Phase 3a Site Remediation Strategy

Plot 9B First Street, Manchester

for

Vita Meadow Limited



31/10/2024

COMPLEX CHALLENGES ...
MADE SIMPLE

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1.0 INTRODUCTION

1.1 Background Information

1.1.1 RoC Consulting has been appointed by Vita Meadow Limited to collate a Phase 3a Site Remediation Strategy for Plot 9B First Street, Manchester (the site) an existing site location plan (Tim Groom Architects drawing – VS9B-TGA-G100-PL-XX-95200), ground floor layout plan (Tim Groom Architects drawing – VS9B-TGA0G200-PL-00-03100) and landscape layout plan (TPM Landscape drawing – Z19B-TPM-G710-PL-XX-4645-101) are provided in Appendix A.

1.1.2 It is understood that the site is to be redeveloped with the erection of a purpose-built student accommodation (PBSA) building (Sui Generis), alongside ancillary amenity space, landscaping, secure cycle parking and other associated works; and use of Land east of River Street as a construction compound.

1.1.3 The Site comprises two areas; the Proposed Development will be located entirely on 'Plot 9b', bound to the west by Medlock Street; to the north by land at Plot 9A of the FSDF area (currently being redeveloped into an office block of up to 9 storeys (pursuant to Planning Permission 132600/FO/2021); to the east by land at Plot 10A (currently being redeveloped into an office block of up to 13 storeys (pursuant to Planning Permission 136043/FO/2023) and to the south east by Hulme Street, and land at Plot 11 of the FSDF area (currently being redeveloped to deliver three co-living buildings of up to 45 storeys (pursuant to Planning Permission 125573/FO/2019 (as amended).

1.1.4 The Site also includes an area bound by the River Medlock to the north; Cambridge Street to the east; Machintosh Mills to the south and River Street and Annie Hornian Street to the west that will be used as a site compound for the construction phase of works (the 'Construction Compound').

1.1.5 Note that for the purpose of this Remediation Strategy report, only the main site area encompassing Plot 9B will be discussed in detail. The 'Construction Compound' is acknowledged to already be in use associated with the nearby Plot 10B and is for a storage and compound area only to be used for a two-year period during the construction of Plot 9B. Given the predominantly hardstanding nature of this area and the proposed use the construction compound is deemed to be low risk with no requirement for any remedial measures.

1.1.6 The site has been subject to previous site investigations, the most recent of which was completed by RoC Consulting in July 2024 (ref. Z19B-ROC-A180-RP-XX-P2101). The aforementioned report presents a refined conceptual model for the site, identifying risks to human health via direct contact and ground gas inhalation pathways, and the permeation of water supply pipes; and recommended that a Remediation Strategy be prepared for the site.

1.2 Scope of Report

1.2.1 The scope of works has been tailored to meet both planning and design requirements in relation to the site development and remediation.

1.2.2 This Remediation Strategy has been commissioned in order to provide guidance on the remedial measures required to mitigate the identified risks from contamination at the site, in the context of the site conceptual model.

1.2.3 This document provides details on the strategy of inspecting and remediating potential ground contamination on the site in order to prevent potential risks to human health and potable water pipes. The report also outlines the scope of remedial measures (e.g. soil capping systems, chemical validation, replacement works etc) required by contractors in order to facilitate the site safe development.

1.3 Site Information

1.3.1 The site is located in Manchester City Centre and forms part of the larger First Street regeneration area. The site itself is an approximately rectangular plot of land occupying an area of circa 0.30ha immediately to the north of Hulme Street centred around grid reference 383730, 397229.

1.3.2 The site is currently utilised by construction contractors BAM as a construction compound associated with the construction of the adjacent Plot 9A office building. Site cabins occupy the southwestern portion of the site, a car parking area and small electrical substation occupy the southeastern area of the site and material storage, and access routes occupy the northern area of the site. Topographically speaking the site appears to be generally level with a slightly lower level in the north associated with access routes to the adjoining Plot 9A.

1.3.3 The site is surrounded by residential and commercial developments as well as a number of construction sites. Plot 9A (an office building) is currently under construction immediately adjacent to the northern boundary of the site, Plot 10B (PBSA) is currently under construction to the east of the site. Additional construction works are underway to the south of the site and immediately adjacent the west of the site is Medlock Street with demolition works beyond.

1.3.4 The site was historically occupied by residential housing until the 1920s when the site was cleared and became a scrap and material yard with a wood burner noted on mapping. During the 1940s to the 1960s several non-descript commercial / industrial buildings were present on the site with the site use being unclear. During the 1960s the site formed part of the wider Dunlop rubber and waterproofing works which until then was located to the east of the site. Insurance mapping records indicate that during the period, the site formed part of the rubber works and was used as a coal yard with associated office building and garage. The site was then converted into a car park from 1968 until becoming a storage compound in the late 2010s. The site underwent several years as vacant land from 2020 to 2023 before becoming a construction compound from BAM Nuttall completing the construction of Plot 9A to the north of the study site.

1.3.5 The site is located within an area of Manchester that has undergone extensive historic industrial development. The most significant nearby historical industry of note includes the Gaythorne gas works, Cambridge Street India rubber works (later Dunlop rubber and waterproofing works), Victoria foundry, coal yards and a printing works.

1.4 Previous Site Investigation Reports

1.4.1 The following assessment has been completed to support design and planning requirements for the redevelopment of the site and follows on from a number of site investigations relating to the development site. Those made available to us are listed below.

1. Cundall Plots 6 & 7, First Street, Manchester - Preliminary Geotechnical and Geoenvironmental Assessment ref: 1011906.RPT.GL.003 Rev A (26/01/2016)

2. Geotechnical Plots 6,7 & 8 First Street, Manchester Factual Report on Ground Investigation ref: 31847 (12/07/2016)

3. Cundall Plots 6 & 7, First Street, Manchester – Geoenvironmental Assessment ref: 1011906.RPT.GL.005 Rev - (28/07/2016)

4. Cundall Plots 6 & 7 First Street, Manchester - Detailed Remediation and Verification Strategy ref: 1011906.RPT.GL.007 Rev A (09/08/2016)

5. Ramboll Ground Investigation Review Plot 6 / 7 First Street ref: 1620002943_CLDS_01 Rev 01 (24/02/2017)

6. Terra Consult, Plots 6 & 7 First Street ref: 3296R001-1 (February 2018)

7. Ramboll, Plot 9 First Street, Manchester Contaminated Land Desk Study ref: 1620002943-RAM-05-XX-RP-YE-00001 Rev I04

8. Terra Consult, Plots 9 & 10 First Street Ground Investigation Report ref: 4302R001-3 (15/01/2020)

9. Ramboll Plots 9 & 10 First Street Manchester Geotechnical and Contaminated Land Interpretative Report ref: 1620002943-GCLIR-03 Rev 03 (03.02.2020)

10. Ramboll Plot 9 First Street, Waste Classification Update (26.02.2020)

11. Ramboll, Plot 9 First Street, Manchester, Waste Assessment Update (31/03/2020)

12. Ramboll, Plot 9 First Street, Manchester, Ground Contamination Risk Assessment and Remedial Strategy ref: 1620002943-RS-01 Rev 1 (29/04/2020)

13. ROC Consulting, Plot 9B First Street, Manchester, Phase 1 Desktop Study. Report Ref Z19B-ROC-A180-RP-XX-P1101 (04/06/2024)

14. ROC Consulting, Plot 9B First Street, Manchester, Phase 2 Site Investigation. Report Ref Z19B-ROC-A180-RP-XX-P2101 (01/10/2024)

2.0 SUMMARY OF CONTAMINATION ASSESSMENTS

2.0.1 The following section includes a brief summary of pertinent geo-environmental findings recorded within previous interpretive reports for the site. This information has been used to enable the refinement of the conceptual model for the site. Reference should be made to the below reports for a more detailed account of the works undertaken and the findings thereof.

2.1 Overview of Historic Site Investigation Reports

Preliminary Geotechnical and Geoenvironmental Assessment completed by Cundall (26/01/2016)

2.1.1 The report refers to a number of historic site investigation reports, which were generally undertaken in relation to the former Gaythorne gas works to the north of the site. The reports were not made available to RoC, and are understood to include Matthew and Mumby 1967/8, Georesearch 1985, Ove Arup 2006, Celtic Technologies Ltd 2008, Capita Symonds 2012 (First Street south and north). The report identified that the historic Gaythorne gas works to the north of the site had been remediated to the satisfaction of Manchester City Council (for human health risks) and the Environment Agency (for controlled waters risks).

2.1.2 Elevated concentrations of lead were recorded within the shallow made ground at the site; and ground gas monitoring identified elevated concentrations of carbon dioxide (CO_2) (7.2%) and methane (CH4) (2.2%), alongside depleted levels of oxygen (O2) (1.4%). Further investigation work was recommended on site to assess the quality of soils both from a geotechnical and environmental perspective as well as to enable the installation of groundwater monitoring wells.

Geoenvironmental Assessment completed by Cundall (28/07/2016)

2.1.3 Cundall produced an interpretive geoenvironmental and geotechnical report, using the information contained within the Factual Ground Investigation Report produced by Geotechnical (2016). The data was considered in the context of the proposed development at the time which comprised temporary public realm with soft landscaping works and hard landscaped footpaths.

2.1.4 Potential evidence of a former river channel was encountered across the centre of the wider site, with potential for this to extend into the northeastern portion of the current Plot 9B. The potential for buried obstructions and deep made ground was noted across the wider site.

2.1.5 Asbestos was recorded in made ground across the wider site (including on Plot 9B with one sample recorded as >0.001% by volume) and a remediation strategy was recommended to mitigate the associated risks to human health.

2.1.6 None of the ground gas monitoring wells were installed at the current study site, however it is noted that monitoring carried out in the vicinity identified depleted oxygen levels consistent with those identified during the previous investigation works. Whilst elevated concentrations of hazardous ground gas were not encountered, it is noted that none of the wells were targeted at the underlying organic strata (i.e. peat/Alluvium).

Detailed Remediation and Verification Strategy complete by Cundall (09/08/2016)

2.1.7 Cundall prepared this remediation strategy in the context of proposed temporary public realm. Recommendations were put forward for the management of human health risk posed to construction workers and future site users, including a clean cover system and environmental best practice during site works including separation of contaminated materials to prevent cross contamination. Chemical threshold criteria were also provided for the reuse and import of material.

Ground Investigation Review completed by Ramboll (24/02/2017)

2.1.8 Ramboll were appointed to produce a review of the existing information in the context of a change to the proposed future use from public realm to 10-14 storey offices. This included some information relating to Plot 9B.

2.1.9 The report concluded that foundations for the proposed office building would likely comprise rock socketed continuous flight auger (CFA) piles and recommendations were made for further site investigation for the purpose of design. Ramboll also noted that it was unlikely significant quantities of site won fill would be reused on site in an engineering capacity.

2.1.10 The following further investigation works were recommended in order to address the identified data gaps with regard to the geo-environmental assessment:

- Updated preliminary risk assessment to reflect the change of use
- Additional ground gas monitoring wells within building footprints and to target alluvium and peat deposits
- Targeted ground investigation and chemical analysis of previously inaccessible areas
- Additional asbestos quantification analysis in previously inaccessible areas
- Waste classification of material to be taken off site and additional WAC analysis
- UKWIR risk assessment in the area of proposed water supply pipes
- Additional rotary percussive probing to validate bedrock across the site
- Production of a detailed remediation and verification strategy

Contaminated Land Desk Study completed by Ramboll, (2018)

2.1.11 Ramboll completed a contaminated land desk study for Plot 9 (comprising both Plots 9A and 9B) in cognizance of updates to the red line boundary and interim ground investigation works (Terra Consult, 2018).

2.1.12 The desk study identified the following aspects requiring further consideration:

- Asbestos in made ground
- Hazardous ground gas associated with made ground/Alluvium
- Data gaps within areas of restricted access
- Potential for volatile contaminants in site soils and underlying aquifer
- Groundwater risks potentially requiring a piling risk assessment
- Remedial strategy document for the proposed development required to address identified contamination issues
- Earthworks at the site to be undertaken in accordance with an appropriate Material Management Plan (MMP)

Geotechnical and Contaminated Land Interpretative report completed by Ramboll (03.02.2020)

2.1.13 A supplementary ground investigation was specified by Ramboll and undertaken by Terra Consult in 2020. The work comprised two rotary boreholes, one dynamic sample borehole, monitoring well installation and rising head tests; and the assessment was undertaken in the context of a future 10-storey commercial development with a single storey basement.

2.1.14 Asbestos was encountered within a number of samples screened and the report concluded that the made ground across the wider site area, including Plot 9B, was likely to have been impacted by asbestos.

2.1.15 Elevated concentrations of PAHs, metals, arsenic and Total Petroleum Hydrocarbons (TPH) were reported in leachate samples taken from made ground deposits in exceedance of environmental quality standards (EQS). Exceedances of TPH were also noted in groundwater samples indicating a minor impact to groundwater from TPH leaching through on site made ground deposits into the underlying groundwater.

2.1.16 Due to elevated levels of semi volatile organic compounds (SVOCs) and hydrocarbons in soils it was deemed likely a barrier pipe would be required for the proposed water supply pipe to the site.

2.1.17 The gas regime at the site was classified as CS2 due to elevated methane (1.5%) and carbon dioxide (9.3%) concentrations.

2.1.18 Due to elevated sulphate levels a design sulphate class of DS-2 and aggressive chemical environment of concrete of AC-2 were suggested for the site.

2.1.19 Recommendations for further work were made including the implementation of a remediation strategy and material management plan.

Waste Assessment Update completed by Ramboll (31/03/2020)

2.1.20 Ramboll attended site during the archaeological investigation completed on Plot 9 to obtain additional soil samples for waste classification and WAC testing.

2.1.21 The report broke down the principal soil types across the site as with made ground being classified as non-hazardous with the exception of asbestos impacted materials; and cohesive made ground, glacial clays possibly reworked and glaciofluvial deposits (GFD) where WAC data indicated exceedances of leachable antimony and fluoride. With regard to the latter, it was noted these were marginal and landfill providers may be able to accept the material at an inert waste landfill site. Alluvium deposits were classified as non-hazardous but unlikely to pass inert WAC due to organic content. Sandstone was classed as non-hazardous.

2.1.22 One sample taken from made ground deposits (TT1) on Plot 9B encountered asbestos above the hazardous waste threshold of 0.1% w/w.

Ground Contamination Risk Assessment and Remedial Strategy completed by Ramboll (29/04/2020)

2.1.23 This report presents a revised assessment of the previous data, to reflect the information relevant to Plot 9 only. No significant changes were made to the conceptual model and GQRA with the main risks remaining, those posed by asbestos to human health, elevated hydrocarbons to water pipes, ground gas generation to construction workers and future site users and the minor groundwater impact from hydrocarbons to the below ground aquifer.

2.1.24 The following remedial strategy was outlined in order to address the identified risks and support the proposed development:

- Material management to be carried out under the CL:AIRE Definition of Waste Code of Practice (DoWCoP)
- Measures for dealing with contaminated / asbestos impacted soils specified including the separation of stockpiles of contaminated and clean material
- Implementation of an asbestos management plan
- Clean capping layer for areas of soft landscaping to break any potential pathways for exposure to asbestos
- Discovery strategy for encountering areas of unexpected contamination
- Piling risk assessment
- Ground gas mitigation measures
- Barrier pipes

Phase 1 Desktop Study completed by RoC (04/06/2024)

2.1.25 This report reviewed the previous ground investigation findings as well as compiling a refined conceptual model and risk assessment specific to Plot 9B and the proposed development of a purpose-built student accommodation block.

2.1.26 Potentially complete pollutant linkages warranting further consideration were identified with regard to the following, and a bespoke Phase 2 investigation of the site was therefore recommended:

- On site asbestos associated with historic building demolition as encountered in historic site investigation works
- On site PAHs, metals and hydrocarbons associated with made ground deposits and ashy material as encountered in historic site investigation works
- On site ground gas generation associated with made ground deposits / organic superficial deposits
- VOCs, SVOCs, Hydrocarbons and PAHs associated with historic rubber works and gas works in close proximity to the site

Phase 2 Site Investigation completed by RoC (October 2024)

2.1.27 The Phase 2 Site Investigation comprised a bespoke intrusive assessment of the site with respect to the proposed development, including further assessment of the risks identified by the previous investigation works.

2.1.28 The site works comprised:

- The formation of two deep rotary boreholes for geotechnical purposes and to install groundwater monitoring wells in order to obtain groundwater samples for controlled waters risk assessment
- Excavation of six window sample boreholes to obtain additional environmental samples to inform geo-environmental risk assessment, permit the sampling of soils for geotechnical testing purposes including the completion of in-situ testing. Four window sample boreholes were also installed with ground gas monitoring wells to allow the completion of a ground gas risk assessment
- The completion of a six-week ground gas monitoring programme

2.1.29 The investigation generally encountered made ground comprising a mixture of granular and cohesive demolition fill material to a depth of 2.93mbgl. Made ground deposits were underlain by GFD comprising medium dense to dense gravelly sand or sandy gravel. In areas of deeper made ground the GFD were found to be absent, and made ground was underlain by Devensian Till (DT) deposits predominantly described as a firm to stiff slightly gravelly clay. Bedrock was encountered at a depth ranging between 6.30 and 8.20mbgl and comprised the reddish-brown sandstone of the Chester Formation.

2.1.30 Perched groundwater was reported at two locations within made ground at 3.80 and 3.70mbgl, groundwater was also reported at similar depths within the GFD. No groundwater was reported within the DT deposits which appears to be acting as an aquiclude between perched groundwater in the made ground and GFD and the principal aquifer in the Chester Formation. Resting water level within the Chester Formation bedrock was recorded in ROC RBH101 at 7.93-8.27mbgl.

2.1.31 Elevated concentrations of heavy metals and PAHs were identified by the assessment, as follows:

Table 1 - Summary of Exceedances of HH GAC

Determinand	No. tested	GAC (mg/kg)	No. of exceedances	Maximum concentration (location, depth)
Lead	13	310	7	1,990 mg/kg (WS104, 0.70 mbgl)
Beryllium	13	1.7	2	2 mg/kg (TT1, 0-0.20 mbgl)
Benzo(a)anthracene	13	11	4	20.1 mg/kg (RBH101, 0.50 mbgl)
Benzo(a)pyrene	13	5.3	6	19 mg/kg (RBH101, 0.50 mbgl)
Benzo(b)fluoranthene	13	4	8	22.50 mg/kg (RBH101, 0.50 mbgl)
Dibenzo(ah)anthracene	13	0.31	11	5 mg/kg (TP103, 0.50 mbgl)
Asbestos	13	Detect	7	0.004% (A0P6-7, 0.75 mbgl)

2.1.32 The results of the assessment identified the widespread presence of metals, PAH and asbestos within the shallow made ground soils with the potential to impact human health of future site users via direct contact pathways, where present. These concentrations are anticipated to be associated with the demolition of historic structures on site. The site observations and exceedances are considered to be typical of a previously developed brownfield site. Consequently, the formulation of a remediation strategy was recommended to address risks to human health. There was no evidence of groundwater contamination.

2.1.33 Following completion of the gas monitoring programme, the ground gas risk assessment classified the site as Characteristic Situation 2 due to levels of carbon dioxide recorded in excess of 5% with a requirement for ground gas protection measures in accordance with BS8485.

2.1.34 Based on laboratory testing, it was considered that well compacted buried concrete should be designed in accordance with Class DS-1 AC1 requirements as specified in BRE Digest Special Digest 1:2005 Concrete in aggressive ground: Version 3.

2.1.35 United Utilities pipework risk assessment testing was undertaken on samples taken from made ground deposits. The results of testing indicate that barrier pipes will be necessary due to the presence of elevated SVOC's and hydrocarbons within site soils.

3.0 REMEDIATION STRATEGY

3.1 Remedial Requirements

Soil Contamination and Construction of Soft Landscaped Zones

3.1.1 The results of the human health risk assessment completed in the RoC Phase 2 report identified the widespread presence of metals, PAH as well as asbestos within the shallow made ground soils with the potential to impact human health via direct contact pathways, where present. It is noted, however, that the majority of the site will be covered with a building and hard landscaping.

3.1.2 Short term risks of exposure to contamination hotspots will remain for construction workers which can be mitigated via the use of comprehensive PPE and site welfare / hygiene facilities.

3.1.3 Direct contact pathways between impacted made ground and site end-users will therefore be limited to areas of soft landscaping, shown in the southwestern corner of the proposed development on the proposed development plan made available at the time of writing this report, as presented in Appendix A.

3.1.4 Any areas of soft landscaping should be subject to a minimum 450mm clean soil capping system or deeper where required in areas of proposed tree pits according to the landscape architect's specification. Soils used in capping should be of natural origin (of which 150mm should be topsoil).

3.1.5 Construction of this capping system entails the excavation, removal, and replacement of existing soils with chemically verified either imported or site won natural strata. The replacement process will require independent validation by RoC Consulting to ensure conformity with our specification, details of which are provided below:

1) Prior to the commencement of any soft landscaping works the principal contractor should contact RoC Consulting and provide details of the preferred source / supplier of soil for use as replacement fill and the precise volumes required to complete the soft landscaping. In addition, the contractor should advise as to the approximate construction programme for all soft landscaped zones so that site validation can be arranged accordingly. Regardless of source, all replacement soils should be from natural sources and must not contain putrescible organic materials, demolition rubble, glass, ash, clinker, slag, colliery shale, or spoil. Additionally, the material must not contain any visual or olfactory indicators of contamination.

2) Imported soil should be subject to chemical validation testing at source. Not doing so may result in material being found to be unsuitable after placement. Our remediation strategy assumes that this will be undertaken by the supplier and provided to RoC for review. However, if this is not feasible it can be undertaken by RoC as part of an additional validation visit.

3) The importation of replacement soils onto the site should not be commenced until Points 1 and 2 have been completed. Any materials being excavated from or brought onto the site for use in soft landscaped zones should be separated from site operations to ensure no cross contamination of soils can occur.

4) At a suitable point in the programme, the construction contractors shall excavate soils within landscaped zones to a minimum depth of 450mm below proposed finished floor levels (or deeper in the case of proposed tree pits). Any landscaping excavations that extend beyond these depths are to be completed as per the landscape architect's specification utilising verified soils that meet the criteria outlined in this strategy.

5) Following placement of the cover system, RoC Consulting will visit the site to obtain samples for chemical validation and obtain photographic records or the construction of the cover system. The sampling and analysis of soil will be completed at a frequency as described below in Table 2.

Table 2 - Sampling and Testing Requirements

	Number of Samples	Testing Schedule
Greenfield soils	1 per 200m^3 or 3 minimum (whichever is the greater)	As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn, PAH (16 USEPA specification), asbestos
Brownfield soils	1 per 150m^3 or 6 minimum (whichever is the greater)	As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn, PAH (16 USEPA specification) SVOC, VOC, TPH (CWG banded), asbestos and any additional analysis based on the history of the donor site.
First generation quarried sand or stone to be used in subsoil / break layer	No testing required; certification of material source is required.	
Recycled stone (6F2 or similar, for use as general fill across the site or below the cover system)	1 per 200m^3 or 6 minimum (whichever is the greater)	As, Cd, Cr, CrVI, Cu, Hg, Ni, Pb, Se, Zn, PAH (16 USEPA specification), TPH (CWG banded), asbestos and any additional analysis based on the history of the donor site.

6) Soil validation samples will be submitted to a suitably accredited analytical laboratory for a 10-day turnaround of results but can be expedited (at an additional cost) as required.

7) The results of the above source and in-situ validation testing should be compared against RSK derived GACs for public open space in close proximity to residential housing, as listed in Appendix B. Failure to meet these criteria may result in the material being rejected.
8) All excavated materials are to be removed off site to a suitable licensed facility / waste transfer station or (where possible) re-used on site beneath areas of building / hard standing.

9) All areas of reduced excavation should be recorded by the use of digital photographs taken of the excavation with a suitable scale (such as survey level) prior to backfilling. All photographs should include landmarks or other indicators proving their location and indicate their entire area of backfilling, as well as detailed assessments of banks and boundaries.

10) The Principal Construction Contractor must maintain adequate site records regarding imported soil including date of delivery, type of material, location of stockpiles on-site, details of sampling and dates of rejection or approval for use by RoC Consulting.

11) Similarly, details should be provided for any site won materials used including the location and reason for excavation (e.g. sub soil excavated as part of foundation construction); approximate volume used and associated RoC Consulting validation information.

12) Upon completion of remedial works, copies of all relevant supply notices, waste disposal records and tip tickets should be provided to RoC Consulting to assist with the completion of the aforementioned site validation report.

3.1.6 It should be noted that the testing outlined above is for environmental purposes only and assessment of the soil's suitability as a growing medium (to BS3882 or similar) is beyond the scope of the assessment. Such assessment is the responsibility of the landscape architect.

3.1.7 It is noted that it is proposed to use land adjacent to the west of the building as a lawn as part of a meanwhile use. This area is outside of the area assessed by the Phase 2 report and thus assessed by this remediation strategy. Recommendations for any cover systems in this location should be based on site investigation in this location.

Ground Gases

3.1.8 The results of ground gas monitoring undertaken at the site revealed a peak CO_2 concentration of 6.3% with negligible flow rates. Although these values yield a gas screening value (GSV) falling within the threshold of CS1 in line with BS8485 guidance the site has been characterised as CS-2 owing to CO_2 levels being above the 5.0% threshold. As such ground gas protection measures commensurate with a CS-2 characterisation will be required for the site.

3.1.9 The risks to development have been assessed in accordance with BS8485:2015+A1:2019, which provides guidance on ground gas (methane and carbon dioxide) characterisation and hazard assessment, as well as providing a framework for the prescription of protection measures within new buildings.

3.1.10 Gas protection measures within new buildings are proscribed on a points scoring system taking into consideration the CS and the proposed building type.

3.1.11 Considering the CS determined for the site and the proposed building type (Type B) a minimum score of 3.5 points is required to achieve an adequate level of protection. Solution scores are awarded for different gas protection measures. BS8485 indicates that the gas protection system should consist of at least two different elements from the below list to achieve the required gas protection score for a Type B building.

- Structural barrier (floor slab / basement);
- Ventilation measures;
- Gas resistant membrane

3.1.12 In order to achieve a score of 3.5, the recommended method of gas protection measures and method of construction is summarised in Table 3.

Table 3 - Recommended Gas Protection Measures

Types of Gas Protection	Score
Cast in-situ monolithic reinforced ground bearing raft or reinforced cast in-situ suspended floor slab with minimal penetrations	1.5
Methane and carbon dioxide resistant membrane installed as per manufacturer's instructions	2
Total	**3.5**

3.1.13 The site developers will be responsible for the detailed design of the proposed gas protection.

Cast in-situ monolithic reinforced ground bearing raft or reinforced cast in-situ suspended floor slab with minimal penetrations.

3.1.14 Contrary to segmental floor construction methods, well-constructed cast in-situ reinforced concrete raft foundations, which are monolithic with few joints can provide resistance for ground gas ingress into buildings. In order to achieve the required point score of 1.5 the following floor structures would be considered suitable:

- Cast in-situ ground bearing monolithic reinforced industrial floor slab with minimal services entering the slab and few perforations
- Suspended or semi suspended floor slab constructed from reinforced dense cast in-situ reinforced structural concrete with minimal perforations

Gas Resistant Membrane

3.1.15 A suitably designed and installed gas resistant membrane would achieve a point score of 2. To achieve a point score greater than zero they should be:

- Sufficiently impervious to methane and carbon dioxide
- Capable after installation of providing a complete barrier to the entry of relevant gas
- Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions
- Sufficiently strong to withstand the installation process and following construction activities until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above the membrane and dropping of tools)
- Chemically resistant to other contaminants that may be present
- Verified in accordance with CIRIA C735

3.1.16 It is recommended that membrane specification sheets be provided to RoC for comment prior to installation of the membrane on site.

3.1.17 All joints and penetrations of the membrane (notably utility services) should be lapped and sealed in accordance with the membrane manufacturers recommendations. The membrane should be placed continuously across the slab construction and lapped onto / extended over cavity wall construction. The membrane should be placed onto a clean surface which is free of any debris that could puncture the membrane.

3.1.18 The final performance requirement of the ground gas protection measures should be confirmed as part of a detailed design in consultation with a specialist contractor and in agreement with building control. All ground gas protection measures incorporated into the design of the building will need to be documented on-site by the contractor in accordance with verification procedures in CIRIA C735.

3.1.19 Visual inspection and photographic evidence prior to concrete pours of the general installation, taping and sealing of a membrane will be required, this may be carried out by RoC or another suitably qualified 3rd party to provide documented evidence confirming robust installation for inclusion in the verification report.

Controlled Waters

3.1.20 No remedial measures were recommended with respect to groundwater or surface water.

Piling Risk Assessment

3.1.21 Given the proposed development loadings and existing ground conditions on site, it is anticipated that a piled foundation solution will be adopted for the proposed structure. A Piling Risk Assessment is being prepared for the site and will be issued under separate cover.

Below Ground Structures

3.1.22 Well compacted buried concrete should be designed in accordance with Class DS-1 AC1 requirements as specified in BRE Digest Special Digest 1:2005 *Concrete in aggressive ground: Version 3*.

Potable Water Supply

3.1.23 As part of the Phase 2 assessment, United Utilities pipework risk assessment testing was undertaken on samples taken from made ground deposits. The results of testing indicate it is likely that metal / barrier pipes will be necessary due to the presence of elevated SVOC's and hydrocarbons within site soils. A template explaining the assessment methodology is presented in Appendix C.

3.1.24 It is likely that metal / barrier pipes will be necessary. It may be feasible to revise this requirement during construction if it can be determined that the pipework will not be placed in contact with the existing onsite made ground deposits – for example in the event that all material at the relevant depth is to be replaced. Equally it may be feasible to disprove this requirement through further testing targeted at the specific installation location. Details of the approach taken, and supporting evidence, should be provided to RoC for review as part of the validation process.

Other Remedial Requirements

3.1.25 In addition to the above, and during the construction period, it is recommended all construction contractors take reasonable precautions to control environmental impacts that may occur as a result of redevelopment works with respect of soil and groundwater quality. These measures should include (and not be limited to):

1) Any sources of contamination uncovered during site development works should be brought to the immediate attention of RoC Consulting for consideration and comment. As required, the findings and recommendations of the current assessment may require amendment to reflect changes in site condition.

Asbestos awareness and management systems should be in place. In the event that identifiable pieces of Asbestos Containing Materials are identified specialist control measures may be required.

2) The operation of plant, refuelling facilities and general excavation works should include appropriate provision to reduce the risk of leakage / spillage, particularly into the site groundwater table or exposed natural soils.

3) Appropriate dust mitigation measures should be deployed during earthworks, including vehicles leaving the site, particularly when handling and excavating made ground deposits.

4) All excavated materials stockpiled should be periodically dampened down to control dust release. Similarly, the disposal of any material from site should be completed using covered wagons.

Validation Reporting

3.1.26 On completion of site construction works a Phase 3b Site Validation report will be required to confirm completion of all remedial requirements. This report should include evidence of the completion of all remedial objectives as well as supporting site records, testing information, photographs etc. Gas membrane specification sheets should also be provided for inclusion for within this report.

3.1.27 Details of any additional remedial requirements (arising as a result of unexpected sources of contamination being discovered during site works), or deviations from the current strategy should also be provided for inclusion with this report.

3.1.28 The report will be required to be submitted to the LPA in order to discharge the associated pre-occupation planning conditions attached to the consent. As such it is essential construction contractors provide information required to collate the validation report in advance of practical completion.

4.0 HEALTH AND SAFETY DURING REMEDIATION

4.0.1 During remediation the workforce will need to adopt full HSE measures to ensure that the elevated concentrations of contaminants requiring cover, treatment and/or removal are dealt with according to current guidelines and codes of practice. Suitably experienced and competent staff should be employed to carry out the on-site remediation.

4.0.2 Site personnel are not permitted to enter unstable excavations, nor excavations in which contamination is present, nor unsupported excavations deeper than 1.2m, in accordance with standard HSE protocols. Standard air sampling and monitoring equipment shall be used which emits an audible warning of the presence of any volatile gases and/or low oxygen atmospheres.

5.0 CONCLUSIONS & RECOMMENDATIONS

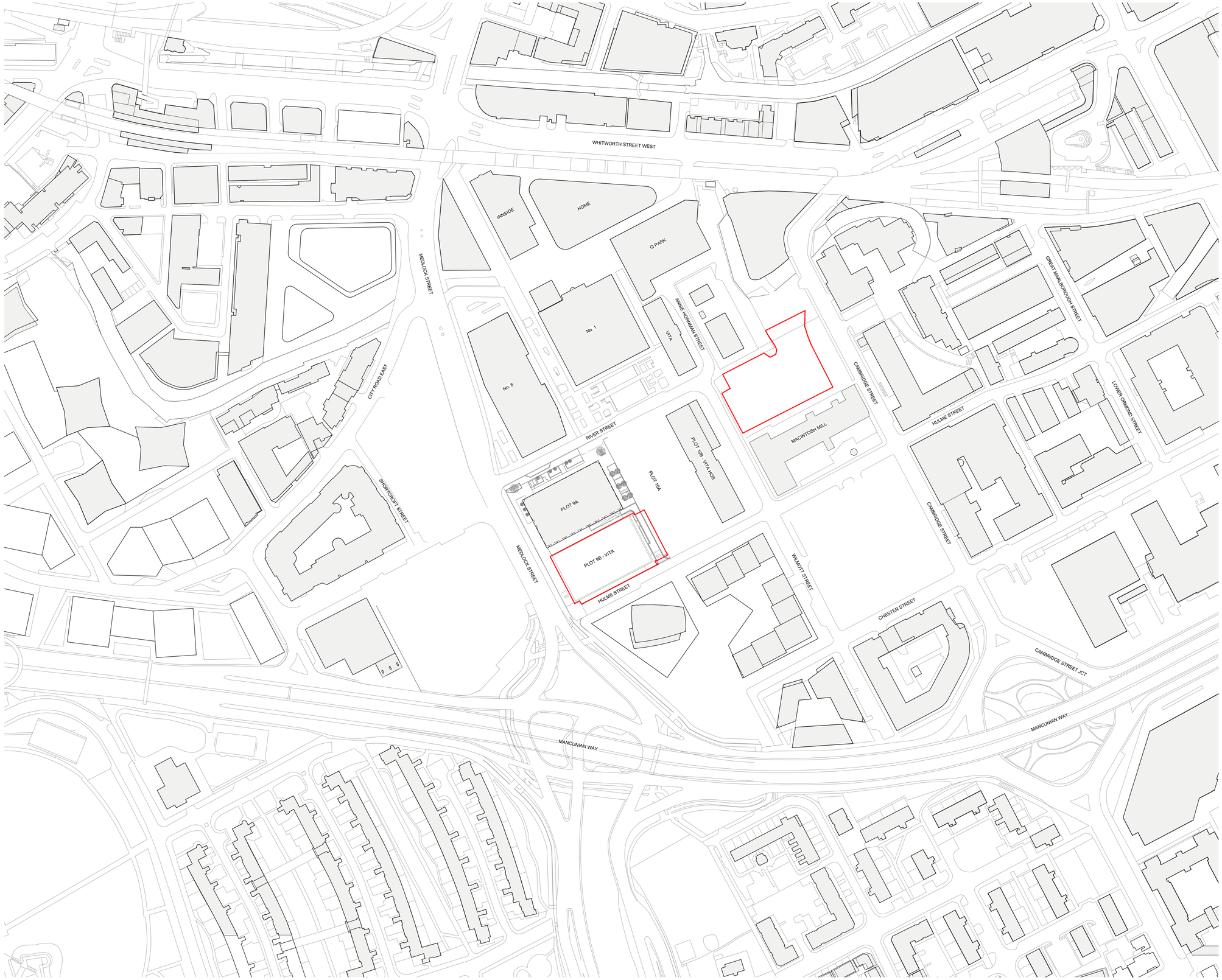
5.0.1 It is understood that the site is to be redeveloped as a high rise PBSA block.

5.0.2 Broadly speaking the Phase 2 Site Investigation has identified that, there are potential pathways to future site users from ground gas and contaminants contained within site soils in soft landscaped area. Risk management measures are also required for construction workers and potable water supply pipes as detailed.

5.0.3 It is recommended the mitigation measures outlined in this report are incorporated into the site redevelopment by the construction contractor. Advice should be sought from specialist contractors (where required) and detailed method statements developed to facilitate the implementation of these measures. Only when all remedial items have been addressed can the conceptual site model be updated and identified risks reduced to low.

5.0.4 The findings and recommendations of this report will require consideration and comment from the regulatory authorities (copies of which have been supplied to relevant parties as part of the current issue). We cannot recommend any remedial works commence until receipt of approval from these parties has been obtained. Any works that commence in advance of an approval will be done so at the contractor's risk and RoC Consulting cannot be held responsible for abortive time / costs that may arise as a result.

APPENDIX A – SITE DRAWINGS



Existing Site Plan

1 : 1250

0m 25m 50m 125 m

N

General Notes

Use figured dimensions only. Do not scale off this drawing. All dimensions must be set out and checked by the contractor on site prior to commencement of construction. Any variations between drawings and site must be reported to TGA before work proceeds.

Drawings to be read in conjunction with Architectural Specification, Structural Engineer's Drawings and Specifications, Mechanical & Electrical Engineer's Drawings and Specifications, all Supplemental Information, including but not limited to; Detailed Fire Strategy, Acoustic Report, Thermal Report & Overheating Report.

No portion of the Works to commence without acceptance of the required submittals by the Employer.

Main Contractor to submit relevant documents to building regulation and legislation approval authorities as required to comply with the Specification.

Legend and Notes

Red Line Planning Boundary

Rev	Description	Date	By
P01	First Issue	18.10.24	LS

Title
Existing Site Location Plan

Drawing No.
VS9B-TGA-G100-PL-XX-95200

Revision
P01

Status

Scale
As indicated@A1

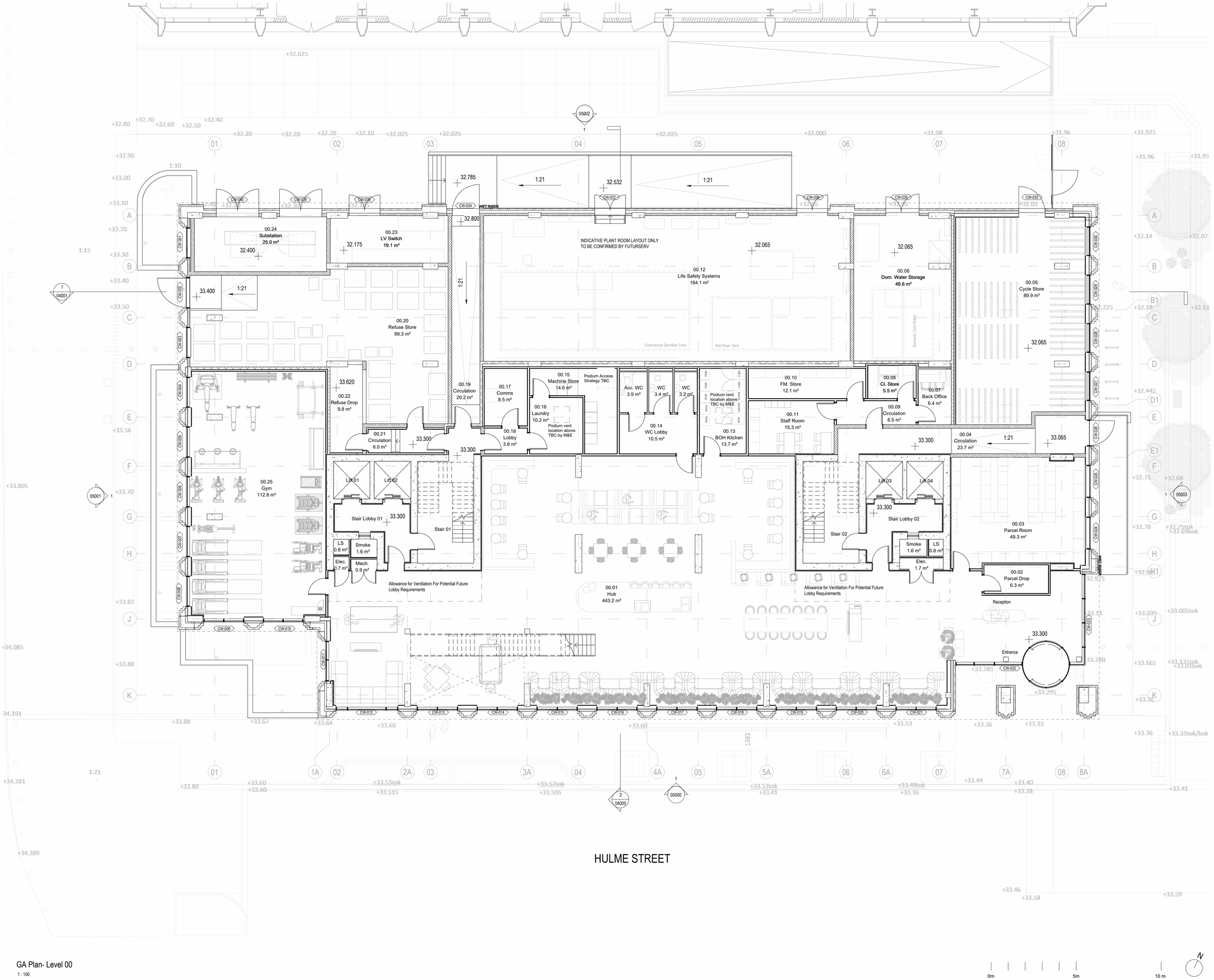
Project
Plot 9B_First Street

Client
VITA

TIM GROOM ARCHITECTS

Eastgate, 2 Castle Street, Manchester, M3 4LZ 0161 870 1152

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GA Plan- Level 00

1 : 100

0m 5m 10 m

General Notes

Use figured dimensions only. Do not scale off this drawing. All dimensions must be set out and checked by the contractor on site prior to commencement of construction. Any variations between drawings and site must be reported to TGA before work proceeds.

Drawings to be read in conjunction with Architectural Specification, Structural Engineer's Drawings and Specifications, Mechanical & Electrical Engineer's Drawings and Specifications, all Supplemental Information, including but not limited to; Detailed Fire Strategy, Acoustic Report, Thermal Report & Overheating Report.

No portion of the Works to commence without acceptance of the required submittals by the Employer.

Main Contractor to submit relevant documents to building regulation and legislation approval authorities as required to comply with the Specification.

Legend and Notes

To be read in conjunction with the following drawing series;

21 - External Walls
22 - Internal Walls
23 - Slab Setting Out
24 - Stairs
28 - Facade Setting Out
31 - Windows & Curtain Walling
32 - Doors
42 - Internal Finishes
68 - Fire Strategy Plans
70 - Apartment Types

1.01 / Type A / 40m² — Level . Room Number / Apartment Type (Refer to 70 Series for Types) / Area

00.03.3 / DT-003 — Door Number / Door Type

01.01 / WT-01 — Window Number / Window Type

CW-001 — Curtain Wall Numbers

Concrete column
Refer to Structural Engineers drawings

Bike Store Schedule

Description	No. of Bike Racks	No. of Bike Spaces
Sheffield Bike Stand	5	10
	5	10
Double Stacked	68	136
	68	136
Grand Total	73	146

Rev	Description	Date	By
P01	Stage 03 Preliminary Issue	01.10.24	AV
P02	Stage 04 Preliminary Issue	08.11.24	AV

Title
Detailed Plan - Level 00

Drawing No.
VS9B-TGA-G200-PL-00-03100

Revision
P02

Status
Stage 04

Scale
1 : 100@A1

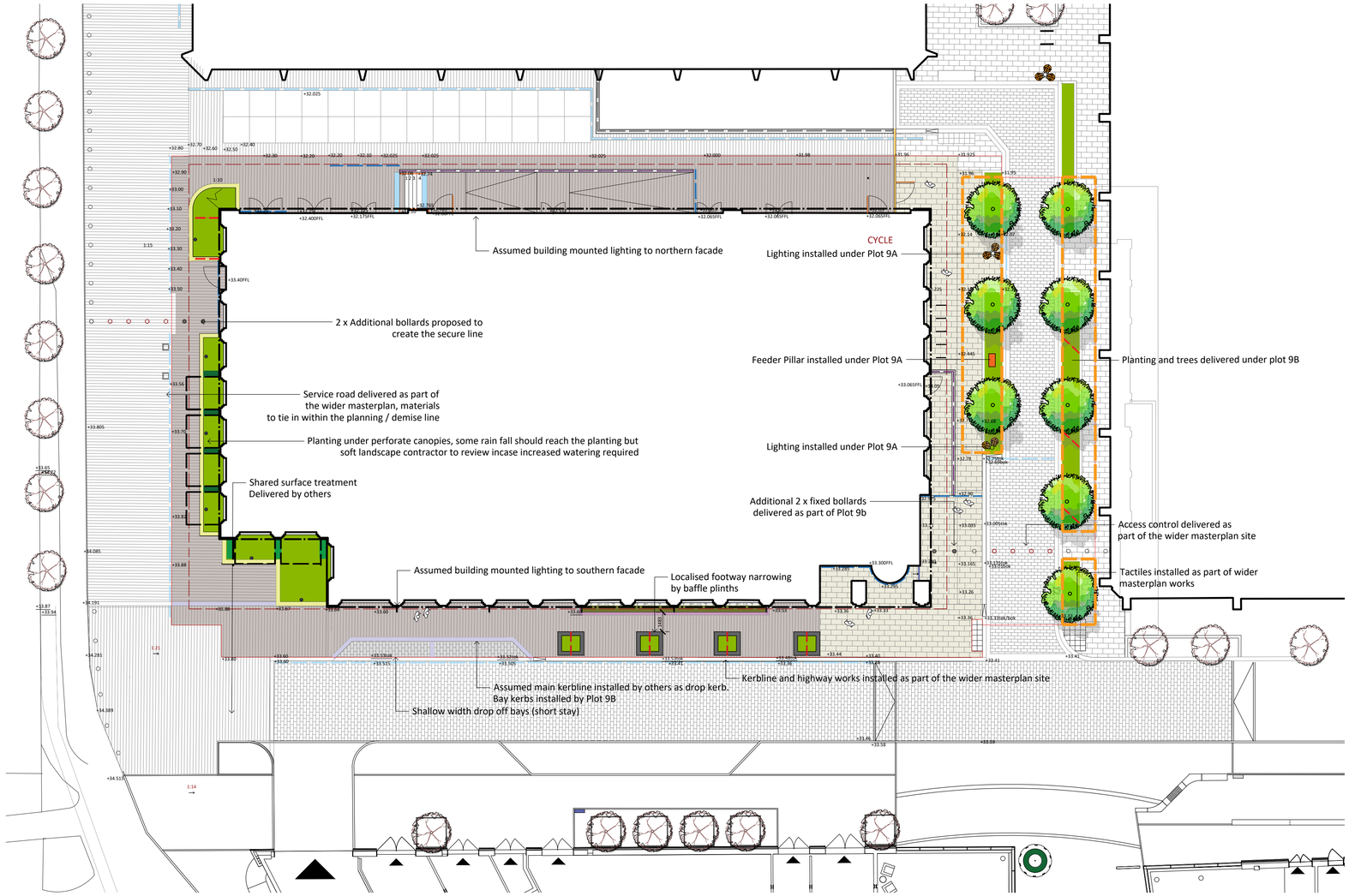
Project
Plot 9B_First Street

Client
VITA

TIM GROOM ARCHITECTS

Eastgate, 2 Castle Street, Manchester, M3 4LZ 0161 870 1152

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HARD LANDSCAPE

Established Masterplan Paving Installed Under Other Phases

Proposed Paving Type 1 - Concrete
Product: Hydro Lineo 40 by Hardscape (or similar approved)
Plan Size: 300 x 100 x 100
Colour: Standard Grey
Laying Bond: Stretcher Bond
Other: 5mm Butt jointed

Proposed Paving Type 2 - Granite Mix Setts
Product: 30% Kobra & 70% Royal White Mix by Hardscape (or similar approved)
Plan Size: 100x 300 x 63mm (depth tbc)
Finish: Flamed
Laying Bond: Stretcher Bond

Proposed Paving Type 2 - Yorkstone Flags
Product: Scoutmoor Yorkstone Flags to match existing First Street Surfacing
Plan Size: 400-900 x 300 x 63mm (depth tbc)
Finish: Sawn
Laying Bond: Min 100mm overlap

Proposed Edge Type 1 - Flush Planting Bed Surround
Product: Royal White Granite by Hardscape (or similar approved)
Plan Size: 200x900x150 (depth tbc)
Finish: Flamed
Upstand: 0mm

Proposed Edge Type 2 - Raised Planting Bed Surround
Product: Royal White Granite by Hardscape (or similar approved)
Plan Size: 300x900x250 (depth tbc)
Finish: Flamed
Upstand: 125mm

Proposed Edge Type 3 - Flush Kerb
Product: Royal White Granite by Hardscape (or similar approved)
Plan Size: 300x900x200 (depth tbc)
Finish: Flamed
Upstand: 0mm

Proposed Edge Type 4 - Wall and Balustrade
Product: Brick clad wall to match the architecture
Laying Bond: Staggered bond
Other: Brick on Edge copings - special ends, Vertical flat bar railings (min 1.1m high)

Proposed Edge Type 5 - Steps
Product: Royal White Granite by Hardscape (or similar approved)
Plan Size: 1100x300x175mm
Finish: Flamed
Other: Contrast nosing
Other: Corduroy s/s strip tactile pavings

FURNITURE

Proposed Bollard to Match Masterplan Furniture
Product: K8 Shallow Depth Terra Neptune SIngle by Frontier Pitts LTD (or similar approved)
Class Code:V/7500/64/90:0.0
Foundation: Shallow Mount

Proposed Lighting to Match Masterplan Furniture
Product: 2/3 head Multi Woody by IGuzzini or similar approved
Height: 5m
Materials: S/S

Proposed Lighting Bollard to Match Masterplan Furniture
Product: Unknown - to match the wider masterplan palette
iWay bollard Super Comfort round 180degrees

Proposed Cycle Stands to Match Masterplan Furniture
Product: S/S or similar approved

NB Baffles: Patternation and colour tone to tie with the architectural narrative

Proposed Movable Plinth Planter with Baffle
Product: Bespoke weighted Plinth Planter with Baffle
Plinth Materials: Granite 1800w x1800l x500h
Baffle Dimension: 1800w x 2500h
Other: 50% Porosity - Perforate Pattern (tbc)

Proposed Baffle - Building Entrance
Product: Bespoke
Dimension: 1100w x 3000h
Other: 50% Porosity - Perforate Pattern (tbc)

Proposed Baffle - Located in Planting Beds
Product: Bespoke
Dimension: 1800w x 3000h
Other: 50% Porosity - Perforate Pattern (tbc)

Proposed Fin - Southern Building Facade
Product: Bespoke
Dimension: 500w x 1800h
Other: Perforate Pattern (tbc)

Proposed Railings and Gate
Product: To Match Wider masterplan proposals
Other: To be ascertained if part installed under Plot 9A

Indicative Drainage Channel

Drainage Channel Delivered by Others

Proposed Feeder Pillar Delivered by Another Phase

SOFT LANDSCAPE

Trees Proposed on Other Development Plots

Proposed Tree Planting
Typical Species: Tilia Cordata
Size: 25-30cm (to be viewed against Plot 9A trees)
Other: Clear Stem 2m

Proposed Ornamental Planting
5L Ornamental planting stock at 5 per m2
70mm Depth Melcourt Bark Nuggets or similar approved

Proposed Hedge Type 1
Type: Evergreen
Size: 1.2m long x 0.5m wide x 1.5m high

Proposed Hedge Type 2
Type: Evergreen
Size: 1.6m long x 0.5m wide x 1m high

Proposed Hedge Type 3
Type: Evergreen
Size: 7m long x 0.5m wide x 1m high

Proposed Below Ground Structural Tree Cells
Product: Rootspace by GreenBlue Urban or similar approved
Sizes: Modules of 0.5m x depth cells 1m

GENERAL NOTES

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2. This drawing is to be read in conjunction with detail landscape drawings, details and specification.
3. This drawing is to be read in conjunction with all relevant Architects', Engineer's, Specialists, Bills of Quantities and Specifications.
4. The insertion of any firm or proprietary brand on this drawing is an indication of the class or quality required and does not exclude the use of alternative materials that are equal in performance, quality and appearance, provided that they have been approved in writing by the Landscape Architect.
5. The Contractor is responsible for accurately ascertaining the position of underground services and responding to all relevant service easement requirements.
6. All dimensions are in millimetres unless stated otherwise, for the purposes of construction this drawing must not be scaled and only written dimensions used. Written and scaled dimensions to be checked on site, any discrepancies reported prior to work commencing. IF IN DOUBT PLEASE ASK.
7. All work and materials are to be in accordance with the relevant British Standards and Code of Practice.
8. All Proprietary products are to be used strictly in accordance with the manufacturer's instructions and details.

REVISION NOTES

Rev	By	Description	Date
P2	KH	Coordinated Issue	xx/10/2024
P1	KH	First Issue	09/10/2024

Client
Vita Living

Project
First Street - Plot 9B

Description
Landscape Layout

Status
For Information

Scale @ A1	Drawn	Checked	Date
1:200	KH	KH	09.10.2024

Drawing number
Z19B-TPM-G710-PL-XX- 4645 101

Revision
P2

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chartered landscape architects
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tel: 0161 235 0600 fax 0601 email info@tpmlandscape.co.uk

COMPLEX CHALLENGES ...
MADE SIMPLE

APPENDIX B – RSK GAC FOR PUBLIC OPEN SPACE IN CLOSE PROXIMITY TO RESIDENTIAL HOUSING

Generic assessment criteria for human health: Public open space (near residential housing) scenario

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014 the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs. The publication of C4SL introduced two new land-use scenarios relating to public open spaces.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report[3] and associated chemical specific reports[6], and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications have been applied to the RSK GAC. The current RSK GAC also use updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3].

Conceptual model

This GAC derivation considers POS_{Resi} to relate to public open space in close proximity to residential housing. This includes predominantly grassed areas adjacent to high-density housing such as a green surrounded by houses, in accordance with the C4SL POS_{Resi} land-use scenario[3]. This would also include smaller areas incorporated in newer developments.

The POS_{Resi} scenario considers risk to a child receptor (female) between the ages of >3 and <9years old. In accordance with Section 3.6.3.3 of the SP1010 project report[3], exposure

assumptions are based on the adaptation of the CLEA residential land–use scenario without consumption of home-grown produce and vapour ingress to the building. The pathways considered for production of the SAC in the POS_{Resi} scenario are

- ingestion of soil and dust (outdoors and indoors respectively)
- dermal contact with soil (outdoors; and soil-derived dust indoors)
- inhalation of dust (outdoors and indoors)
- inhalation of vapours outdoors.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits.
- Where the vapour pathway is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible, as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on site. RSK has therefore applied an empirical subsurface correction factor of 10 into the CLEA chemical database for all petroleum hydrocarbons (including BTEX, trimethylbenzenes, and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated chemical specific reports[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a LLTC[3,6] has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the POS_{Resi} scenario, project report SP1010[3] considers the potential for soil to be tracked into nearby houses with the potential for ingestion and inhalation of dust within the house. The CLEA default building is a small, two-storey terrace house.

POS_{resi} is considered to be a predominantly grassed area of up to 500m^2 (0.05 ha) with up to 50% potentially being bare soil. The input parameters were based on the air dispersion model and the vapour model detailed in SR3[5]. Full details of the land use scenario are presented in Table 3.6 of project report SP1010[3].

The parameters for a sandy loam soil type were used in line with SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this parameter, RSK has produced an additional set of SAC for an SOM of 1% and 2.5%.

The SAC were produced using the input parameters in Table 1 below and Table 3.6 of project report SP1010[3]. The GAC by pathway are presented in Table 2 and the combined GAC presented in Table 3.

Figure 1: Conceptual model for CLEA public open space (residential) scenario

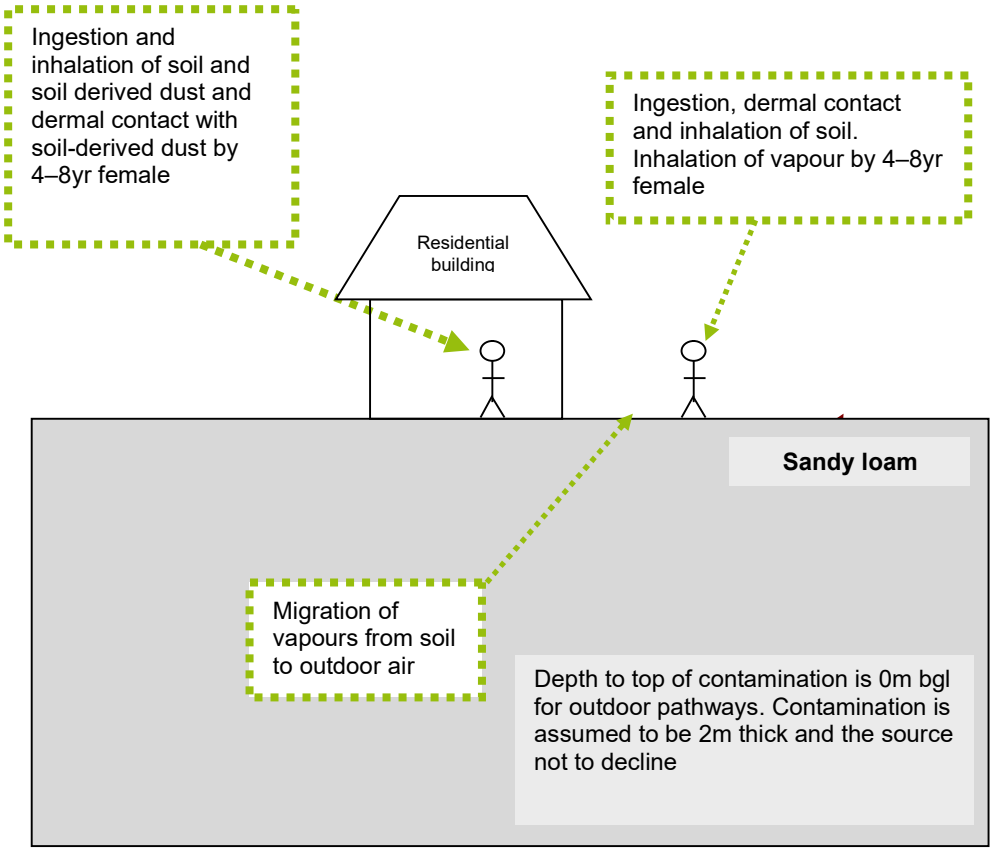


Table 1: Exposure assessment parameters for public open space (residential) scenario – inputs for CLEA model

Parameter	Value	Justification
Land use	Public open space (residential)	Chosen land use. Table 3.6 of SP1010[3]
Receptor	Female child	Taken as female child exposed over 6 years from 4 to 8 years, Table 3.6, SP1010[5]
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, Table 4.4, SR3[5]).
Start age class (AC)	4	Range of AC corresponding to key generic assumption that the critical receptor is a young female child aged 4–8 years (>3-<9). From Table 3.6, SP1010[5]
End AC	9	
SOM (%)	6	Representative of sandy loam according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM < 6% as often observed by RSK
	2.5	
pH	7	Model default

References

1. Environment Agency (2009), Science Reports SC050021 - SGV and TOX reports for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'; 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs' and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'. Available at: https://www.gov.uk/government/publications/contaminants-in-soil-updated-collation-of-toxicological-data-and-intake-values-for-humans and https://www.gov.uk/government/publications/land-contamination-soil-guideline-values-sgvs (accessed 4 February 2015)

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3. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014), 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.

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5. Environment Agency (2009), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).

6. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014), 'Appendices C to H). DEFRA research project SP1010'. CL:AIRE (2021). Category 4 Screening Levels: Trichloroethene (TCE). CL:AIRE, London. ISBN 978-1-905046-38-6. CL:AIRE (2021). Category 4 Screening Levels: Vinyl Chloride. CL:AIRE, London. ISBN 978-1-905046-36-2. CL:AIRE (2021). Category 4 Screening Levels: Tetrachloroethene (PCE). CL:AIRE, London. ISBN 978-1-905046-37-9.

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8. Environment Agency (2009), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2* (Bristol: Environment Agency).

9. Environment Agency (2009), *Science Report – SC050021/SR4 CLEA Software (version 1.05) Handbook* (Bristol: Environment Agency).

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11. CL:AIRE (2010), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).

12. USEPA (2011), *Exposure factors handbook*, EPA/600/R-090/052F (Washington DC: Office of Research and Development).

13. Environment Agency (2009), 'Changes made to the CLEA framework documents after the three-month evaluation period in 2008', released January 2009.

14. USEPA (2010). Hydrogen cyanide and cyanide salts. Integrated Risk Information Systems (IRIS) Chemical Assessment Summary. September 2010. https://www.epa.gov/iris (accessed 9 December 2015)

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - PUBLIC OPEN SPACE (IN CLOSE PROXIMITY TO RESIDENTIAL HOUSING)

Table 2

Human Health Generic Assessment Criteria for Public Open Space (in close proximity to residential housing)

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	7.92E+01	5.31E+02	NR	NR	7.92E+01	5.31E+02	NR	NR	7.92E+01	5.31E+02	NR	NR
Barium	(b)	2.68E+03	NR	NR	NR	2.68E+03	NR	NR	NR	2.68E+03	NR	NR	NR
Beryllium		3.91E+02	2.19E+00	NR	NR	3.91E+02	2.19E+00	NR	NR	3.91E+02	2.19E+00	NR	NR
Boron		2.15E+04	6.62E+06	NR	NR	2.15E+04	6.62E+06	NR	NR	2.15E+04	6.62E+06	NR	NR
Cadmium	(a)	3.64E+02	4.94E+02	2.20E+02	NR	3.64E+02	4.94E+02	2.20E+02	NR	3.64E+02	4.94E+02	2.20E+02	NR
Chromium (III) - trivalent	(c)	3.98E+04	1.54E+03	NR	NR	3.98E+04	1.54E+03	NR	NR	3.98E+04	1.54E+03	NR	NR
Chromium (VI) - hexavalent	(a,d)	1.18E+02	2.08E+01	NR	NR	1.18E+02	2.08E+01	NR	NR	1.18E+02	2.08E+01	NR	NR
Copper		2.15E+04	1.95E+04	1.20E+04	NR	2.15E+04	1.95E+04	1.20E+04	NR	2.15E+04	1.95E+04	1.20E+04	NR
Lead	(a)	6.26E+02	NR	NR	NR	6.26E+02	NR	NR	NR	6.26E+02	NR	NR	NR
Elemental Mercury (Hg^0)	(d)	NR	1.57E+01	NR	4.31E+00	NR	1.58E+01	NR	1.07E+01	NR	1.58E+01	NR	2.58E+01
Inorganic Mercury (Hg^{2+})		1.28E+02	4.62E+03	1.24E+02	NR	1.28E+02	4.62E+03	1.24E+02	NR	1.28E+02	4.62E+03	1.24E+02	NR
Methyl Mercury (Hg^{4+})		3.97E+01	5.86E+03	3.94E+01	7.33E+01	3.97E+01	7.06E+03	3.95E+01	1.42E+02	3.97E+01	8.43E+03	3.95E+01	3.04E+02
Nickel	(d)	3.74E+02	2.31E+02	NR	NR	3.74E+02	2.31E+02	NR	NR	3.74E+02	2.31E+02	NR	NR
Selenium	(b)	1.14E+03	NR	NR	NR	1.14E+03	NR	NR	NR	1.14E+03	NR	NR	NR
Vanadium		2.47E+03	1.99E+03	NR	NR	2.47E+03	1.99E+03	NR	NR	2.47E+03	1.99E+03	NR	NR
Zinc	(b)	8.08E+04	4.62E+07	NR	NR	8.08E+04	4.62E+07	NR	NR	8.08E+04	4.62E+07	NR	NR
Cyanide (free)		8.02E+01	1.75E+04	8.01E+01	NR	8.02E+01	1.75E+04	8.01E+01	NR	8.02E+01	1.75E+04	8.01E+01	NR
Volatile Organic Compounds													
Benzene	(a)	1.44E+02	8.35E+03	1.41E+02	1.22E+03	1.44E+02	1.12E+04	1.42E+02	2.26E+03	1.44E+02	1.58E+04	1.43E+02	4.71E+03
Toluene		5.61E+04	6.86E+06	5.57E+04	8.69E+02	5.61E+04	9.88E+06	5.58E+04	1.92E+03	5.61E+04	1.42E+07	5.59E+04	4.36E+03
Ethylbenzene		2.52E+04	4.74E+05	2.39E+04	5.18E+02	2.52E+04	6.95E+05	2.43E+04	1.22E+03	2.52E+04	9.98E+05	2.46E+04	2.84E+03
Xylene - m		4.53E+04	4.14E+05	4.08E+04	6.25E+02	4.53E+04	6.05E+05	4.22E+04	1.47E+03	4.53E+04	8.62E+05	4.31E+04	3.46E+03
Xylene - o		4.53E+04	4.28E+05	4.10E+04	4.78E+02	4.53E+04	6.22E+05	4.23E+04	1.12E+03	4.53E+04	8.84E+05	4.32E+04	2.62E+03
Xylene - p		4.53E+04	4.07E+05	4.08E+04	5.76E+02	4.53E+04	5.93E+05	4.22E+04	1.35E+03	4.53E+04	8.46E+05	4.31E+04	3.17E+03
Total xylene		4.53E+04	4.07E+05	4.08E+04	6.25E+02	4.53E+04	5.93E+05	4.22E+04	1.47E+03	4.53E+04	8.46E+05	4.31E+04	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		7.57E+04	5.10E+06	7.46E+04	2.04E+04	7.57E+04	6.33E+06	7.48E+04	3.31E+04	7.57E+04	8.36E+06	7.51E+04	6.27E+04
Trichloroethene (TCE)		7.59E+01	4.09E+03	NR	1.54E+03	7.75E+01	5.80E+03	NR	3.22E+03	7.87E+01	8.38E+03	NR	7.14E+03
Tetrachloroethene (PCE)		3.52E+03	3.67E+04	3.21E+03	4.24E+02	3.52E+03	5.37E+04	3.31E+03	9.51E+02	3.52E+03	7.86E+04	3.38E+03	2.18E+03
1,1,1-Trichloroethane		1.51E+05	1.46E+06	1.37E+05	1.43E+03	1.51E+05	2.06E+06	1.41E+05	2.92E+03	1.51E+05	2.98E+06	1.44E+05	6.39E+03
1,1,1,2 Tetrachloroethane		1.45E+03	5.44E+04	1.41E+03	2.60E+03	1.45E+03	7.78E+04	1.42E+03	6.02E+03	1.45E+03	1.09E+05	1.43E+03	1.40E+04
1,1,2,2-Tetrachloroethane		1.45E+03	8.07E+04	1.42E+03	2.67E+03	1.45E+03	1.07E+05	1.43E+03	5.46E+03	1.45E+03	1.42E+05	1.43E+03	1.20E+04
Carbon Tetrachloride		1.01E+03	4.08E+03	8.86E+02	1.52E+03	1.01E+03	5.95E+03	9.23E+02	3.32E+03	1.01E+03	8.76E+03	9.50E+02	7.54E+03
1,2-Dichloroethane		3.03E+01	6.29E+02	2.89E+01	3.41E+03	3.03E+01	7.45E+02	2.91E+01	4.91E+03	3.03E+01	9.52E+02	2.94E+01	8.43E+03
Vinyl Chloride (chloroethene)		7.85E+00	5.62E+03	7.84E+00	1.36E+03	7.85E+00	6.38E+03	7.84E+00	1.76E+03	7.85E+00	7.87E+03	7.84E+00	2.69E+03
1,2,4-Trimethylbenzene		NR	2.48E+02	NR	4.74E+02	NR	2.49E+02	NR	1.16E+03	NR	2.50E+02	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
Semi-Volatile Organic Compounds													
Acenaphthene		1.49E+04	3.25E+06	1.48E+04	5.70E+01	1.49E+04	3.64E+06	1.48E+04	1.41E+02	1.49E+04	3.94E+06	1.48E+04	3.36E+02
Acenaphthylene		1.49E+04	3.21E+06	1.48E+04	8.61E+01	1.49E+04	3.61E+06	1.48E+04	2.12E+02	1.49E+04	3.91E+06	1.48E+04	5.06E+02
Anthracene		7.44E+04	1.94E+07	7.41E+04	1.17E+00	7.44E+04	2.06E+07	7.41E+04	2.91E+00	7.44E+04	2.14E+07	7.41E+04	6.96E+00
Benzo(a)anthracene		3.84E+01	1.11E+02	2.85E+01	1.71E+00	3.84E+01	1.13E+02	2.86E+01	4.28E+00	3.84E+01	1.14E+02	2.87E+01	1.03E+01
Benzo(a)pyrene	(a)	1.04E+01	3.89E+01	NR	9.11E-01	1.04E+01	3.93E+01	NR	2.28E+00	1.04E+01	3.95E+01	NR	5.46E+00
Benzo(b)fluoranthene		9.67E+00	2.83E+01	7.21E+00	1.22E+00	9.67E+00	2.86E+01	7.23E+00	3.04E+00	9.67E+00	2.89E+01	7.24E+00	7.29E+00
Benzo(g,h,i)perylene		8.53E+02	2.50E+03	6.36E+02	1.54E-02	8.53E+02	2.51E+03	6.37E+02	3.85E-02	8.53E+02	2.52E+03	6.37E+02	9.23E-02
Benzo(k)fluoranthene		2.55E+02	7.49E+02	1.90E+02	6.87E-01	2.55E+02	7.56E+02	1.91E+02	1.72E+00	2.55E+02	7.61E+02	1.91E+02	4.12E+00
Chrysene		7.68E+01	2.21E+02	5.70E+01	4.40E-01	7.68E+01	2.24E+02	5.72E+01	1.10E+00	7.68E+01	2.27E+02	5.74E+01	2.64E+00
Dibenzo(a,h)anthracene		7.68E-01	2.25E+00	5.73E-01	3.93E-03	7.68E-01	2.27E+00	5.74E-01	9.82E-03	7.68E-01	2.29E+00	5.75E-01	2.36E-02
Fluoranthene		3.10E+03	8.82E+05	3.08E+03	1.89E+01	3.10E+03	9.10E+05	3.09E+03	4.73E+01	3.10E+03	9.27E+05	3.09E+03	1.13E+02
Fluorene		9.91E+03	2.34E+06	9.87E+03	3.09E+01	9.91E+03	2.57E+06	9.87E+03	7.65E+01	9.91E+03	2.73E+06	9.87E+03	1.83E+02

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - PUBLIC OPEN SPACE (IN CLOSE PROXIMITY TO RESIDENTIAL HOUSING)

Table 2

Human Health Generic Assessment Criteria for Public Open Space (in close proximity to residential housing)

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Indeno(1,2,3-cd)pyrene		1.10E+02	3.19E+02	8.17E+01	6.13E-02	1.10E+02	3.24E+02	8.20E+01	1.53E-01	1.10E+02	3.26E+02	8.22E+01	3.68E-01
Naphthalene		4.89E+03	1.93E+04	3.90E+03	7.64E+01	4.89E+03	2.53E+04	4.10E+03	1.83E+02	4.89E+03	3.16E+04	4.24E+03	4.32E+02
Phenanthrene		3.08E+03	8.12E+05	3.07E+03	3.60E+01	3.08E+03	8.61E+05	3.07E+03	8.96E+01	3.08E+03	8.94E+05	3.07E+03	2.14E+02
Pyrene		7.43E+03	2.11E+06	7.41E+03	2.20E+00	7.43E+03	2.18E+06	7.41E+03	5.49E+00	7.43E+03	2.22E+06	7.41E+03	1.32E+01
Phenol		1.31E+05	1.11E+04	1.02E+04	2.42E+04	1.31E+05	1.12E+04	1.03E+04	3.81E+04	1.31E+05	1.12E+04	1.03E+04	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC_5-EC_6		6.31E+05	2.03E+06	5.75E+05	3.04E+02	6.31E+05	2.74E+06	5.91E+05	5.58E+02	6.31E+05	3.92E+06	6.04E+05	1.15E+03
Aliphatic hydrocarbons >EC_6-EC_8		6.31E+05	3.16E+06	5.97E+05	1.44E+02	6.31E+05	4.68E+06	6.09E+05	3.22E+02	6.31E+05	6.99E+06	6.16E+05	7.36E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		1.26E+04	3.80E+05	1.25E+04	7.77E+01	1.26E+04	5.83E+05	1.26E+04	1.90E+02	1.26E+04	8.74E+05	1.26E+04	4.51E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		1.26E+04	8.12E+05	1.26E+04	4.75E+01	1.26E+04	1.23E+06	1.26E+04	1.18E+02	1.26E+04	1.80E+06	1.26E+04	2.83E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		1.26E+04	2.07E+06	1.26E+04	2.37E+01	1.26E+04	2.95E+06	1.26E+04	5.91E+01	1.26E+04	3.99E+06	1.26E+04	1.42E+02
Aliphatic hydrocarbons >EC_{16}-EC_{35}	(b)	2.51E+05	NR	NR	8.48E+00	2.51E+05	NR	NR	2.12E+01	2.51E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC_{35}-EC_{44}	(b)	2.51E+05	NR	NR	8.48E+00	2.51E+05	NR	NR	2.12E+01	2.51E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC_8-EC_{10}		5.05E+03	2.16E+05	5.02E+03	6.13E+02	5.05E+03	3.21E+05	5.03E+03	1.50E+03	5.05E+03	4.60E+05	5.04E+03	3.58E+03
Aromatic hydrocarbons >EC_{10}-EC_{12}		5.05E+03	4.48E+05	5.04E+03	3.64E+02	5.05E+03	6.34E+05	5.04E+03	8.99E+02	5.05E+03	8.52E+05	5.04E+03	2.15E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		5.05E+03	1.02E+06	5.05E+03	1.69E+02	5.05E+03	1.29E+06	5.05E+03	4.19E+02	5.05E+03	1.52E+06	5.05E+03	1.00E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(b)	3.77E+03	NR	NR	5.37E+01	3.77E+03	NR	NR	1.34E+02	3.77E+03	NR	NR	3.21E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(b)	3.77E+03	NR	NR	4.83E+00	3.77E+03	NR	NR	1.21E+01	3.77E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC_{35}-EC_{44}	(b)	3.77E+03	NR	NR	4.83E+00	3.77E+03	NR	NR	1.21E+01	3.77E+03	NR	NR	2.90E+01

Notes:

Public open space (resi) and (park) GAC are based on the exposure parameters detailed within SP1010 "Development of Category 4 Screening Levels for Assessment of Land affected by Contamination", Final, 20th December 2013

EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.

Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.

Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for barium and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - PUBLIC OPEN SPACE (IN CLOSE PROXIMITY TO RESIDENTIAL HOUSING)

Table 3
Human Health Generic Assessment Criteria for Public Open Space (in close proximity to residential housing)

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	79	79	79
Barium	2,680	2,680	2,680
Beryllium	2.2	2.2	2.2
Boron	21,500	21,500	21,500
Cadmium	220	220	220
Chromium (III) - trivalent	1,540	1,540	1,540
Chromium (VI) - hexavalent	21	21	21
Copper	12,000	12,000	12,000
Lead	630	630	630
Elemental Mercury (Hg^0)	16	16	16
Inorganic Mercury (Hg^{2+})	120	120	120
Methyl Mercury (Hg^{4+})	39	39	40
Nickel	230	230	230
Selenium	1,100	1,100	1,100
Vanadium	1,990	1,990	1,990
Zinc	81,000	81,000	81,000
Cyanide (free)	80	80	80
Volatile Organic Compounds			
Benzene	140	140	140
Toluene	55,700	55,800	55,900
Ethylbenzene	23,900	24,300	24,600
Xylene - m	40,800	42,200	43,100
Xylene - o	41,000	42,300	43,200
Xylene - p	40,800	42,200	43,100
Total xylene	40,800	42,200	43,100
Methyl tertiary-Butyl ether (MTBE)	74,600	74,800	75,100
Trichloroethene (TCE)	76	78	79
Tetrachloroethene (PCE)	3,200	3,300	3,400
1,1,1-Trichloroethane	140,000	140,000	140,000
1,1,1,2 Tetrachloroethane	1,400	1,400	1,400
1,1,2,2-Tetrachloroethane	1,400	1,400	1,400
Carbon Tetrachloride	886	923	950
1,2-Dichloroethane	29	29	29
Vinyl Chloride (chloroethene)	7.8	7.8	7.8
1,2,4-Trimethylbenzene	250	250	250
1,3,5-Trimethylbenzene	NR	NR	NR
Semi-Volatile Organic Compounds			
Acenaphthene	14,800	14,800	14,800
Acenaphthylene	14,800	14,800	14,800
Anthracene	74,100	74,100	74,100
Benzo(a)anthracene	29	29	29
Benzo(a)pyrene	10	10	10
Benzo(b)fluoranthene	7	7	7
Benzo(g,h,i)perylene	640	640	640
Benzo(k)fluoranthene	190	191	191
Chrysene	57	57	57
Dibenzo(a,h)anthracene	0.57	0.57	0.58
Fluoranthene	3,100	3,100	3,100
Fluorene	9,900	9,900	9,900
Indeno(1,2,3-cd)pyrene	82	82	82
Naphthalene	4,900	4,900	4,900
Phenanthrene	3,100	3,100	3,100
Pyrene	7,400	7,400	7,400
Phenol	440*	690*	1,300*
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	570,000 (304)	590,000	600,000
Aliphatic hydrocarbons >EC_6-EC_8	600,000	610,000	620,000
Aliphatic hydrocarbons >EC_8-EC_{10}	13,000	13,000	13,000
Aliphatic hydrocarbons >EC_{10}-EC_{12}	13,000	13,000	13,000
Aliphatic hydrocarbons >EC_{12}-EC_{16}	13,000	13,000	13,000
Aliphatic hydrocarbons >EC_{16}-EC_{35}	250,000	250,000	250,000
Aliphatic hydrocarbons >EC_{35}-EC_{44}	250,000	250,000	250,000
Aromatic hydrocarbons >EC_8-EC_{10}	5,000	5,000	5,000
Aromatic hydrocarbons >EC_{10}-EC_{12}	5,000	5,000	5,000
Aromatic hydrocarbons >EC_{12}-EC_{16}	5,000	5,000	5,000
Aromatic hydrocarbons >EC_{16}-EC_{21}	3,800	3,800	3,800
Aromatic hydrocarbons >EC_{21}-EC_{35}	3,800	3,800	3,800
Aromatic hydrocarbons >EC_{35}-EC_{44}	3,800	3,800	3,800
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC)[1]		

Notes:
'-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.
NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used
EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.
* The GAC for Phenol is based on a threshold which is protective of direct contact (SC050021/Phenol SGV report)

Public open space (resi) and (park) GAC are based on the exposure parameters detailed within SP1010 "Development of Category 4 Screening Levels for Assessment of Land affected by Contamination", Final, 20th December 2013

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58.
1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

(VALUE IN BRACKETS) The SAC has been set as the model calculated SAC with the saturation limit shown in brackets.

APPENDIX C – UNITED UTILITIES PIPE WORK RISK ASSESSMENT PROFORMA

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

United Utilities
Water for the North West

Introduction

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

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

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

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

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

Risk Assessment for Water Pipes in Land Potentially Affected by Contamination

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

As a minimum a desk study (preliminary risk assessment) shall be provided with the RA in accordance with the framework in Environment Agency publication "Model Procedures for the Management of Land Contamination" (ref: CLR11) that sets out whether the land through which the pipes are to be laid may be affected by contamination. The application of the source, pathway, receptor concept will be an integral part of any pipeline risk assessment. For each potential source (the contamination) and each potential receptor (the water pipe), consideration shall be given to whether a potential pathway between source and receptor exists, or may exist in the future, linking the two. There are normally only three pathways by which contamination may come into contact with water pipes. These are direct contact with the soil or backfill, an excessive vapour phase or a contaminated groundwater regime. If none of these conditions exist on site (adopting the source, pathway, receptor concept) then it is likely that extended and/or targeted soil testing will not be required and a simple risk assessment will suffice. For those sites where land may be affected by contamination appropriate testing shall be undertaken on the materials within which the pipes are to be laid, whether that be existing ground materials, remediated materials or imported capping materials. The testing requirements are as described in the following section.

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

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

How to contact us about the information in this leaflet



DeveloperServicesWater@uuplc.co.uk



0345 072 6067
Opening hours:
8am-5pm Mon to Thurs
8am-4.30pm Fri

Testing Requirements

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

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

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

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

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

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

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

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

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

- pH, Conductivity and redox potential

Sufficiency of Testing

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

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

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

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

Detection Limits

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

Protective Measures

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

a) a robust risk assessment to show how any contaminants will not significantly impact on proposed water supplies or buried assets over the lifetime of the assets; or

b) more suitable pipe materials; or

c) an engineering solution to protect the pipe work backed up by an adequate assessment of the risk.

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

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

References

BS10175: 2011
"Investigation of Potentially Contaminated Sites Code of Practice"

CLAIRE/CIEH
"Guidance on comparing soil contamination data with a critical concentration" 2008

Department of the Environment Contaminated Land Research Report
"Sampling strategies for contaminated land" prepared by The Centre for Research into the Built Environment, Nottingham Trent University (Ref: CLR 4) 1994

Environment Agency
"Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination"
(ref: R&D Technical Report P5-066/TR) 2000

Environment Agency
"Model Procedures for the Management of Land Contamination" (ref: CLR11), 2004

Environment Agency P5-080/TR3
"The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils", 2005

UK Water Industry Research (UKWIR)
"Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (Ref 10/WM/03/21) January 2011

Water Regulations Advisory Scheme (WRAS) Information and Guidance Note 9-04-03
"Laying Pipes in Contaminated Land" 2002

Frequently asked questions

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

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

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

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

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

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

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

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

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

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

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

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

Examples where defaulting to barrier pipe would not be acceptable:

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

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

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

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

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

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

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

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

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

Have any other Water Companies adopted the UKWIR Guidance yet?

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

United Utilities
Water for the North West

About us

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

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

LRA1A-11/19v0

11/19/SD/8483f-1

Risk assessment for water pipes (RA)

United Utilities
Water for the North West

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

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

Section 1: Development details	
Development name *(if it has one)*	Plot 9B First Street, Manchester
Development address	Land off Hulme Street, Manchester
OS Grid reference *(mid point)*	383743 , 397241
Developer's name	Vita Meadow Limited
UUW reference number *(for UU use only)*	

Please provide details below of the current and historical use of the site and adjacent sites.
If your supporting information has details of the current and historical site use, please reference below the relevant sections of your report.

The site is currently in use as a construction compound associated with the construction of an office building immediately to the north of the subject site.

Historically the site has been occupied by terrace housing, a scrap and material yard with an associated wood burner, a coal yard with associated office building and garage and finally a car park.

Nearby historic site uses of note include a gas works, rubber and waterproofing works, foundry, print works, coal yards and tank features.

Section 2: Preliminary risk assessment	
Has your desk study and site walkover identified any land potentially affected by contamination?	☑ Yes ☐ No

If the site is potentially affected by contamination but you have not completed any intrusive site investigation please provide details below of the rationale behind the intended pipe selection.
If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.

Intrusive investigation works have been completed on site and results of chemical testing of site soils detailed in Table 1 below.

Ethers, Aldehyde, Ketones and Amines were not not tested as these were not identified as being a risk in the RoC Consutling Phase 1 Desktop Study (4770-ROC-ZZ-XX-RP-ES-P1-101).

Section 3: Intrusive site investigation

Have you completed any intrusive site investigation?	☑ Yes ☐ No
Have you completed any none intrusive site investigation?	☐ Yes ☐ No
Date(s) when the site investigation(s) undertaken	01 10 2024 (DD MM YYYY)
At what level has groundwater been encountered?	3 metres below ground level or ☐ Not encountered

Table 1 (Pipeline Selection Risk Assessment Summary (PSRAS)) below classifies testing required where the preliminary risk assessment has identified land potentially affected by contamination. Please provide details below of any test groups which have not been tested and the rationale for not testing.

If your supporting information has details of the rationale behind not testing any particular test groups, please reference below the relevant sections of your report.

All test groups identified as being potentially located on site have been tested in obtained samples.

If the intrusive site investigation has identified concentrations above the PE threshold (see PSRAS) and your intended pipe selection is PE. Please provide details below of the rationale behind the intended pipe selection.

If your supporting information has details of the rationale behind the intended pipe selection, please reference below the relevant sections of your report.

N/A

Section 4: Site remediation

Please provide details below of any site remediation (which may include a change in site levels) already completed.

If your supporting information has details of the site remediation already completed, please reference below the relevant sections of your report.

There are no remedial measures proposed that will have an effect on contaminants concentrations in site soils.

Has the PSRAS (Table 1) been completed using appropriate data after remediation?	☐ Yes ☐ No ☑ N/A

Please provide details below of any proposed site remediation and an analysis of whether this will affect your intended pipe selection.

If your supporting information has details of any proposed site remediation and whether this will affect your intended pipe selection, please reference below the relevant sections of your report.

N/A

Section 5: Final use of site

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

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

No known chemicals to be stored on site during future use a purpose built student accommodation block. Due to elevated levels of SVOCs and Hydrocarbons encountered within site soils it is recommended that barrier pipes are installed on site.

What water pipe materials are intended to be used on site?	☐ PE ☑ PE Barrier Pipe Type A ☐ PE Barrier Pipe Type B Other *(please specify):*

Section 6: Additional information

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

P for UKAS accreditation = partial.

Section 7: Risk assessor

Name and relevant qualifications of person directing the risk assessment for water pipes	Alex Smiles BSc (hons) CEnv MIEMA FGS
Name and address of risk assessor's company	RSK Geosciences 57 Hilton Street M1 2EJ
Date risk assessment performed	30 10 2024

Section 8: Declaration

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

Name	Reece McGuinness	Company	RoC Consulting
Telephone	0161 214 5390	Date	30 MM YYYY

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

United Utilities
Water for the North West

About us

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Table 1 - Pipe selection risk assessment summary (PSRAS)

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

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

What materials have been tested to populate Table 1 below?	☑ Existing ground materials ☐ Remediated materials ☐ Imported capping materials

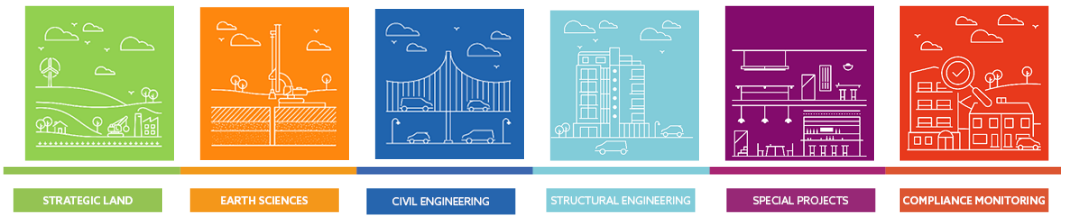
All concentrations in mg/kg

Test Group	Testing Required?	PE threshold	Metal Pipes/ Barrier Pipe	Laboratory Detection Limit	Testing UKAS accredited Y/N	Maximum concentration at proposed pipeline depth *See Note [2]*	Maximum site concentration *See Note [3]*	Locations and depths where concentrations exceed proposed pipeline threshold
Total VOCs	Where Preliminary Risk Assessment (PRA) has identified land potentially affected by contamination	0.5	Pass	0.01	P	<0.01	<0.01	N/A
Total BTEX & MTBE		0.1	Pass	0.001	N	<0.001	<0.001	N/A
Total SVOCs (excluding PAHs and those substances marked with an *)		2	Pass	0.1	N	3.22	3.22	WS102 @ 0.50m
EC5-EC10 aliphatic and aromatic hydrocarbons		2	Pass	0.01 / 1	P	<1	<1	N/A
EC10-EC16 aliphatic and aromatic hydrocarbons		10	Pass	1	P	9	9	N/A
EC16-EC40 aliphatic and aromatic hydrocarbons		500	Pass	1	P	621	621	WS102 @ 0.50m
Phenols* (from SVOC analysis)		2	Pass	0.1	N	<0.1	<0.1	N/A
Cresols and chlorinated phenols* (from SVOC analysis)		2	Pass	0.1	N	<0.1	<0.1	N/A
Ethers*	Only where identified	0.5	Pass					
Nitrobenzene*		0.5	Pass					
Ketones*		0.5	Pass					
Aldehydes*		0.5	Pass					
Amines		Fail	Pass					
Corrosive	Conductivity, Redox and pH	Pass	*See Note [1]*	N/A	N,N,Y	197, 209 & 8.71	197, 209 & 8.71	N/A

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

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

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



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