAPE PLAN

SOFTWORKS



Scale: 1:200@A1 Date: 13.10.23

By:	GH	Status:	INFORMATION
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Checked: **AW** Approved: **AW**

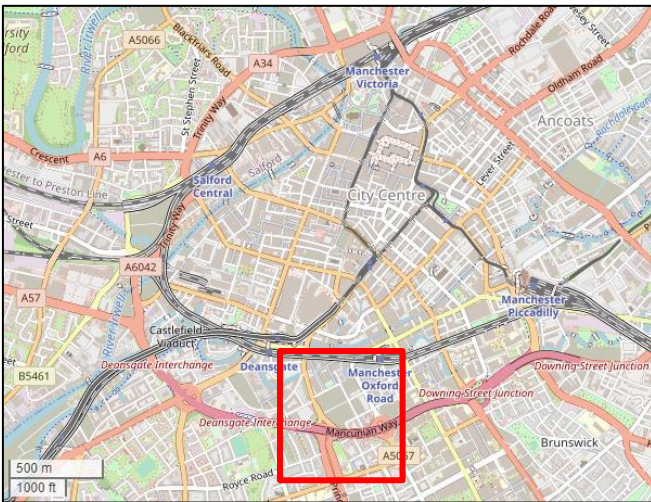
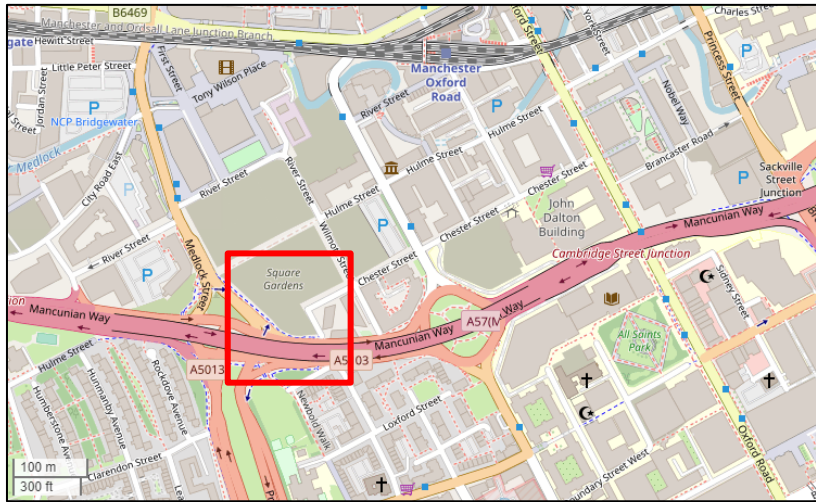
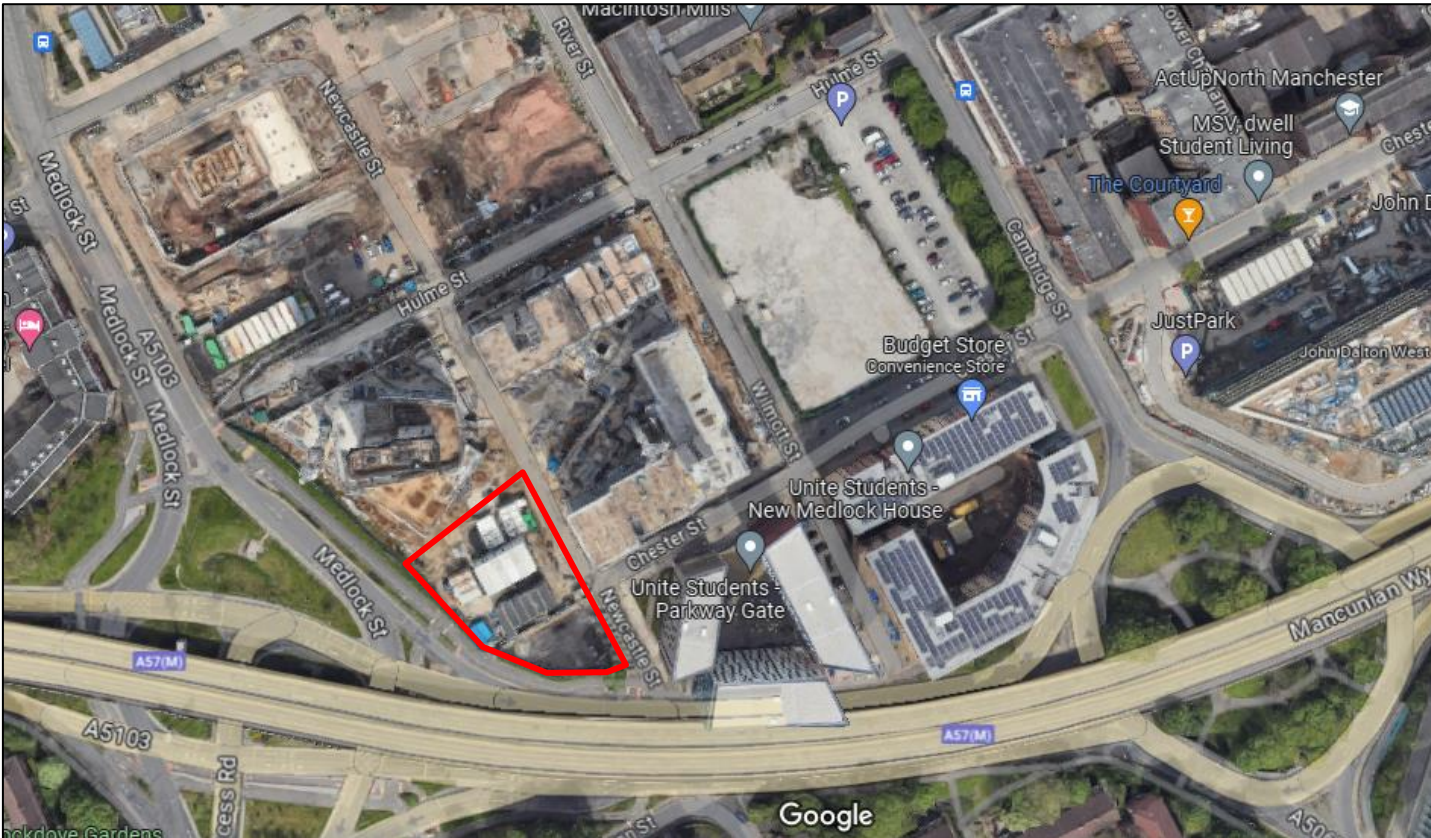
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CLIENT:

**Downing Living
(Manchester South)**

PROJECT:

**Block C, First Street,
Manchester**

TITLE:

Site Location Plan

SCALE@SIZE :

NTS

ISSUE:

FINAL

DESIGN/DRAWN by :

DATE:

PROJECT No:

P10418

DRAWING No:

001

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	GRM TIER 1 ASSESSMENT CRITERIA		
LAND USE	Residential without Plant Uptake		
CONTAMINANT	1%	2.50%	6%
^a Arsenic	40	40	40
^a Cadmium	150	150	150
^b Chromium III	910	910	910
^a Chromium VI	21	21	21
^a Lead	310	310	310
^{b/c} Mercury	56	56	56
^b Selenium	430	430	430
^b Nickel	180	180	180
^b Phenols	750	1300	2300
^b Copper	7100	7100	7100
^b Zinc	40000	40000	40000
^d Cyanide	34	34	34
^b Benzene	0.4	0.7	1.4
^b Toluene	880	1900	3900
^b Ethylbenzene	83	190	440
^b <i>o</i> - xylene	88	210	480
^b <i>m</i> - xylene	82	190	450
^b <i>p</i> - xylene	79	180	430
Non Genotoxic PAHs			
^b Acenaphthene	3000	4700	6000
^b Acenaphthylene	2900	4600	6000
^b Anthracene	31000	35000	37000
^b Fluoranthene	1500	1600	1600
^b Fluorene	2800	3800	4500
^b Naphthalene	2.3	5.6	13
^b Phenanthrene	1300	1500	1500
^b Pyrene	3700	3800	3800
Genotoxic PAHs			
^{a/e} Benzo(a)pyrene	5.3	5.3	5.3
ALIPHATIC HYDROCARBONS			
^b C5-C6	42	78	160
^b C6-C8	100	230	530
^b C8-C10	27	65	150
^b C10-C12	130	330	770
^b C12-C16	1100	2400	4400
^b C16-35	65000	92000	110000
AROMATIC HYDROCARBONS			
^b C5-7 (benzene)	370	690	1400
^b C7-8 (toluene)	860	1800	3900
^b C8-C10	47	110	270
^b C10-C12	250	590	1200
^b C12-C16	1800	2300	2500
^b C16-C21	1900	1900	1900
^b C21-C35			

Notes

- a C4SL - SP1010 (2014) - Benzene and Benzo(a)pyrene values for 1% and 2.5% SOM have been calculated using default C4SL parameters in CLEA v1.07
- b LQM/CIEH S4UL values (2015).
- c S4UL for inorganic Hg used.
- d Atkins ATRISKsoil Value
- e Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)

GRM TAC 11-2016