



GROUNDTECH
CONSULTING

WITHINGTON CDC

GEO-ENVIRONMENTAL APPRAISAL

CCS CONSULTING

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SUMMARY

Site Details	
Site Location	<i>The site is located circa 5.85km south of Manchester City Centre and is approximately centred on National Grid Reference 383735, 392007.</i>
Site Area	<p><i>The site is rectangular in shape and covers an area of 0.56 hectares. The topography gently slopes upwards towards the centre of the site and has likely been created as a result of previous buildings on site being demolished.</i></p> <p><i>The site is currently disused and heavily overgrown with weeds, moss and young trees. Semi-mature trees line the eastern, southern, and western borders. A manhole cover was identified in the northern part of the site.</i></p>
Ground Model	
Made Ground Soils	<p><i>The surfacing of the site comprised brown slightly clayey slightly gravelly fine to coarse sand to a maximum depth of 0.30m bgl.</i></p> <p><i>The remainder of the Made Ground generally consisted of brown and yellow brown clayey gravelly sand to depths of up to 2.6m bgl. Soft grey slightly sandy slightly gravelly clay was encountered in TP04 from 1.5m to a maximum depth of 1.7m bgl.</i></p>
Natural Soils	<p><i>Three main natural stratification encountered during the investigation and are described below:</i></p> <ul style="list-style-type: none"> <i>Medium dense to dense Light grey brown gravelly fine to coarse Sand was encountered in CP01, CP02 and TP04 from 2.0m to a maximum depth of 7.4m bgl. Orange grey gravelly fine to coarse Sand was in TP03 from 1.6m to a maximum depth of 2.7m bgl where the pit was terminated.</i> <i>Firm to stiff brown sandy gravelly Clay was in CP01 and CP02 from 6.1m to the base of the boreholes at a maximum of 14.92m bgl.</i>
Bedrock	<i>Bedrock was not encountered during this investigation.</i>
Groundwater	<i>A groundwater strike was observed in CP01 at 6.0m bgl.</i>
Ground Engineering Assessment	
Foundations	<i>Traditional shallow foundations may be suitable for the proposed Endoscopy building. If this is not the preferred solution, mini piled foundations end bearing in the natural dense granular deposits beneath the site will be considered feasible.</i>
Highways	<i>A minimum CBR value of 7.6% was recorded at ground level and will meet the design criteria of 5%. As a minimum, the subgrade should be proof rolled prior to construction.</i>
SuDS	<i>Due to the depth of Made Ground across the site, it is unlikely that a SuDS drainage solution will be feasible for the proposed development. However, in areas where shallower Made Ground was encountered, such as TP02 and TP03, SuDS may be possible due to the granular deposits encountered beneath the site.</i>

Constraints	<p><i>Made Ground has been encountered to a depth of 2.6m bgl within the area of the proposed endoscopy unit. Shallow foundations will need to be deepened through this should they choose to be adopted.</i></p> <p><i>Natural firm gravelly sandy Clay has been encountered beneath the natural Sand from 6.1m bgl. Should piled foundation be adopted, they should end bear in the granular deposits to avoid the implication of heave precautions.</i></p>
GQRA and Revised (PL) Assessment	
Human Health	<p><i>Testing on the Made Ground beneath the site indicated no elevated levels of metals, PAHs and PCBs. Asbestos was detected in three out of the six samples. As areas of soft landscaping are to be included as part of the proposed development, a clean cover system will need to be adopted in order to mitigate the risk. Currently, the risk is considered to be Moderate.</i></p>
Controlled Waters	<p><i>No evidence of mobile contamination was encountered during the ground investigation and no surface water features are present within 250m of the site. The risk is therefore Low.</i></p>
Permanent Ground Gas	<p><i>Gas monitoring visits classify the site as CS2 due to the elevated GSV calculated for carbon dioxide and basic gas protection measures will need to be incorporated adopted such as beam and block or underfloor ventilation. The risk is considered to be Moderate with respect to ground gases.</i></p> <p><i>Radon measures not required.</i></p>
Final Appraisal	

The following further work is considered necessary to progress the site to construction phase:

- *Tree survey by a qualified arboriculturist.*
- *Detailed foundation design.*
- *Confirmation of recommendations made in this appraisal with regulators.*

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Plans		
<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
<i>GRO-23019-P01</i>	-	<i>Project Location Plan</i>
<i>GRO-23019-P04</i>	-	<i>Exploratory Hole Location Plan</i>
<i>GRO-23019-P05</i>	-	<i>Generalised Ground Model</i>
<i>GRO-23019-P06</i>	-	<i>Illustrative Revised CSM</i>

1.0 INTRODUCTION

1.1 Project Objectives

Groundtech Consulting Limited have been instructed by CCS Consulting to undertake a Ground Investigation for site at Withington Community Hospital in Manchester.

A main investigation was undertaken in accordance with BS 5930:2015, BS 10175:2017, BS 8576:2013 and Eurocode 7 to revise the CSM and quantify the level of risk identified in the PRA. The Appraisal has been prepared in accordance with current UK Legislation and to discharge Land Quality pre-commencement planning conditions.

The report has been undertaken to fulfil the requirements of a preliminary risk assessment in accordance with current LCRM risk assessment guidance.

A Preliminary Risk Assessment has previously been prepared for the site by Groundtech Consulting Limited referenced GRO-23019-4177_1.1, dated 16th June 2023.

1.2 Proposed Development

The proposed development is commercial end use comprising an endoscopy and cardiorespiratory unit to be linked up to the existing hospital building adjacent to the site.



1.3 Limitations

Other conditions may exist on the site that have not been taken into account in this assessment as they are outside the scope of works. Groundtech Consulting are not responsible for these circumstances that are not outlined in the report.

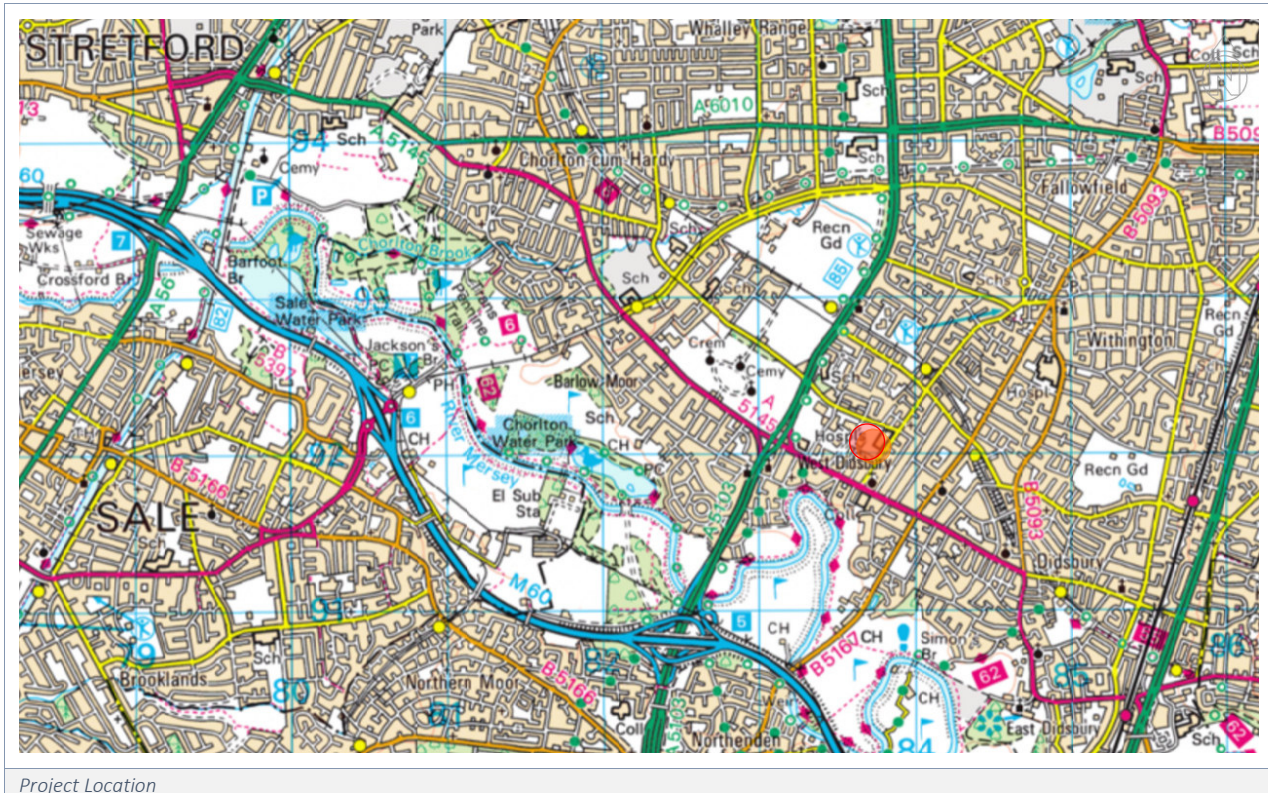


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2.0 SITE SETTING

2.1 Location

The site is located circa 5.85km south of Manchester City Centre as shown on the Project Location Plan GRO-23019-P01 and is approximately centred on National Grid Reference 383735, 392007.



Access to the site is gained off Nell Lane to the north.

2.2 Site Description

The site is irregular in shape and covers an area of 0.56 hectares. The topography gently slopes upwards towards the centre of the site and has likely been created as a result of previous buildings on site being demolished.

Onsite Features

The site is currently disused and heavily overgrown with weeds, moss and young trees. Semi-mature trees line the eastern, southern, and western borders.

A manhole cover was identified in the northern portion of the site.

No other significant features were recorded onsite.

Boundaries and Surrounding Land Uses

The southern boundary is marked by metal security fencing whilst the remaining boundaries are formed by vegetation.



The site is surrounded by following features/land uses:

- *North* - *Withington Community Hospital and associated tarmacked car park.*
- *East* - *Residential properties.*
- *South* - *Residential properties.*
- *West* - *Care home.*

Photographs are presented in *Appendix 2*.

3.0 SUMMARY OF PRELIMINARY RISK ASSESSMENT

3.1 Introduction

A Preliminary Risk Assessment was previously completed by Groundtech Consulting Limited dated 16th June 2023 and referenced *GRO-23019-4177_1.1*. The pertinent information is summarised in the following sections.

3.2 Site History

The site was undeveloped up to 1955 when several government buildings were constructed. The site remained unchanged until 2003 when the buildings were demolished, and the site has remained unchanged since then.

3.3 Geology/ Hydrogeology

Made Ground is not indicated to be present on any of the available geological plans however, due to the previous buildings onsite, Made Ground is to be anticipated.

The site is indicated to be underlain by superficial deposits of Glaciofluvial sand and gravel deposits comprising sand and gravel, locally with lenses of silt, clay or organic material.

The bedrock beneath the site is the Wilmslow Sandstone Formation comprising red fine to medium grained cross bedded sandstones.

There are no geological faults on or within influencing distance of site.

The superficial Glaciofluvial sand and gravel deposits are classified as a Secondary A Aquifer and the Wilmslow Sandstone Formation is classified as a Principal Aquifer.

The site does not lie within 500m of a Source Protection Zone.

There are two active groundwater abstraction licences within 2000m, the nearest being 1438m west at Chorlton-Cum-Hardy Golf Club.

No potable water abstractions are present within 2000m of the site.

There are no surface water abstractions within 2000m of the site.

3.4 Preliminary Conceptual Site Model

The following risks were determined by Groundtech Consulting Limited:

Human Health

Receptor	Level of Risk	Comments
Site End Users (Soils)	Moderate to Low	<i>Made Ground potentially present from the buildings formerly onsite could be a source of heavy metals, PAHs and asbestos. An electricity substation located west of site could also be a source of PCBs, although these are likely to be relatively immobile.</i>

Site End Users (VOCs)	Low	No significant sources of vapours have been identified onsite so no pollution linkage is considered to exist.
Site End Users (Ground Gas)	Moderate	Made Ground potentially present onsite from the demolition of the buildings formerly onsite could be a source of ground gases.
Adjacent Residents	Low	No significant sources of pollution have been identified so no viable pollution linkage is considered to exist.
Water Supply Pipe	Low to Moderate	Made Ground is likely to be present at installation depth, so a potential pollution linkage is considered to exist, therefore a local water company risk assessment is required for the potable water supply.

Controlled Waters

Receptor	Level of Risk	Comments
Aquifers	Low	No significant sources of mobile contamination have been identified and due to the cohesive nature of the superficial deposits no pollution linkage is considered to exist.
Surface Waters	Low	There are no surface water features within 250m of site and no mobile sources of contamination have been identified.

4.0 SCOPE OF INVESTIGATION AND RATIONALE

4.1 Project Objectives

The aim of the fieldwork was to:

Determine the stratification beneath the site.
Maintain a watching brief for visual and olfactory evidence of contamination.
Obtain samples using methodology in current guidance for contamination analysis.
Identify realistic pollution linkages to groundwater.
Obtain relevant geotechnical parameters for preliminary foundation design to address both ULS and SLS conditions.
Determine if targeted supplementary investigation in areas of concern is required and for remedial design.
Install monitoring standpipes for gas and groundwater monitoring.
Assess the identified pollution linkages in the CSM.

4.2 Scope of Works

The following scope of works was completed between the dates of 9th and 10th May 2023.

- 5 No. Trial Pits were excavated to a maximum depth of 3.2m bgl.
- 2 No. Cable Percussive boreholes were advanced to a maximum depth of 14.5m bgl.
- 2 No. Plate Load Tests were carried out to determine CBR values.

The exploratory hole locations are presented on Groundtech Plan GRO-23019-P04 and the logs are in Appendix 3.

The exploratory holes were positioned to establish the stratification beneath the site and target any areas of concern as summarised in the table below:

Location	Target Rationale
CP01 and CP02 TP03 to TP05	Within the vicinity of the proposed development.
TP01 and TP02	Areas of proposed car park to the north west.
PL01 and PL02	Areas of proposed new highways.

The exploratory holes were logged by a suitably experienced geo-environmental engineer in general accordance with the following current guidance:

- BS 5930 'Code of Practice for Site Investigations' 2015.
- BS EN 14688-1:2002 'Geotechnical Investigation and Testing – Identification and classification of soil'.

4.3 Soil Sampling

During the intrusive investigation, representative samples were taken at regular intervals, changes of strata and where evidence of contamination existed. Laboratory analysis was scheduled on the samples obtained.

The samples obtained are summarised in the table below:

Soil Sample	Number
<i>Environmental Sample</i>	22
<i>Disturbed Sample</i>	10
<i>Bulk Sample</i>	26
<i>Undisturbed U100 Sample</i>	5

The samples have been obtained in accordance with current environmental and geotechnical guidance. The sampling plan has been designed to obtain samples from all required strata using the correct methodology.

Disturbed samples of soil for geo-environmental testing were placed in the correct sampling containers as required by the laboratory in accordance with their MCERTS and UKAS Accreditation. Transportation was arranged in a timely manner and the samples were at the correct temperature.

The sample locations and depths are recorded on the exploratory logs.

4.4 Geo-Environmental Testing

To inform the Generic Quantitative Risk Assessment, the following geo-environmental testing was scheduled to assess the risk from contamination on the site. The testing is based on the potential sources identified in the PRA and observations during the Ground Investigation.

Contaminant of Concern (CoC)	Matrix	Number
<i>Arsenic, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, zinc and pH.</i>	<i>Soil</i>	6
<i>PCBs</i>	<i>Soil</i>	2
<i>Speciated PAHs</i>	<i>Soil</i>	6
<i>Waste Acceptance Criteria (WAC)</i>	<i>Soil</i>	6
<i>Asbestos Screen</i>	<i>Soil</i>	6
<i>Asbestos Quantification</i>	<i>Soil</i>	3

The Geo-Environmental Laboratory Testing Results are presented in *Appendix 4*.

Representative disturbed samples were obtained for all soil types encountered. Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' 1990. The following tests were scheduled:

British Standard	Test Method	Number
<i>Part 2</i>	<i>Water Content</i>	4
<i>Part 2</i>	<i>Atterberg Limits</i>	4
<i>Part 3</i>	<i>pH Value</i>	1
<i>Part 3</i>	<i>Water Soluble Sulphate Content</i>	1
<i>Part 7</i>	<i>Undrained Shear Strength in Triaxial Compression</i>	3

The Geotechnical Laboratory Testing Results are presented in *Appendix 5*.

4.5 Gas Monitoring

Gas and groundwater monitoring installations were constructed in the boreholes. The standpipes consisted of high-density polyethylene (HDPE) pipe - a bentonite seal was placed around the plain pipe and a clean gravel pack was placed around the slotted pipe. A summary of the installation construction is presented in the table below:

Location	Depth	Response Zone (m bgl)	Targeted Strata	Reason
CP01	14.88	1-6	Made Ground	Ground Gas
CP02	18.92	1-5	Made Ground	Ground Gas

Permanent gas and flow rate monitoring was carried out using GFM 436 infrared gas monitor with integral electronic flow analyser. The measurements taken are listed below:

- Oxygen (O_2), carbon dioxide (CO_2) and methane (CH_4) as the percentage volume in air (%v/v).
- Hydrogen sulphide (H_2S) and carbon monoxide (CO) as the percentage volume in air (%v/v).
- Lower Explosive Limit (%LEL) of methane.
- Atmospheric and borehole pressure, including pressure trend.
- Flow measurements (l/hr).
- Weather conditions.

Both peak and steady state conditions were monitored to understand the behaviour of the permanent ground gas, the steady state conditions were recorded by allowing the gas monitor to run for a minimum of 3 minutes.

Permanent gas and groundwater monitoring results are presented in *Appendix 6*.

5.0 GROUND MODEL

5.1 Made Ground

The surfacing of the site comprised brown slightly clayey slightly gravelly fine to coarse sand to a maximum depth of 0.30m bgl.

Made Ground was encountered in all exploratory holes during the investigation as described below:

- *Brown gravelly fine to coarse sand was encountered in CP02 from 0.2m bgl to a maximum depth of 0.8m.*
- *Dark grey concrete was encountered in TP04 from 1.3m to a maximum depth of 1.4m bgl.*
- *Brown clayey gravelly fine to coarse sand was encountered in CP01 to CP02 and TP01 to TP05 from 0.3m to a maximum depth of 2.6m bgl.*
- *Yellow brown clayey gravelly fine to coarse sand was in CP02, TP04 and TP05 from 1.0m bgl to a maximum depth of 2.2m bgl.*
- *Soft grey slightly sandy slightly gravelly clay was encountered in TP04 from 1.5m to a maximum depth of 1.7m bgl.*



5.2 Natural Strata

The natural strata encountered generally confirmed the published geological records.

Three main natural stratification encountered during the investigation and are described below:

- *Light greyish brown gravelly fine to coarse Sand was encountered in CP01, CP02 and TP04 from 2.0m to a maximum depth of 7.4m bgl.*
- *Firm to stiff brown sandy gravelly clay was encountered in CP01 and CP02 from 6.1m bgl to the base of the boreholes at a maximum of 14.92m bgl.*
- *Orange mottled grey gravelly fine to coarse Sand was encountered in TP03 from 1.6m to a maximum depth of 2.7m bgl where the borehole was terminated.*

5.3 Bedrock

Bedrock was not encountered in this investigation.

5.4 Groundwater

A groundwater strike was observed in CP01 only at 6.00m bgl.

5.5 Watching Brief

A watching brief was maintained during the Ground Investigation for visual and olfactory evidence of contamination.

No evidence of contamination was noted.

5.6 Excavation Stability

TP02 experienced collapse of the pit walls in the natural sand deposits.

5.7 Excavation Progress

An obstruction in the form of a concrete slab was encountered in TP04 at 0.8m in the east side of the pit so the pit was relocated to the west to avoid the obstruction and the trial pit was continued. Another concrete slab was also encountered in TP05 at 1.6m terminating the trial pit.

6.0 GROUND ENGINEERING

6.1 Geotechnical Testing Results

Comparison of water content and the value of 0.4 times the Liquid Limit in accordance with BRE Digest 412 'Desiccation in Clay Soils' suggests significant desiccation has taken place when 0.4 times the Liquid Limit is greater than the actual water measured water content. This is a rudimentary method but also a good guide.

Results of the moisture content of the Clay is summarised in the table below:

Reference	Depth (m bgl)	Moisture Content (%)
CP01	7.50	18
CP01	14.50	15
CP02	9.00	26
CP02	13.50	18

Results of the Quick Undrained Triaxial test are summarised below:

Reference	Depth (m)	Shear Strength (kPa)	Strength Classification
CP01	7.50 - 7.95	84	High
CP01	9.00 - 9.45	54	Medium
CP02	7.50 - 7.95	82	High

6.2 Assessment Background

The ground engineering investigation has been undertaken to formulate an accurate ground model in order to undertake preliminary foundation design. The ground model has been constructed with a moderate to high level of confidence and has evolved from the information obtained by the PRA. The Ground Engineering Model is visually represented on Drawing *GRO-23019-P05*.

The site is currently disused and heavily overgrown with weeds, moss and young trees. Semi-mature trees line the east, south, and west borders. A manhole cover was identified in the northern part of the site. The topography of the site gently slopes upwards towards the centre of the site and has likely been created as a result of previous buildings on site being demolished.

It is proposed to strip back all vegetation and trees present on site and construct an endoscopy and cardiorespiratory unit to be linked up to the existing hospital building adjacent to the site. New highways and areas of hardsurfaced car parking will also be incorporated within the western area of the site.

Ground Conditions

Made Grund has been encountered beneath the site to a maximum depth of 3.0m bgl and was generally underlain by medium dense to dense gravelly Sand to depths of between 6.1m and 7.4m bgl. This was followed by firm sandy gravelly Clay to the base of the boreholes between 14.88m and 14.92m bgl.

A groundwater strikes was noted at 6.0m bgl in CP01 within the natural granular soils.

Limitations

The main limitation to the proposed development is the deep Made Ground encountered to depths of between 1.3m and 3.0m bgl. Foundations will need to be deepened through this Made Ground in order to end bear in the underlying natural granular deposits.

Obstructions in the form of a concrete slab was encountered in TP04 at 0.8m and at 1.6m bgl in TP05. These obstructions will require breaking out and grubbing up prior to the construction phase.

Trees are currently present across the majority of the site and will require removing as part of the enabling works.

6.3 Geotechnical Parameters

The geotechnical test results have been evaluated to derive geotechnical parameters for the soils underlying the site. A 'depth to SPT N value' graph is presented on Plan GRO-23019-P05 in Appendix 7 to provide a generalised ground model for the site.

Characterisation of the geotechnical parameters above has been undertaken to select a characteristic value, which is a cautious estimate of the value affecting the occurrence of the limit state.

- *For the medium dense Sand deposits, a characteristic SPT 'N' value of 19 has been recorded and by correlation, a ϕ' of 32° has been selected for ULS conditions.*
- *For the dense Sand deposits, a characteristic SPT 'N' value of 25 has been recorded and by correlation, a ϕ' of 35° has been selected for ULS conditions.*
- *For the medium strength Clay, an undrained shear strength (C_u) characteristic value of 54kPa has been selected to satisfy ULS conditions based on the laboratory testing results.*
- *For the high strength Clay, an undrained shear strength (C_u) characteristic value of 82kPa has been selected to satisfy ULS conditions based on the laboratory testing results.*

6.4 Preliminary Foundation Design

The most suitable foundations for the proposed development are considered to be traditional trench fill and pad foundations constructed within the underlying natural medium dense to dense granular deposits encountered from 1.3m bgl within the proposed development area. Foundations will require deepening through Made Ground deposits.

Preliminary foundation design has been calculated, and a safe allowable bearing capacity of 250kN/m² is provided for ultimate limit state design for a 1.00m wide pad foundation constructed within the medium dense gravelly Sand deposits at 2.0m bgl.

Within CP01, Made Ground was encountered to 2.6m bgl, therefore foundations will need to be deepened locally within this area of the site.

Using the above pressures, settlement criteria of 25mm will not be exceeded and Serviceability Limit State conditions will be satisfied. As foundations are to be constructed in the medium dense to dense granular soils, the majority of the settlement will occur during the construction phase.

As the proposed development is an extension, consideration should be given to issues arising from differential settlement, movement joints should be installed between the existing hospital building and

proposed extension and the angle of distortion taken into consideration to ensure settlement will be within an allowable tolerance.

Alternative Solution – Mini Piles

If load capacities are greater than anticipated or trench fill foundations are deemed too deep to be suitable, a traditional driven pile foundation is also considered feasible for the proposed development where loads can be transferred to the underlying medium dense to dense Sand deposits that have been encountered from between 3.0m and 5.0m bgl. The preliminary design by calculation is based on the following ground conditions encountered in CP02:

• Made Ground	-	2.20m bgl
• Medium dense gravelly Sand	-	5.00m bgl
• Dense gravelly Sand	-	6.00m bgl
• Firm sandy gravelly Clay	-	14.92m bgl

For a single driven 300mm square pile 5.0m in length end bearing in the dense gravelly Sand deposits an allowable load of 400kN has been calculated. If greater loads are required, the piles should be installed in groups or larger diameter piles should be considered. The above should be considered when the loadings are confirmed. A more efficient design can be achieved using partial factors in accordance with EC7, permanent and variable loads are required to undertake EC7 compliant calculations.

Piled Solution – Design Validation

The piling type, length, depth of reinforcement and design should be discussed with a specialist piling contractor. They can then undertake the detailed design including drawings and specifications to provide fitness for purpose design.

The depth of investigation does not meet the requirements of 5.0m beyond the base of the pile and the piling contractor should be consulted to confirm validation and warranty requirements.

The piling works should be carried out in accordance with Execution Standard BS EN 12699:2015 'Execution of special geotechnical works. Displacement piles'. If driven piles are the preferred installation method, they will be driven to set using pile driving formulae in accordance with Eurocode 7.

Construction Recommendations

The recommendations in this appraisal are preliminary and the detailed design should be developed in advance and during the construction phase. If the ground conditions or groundwater regime encountered during the construction phase differ significantly to the conditions encountered during the Ground Investigation, work should cease and Groundtech Consulting contacted for further advice.

During the construction phase, supervision by a suitably qualified geotechnical engineer should be on a continuous basis to check the design assumptions are correct and construction conforms to design in accordance with EC7. Supervision should include inspections, Control Ground Investigations and monitoring by a suitably qualified geotechnical engineer.

6.5 Building Near Trees

Trees are currently present across the site, and these are set to be removed as part of the enabling works.

Foundations are set to be constructed within the natural granular deposits beneath the site and are therefore unlikely to encounter cohesive strata. Heave precautions are not deemed necessary.

6.6 Floor Slabs

A suspended floor slab is recommended for the proposed development due to the depth of Made Ground. Additionally, if piled foundations are adopted, a suspended floor slab will be required.

6.7 Construction

The trial pits indicate that instability of excavations in natural soils is anticipated locally. Instability of the Made Ground is a possibility and should be considered in the groundworks method statements.

Tracked high specification plant is recommended to maintain the build programme and breaking equipment will be required to break through obstructions identified during the Ground Investigation.

Groundwater is unlikely to be observed in foundation excavations.

6.8 Concrete Classification

Made Ground

Water soluble sulphate testing was undertaken on six samples of the Made Ground. The range of soluble sulphate (SO₄) recorded is 20.3mg/l to 128.7mg/l and associated pH values ranged between 8.34 and 9.72 indicating slightly alkaline conditions.

Natural Strata

Water soluble sulphate testing was also undertaken on one sample of the natural strata. Water soluble sulphate was recorded at 23.4 mg/l and the associated pH values was recorded at 8.04 indicating slightly alkaline conditions.

A groundwater strike was observed at 6.0m bgl in CP01 within the natural granular deposits and is therefore considered to be relatively immobile.

The results of laboratory pH and sulphate content indicate that ACEC Class AC-1 and sulphate class DS-1 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site-specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

6.9 Highway/Pavement Design

Plate load testing was undertaken at ground level in order to obtain representative CBR values. The full results are presented in *Appendix 8* and a summary of the results is below:

Location	Depth (m bgl)	Strata	Plate Diameter (mm)	CBR Value (%)
PLT01	Ground level	Made Ground	450	14.6%
PLT02	Ground level	Made Ground	450	7.6%

CBR testing was undertaken at two locations within the proposed development area (PLT01 and PLT02). A minimum CBR value of 7.6% was recorded at ground level and will meet the design criteria of 5%. As a minimum, the subgrade should be proof rolled prior to construction.



The soils are considered to be frost susceptible due to the fines content and highway/pavement construction should be a minimum thickness of 450mm to mitigate the risk.

6.10 Sustainable Urban Drainage System (SuDS)

Made Ground was encountered to depths of between 1.3m and 3.0m bgl and was typically underlain by slightly clayey slightly gravelly Sand.

Due to the depth of Made Ground across the site, it is unlikely that a SuDS drainage solution will be feasible for the proposed development. However, in areas where shallower Made Ground was encountered such as TP02 and TP03, SuDS may be feasible due to the granular deposits encountered beneath the site.

7.0 LAND QUALITY

7.1 Geo-Environmental Testing Results - Soils

Samples of Made Ground and natural strata have been tested for a range of relevant Contaminants of Concern. In accordance with LCRM, a Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of the concentrations as derived through Geo-Environmental testing.

The GQRA process comprises the comparison of the actual concentrations measured on site with Generic Assessment Criteria (GACs) for the protection of human health.

The GACs used for the assessment of soil concentrations have been derived using the CLEA model. The GACs used are listed below:

- *Soil Guideline Values (SGVs) which demonstrate minimal risk.*
- *LQM/CIEH S4ULs which use the same toxicological data as the SGVs but different exposure criteria.*
- *C4SLs which demonstrate low risk.*

In deriving the GACs for use on Brownfield sites, we have assumed worst case of 1% Soil Organic Matter.

The proposed end-use for the site is a commercial development comprising an endoscopy and cardiorespiratory unit to be linked up to the existing hospital building adjacent to the site, with associated areas of car parking and soft landscaping. We have therefore undertaken the GQRA on the basis that the proposed development site falls under the Commercial land-use scenario as defined in SR3 (EA, 2009b).

The strata or sources of contamination targeted by the laboratory testing scheduled is summarised in the table below:

Strata	Number of Samples Tested	Locations
<i>Granular Made Ground (Population 1)</i>	6	<i>CP01, CP02, TP01, TP03-TP05,</i>

A summary of the Geo-Environmental Testing results is presented below and the GQRA screening values are presented in *Appendix 9*:

Contaminant	Range (mg/kg)	Metals	Exceedances	Locations
		Screening value (mg/kg)		
<i>Arsenic</i>	<i>7.0 - 8.6</i>	<i>640</i>	<i>0</i>	<i>-</i>
<i>Cadmium</i>	<i>0.2 - 0.6</i>	<i>230</i>	<i>0</i>	<i>-</i>
<i>Chromium</i>	<i>30.8 - 44.6</i>	<i>8,600</i>	<i>0</i>	<i>-</i>
<i>Hexavalent Chromium</i>	<i><0.3</i>	<i>49</i>	<i>0</i>	<i>-</i>
<i>Copper</i>	<i>13 - 26</i>	<i>68,000</i>	<i>0</i>	<i>-</i>
<i>Lead</i>	<i>33 - 101</i>	<i>2,300</i>	<i>0</i>	<i>-</i>
<i>Mercury</i>	<i><0.1 - 1.5</i>	<i>26</i>	<i>0</i>	<i>-</i>
<i>Nickel</i>	<i>9.5 - 14.6</i>	<i>1,800</i>	<i>0</i>	<i>-</i>
<i>Selenium</i>	<i><1 - 1</i>	<i>13,000</i>	<i>0</i>	<i>-</i>
<i>Zinc</i>	<i>54 - 110</i>	<i>730,000</i>	<i>0</i>	<i>-</i>

Polycyclic Aromatic Hydrocarbons (PAHs)				
Contaminant	Range (mg/kg)	Screening value (mg/kg)	Exceedances	Locations
Naphthalene	0.05 - 0.40	190	0	-
Acenaphthylene	0.04 - 0.30	83,000	0	-
Acenaphthene	0.08 - 0.88	84,000	0	-
Fluorene	0.06 - 0.66	63,000	0	-
Phenanthrene	0.68 - 8.41	22,000	0	-
Anthracene	0.28 - 3.73	520,000	0	-
Fluoranthene	3.05 - 17.12	23,000	0	-
Pyrene	2.94 - 14.54	54,000	0	-
Benzo(a)anthracene	1.57 - 6.87	170	0	-
Chrysene	1.75 - 7.13	350	0	-
Benzo(b)fluoranthene	2.41 - 8.84	44	0	-
Benzo(k)fluoranthene	0.94 - 3.44	1,200	0	-
Benzo(a)pyrene	2.20 - 7.99	35	0	-
Indeno(123cd)pyrene	1.51 - 5.59	500	0	-
Dibenzo(ah)anthracene	0.23 - 0.98	3.5	0	-
Benzo(ghi)perylene	1.45 - 4.89	3,900	0	-
TPH CWG - Aromatics				
Contaminant	Range (mg/kg)	Screening value (mg/kg)	Exceedances	Locations
MTBE	<0.005	7,900	0	-
Benzene	<0.005	95	0	-
Toluene	<0.005	4,400	0	-
Ethylbenzene	<0.005	2,800	0	-
m/p-Xylene	<0.005	3,200	0	-
o-Xylene	<0.005	2,600	0	-
Others				
Organic Matter	1.07 - 3.51%			
Asbestos Screen				
Position	Depth (m bgl)	Result	Quantification	
CP01	1.00	None Detected	n/a	
CP02	0.50	None Detected	n/a	
TP05	0.40	None Detected	n/a	
TP03	0.40	Fibre Bundles detected		
TP01	1.20	Fibre Bundles detected		
TP04	1.50	Fibre Bundles detected		

All PCBs were recorded below the limit of laboratory detection.

7.2 Generic Quantitative Risk Assessment - Soils

The site is currently disused and heavily overgrown with weeds, moss and sapling trees. Historically, the site was undeveloped up to 1955 when several government buildings were constructed. The site remained unchanged until 2003 when the buildings were demolished. No new constructions have occurred on site since.

No visual or olfactory evidence of contamination was noted during the ground investigation.

Metals

No elevated levels of metals were recorded in any of the samples tested.

Speciated Polycyclic Aromatic Hydrocarbons (PAHs)

No elevated levels of any PAHs were recorded in any of the samples tested.

PCBs

All PCBs were recorded below the limits of laboratory detection.

Asbestos

Asbestos was detected in three out of the six samples tested and quantification of these results has been scheduled. A revised report will follow once these results have been received.

7.3 Permanent Ground Gases

Two standpipes were installed for ground gas monitoring within CP01 and CP02. Four monitoring visits have been carried out between 25th July and 30th August 2023.

Methane was not recorded within any of the boreholes. Carbon dioxide was detected at a maximum concentration of 12.8% v/v and associated depleted oxygen levels recorded a minimum concentration of 9.3% v/v.

No positive gas flow rates were recorded during the monitoring period.

The atmospheric pressure recorded ranged between 1000mb and 1013mb and the monitoring visits were undertaken during periods of rising and falling barometric pressure.

Groundwater was recorded between depths of 3.82m and 4.10m bgl within the monitoring standpipes.

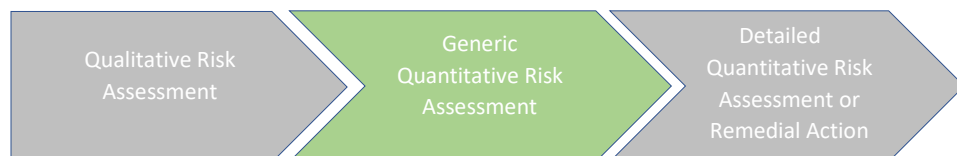
The GSV for carbon dioxide has been calculated based on the monitoring visits and the calculated GSV places the site within CS2 where basic gas protection measures are required such as reinforced concrete cast in situ floor slab, beam and block or underfloor venting.

The site is not in an area requiring Radon precautions.

7.4 Revised Pollution Linkage Assessment

The CSM has been revised based on the Ground Investigation and testing using Source-Pathway-Receptor assessment criteria that is applicable in the UK, a risk assessment has been completed to determine if a plausible pollution linkage exists between the identified contaminants and receptors. The risk classification has been estimated in accordance with the CIRIA C552 assessment criteria outlined in *Appendix 10*.

Human Health Pollution Linkage Assessment



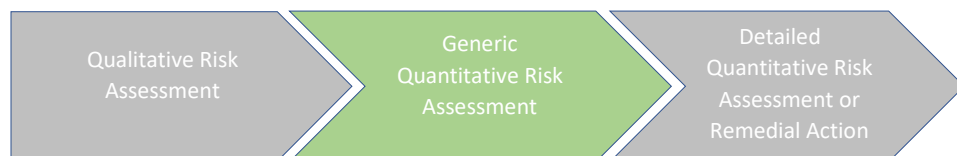
- The table below represents the second stage in the land quality risk assessment process - **the Generic Quantitative Risk Assessment**.
- In order for a development site to be deemed 'suitable for use' the level of risk needs to be reduced to an acceptable level - low to negligible risk. The purpose of each stage of risk assessment is to establish if there is a requirement for additional stages of assessment in order to have sufficient confidence to support a risk characterisation or remedial action.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
PL1	Contaminated Soils	Ingestion of soil and dust. Dermal contact with soil.	Low Likelihood	Medium	Moderate	<p>Pollution Linkage 1 refers to proposed site users coming into contact with contaminated soils on the site.</p> <p>Made Ground has been encountered beneath the site depths of between 1.3m and 3.00m bgl. Testing indicated no elevated levels of metals, PAHs or PCBs. However, asbestos was encountered in three of the six samples tested.</p> <p>The proposed development is of commercial end use however plans indicate that areas of soft landscaping are set to be included as part of the development. A pollution linkage is therefore considered to exist between the contaminated Made Ground soils and site end users.</p> <p>To mitigate the risk, a clean cover system should be placed within areas of planned soft surfacing, consisting of a minimum 600mm of clean soil inclusive of 150mm of topsoil to act as a growing medium. The cover system will require validating for depth and chemical suitability.</p>

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
PL2	Contaminated Soils	Inhalation of vapour.	Unlikely	Medium to Severe	Low	<p>Pollution linkage 2 refers to vapours migrating into confined spaces within the proposed development.</p> <p>No sources of mobile contamination have been identified and no evidence of hydrocarbon contamination was identified during the ground investigation. No risk from vapours is considered to exist.</p>
PL3	Contaminated Soils	Inhalation of soil dust by adjacent site users.	Unlikely	Medium	Low	<p>Pollution Linkage 3 relates to contamination on the subject site affecting adjacent site users.</p> <p>No evidence of mobile contamination has been encountered during the ground investigation therefore a pollution linkage does not exist.</p>
PL4	Contaminated Soils	Attacking potable water supply pipe.	Unlikely	Medium	Low	<p>Pollution Linkage 4 refers to the possible contaminants permeating potable water pipes and consumption by the future site end users of the tainted water supply.</p> <p>No elevated contaminants have been encountered in the Made Ground beneath the site. No risk is therefore considered to be present.</p>
PL5	Ground Gas	Migration and accumulation of	Likely	Medium to Severe	Moderate	<p>Four monitoring visits have been undertaken at the site. Methane was not recorded within any of the boreholes. Carbon dioxide was detected at a maximum concentration</p>

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
		ground gas in internal spaces.				<p>of 12.8% v/v and associated depleted oxygen levels recorded a minimum concentration of 19.4% v/v.</p> <p>The GSV for carbon dioxide has been calculated based on the monitoring visits and the calculated GSV places the site within CS2 where basic gas protection measures are required, such as suspended floor slabs, beam and block or underfloor venting.</p> <p>The risk from ground gases is therefore considered to be Moderate.</p> <p>The site is not within an area requiring radon precautions within foundations.</p>

Controlled Waters Pollution Linkage Assessment



- The table below represents the second stage in the land quality risk assessment process – **Generic Quantitative Risk Assessment**.
- In order for a development site to be deemed 'suitable for use' the level of risk needs to be reduced to an acceptable level - low to negligible risk. The purpose of each stage of risk assessment is to establish if there is a requirement for additional stages of assessment in order to have sufficient confidence to support a risk characterisation or remedial action.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential source	Pollution linkage	Likelihood	Severity	Level of risk	Rationale
PL6	Contaminated Soils	<p>Impaction of groundwater from soil contamination (diffuse and point).</p> <p>Impaction of groundwater from groundwater plume.</p>	Unlikely	Medium	Low	<p>Made Ground was identified to a maximum depth of 3.0m bgl and testing revealed no elevated levels of any contaminants of concern. No mobile contamination was identified during the Ground Investigation.</p> <p>Sand and gravel were encountered beneath the Made Ground to a maximum depth of 7.4m bgl. This was underlain by firm gravelly sandy Clay which will restrict the migration of any contamination into the principal bedrock aquifer beneath the site.</p> <p>As no contamination was identified during the Ground Investigation, a pollution linkage is not considered to exist.</p>

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential source	Pollution linkage	Likelihood	Severity	Level of risk	Rationale
PL7	Contaminated Soils	Migration of soil and groundwater contamination impacting surface waters.	Unlikely	Medium	Low	<p>No water courses have been identified within 250m of the site. Furthermore, no evidence of mobile contamination was encountered during the ground investigation.</p> <p>No pollution link is therefore considered to exist.</p>

7.5 Outline Remedial Strategy

The proposed development comprises the construction of an endoscopy and cardiorespiratory unit to be linked up to the existing hospital building adjacent to the site with associated areas of hard standing car park spaces and soft landscaping.

Soils

Made Ground was encountered to a maximum depth of 3.0m bgl. No elevated levels of metals, PAHs or PCBs have been encountered within the soils tested beneath the site. Asbestos has been detected within TP01, TP03 and TP04. Due to the presence of asbestos, a pollution linkage will exist where soft landscaped areas of POS are proposed and to mitigate the risk, a clean cover system should be placed within areas of planned soft surfacing, consisting of a minimum 600mm of clean soil inclusive of 150mm of topsoil to act as a growing medium. The cover system will require validating for depth and chemical suitability. This will be reviewed upon retrieval of the asbestos quantification results.

Ground Gas

Interim ground gas monitoring results place the site within CS2 and gas protection measures are deemed necessary. Gas protection measures as outlined in CIRIA C665 for CS2 are as follows:

- a. *Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft) with at least 1200-gauge DPM.*
- b. *Beam and block or precast concrete slab and minimum 2000-gauge DPM/reinforced gas membrane.*
- c. *Possibly underfloor venting or pressurisation in combination with a) and b) depending on use.*

All joints and penetrations must be sealed.

The site is not in an area requiring radon protection measures and no risk from vapours has been identified.

Controlled Waters

No risk to controlled waters has been identified.

Watching Brief

A watching brief should be in place during ground works and construction. If previously unidentified contamination is encountered, work should cease in that area and Groundtech Consulting contacted for advice.

Regulatory compliance should be obtained pre-commencement to avoid delays during the construction phase which will have cost implications.

7.6 Asbestos in Soils

The presence of asbestos within the ground will require, a safe system of work to be set up on site to deal with the asbestos risk from the made ground. This may include but be not limited to:

- *The use of qualified personnel where required.*
- *Careful segregation of stockpiles on site.*
- *Defining transport routes.*
- *Cleaning down of machinery in designated areas.*

- *Decontamination unit for ground workers.*
- *Damping down of soils to prevent dust migration.*

Quantification testing is currently being undertaken to fully assess the risk.

7.7 Health and Safety – Construction and Groundworkers

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

PL Ref	Potential Source	Pollution Linkage	Likelihood	Severity	Level of Risk
PL8	Made Ground	Ingestion, direct contact, inhalation of dusts.	Unlikely	Medium	Low
PL8	Asbestos	Inhalation of dusts.	Low Likelihood	Medium	Moderate to Low

Asbestos has been detected in three samples of Made Ground and the risk should be communicated to ground workers through a site induction.

General guidance on these matters is given in the Health and Safety Executive (HSE) document “Protection of Workers and the General Public during the Redevelopment of Contaminated Land”. In summary, the following measures are suggested to provide a minimum level of protection:

- *All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.*
- *Hand-washing and boot-washing facilities should be provided.*
- *Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.*
- *Good practices relating to personal hygiene should be adopted on the site.*
- *The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.*

7.8 Waste Classification by Assessment

We have reviewed the testing results and inputted them into the HazWasteOnline model which allows users to code and classify waste as defined in the EWC (European Waste Catalogue 2002) based on EC Regulation 1272/2008 on the Classification, labelling and packaging of substances and mixtures (CLP) and latest Environment Agency guidance (WM3 “Guidance on the classification and assessment of waste (1st edition 2015)-Technical Guidance”).

This is a useful tool as waste producers have the legal responsibility to classify any waste they produce.

Ten samples were tested to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3. The results are in the Waste Classification Report presented in *Appendix 11*.

Based on the assessment tool, the made ground soils have been classified as *Non-Hazardous* for waste disposal purposes.

Total testing was not undertaken on the natural soils and are assumed too also be *Non-Hazardous*.

Asbestos has been recorded in three of the samples tested. Provided quantification results are less than 0.1%, the overall waste classification of the samples will not be affected.

7.9 Waste Acceptance Criteria (WAC) Results

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste) led to the establishment of a methodology for classifying wastes. Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. There are three different WAC, these are for:

- *Inert waste*
- *Non-Hazardous waste*
- *Hazardous waste*

Wastes should first be classified based on their total concentrations as detailed in the previous section. WAC testing is then required if the end disposal route is a landfill.

Solid and eluate WAC analysis was undertaken on six samples, the findings of which are presented in the table below.

Reference	Depth (m)	Strata Type	Classification by Assessment	WAC Analysis	Landfill Disposal
CP01	0.50	Made Ground	Non-Hazardous	Stable Non-reactive	Non-Hazardous
CP02	2.00	Made Ground	Non-Hazardous	Inert	Inert
TP05	0.40	Made Ground	Non-Hazardous	Inert	Inert
TP03	0.40	Made Ground	Non-Hazardous	Inert	Inert
TP04	1.50	Made Ground	Non-Hazardous	Inert	Inert
TP05	0.40	Made Ground	Non-Hazardous	Inert	Inert

The WAC testing has revealed that if the end disposal route of the Made Ground is landfill, the material would be accepted at an *Inert Landfill*. The Made Ground material from CP01 would be accepted at a *Non-Hazardous Landfill*.

The possibility of automatic inert classification of the natural soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing, this is the case if:

- *They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source)*
and
- *There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other their disposal in other classes of landfill.*



If any organic contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous, and testing should be undertaken at that time.

Materials should be segregated and where necessary sufficient time is allowed to further classify the material properly, including discussion with landfill sites and waste transfer stations to find the best disposal route. It is recommended that where possible that the soils could be recycled at a suitable local waste treatment plant or transfer station rather than a landfill disposal route.

The reuse of soils on the site this should be done in accordance with the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE CoP). Any re-use scheme should be designed to minimise disposal costs.

After a cut and fill balance plan/volume calculation has been carried out, a U1 and T5 exemption could be registered. This will allow the use of the following soils without a waste permit or under Dow CoP MMP:

- *1,000 tonnes (c.600m³) of non-hazardous soil*
- *5,000 tonnes (c.3,000m³) of natural sand and gravels.*
- *50,000 tonnes (c.25,000m³) of bituminous material to be used in roadways.*
- *5,000 tonnes (c.3,000m³) of crushed concrete/stone.*

8.0 FINAL APPRAISAL

8.1 Land Quality

Historically, the site was undeveloped up to 1955. Serval government buildings were then constructed on site and are indicated on plans until 2003 where they were demolished. Currently, the site is disused and heavily overgrown with weeds, moss and young trees. Semi-mature trees line the east, south, and west borders.

Made Ground has been encountered to depths of between 1.3m and 3.0m bgl across the site. No visual or olfactory evidence of contamination was noted during the ground investigation.

No elevated levels of metals, PAHs or PCBs were recorded based off the Made Ground samples tested. Asbestos was detected in three out of the six samples and quantification of this has been scheduled.

Areas of soft landscaping are set to be included as part of the proposed development. Whilst dependent on the quantification results, due to the asbestos encountered, a clean cover system should be placed consisting of a minimum 600mm of clean soil inclusive of 150mm of topsoil to act as a growing medium.

No evidence of mobile contamination was noted during the ground investigation. The risk from vapours is therefore considered to be *Low*.

Gas monitoring visits classify the site as CS2 due to the elevated GSV calculated for carbon dioxide and basic gas protection measures will need to be adopted. The risk is considered to be *Moderate* with respect to ground gases.

No mobile contamination was encountered during the ground investigation and no watercourses are present within 250m of the site. The risk to controlled water is therefore *Low*.

The soils beneath the site have been classified as being Non-Hazardous for waste disposal purposes.

8.2 Ground Engineering

Traditional trench fill foundations may be suitable for the proposed Endoscopy building founding in the medium dense to dense Sand. If this is not the preferred solution, mini piled foundations end bearing in the natural dense granular deposits beneath the site will be considered feasible.

Suspended floor slabs will be required due to the depth of Made Ground encountered across the development area.

Due to the depth of Made Ground across the site, it is unlikely that a SuDS drainage solution will be feasible for the proposed development. However, in areas where shallower Made Ground was encountered such as TP02 and TP03, SuDS may be possible due to the granular deposits encountered beneath the site.

8.3 Required Further Work

The following further work is considered necessary to progress the site to construction phase:



Tree survey by qualified arboriculturist.

Detailed foundation design.

Confirmation of recommendations made in this appraisal with regulators.

9.0 RELEVANT INDUSTRY REFERENCES

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Total Petroleum Hydrocarbon Criteria Working Group Volume 3 Selection of Representative TPH Fractions Based on Fate and Transport Considerations July 1997.

Total Petroleum Hydrocarbon Criteria Working Group Volume 4 Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH).

Total Petroleum Hydrocarbon Criteria Working Group Volume 5 Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach June 1999.



APPENDIX 1 - Plans

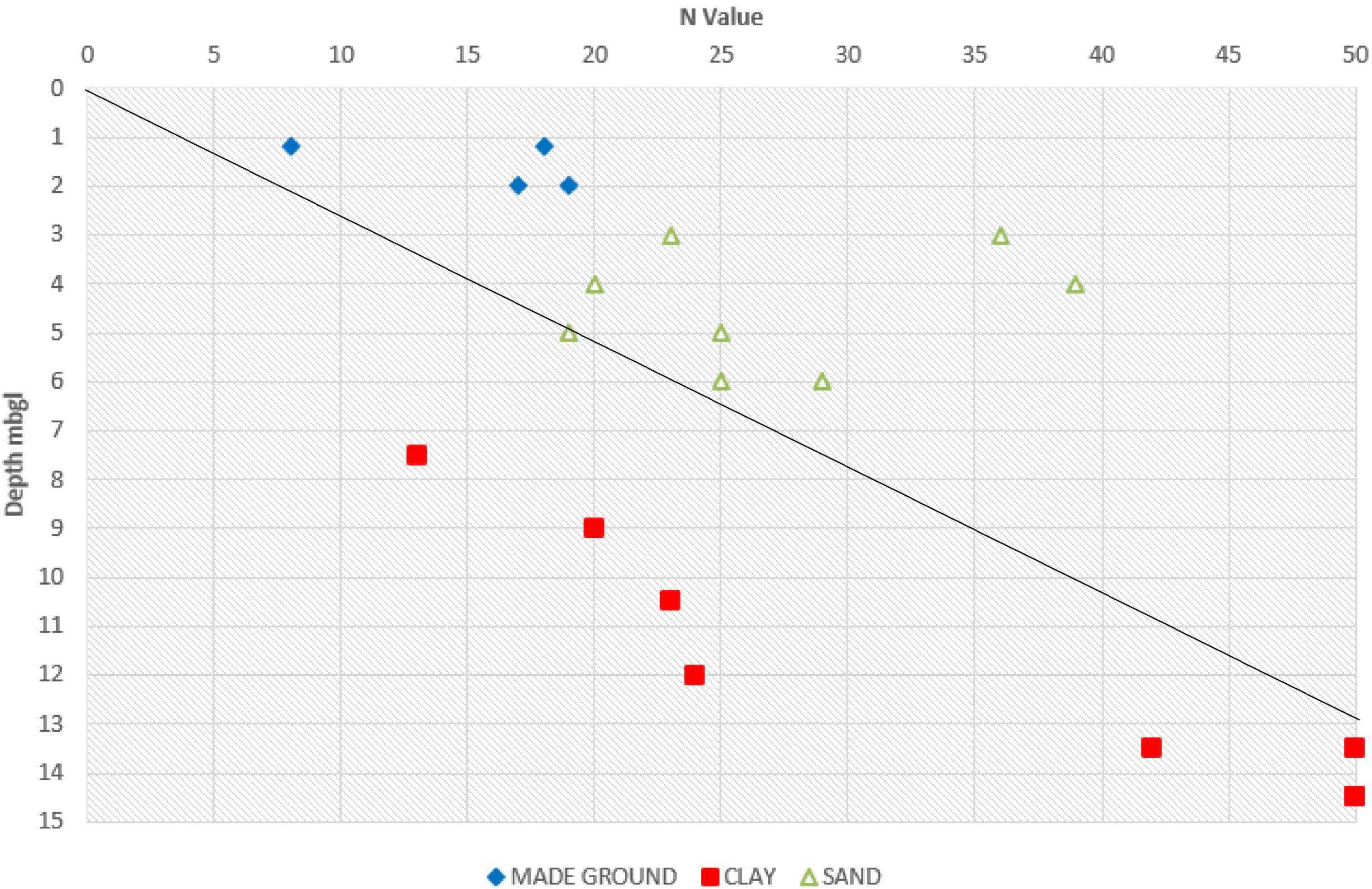


<div>GROUNDTECH</div> <div>CONSULTING</div> <div></div>	CLIENT	DATE				Status		<div>Notes</div> <div><div><div></div></div><div>SITE LOCATION</div></div>
	CCS CONSULTING	FEBRUARY 2023				Preliminary		
	PROJECT TITLE	SCALE				Draft		
	WITHINGTON CDC	NTS				Issued		
	PLAN TITLE	PLAN NUMBER				For Comment		
	PROJECT LOCATION PLAN	GRO-23019-P01	Rev.	Details	Date	Approved		



<div>GROUNDTECH</div> <div>CONSULTING</div> <div></div>	CLIENT	DATE			Status		<div>Notes</div> <div> Cable percussive borehole locations</div> <div> Trial pit locations</div> <div> Plate load test locations</div>
	CCS CONSULTING	SEPTEMBER 2023			Preliminary		
	PROJECT TITLE	SCALE			Draft		
	WITHINGTON CDC	NTS			Issued		
	PLAN TITLE	PLAN NUMBER			For Comment		
	EXPLORATORY HOLE LOCATION PLAN	GRO-23019-P04	Rev.	Details	Date	Approved	

DEPTH vs SPT 'N' VALUE



GROUNDTECH
CONSULTING



CLIENT

CCS CONSULTING

PROJECT TITLE

WITHINGTON CDC

PLAN TITLE

GENERSIED GROUND MODEL

DATE

SEPTEMBER 2023

SCALE

NTS

PLAN NUMBER

GRO-23019-P05

Rev.

Details

Date

Status

Preliminary

Draft

Issued

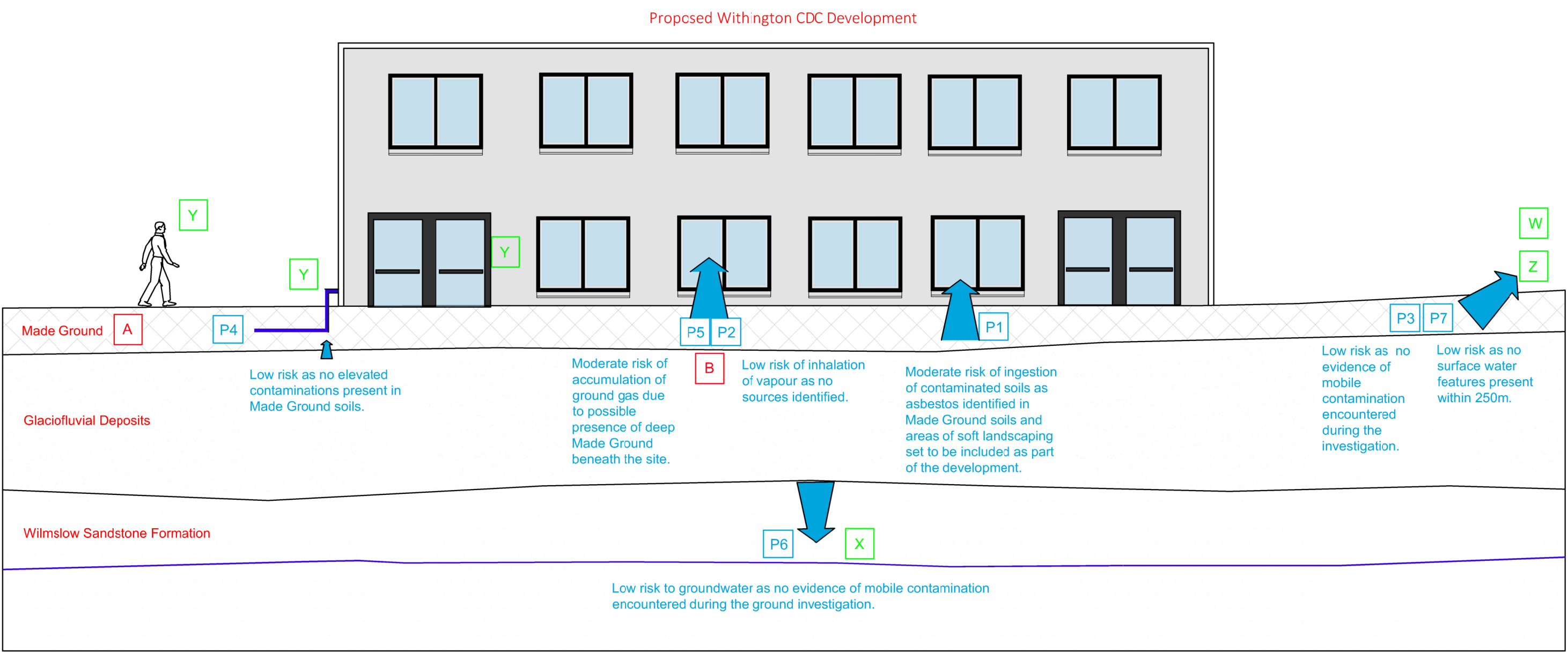
For Comment

Approved

Notes



SOURCES	POLLUTION LINKAGES	RECEPTORS
<p>A. Contaminated soils / Made Ground.</p> <p>B. Ground gas.</p>	<p>P1. Ingestion of soil and dust.</p> <p>P2. Inhalation of vapour.</p> <p>P3. Inhalation of soil dust by adjacent site users.</p> <p>P4. Attacking of potable water supply pipe.</p> <p>P5. Migration and accumulation of ground gas in internal places.</p> <p>P6. Impaction of groundwater from soil contamination.</p> <p>P7. Migration of soil and groundwater contamination impacting surface waters.</p>	<p>W. Nearby surface waters.</p> <p>X. Groundwater within the Secondary A and Principal Aquifers.</p> <p>Y. Site end users.</p> <p>Z. Adjacent site users.</p>



<div>GROUNDTECH</div> <div>CONSULTING</div> <div></div>	CLIENT	DATE				Status		Notes
	CCS CONSULTING	SPETEMBER 2023				Preliminary		
	PROJECT TITLE	SCALE				Draft		
	WITHINGTON CDC	NTS				Issued	<div></div>	
	PLAN TITLE	PLAN NUMBER				For Comment		
	ILLUSTRATIVE REVISED CSM	GRO-23019-P06	Rev.	Details	Date	Approved		







APPENDIX 2 - Site Photographs