

A FOUNDATION WORKS RISK ASSESSMENT FOR THE PROPOSED SEND SCHOOL, ROCHDALE

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**A FOUNDATION WORKS
RISK ASSESSMENT FOR
THE PROPOSED SEND
SCHOOL, ROCHDALE**

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1 INTRODUCTION

SoilSafe Ltd was commissioned by Tilbury Douglas to undertake a Foundation Works Risk Assessment for a site referred to as Rochdale SEND School (the “Site”). The purpose of this document is to correspond with the requirements of Planning Condition 9 of the Planning Permission 23/00852/PSID for the proposed development.

For the avoidance of doubt, Planning Condition 9 states “No piling or any other foundation designs using penetrative methods shall take place unless a scheme for such works, that demonstrate that there is no resultant unacceptable risk to groundwater or land stability, has first been submitted to and approved in writing by the Local Planning Authority. Thereafter, the development shall be carried out in accordance with the approved details”. This report satisfies this Planning Condition.

At the time of writing, the proposed development is to be founded on piles using continuous flight auger methods. A layout of the proposed piles along with the termination depths and dimensions is included in Appendix C as Drawing FS0911-AJP-ZZ-00-D-S-1000.

The following documents were used to make this assessment:

- ‘Piling and Penetrative Ground Improvement Methods on Land Affected By Contamination: Guidance on Pollution Prevention’, NGWCL Centre Project NC/99/73
- Piling into contaminated sites:
<http://webarchive.nationalarchives.gov.uk/20140328084622/http://cdn.environment-agency.gov.uk/scho0202bisw-e-e.pdf>

The comments and opinions presented in this report are based on the desk study and ground conditions encountered during an intrusive investigation performed by SoilSafe Ltd and the laboratory determined chemical test results. There may be other conditions prevailing on the Site which have not been revealed by this investigation and which have not been taken into account by this report. Responsibility cannot be accepted for any conditions not revealed by these investigations. Any diagram or opinion on the possible configuration of the findings is conjectural and given for guidance only. Confirmation of intermediate ground conditions should be undertaken if deemed necessary.

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2 SITE DETAILS AND DESCRIPTION

Table 2.1 – Site Details

Site name	Rochdale SEND School
Site address	Land North Of West Starkey Street, Heywood, ,
National Grid Reference	National Grid Reference SD 385123, 411132
Location description	The site is situated on a series of terraces on a hillside, with short slopes between different areas. The existing school building is at approximately 188 m OD, with a slope down to a terrace containing sports pitches to the southeast at approximately 185 m OD
Approximate Site area	The site is approximately 100m x 100m
Site shape	The site is irregularly shaped
Current land use	The site is an area of unused grassland, bordered to the north by sports pitches, to the east by Heywood Sports Village and a carpark, to the south by West Starkey Street and to the west by a row of trees and properties along Cedar Avenue. The site is flat-lying and available ordnance survey mapping shows the site to have an approximate elevation of 115m AOD. The land to the north and the east is around 1m higher. The site is currently owned by Rochdale Borough Council and site access is available through Heywood Sports Village.
Surrounding land uses	The surrounding area has seen residential, commercial and industrial development over the years. Of note, several cotton mills and associated reservoirs are shown to be present within 200m of the site from the late 1800's. From 1911 a 'refuse destructor' is present 150-200m to the northeast of site and filter beds and tanks are present 150m to the southeast, until 1929 when a tank is shown in vicinity. From 1929 the Moss Iron Works are shown adjoining the Times Cotton Mill, 250m to the southeast. From 1957 the Times Mill (now an Electrical Engineering company) and the Iron Works have expanded significantly, until 1984 when the iron works is redeveloped as a Supermarket. The current Heywood Sports Village replaces a previous swimming pool and sports village directly east of the site. More recently the site was an old football pitch.



3 CONCEPTUAL SITE MODEL

The conceptual model, as presented in the desk study for the site has been revised considering the information obtained by SoilSafe during the site investigation works. This Revised Conceptual Site Model serves as the basis for any required remediation works.

3.1 GENERAL UNDERSTANDING OF THE GROUND MODEL

The following documents, reports etc have been provided to SoilSafe by Tilbury Douglas on behalf of The Department for Education for use in the preparation of this report:

- Mott MacDonald. October 2019. 'SEN Schools North West – Heywood Geotechnical and Geo-environmental Desk Study', Ref: 410640-03-A (Mott MacDonald, 2019);
- Mott MacDonald. August 2020. 'HVA SEND Schools North West – Heywood – Geological Technical Note', Ref: N/A (Mott MacDonald, 2020);
- Geotechnics. July 2020. 'Heywood School, Rochdale Factual Report – Ground Investigation', Ref: 9228L/ea2 (Geotechnics, 2020); and
- Coal Authority, October 2021. Consultants Coal Mining Report. Heywood Sports Centre, OL10 4TW, Ref. 51002685361001, 01.10.21.
- Ellis Williams, October 2021, Preliminary Landscape Masterplan, Rochdale SEND, Ref. RSC-EWA-ZZ-ZZ-DR-L-79001, REV P4.
- Hydrock, October 2021 Coal Mining Risk Assessment (Ref: 19522-HYD-XX-XX-RP-GE-0001).

A summary of the report findings are presented below:

Table 3-1: Summary of Geotechnical and Geoenvironmental Ground Investigation Reports to date

Site Setting	The history of the site has been reviewed from historical OS maps at various scales (as presented in the provided Geotechnical and Geo-environmental Desk Study) to identify any previous land use on site or nearby that may pose a geo-environmental risk to the proposed scheme. In summary, the site appears not to have changed from fields shown on the earliest available maps from 1851, until circa 1956, when four rows of houses are shown under construction on the southern half of the site. The houses ran north-south from West Starkey Street. However, by 1977 the properties are no longer present and the site is part of a larger playing field. The site has not been developed in the subsequent years. The surrounding area has seen residential, commercial and industrial development over the years. Of note, several cotton mills and associated reservoirs are shown to be present within 200m of the site from the late 1800's. From 1911 a 'refuse destructor' is present 150-200m to the northeast of site and filter beds and tanks are present 150m to the southeast, until 1929 when a tank is shown in vicinity. From 1929 the Moss Iron Works are shown adjoining the Times Cotton Mill, 250m to the southeast. From 1957 the Times Mill (now an Electrical Engineering company) and the Iron Works have expanded significantly, until 1984 when the iron works is redeveloped as a Supermarket. The current Heywood Sports Village replaces a previous swimming pool and sports village directly east of the site. More recently the site was an old football pitch.
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Geology	The superficial geology comprises Glaciofluvial Deposits (sand and gravel) present in the southwest and centre of the site with Glacial Till (clays, sands, gravels and cobbles) present over the remainder of the site. The solid geology comprises Pennine Lower Coal Measures Group, consisting of interbedded Mudstone, Siltstone, Sandstone and coal seams, of Carboniferous age. The Coal Mining Risk Assessment, states that two seams of coal (possibly the Arley Coal and Smith (Bottom Neddy) Coal), sub crop within 250m of the north-eastern corner of the site, with the one seam (possibly Smith Coal) being very close to the north-eastern corner of the site. The Arley Coal was formerly referred to as the Rowley Mine Coal. The abandonment plan (Ref 16820/6) shows the 'crop of the Royley Mine Coal' seam to the north east of the site area. A geological fault with a downthrow to the east, is located 300m to the west of the site. The ground conditions proven by a previous investigation (Geotechnics, 2020), comprise: • Made Ground (gravelly silty clayey SAND with cobbles) up to 0.90m bgl. • Peat (spongy fibrous PEAT with rootlets and plant remains) up to 0.80-2.60m bgl, increasing in thickness from southwest to northeast from 0.30 to 1.65m. • Alluvium (very soft to soft silty sandy gravelly CLAY grading to slightly sandy gravelly SILT) up to 5.50-7.00m bgl. • Interlayered Glacial Till (stiff sandy gravelly CLAY) and Glaciofluvial Deposits (medium dense gravelly silty SAND) to at least 12.50m bgl. As detailed in the previous report, the strata underlying the Peat and Made Ground has been classified as Alluvium. While a case can be made for classifying these clays as Alluvium, Hydrock believes this should be classified as Glacial deposits due to the unsorted nature of the clays encountered and the published BGS mapping information. The shallow ground conditions were described as soft and loose, with Peat being particularly susceptible to settlement via consolidation and compression.
Geology and Hydrogeology	The Glacial Till and Glaciofluvial Deposits present on site are classed by the Environment Agency as a Secondary undifferentiated Aquifer and are likely to provide a minor/very limited base flow contribution to the River Roch to the northwest. The Pennine Lower Coal Measures is classified as a Secondary A Aquifer and is inferred to provide minor base flow contribution to surface water bodies on a regional basis. The site is not in any Source Protection Zone and there are no active licensed groundwater abstractions within 250m of the site. The environmental data report indicates a potential for groundwater flooding of property situated below ground level and to occur at the surface. In the previous investigation, groundwater was struck at 10.70 - 10.90m bgl within Glaciofluvial Deposits and was recorded at 9.60 – 9.90m bgl across six monitoring visits. The primary natural drainage feature is the River Roch approximately 350m to the northwest, flowing east to west. Reference to the Environment Agency web site shows the site is located within the catchment of the North West River Basin District, with the specific river water body being the Roch Spodden to Irwell. The current (2019 cycle 2) overall status under the Water Framework Directive is 'moderate'.



	There are no licensed surface water abstractions within 250m of the site.
Soil Contamination – Human Health	The screening exercise has identified asbestos and chloromethane in Made Ground, and Peat at concentrations above the GAC. These are considered further below to assess if the exceedance may be acceptable with respect to the proposed development. The phrase ‘further assessment’ does not necessarily mean that the soil is ‘contaminated’ or not fit for use. No Asbestos Containing Materials have been identified visually. However, there were a number of exploratory hole locations where asbestos fibres (<0.001%v/v of chrysotile) have been detected in the Made Ground, which requires further consideration. Guidance on the assessment of risk associated with asbestos in soils was published by CIRIA C733 in 2014. This proposed a semi-quantitative risk assessment methodology for asbestos, based on potential for inhalation of airborne fibres. As many factors affect the potential magnitude of fibre inhalation in addition to concentration, it is not practicable to derive generic screening criteria for asbestos concentrations in soil. Risk factors applicable to this site are considered below: • No visible evidence of asbestos materials was noted in the exploratory holes, suggesting that asbestos materials are present only as very minor constituents in the soil. • Where asbestos was identified by laboratory testing, the concentration was assessed as being less than the limit of detection (0.001%). • Only chrysotile (white) asbestos fibres were identified. Chrysotile is the least hazardous of the three principal asbestos forms, most commonly associated with asbestos cement products. • Although the impacted soils might be excavated and disturbed, with consequent potential for fibre release during groundworks, future disturbance is likely to be minimal due to the requirement to import a clean topsoil/subsoil growing medium (proposed 450mm) or hardstanding cover. • The materials in which asbestos was identified were of mixed composition but included some clay content. The likelihood of asbestos fibres being released from cohesive materials is less than might be the case for loose material such as sand /silt. Overall, the risk associated with the identified presence of asbestos is considered to be low. However, mitigation will be required to ensure risks to site users remains negligible.
Soil Contamination – Controlled Waters	The EQS/DWS have been exceeded for a number of chemicals of potential concern in both the leachate samples (Made Ground and Peat) and groundwater sample from the Glaciofluvial Deposits. In the Made Ground the EQS was exceeded for ammoniacal nitrogen, pH and the DWS was exceeded for iron and pH. In the Peat, EQS was slightly exceeded for copper. In the Glaciofluvial Deposits the EQS was exceeded for manganese and ammoniacal nitrogen, as well as the petroleum hydrocarbon fractions Aliphatic >EC8-EC10 to >EC12-EC16 and Aromatic >EC10-EC12 to >EC21-EC35. The DWS was exceeded for manganese and the petroleum hydrocarbon fractions Aliphatic >EC8-EC10 to >EC12-EC16 and Aromatic >EC10-EC12 to >EC21-EC35 (see below). Whilst there are exceedances of the water quality targets, excluding the petroleum hydrocarbons, these are considered not to represent a significant risk of pollution of Controlled Waters for the following reasons:



**Ground Gas Risk
Assessment**

- Many of the exceedances are only slight;
- Chemicals such as ammonium are likely to be related to the long-term degradation of organic materials found in the clays and silts of the Made Ground, Peat or Glacial Deposits;
- The inland waters EQSs for copper, manganese, are based on the bioavailable fraction and because bioavailability has not been calculated for these metals, the assessment is conservative as it assumes 100% bioavailability; and
- The Pennine Lower Coal Measures Secondary A Aquifer is separated from the Made Ground and Peat above it by more than 10m of low-permeability clay. The River Roch, is in turn separated from the site by a distance of 350m.

There is currently no explanation for the hydrocarbon content of the groundwater sample from BH0102, as no visual or olfactory evidence of petroleum hydrocarbons, has been noted within the surrounding soils in BH102 or in any of the surrounding exploratory holes. This discovery will be subject to additional testing to rule out either cross-contamination or a laboratory reporting error.

On 13/01/2022 the monitoring well at BH102 was developed and a sample of the groundwater was collected for chemical analysis. There was no visual or olfactory evidence of contamination on the water that was purged or sampled from BH102. The chemical analysis results of the groundwater show all hydrocarbons to be below the limit of detection.

On this basis, and given that there has been no viable source of hydrocarbons identified on site it would be justified to suggest that the elevated concentrations identified in the previous investigation is a result of possible cross-contamination or a laboratory reporting error. No further consideration to petroleum hydrocarbons in groundwater is required.

computed GSV for carbon dioxide indicates CS2 conditions, with methane classifying as CS1. As such, given the frequently detected concentrations of carbon dioxide above 5% in the peat deposits in addition to the sensitivity of the site redevelopment as a school facility, it would be appropriate to classify the site as Characteristic Situation 2.

Within the PLCM flow rate and steady methane concentrations remained below the limit of detection, and steady carbon dioxide concentrations did not exceed 0.2%. Peak carbon monoxide was recorded at 108ppm in RO01 on one occasion, however the steady levels ranged between 5ppm and 14ppm. As such the computed GSV for carbon dioxide and methane indicates CS1 conditions. Peak carbon monoxide was detected at 108ppm on one occasion in the PLCM, however this is considered to be a spurious reading resulting from the groundwater level exceeding the response zone, hence the steady carbon monoxide on the same occasion falling to 7ppm.

On the basis that the computed GSV for the PLCM is CS1 and that mitigation measures are required for all new buildings commensurate with CS2 Conditions due to gassing peat deposits then no uplift from CS2 conditions are considered necessary.

Mitigation of the risk from ground gases needs to be undertaken in accordance with BRE 414, CIRIA 665, BS 8485:2015 +A1:2019, CIRIA C735. In accordance with BS 8485:2015 +A1:2019, the design of gas protection



measures needs to be undertaken in accordance with the Characteristic Situation and the building type:

- The site is classified as Characteristic Situation 2.
- The school is classified as a type C building, as such requires 2.5 points of protection.

3.2 REVISED CONCEPTUAL MODEL

The revised conceptual site models taken from the Hydrock Ground Investigation Report (Ref: 19522-HYD-XX-XX-RP-GE-0002) outlines the source-pathway-receptor linkages identified for the site. The below conceptual site model was produced:

3.2.1 Sources

- Human Health: Presence of low level asbestos within Made Ground soils.
- Carbon dioxide from biodegradable matter in the Peat.
- TPH in soils in the northeast of the site.

3.2.2 Pathways

- Dermal contact, ingestion and inhalation of contaminated dust and fibres.
- Migration through soils or groundwater to indoor air.
- Direct contact

3.2.3 Receptors

- Future users of the Site.
- End users of new buildings (asphyxiation).
- Plastic pipes
- Site investigation, demolition and construction staff and future underground service maintenance workers from hazardous short-term exposure

3.3 UNCERTAINTIES

- Any potential sources of contamination that were missed during the ground investigation works.
- Any unrecorded geological features.
- Any unrecorded pollution events during the Site's history.
- Any unrecorded underground storage tanks or unreported spillages/leaks.

Based on the chemical testing carried out on the shallow soils and groundwater, the pollutant linkages identified in the Preliminary Conceptual Site Model have been revised. A revised pollutant linkage table is presented in Table 3-2 below.



Table 3-2 – Revised Conceptual; Site Model

Pollutant linkage				
	Source	Pathway(s)	Receptor(s)	Qualitative risk assessment
1	Human Health: Presence of Asbestos and PAHs within Made Ground soils.	Dermal contact, ingestion and inhalation of contaminants including contaminated dust migration during construction.	Future site users (School)	Mild x Unlikely = Negligible Risk
			Current site users (site visitors)	Mild x Unlikely = Negligible Risk
			Adjacent site users (commercial and residential)	Mild x Unlikely = Negligible Risk
			Construction, site investigation, demolition and future workers	Medium x Unlikely = Low Risk
2	Carbon dioxide from biodegradable matter in the Peat.	End users of new buildings (asphyxiation).	Future site users (School)	Medium x Unlikely = Low Risk
3	TPH in soils in the northeast of the site.	Direct Contact	Plastic Pipes	Medium x Unlikely = Low Risk



4 REMEDIATION STRATEGY

4.1 ANTICIPATED REMEDIAL WORKS

Based upon the findings of the site investigation and the proposed development plans, the following Remediation Strategy has been devised in order to make the site safe and suitable for redevelopment.

4.2 ANTICIPATED REMEDIAL WORKS

Based upon the findings of the site investigation by others and the proposed development plans, the following Remediation Strategy has been devised in order to make the site safe and suitable for redevelopment.

If the current development plans change in a manner such that Made Ground soils are present at the surface in areas of soft landscaping, the following remediation strategy should be adhered to.

- General site clearance.
- Removal of all peat soils and replacement with imported soils under MMP (separate to this report).
- Placement of barrier pipe in the northeast of the site.
- Installation of ground gas protection measures.
- Implementing a 600mm thick clean cover system in areas of soft landscaping to YALPAG specification.



5 PROPOSED PILING WORKS

The proposed development is to be founded on piles using continuous flight auger methods. A layout of the proposed piles along with the termination depths and dimensions is included in Appendix C as Drawing FS0911-AJP-ZZ-00-D-S-1000.

The scope is due to comprise 152 CFA piles at 450mm diameter into either glacial soils below.

5.1 PILING METHOD

The piling method to be utilised for this development are Continuous Flight Auger (CFA) piles which will be installed using a CFA piling rig. The piles are to be drilled using boring methods to the final founding depth. The rotation of the auger will bring spoil to surface level. Upon reaching the founding depth concrete will be poured down the hollow stem at a controlled rate as the auger is steadily withdrawn. Throughout this process the auger will constantly be full of spoil arisings. A steel reinforcement cage is inserted into the liquid concrete immediately following the withdrawal of the auger and laying of concrete.

This method of piling ensures that the sides of the holes are constantly supported by the soil-filled auger, reducing any chance of leachable contaminants migrating downwards. The immediate injection of concrete following the drilling process ensures the void created by the boring is immediately plugged. This method causes a closing of any pathway that could have been exposed.

5.2 PILE DEPTHS AND POTENTIAL FOR INTERSECTING DEEP AQUIFER

The Glacial Till and Glaciofluvial Deposits present on site are classed by the Environment Agency as a Secondary undifferentiated Aquifer and are likely to provide a minor/very limited base flow contribution to the River Roch to the northwest. The Pennine Lower Coal Measures is classified as a Secondary A Aquifer and is inferred to provide minor base flow contribution to surface water bodies on a regional basis. The site is not in any Source Protection Zone and there are no active licensed groundwater abstractions within 250m of the site.

As stated previously the piling scope is due to comprise 152 CFA piles, which are proposed to terminate at depths varying between 8m and 10m. Of the 152 piles, all are due to terminate within the Glaciofluvial Sands (at $\geq 10\text{m}$ bgl) and so will potentially intersect the deep aquifer. In the event the deep aquifer, which is considered to be in hydraulic continuity with the Pennine Lower Coal Measures below and therefore Secondary A Aquifer, is intersected the potential for contamination into the wider groundwater body must be considered. The following Foundation Works Risk assessment will consider the potential risks associated with groundwater contamination from pile installation and the appropriate mitigation measures.



6 FOUNDATION WORK RISK ASSESSMENT

It is intended that this report will assess the proposed foundation solution which has been proposed to be employed at the Site, specifically with respect to risk from creation of preferential pathways and associated vertical migration of potential contaminants and risks to construction workers.

Reference has been made, in the preparation of this assessment, to the Environment Agency guidance document 'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention', May 2001 (reference: NC/99/73).

6.1 FOUNDATION WORKS RISK ASSESSMENT APPROACH

Hazard identification has been undertaken to identify potential adverse environmental impacts in a site-specific context. The presence of environmental receptors that could be harmed is defined by the hydrogeological properties of the underlying strata.

EA Guidance states that concerns regarding water protection are likely to be acute when:

- Contaminants are present on site and ground works could allow them to migrate;
- Piling would breach an aquitard (in this case the Glacial Till) and/or capping layer or connect to previously discrete aquifers (Pollution Scenarios 1 and 2);
- The site overlies a Secondary A Aquifer or other sensitive aquifer;
- The site is not located within a Source Protection Zone (SPZ);
- Groundwater is currently of good quality;
- Water table is shallow or likely to be intersected by piles;
- The deep geological strata are fractured or fissured;
- Works are not close to a surface water body and run-off from arisings are very unlikely to pollute waters.

In addition to the above, the Environment Agency has identified other pollution scenarios that may be of particular concern:

- Direct contact of site workers and others with contaminated soil arisings that have been brought to the surface (Pollution Scenario 3);
- Direct contact of the piles or engineered structures with contaminated soils or leachate causing degradation of materials that causes structural issues or possibly creating migration pathways (Pollution Scenario 4);
- Pushing of solid contaminants down into an aquifer during pile driving (Pollution Scenario 5);
- Contamination of groundwater and, subsequently, surface waters by wet concrete, cement paste or grout (Pollution Scenario 6)

The report below has been structured in line with the 'Risk assessment flowchart' (Figure 6.1) presented in the EA Guidance



6.2 SITE BACKGROUND

The geoenvironmental risk assessment works have demonstrated measured concentrations of low level asbestos and widespread Polycyclic Aromatic Hydrocarbons (PAHs) that present in soils which potentially significant risk to human health.

Localised low level exceedances in are considered typical within an area of significant historical development within an urban environment, particularly one with previous developmental usages. These are not considered to present a significant risk to controlled waters.

In terms of receptors the nearest groundwater abstraction license is located 250m of the Site boundary.

In considering the overall risk to controlled waters the following factors have been considered:

- PAHs have a low mobility in the water environment and the nearest abstraction license is 250m of the Site.
- The cohesive soils of the Glacial Till would act to prevent the downward migration of any shallow PAH impacted groundwater into the underlying aquifer.

Based on the above, the site is not considered to present a risk to controlled waters.

Furthermore, in consideration of the industrial heritage of the surrounding area it was suggested in the GI report that the elevated concentrations of inorganic contaminants identified in the deep groundwater may have migrated onto the Site from off Site sources. Given the marginal nature of the exceedances and the relatively low sensitivity of the controlled waters receptors, it was not considered that the reported concentrations were evidence of pollution of controlled waters from an on-site source.

The low sensitivity of the aquifer system beneath the Site is, in part, a function of the historical industrial past of the surrounding area and the presence of an aquitard that appears to have prevented historical pollution of the deeper aquifer from off-site sources in the surrounding area (i.e. out with the Site boundary). The regional shallow groundwater quality is likely to be poor and of limited resource potential. It is within these controlled waters sensitivity context that the piling risk assessment, presented in the following section, has been developed.

6.3 GROUND CONDITIONS AND PREFERRED FOUNDATION SOLUTION DETERMINATION

Due to the excessive depth to suitable ground in parts of the site and the anticipated high loads associated with the majority of the proposed buildings, it was considered that shallow foundations did not represent an economic or technically sound foundation solution.

Given the encountered ground conditions and the nature of the proposed development, the most likely foundation solution recommended was a piled solution. This would need to be adopted for the entire structure, dependent upon the design requirements and economic feasibility.

Piles were considered likely to be the most appropriate solution due to the anticipated loads and the absence of a suitable founding stratum at shallow depth.



It was considered that vibro displacement ground improvement was not a viable option. Driven piles were not considered suitable due to the proximity of adjacent commercial and residential properties due to the risk of vibration damage.

On the basis of the above, a Continuous Flight Auger (CFA) technique was considered the preferred piling solution. It is anticipated that the piling solution will comprise CFA piles toed into the glacial soils and are anticipated to be 450mm in diameter and around 8-10m in length.

6.4 FOUNDATION WORKS RISK ASSESSMENT

SoilSafe Ltd have identified potentially adverse environmental impacts and undertaken a site specific assessment of the identified potential risks in line with the considerations detailed in the 'Foundation Works Risk Assessment Approach' section of this report. The assessment has been undertaken assuming a preferred CFA piling technique will be employed, based on the structural, geotechnical and commercial considerations described in the section above.



7 ASSESSMENT OF POLLUTION SCENARIOS

When considering the potential pollutant linkages and the potential for CFA piles creating adverse conditions for the wider environment both above and below ground level, the Environment agency outlines seven pollution scenarios which should be considered when implementing deep foundation solutions for a Site. These scenarios are outlined and assessed below.

7.1 POLLUTION SCENARIO 1 - CREATION OF PREFERENTIAL PATHWAYS THROUGH AN AQUITARD TO ALLOW POTENTIAL CONTAMINATION OF AN AQUIFER

The most prominent risk to receptors for the site is the Pollution Scenario 1. In this case the piles can create a preferential pathway for the contaminants within the perched groundwater through a low permeability aquitard, in this case the Glacial Till, into the deeper permeable aquifer, in this case the Pennine Lower Coal Measures (Secondary A Aquifer).

The potential risk is that the installation of the CFA piles will create a preferential pathway for dissolved contaminants to migrate downwards through the cohesive deposits, which is acting as an aquitard, and into the deeper Pennine Lower Coal Measures Aquifer.

the piling scope is due to comprise 152 CFA piles, which are proposed to terminate at depths varying between 8m and 10m. Of the 152 piles, all are due to terminate within the Glaciofluvial Sands (at $\geq 10\text{m}$ bgl) and so will potentially intersect the deep aquifer. In the event the deep aquifer, which is considered to be in hydraulic continuity with the Pennine Lower Coal Measures below and therefore Secondary A Aquifer, is intersected the potential for contamination into the wider groundwater body must be considered. The following Foundation Works Risk assessment will consider the potential risks associated with groundwater contamination from pile installation and the appropriate mitigation measures.

7.1.1 Contamination Assessment

The site is currently an area of unused grassland (a former sports pitch). The site is underlain by varying layers of Made Ground, underlain by Peat, between 0.35m and 3.00m bgl, comprising plastic to firm black and brown fibrous PEAT with wood fragments; over • Glacial Deposits (Glacial Till and Glaciofluvial Deposits) between 0.80m to >12.45m bgl, comprising soft sandy slightly gravelly CLAY, with occasional bands of clayey gravelly SAND of varying thickness. It is the intention of the client to remove all peat and replace with imported soils, some of which may comprise Made Ground. In addition, site won Made Ground soils may be used if deemed geotechnically suitable. The building will then be piled with a suspended floor slab.

Several phases of ground investigation have been undertaken at the site. It was identified within these reports that there is a low to moderate risk regarding asbestos and potential contaminated soils:

Human health:

- Asbestos fibres (<0.001%v/v of chrysotile) measured in soil samples in the Made Ground.
- Chloroethene (vinyl chloride) has been tested in the original investigation, all results were recorded as less than the laboratory limit of detection. It should be noted, the limit of detection is in excess of the GAC but Hydrock do not believe this poses a risk.



- Slightly elevated concentrations of Chloromethane (maximum value of 0.033mg/kg vs a GAC of 0.019mg/kg).

Plant growth:

- No exceedances.

Controlled Waters:

- Soil leachate and groundwater samples exceed WQT for Copper, Iron, Manganese, Ammoniacal Nitrogen, pH and petroleum hydrocarbons fractions, as an indicator of potential groundwater risk.

Ground gases or vapours:

- Moderate risk from ground gases and CS2 conditions apply.

Radon:

- The site is not in a Radon Affected Area.

Water supply pipes:

- This is a brownfield site and the presumption in the guidance is that barrier pipe will be used; however, the investigation and assessment has indicated no significant Contaminants of Concern and as such standard pipework may be suitable for the site following negotiations with the supply company.

7.1.2 Potential Migration of Contaminants into Secondary A Aquifer

At the time of writing the piling scheme has not been developed to include for specific pile lengths throughout the development. The CFA piles at their deepest design depth will be likely be terminated in the Glacial Till, with no requirements to extend beyond this and into the Pennine Lower Coal Measures below. The deepest pile is due to be terminated at 10m bgl, this would allow a significant vertical distance between the pile end and the Pennine Lower Coal Measures aquifer.

Ultimately, whilst the piles may come into contact with the Glaciofluvial aquifer, none of the piles will come into contact with the Pennine Lower Coal Measures, thus rendering the risk of the piles causing turbidity to be negligible, and the downward transfer of contaminants from shallow perched groundwater into the Pennine Lower Coal Measures to be very low. Furthermore, as discussed the boring method and installation of CFA piles greatly reduces the potential for a preferential pathway to form allowing the migration of shallow contaminants to depth.

Furthermore, the intergranular flow within Glaciofluvial soils is low, subsequently creating a low flow velocity, therefore the attenuation of any contaminants is high and the potential distance they will travel is low.



7.2 POLLUTION SCENARIO 2 - CREATION OF PREFERENTIAL PATHWAYS THROUGH A LOW PERMEABILITY SURFACE LAYER, ALLOWING MIGRATION OF LANDFILL GAS, SOIL GAS OR CONTAMINANT VAPOURS TO THE SURFACE

As outlined in previously the ground gas risk assessment has defined the Site as CS2, for which basic gas protection measures are deemed to be required. Furthermore, there is no confining layer between the surface and the shallow deposits which may provide a source of ground gas (Made Ground & Peat). The Glacial Till are considered to be a confining layer due to their low permeability; however, the underlying strata are not considered to be a source of ground gas and so the risk is considered negligible.

7.3 POLLUTION SCENARIO 3 - DIRECT CONTACT OF THE PILES OR ENGINEERED STRUCTURES WITH CONTAMINATED SOIL OR LEACHATE CAUSING DEGRADATION OF MATERIALS

There have been recorded exceedances for PAHs above the relevant GAC within the shallow soils recorded samples of asbestos fibres at <0.001% mass. An adoption of the industry best practice and suitable risk assessment will reduce the risk to the construction workers.

7.4 POLLUTION SCENARIO 4 - DIRECT CONTACT OF THE PILES OR ENGINEERED STRUCTURES WITH CONTAMINATED SOIL OR LEACHATE CAUSING DEGRADATION OF MATERIALS

Soil chemistry tests to determine the potential for aggressive ground were performed on samples recovered during the ground investigation. Based on the results, the soils are classified as DS-1, and, assuming the mobile groundwater AC-1z.

7.5 POLLUTION SCENARIO 5 - THE PUSHING OF SOLID CONTAMINANTS DOWN INTO AN AQUIFER DURING PILE DRIVING

The boring technique used in the installation of a CFA pile minimises the potential for contaminated soils to migrate downwards as the soils are continuously brought up to the surface. The bored hole is also then filled with concrete immediately after exhumation, further minimising any downward migration. It is likely that rotary core piles would involve the extraction of the soil prior to placing the pile, which will not in normal circumstances lead to soil being dragged downwards.

7.6 POLLUTION SCENARIO 6 – CONTAMINATION OF GROUNDWATER AND, SUBSEQUENTLY, SURFACE WATERS BY WET CONCRETE, CEMENT PASTE OR GROUT

The nearest surface water receptor is the River Roch; however, given this is a significant distance from the site, the pathway is effectively removed and the risk negligible.

Where CFA piles require the casting of concrete directly against soil, or the use of bentonite slurry as a lubricant as there is a potential for the leaching of wet concrete, cement paste or



grout into fast flowing groundwater. Where permanent casing protects the wet concrete from contact with the groundwater until it has been allowed to set, this potential is reduced or eliminated. Volumes of cement can be monitored during piling, to monitor if any significant loss is noted and piling works may be ceased immediately. Significant thickness of low permeability Clays means risk through the majority of the pile is minimal.

It is recommended that concreting is to be undertaken under nominal pressure (i.e. not injected under pressure) to ensure that concrete is not lost through granular materials or fractures. Rig operator and concrete pump operator to work closely to monitor concrete flow during installation of piles. Concrete mix consistency and strength designed for the ground conditions by specialist piling contractor as detailed in method statements

7.7 POLLUTION SCENARIO 7 – OFF SITE HUMAN HEALTH RECEPTORS

There is a risk of dust being generated through the piling works which may pose a risk to on and off-site receptors. The contractor will be required to ensure the risk of dust entering the atmosphere is minimised using wetting and other suppressive techniques. Any waste soils to be removed from site must be handled in accordance with the Duty of Care.



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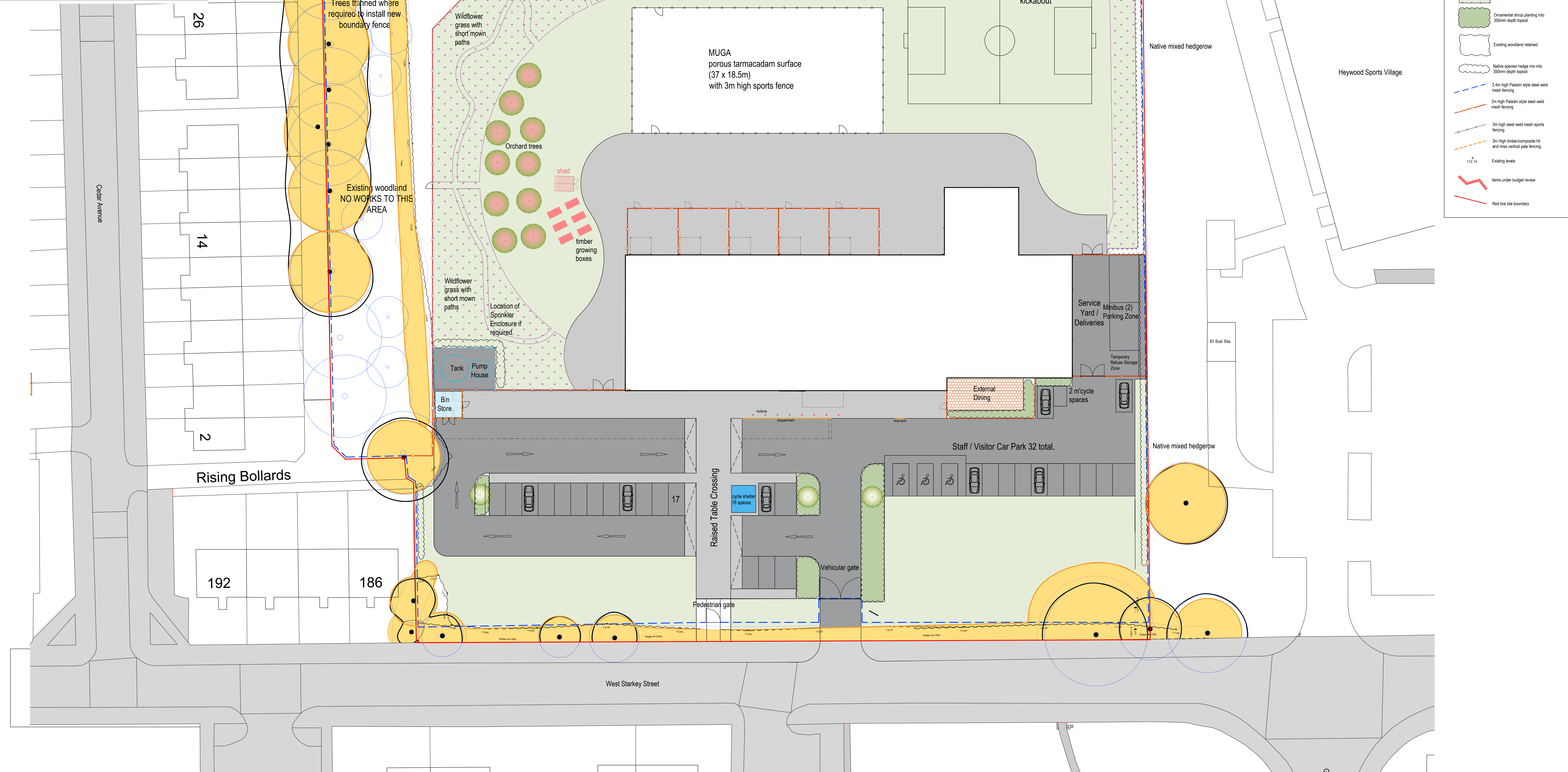
Piling and Penetrative Ground Improvement Methods on Land Affected By Contamination: Guidance on Pollution Prevention, NGWCL Centre Project NC/99/73



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APPENDIX A – DRAWINGS

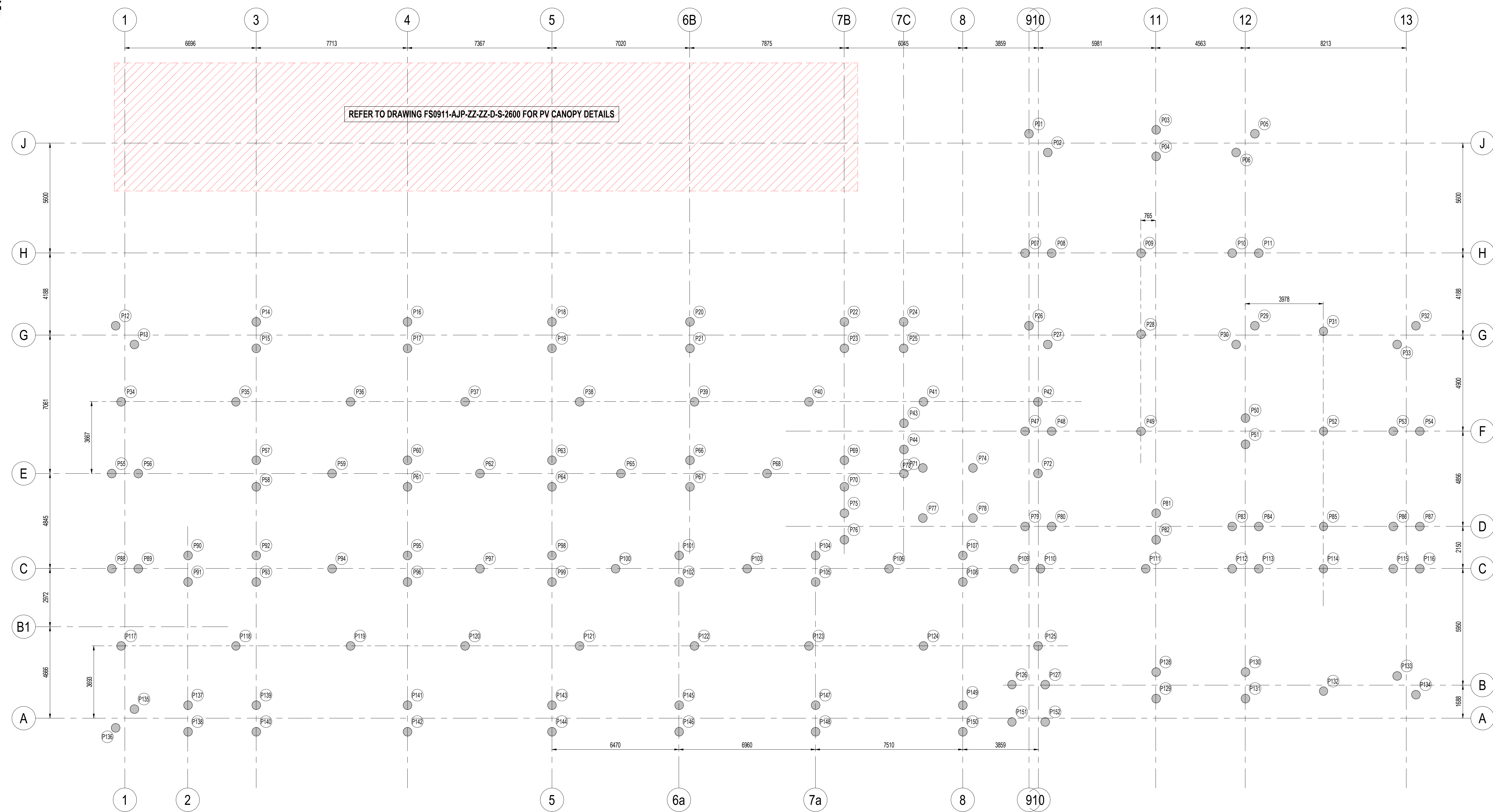
BB104 Site Areas		
For special schools without formal teams games		
Recommended min. external areas for all special schools	BB104 Area (m2)	Proposed Area (m²)
Soft Outdoor PE	n/a	91
Hard Outdoor PE	276	685 (MUGA)
Soft informal and social areas	752	1711
Hard informal and social areas	752	1264
Habitat areas	276	3179
Float	3184	-
Non-net area	6096	5700
Min. recommended Site area (BB104)	11336	
Max. recommended Site area (BB104)	14,692	
Proposed Site Area		12630
Cost Plan GIFA	2,224	
Proposed GIFA	2,224	
Min. Building GIFA (BB104)	2,152	
Max. Building GIFA (BB104)	2,504	





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APPENDIX B - PILE SCHEDULE AND LAYOUT



	WARNING RISK INDICATES A RESIDUAL RISK AS A WARNING.
	COMPULSORY RISK INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION.
	PROHIBITIVE RISK INDICATES A RESIDUAL RISK REQUIRING A PROHIBITIVE ACTION.
	INFORMATION RISK INDICATES A RESIDUAL RISK FOR INFORMATION

FOUNDATION SOLUTION IS PRELIMINARY AND SUBJECT TO ONGOING SITE INVESTIGATIONS AND GEO-ENVIRONMENTAL CONSULTANT INPUT. PILE TYPE AND DIAMETERS TO BE DEVELOPED WITH PILING SPECIALIST TO SUIT FURTHER SITE INVESTIGATION FINDINGS AND GROUND IMPROVEMENT SOLUTION CFA PILE TYPE CURRENTLY ASSUMED.

REFER TO DRAWING
SRP1051-AJP-ZZ-FN-DR-S-1009-PILE SCHEDULE FOR
PILE SCHEDULE DATA

 NOTE RESTRICTED NATURE / ACCESS OF SITE. CONTRACTOR TO DEVELOP SAFE SYSTEMS OF WORK INCLUDING ALL NECESSARY PROTECTIONS, ACCESS & LIFTING ARRANGEMENTS

DRAWING STATUS:

CLIENT: **TILBURY DOUGLAS**

ARCHITECT: EWA | ELLIS WILLIAMS ARCHITECTS

PROJECT: **ROCHDALE SEND**

TITLE: **PILING LAYOUT**

SCALE @ A1: 1:100	DESIGNED: FC	DRAWN: GO	CHECKED: PB	APPROVED: PB	DATE: JUNE '23
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Piling Schedule						
Pile Reference	Pile Diameter	Safe Working Load (kN)	Horizontal Load (kN)	Co-ordinates		Cut Off Level
				X	Y	
P01	450	175	50			
P02	450	225	50			
P03	450	250	0			
P04	450	225	0			
P05	450	175	0			
P06	450	200	0			
P07	450	175	15			
P08	450	325	15			
P09	450	350	0			
P10	450	300	15			
P11	450	200	15			
P12	450	200	10			
P13	450	250	10			
P14	450	425	15			
P15	450	375	15			
P16	450	425	15			
P17	450	400	15			
P18	450	425	15			
P19	450	400	15			
P20	450	425	15			
P21	450	400	15			
P22	450	325	20			
P23	450	300	20			
P24	450	275	0			
P25	450	250	0			
P26	450	400	0			
P27	450	350	0			
P28	450	400	0			
P29	450	350	0			
P30	450	325	0			
P31	450	250	15			
P32	450	200	75			
P33	450	225	75			
P34	450	175	0			
P35	450	350	0			
P36	450	325	0			
P37	450	325	0			
P38	450	325	0			
P39	450	325	0			
P40	450	325	0			
P41	450	350	0			
P42	450	250	0			
P43	450	200	0			
P44	450	200	0			
P47	450	275	0			
P48	450	375	0			
P49	450	375	0			
P50	450	450	0			
P51	450	450	0			
P52	450	350	0			

Piling Schedule						
Pile Reference	Pile Diameter	Safe Working Load (kN)	Horizontal Load (kN)	Co-ordinates		Cut Off Level
				X	Y	
P53	450	325	0			
P54	450	200	0			
P55	450	225	0			
P56	450	425	0			
P57	450	550	0			
P58	450	550	0			
P59	450	275	0			
P60	450	500	0			
P61	450	500	0			
P62	450	275	0			
P63	450	475	0			
P64	450	475	0			
P65	450	275	0			
P66	450	500	0			
P67	450	500	0			
P68	450	300	0			
P69	450	400	45			
P70	450	350	45			
P71	450	375	0			
P72	450	175	0			
P73	450	275	0			
P74	450	350	0			
P75	450	250	15			
P76	450	200	0			
P77	450	175	0			
P78	450	125	0			
P79	450	200	0			
P80	450	425	0			
P81	450	400	0			
P82	450	400	0			
P83	450	375	0			
P84	450	325	0			
P85	450	300	0			
P86	450	275	0			
P87	450	150	0			
P88	450	225	0			
P89	450	300	0			
P90	450	275	0			
P91	450	300	0			
P92	450	475	0			
P93	450	475	0			
P94	450	275	0			
P95	450	525	0			
P96	450	525	0			
P97	450	300	0			
P98	450	500	25			
P99	450	500	25			
P100	450	275	0			
P101	450	450	0			
P102	450	450	0			

Piling Schedule						
Pile Reference	Pile Diameter	Safe Working Load (kN)	Horizontal Load (kN)	Co-ordinates		Cut Off Level
				X	Y	
P103	450	275	0			
P104	450	425	0			
P105	450	425	0			
P106	450	275	0			
P107	450	400	0			
P108	450	400	0			
P109	450	175	0			
P110	450	225	0			
P111	450	350	0			
P112	450	350	0			
P113	450	300	0			
P114	450	275	0			
P115	450	275	0			
P116	450	175	0			
P117	450	175	0			
P118	450	350	0			
P119	450	325	0			
P120	450	325	0			
P121	450	325	0			
P122	450	325	0			
P123	450	325	0			
P124	450	350	0			
P125	450	200	0			
P126	450	225	0			
P127	450	275	0			
P128	450	300	0			
P129	450	325	0			
P130	450	275	0			
P131	450	275	0			
P132	450	225	0			
P133	450	225	0			
P134	450	175	0			
P135	450	225	0			
P136	450	225	0			
P137	450	275	0			
P138	450	250	0			
P139	450	325	0			
P140	450	350	0			
P141	450	425	0			
P142	450	450	0			
P143	450	400	0			
P144	450	425	0			
P145	450	375	0			
P146	450	400	0			
P147	450	400	0			
P148	450	425	0			
P149	450	300	0			
P150	450	325	0			
P151	450	75	0			
P152	450	125	0			

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH
DRAWING "FS0911-AJP-ZZ-ZZ-DR-S-0001"
WHICH CONTAINS ALL GENERAL NOTES

GENERAL NOTES

- THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS, ARCHITECTS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
- ALL RELEVANT DIMENSIONS TO BE OBTAINED/CHECKED AGAINST ARCHITECT'S DRAWINGS AND BY SITE MEASUREMENT PRIOR TO THE COMMENCEMENT OF WORKS OR ORDERING OF MATERIALS. DISCREPANCIES BETWEEN THE DRAWINGS AND SITE CONDITIONS TO BE NOTIFIED TO THE ENGINEER.
- DO NOT SCALE FROM THIS DRAWING.
- ALL STRUCTURAL WORKS TO BE CARRIED OUT STRICTLY IN ACCORDANCE WITH THE DETAILS GIVEN BY THE ALAN JOHNSTON PARTNERSHIP LLP. THE ENGINEER IS TO BE ADVISED OF ANY SIGNIFICANT VARIATION PRIOR TO ITS IMPLEMENTATION.
- SETTING-OUT OF WALLS TO BE IN ACCORDANCE WITH LATEST RELEVANT ARCHITECT'S DRAWING.
- MATERIALS OR WORKMANSHIP NOT COMPLYING WITH THE ENGINEERS DRAWINGS AND SPECIFICATION SHALL BE DEEMED UNACCEPTABLE AND REMOVED FROM SITE AND REPLACED WITH WORK CORRECTLY MANUFACTURED, DELIVERED AND ERECTED.
- THE SYMBOLS REPRESENTED ON THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH BS 8541-2.

KEY TO H&S SYMBOLS



WARNING RISK
INDICATES A RESIDUAL RISK AS A WARNING.



COMPULSORY RISK
INDICATES A RESIDUAL RISK
REQUIRING A COMPULSORY ACTION.



PROHIBITIVE RISK
INDICATES A RESIDUAL RISK
REQUIRING A PROHIBITIVE ACTION.



INFORMATION RISK
INDICATES A RESIDUAL RISK FOR INFORMATION.

PIILING MATT REQUIREMENTS TO BE CONFIRMED SUBJECT TO SITE INVESTIGATION AND PILING RIG REQUIREMENTS.
ALLOW 6F2 / 6 F5 MAT AND GEO-GRID.

GROUND STABILISATION / IMPROVEMENT REQUIRED TO PROVIDE SAFE WORKING PLATFORM. ALL TO BE DEVELOPED WITH SPECIALIST INPUT AND GEO-ENVIRONMENTAL ENGINEER.

FOUNDATION SOLUTION IS PRELIMINARY AND SUBJECT TO ONGOING SITE INVESTIGATIONS AND GEO-ENVIRONMENTAL CONSULTANT INPUT. PILE TYPE AND DIAMETERS TO BE DEVELOPED WITH PILING SPECIALIST TO SUIT FURTHER SITE INVESTIGATION FINDINGS AND GROUND IMPROVEMENT SOLUTION. CFA PILE TYPE CURRENTLY ASSUMED.

PILE DIAMETERS INDICATED ARE MAXIMUM AND SUBJECT TO DEVELOPMENT OF FOUNDATION SOLUTION AND CONFIRMATION BY PILING SPECIALIST



THE CONTRACTOR IS TO PROVIDE A BELOW GROUND SERVICES SURVEY PRIOR TO COMMENCEMENT OF ANY FOUNDATION WORKS ON SITE.



DEEP EXCAVATIONS ARE TO BE GUARDED TO PREVENT UNAUTHORISED ACCESS.



THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING DRAINS/SEWERS WITHIN THE SITE BOUNDARY TO ASCERTAIN REQUIREMENTS FOR DIVERSION OR REMOVAL.



DEEP EXCAVATIONS ARE TO BE GUARDED TO PREVENT UNAUTHORISED ACCESS AND PREVENT WORKING FROM HEIGHT



EXISTING BELOW GROUND SERVICES MAY BE PRESENT. GROUND WORKS CONTRACTOR TO DEVELOP SAFE SCHEME OF WORKS PRIOR TO COMMENCEMENT ON SITE.



REFER TO DRAWING SRP1051-AJP-ZZ-FN-DR-S-1009 -PILE SCHEDULE FOR PILE SCHEDULE DATA



REFER TO M&E CONSULTANT INFORMATION / UTILITIES SURVEYS FOR DETAILS OF SERVICES CROSSING SITE. FURTHER UNKNOWN BELOW GROUND SERVICES MAY BE PRESENT. CONTRACTOR TO DEVELOP SAFE SYSTEM OF WORKS PRIOR TO COMMENCEMENT ON SITE



THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES WITHIN THE SITE BOUNDARY TO ASCERTAIN REQUIREMENTS FOR PROTECTING / DIVERTING.



THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING DRAINS/SEWERS WITHIN THE SITE BOUNDARY TO ASCERTAIN REQUIREMENTS FOR DIVERSION OR REMOVAL



CONTRACTOR TO PROVIDE SAFE WORKING PLATFORM FOR SITE PLANT, INCLUDING ALL NECESSARY PLATFORM CALCULATIONS AND TESTING TO VERIFY SUITABILITY AGAINST CHOSEN PLANT



NOTE RESTRICTED NATURE / ACCESS OF SITE. CONTRACTOR TO DEVELOP SAFE SYSTEMS OF WORK INCLUDING ALL NECESSARY PROTECTIONS, ACCESS & LIFTING ARRANGEMENTS

P03	22.09.23	STAGE 4 ISSUE	GO	PB
P02	11.08.23	STAGE 4 ISSUE	GO	PB
P01	12.06.23	STAGE 3 ISSUE	GO	PB
REV	DATE	DESCRIPTION	BY	APP

DRAWING STATUS

STAGE 4

CLIENT:

TILBURY DOUGLAS

ARCHITECT:

EWA | ELLIS WILLIAMS ARCHITECTS

PROJECT:

ROCHDALE SEND

TITLE:

PILE SCHEDULE

STATUS: S3

PROJECT No: 223-018

PROJECT: FS0911 - AJP- ZZ - ZZ - D - S - 1009

REV: P03

SCALE @ A1: 1:100

DESIGNED: FC

DRAWN: GO

CHECKED: PB

APPROVED: PB

DATE: AUG' 23



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APPENDIX C- GLOSSARY OF TERMS

ACEC	Aggressive Chemical Environment for Concrete (classification)
aOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
BRE	Building Research Establishment
CBR	California Bearing Ratio (test)
COMAH	Control of Major Accident Hazards (regulations)
Designated location	Site (and the ecosystem on that site) protected under national or international legislation. A potential ecological receptor to be considered as part of the assessment of land contamination. Example designated locations include SSSIs (q.v.), SACs (q.v.), national nature reserves, Ramsar sites and bird special protection areas.
DQA	Data Quality Assessment
DQO	Data Quality Objective
DQRA	Detailed Quantitative Risk Assessment
DWS	Drinking Water Standard
EQS	Environmental Quality Standard
GAC	Generic Assessment Criterion
GQA	General Quality Assessment (Environment Agency)
GSV	Gas Screening Value
HCV	Health Criteria Value
IPPC	Integrated Pollution Prevention and Control (regulations)
KOW	Octanol-water partition coefficient
LEL	Lower Explosive Limit
LL	Liquid Limit
LoD	Limit of Detection (analytical)
LoQ	Limit of Quantification (analytical)



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Mean Value Test

Statistical test (described in the CIEH Guidance) to estimate the mean value of a normally distributed population of data at a given level of confidence. Normally for contaminated land assessment, the 95th percentile (referred to as the 95%UCL or US95) is applied as a reasonable but conservative estimate of the mean concentration for comparison with the relevant assessment criteria.

Maximum Value Test

Statistical test (described in the CIEH Guidance) to identify whether an elevated concentration within a normally distributed data set forms part of the underlying population from which it has been sampled or whether it is an outlier (such as a localised area of contamination) that merits further consideration.

MC

Moisture Content

NGR

National Grid Reference

NIHHS

**Notification of Installations Handling
Hazardous Substances (regulations)**

OS

Ordnance Survey

PI

Plasticity Index

PID

Photoionisation Detector

PL

Plastic Limit

ppm

Parts per million

ppmv

Parts per million by volume

QA

Quality Assurance

QC

Quality Control

SAC

Special Area of Conservation

SOM

Soil Organic Matter

SPT

Standard Penetration Test

SPZ

Source Protection Zone

SSAC

Site-Specific Assessment Criterion

SSSI

Site of Special Scientific Interest

SVOC

Semi-Volatile Organic Compound

TEF

Toxicity Equivalent Factor



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APPENDIX D – QUALITATIVE AND QUANTITATIVE RISK ASSESSMENTS



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For the qualitative and quantitative assessment of risks posed by potential pollutant linkages have been undertaken using the risk matrix adapted from CIRIA C552 and outlined in the table below.

	Category	Definition			
Potential severity	Severe	Acute (short term) risk to human health, Major pollution of sensitive controlled waters, ecosystems or habitat. Catastrophic damage to buildings or property or crops.			
	Medium	Chronic (Medium / long term) risk to human health Pollution of sensitive controlled waters, ecosystems or species, Significant damage to crops, buildings or structures			
	Mild	Easily preventable permanent health effects on humans. Pollution of non-sensitive controlled waters. Minor damage to buildings or structures.			
	Minor	Easily preventable non-permanent health effects on humans, or no effects. Minor, low level and localised contamination of on-site soil. Easily repairable damage to buildings or structures.			
Probability of risk	High Likelihood	Pollutant linkage may be present and the risk is almost certain to occur , or there is evidence of harm already occurring.			
	Likely	Pollutant linkage may be present and it is probable that the risk will occur over the long term.			
	Low Likelihood	Pollutant linkages may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.			
	Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.			
		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of risk	High Likelihood	Very high	High	Moderate	Moderate/Low
	Likely	High	Moderate	Moderate/Low	Low
	Low Likelihood	Moderate	Moderate/Low	Low	Negligible
	Unlikely	Moderate/Low	Low	Negligible	Negligible



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