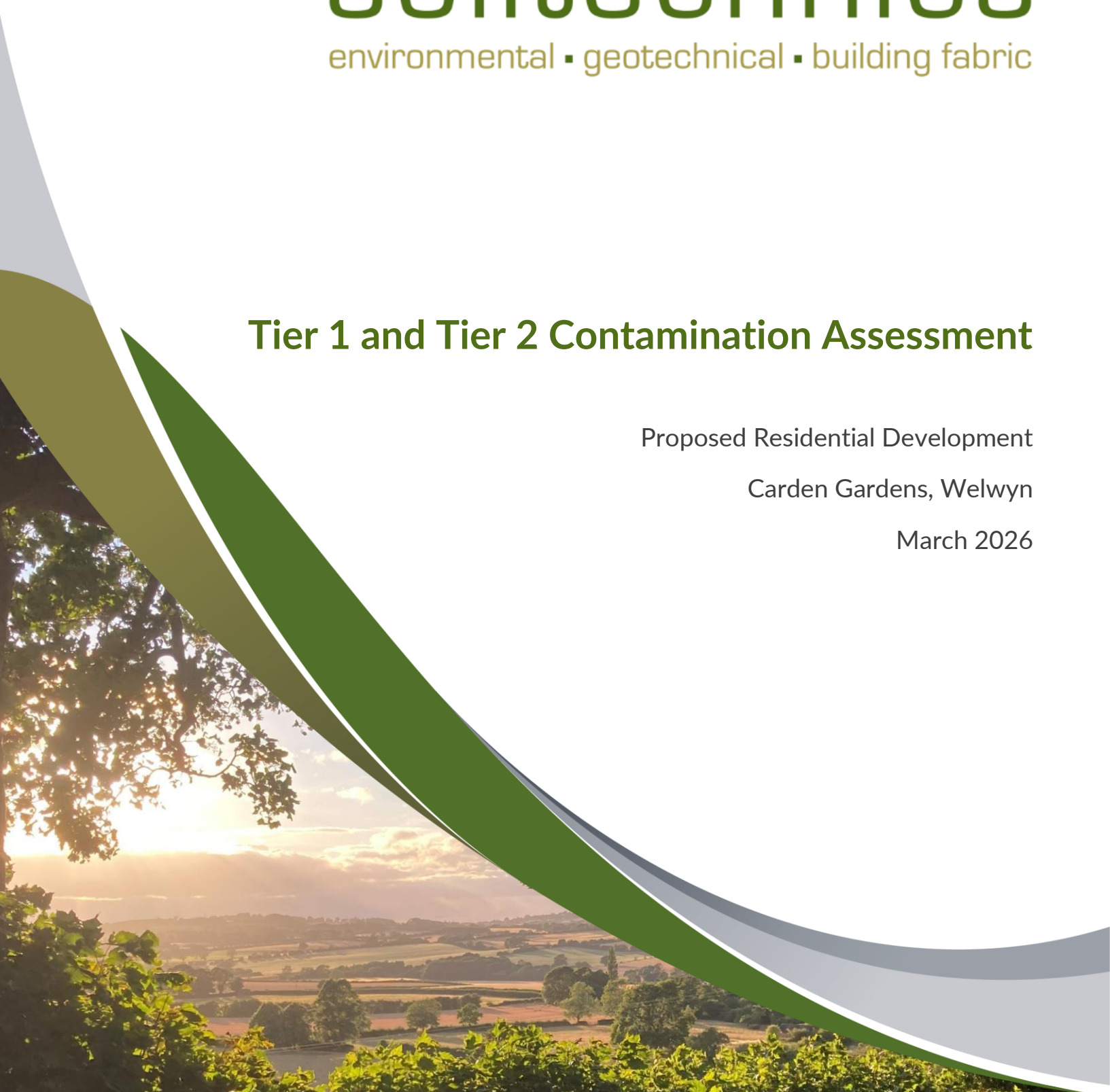




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Tier 1 and Tier 2 Contamination Assessment

Proposed Residential Development

Carden Gardens, Welwyn

March 2026



Project Details

Site: Carden Gardens, Welwyn

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Title	Produced by	Date	Reference
Location Plan	Park Designs	February 2026	P379C26 – 11 – REV A
Exploratory Borehole Location Plan	Soiltechnics	July 2025	STX7068-D01
Photographic Location Plan	Soiltechnics	July 2025	STX7068-D02
Masterplan(Proposed Site Plan)	Park Designs	March 2026	P379C16 – 13 – REV A

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Non-technical Summary

Topic	Commentary
Site description	The site is undeveloped land but appears to be partially used as a commercial space/vehicle parking. The north of the site is surfaced in gravel and contains temporary buildings.
Development proposals	Construction of park homes.
Site history	The site has historically been quarried and partially infilled. More recently, there is evidence the site was used by a landscape garden company and later a poultry farm. There is anecdotal evidence from previous discussions with the Local Authority that the site has also been used for unpermitted waste dumping and burning.
Ground conditions	Ground conditions comprised Made Ground to depths generally of 3.4m and >5.45m but to 1.1m in the northern corner (outside the former quarry extent). Soils below comprised sands and clays considered to be Glaciofluvial Deposits. No groundwater was encountered to depths of 5.45m.
Quarrying and mining Risk	The site is not located within a mining area. The site is a former quarry and there are several historical quarries/pits in the local area, which appear to have been backfilled.
Chemical contamination and remedial requirements	Made Ground on site contains elevated PAHs, which could pose a risk to end users where hardstanding is absent. Depending on final design proposals, remediation measures could comprise a full site strip and introduction of a capping layer across the site or provision of hardstanding and clean capping within soft landscaping and a geotextile membrane beneath any gravel surfacing. A Remediation Statement and Verification Report will be required to confirm the above. Barrier pipe is likely to be required for all potable water pipes.
Radon, gas risk and protection measures	The property is in an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). No radon protection measures are required and the proposed buildings are Park Homes which also do not require radon protection. Gas protection is not considered necessary within proposed Park Homes. If permanent buildings are proposed, an additional gas risk assessment will be required. With regard to construction operatives, there is the possibility for reduced levels of oxygen within sub-surface excavations which we recommend be monitored should they require entry.
Soil and waste management	Where Made Ground soils are to be reused onsite or materials transferred between sites, a Materials Management Plan (MMP) or Waste Exemption is recommended. Where soils require off-site disposal, appropriate testing will be required. Based on current development proposals, the residual quarry to the southwest will require infilling prior to redevelopment. This will either require an environmental permit or could be controlled under an MMP in accordance with the CL:AIRE DoW CoP.
Recommendation for further works	A Remediation Strategy and subsequent Verification Report will be required. The Principal Contractor should liaise with the statutory undertaker to confirm the requirement for barrier pipe. A detailed UXO desk study to support the whole construction phase. A Materials Management Plan or environmental permit will be required to facilitate the infilling of the existing quarry.

1 Introduction

1.1 Scheme Outline

- 1.1.1 The scheme at Carden Gardens consists of the development of land to provide 27 residential park homes as shown on the layout presented below.



Figure 1-A: Proposed layout

- 1.1.2 The report is based on the project proposals and information outlined above; should the scheme change then it will be necessary to review the conclusions and recommendations presented in this report.

1.2 Planning Status

- 1.2.1 It is understood that the scheme has yet to be submitted for planning. This report has been prepared to accompany any future planning application and provides an assessment of land contamination.

1.3 Brief

- 1.3.1 This report has been prepared for Royale Quarters (SV) Limited , the Client.
- 1.3.2 The overall brief of works is to support the planning application by assessing the potential risks from contamination at the site.
- 1.3.3 The objectives of this report are outlined below:
- i) Review and summarise desk study information.
 - ii) Undertake a land contamination Tier 1 preliminary risk assessment.
 - iii) Summarise the intrusive investigation works undertaken and associated laboratory testing.
 - iv) Present a ground model summarising the ground and groundwater conditions at the site.
 - v) Undertake a land contamination Tier 2 generic quantitative risk assessment.
 - vi) Provide recommendations to inform an Options Appraisal and Remediation Strategy

1.4 Definition of Scope

- 1.4.1 The phasing and scope of the ground investigation works is broadly defined by the following documents.

Title	Document Reference	Publisher	Investigation Scope
Code of practice for ground investigations	BS 5930: 2015	British Standards Institution	Phase 1: Desk study Phase 2: Preliminary investigation
Investigation of potentially contaminated sites – Code of practice	BS 10175: 2011+A2:2017	British Standards Institution	Preliminary Investigation (desk study) Exploratory Investigation
Land contamination risk management	Online resource, updated April 2021	Environment Agency	Stage 1 Risk Assessment: Tier 1: Preliminary risk assessment Tier 2: Generic quantitative risk assessment

Table 1-A: Definition of investigation scope

1.5 Limitations

- 1.5.1 Soiltechnics disclaims any responsibility to our Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence in accordance with the terms of our contract, taking account of the resources, investigations and testing devoted to it by agreement with our Client. This report is confidential to our Client and Soiltechnics accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

2 Desk Study

2.1 Sources of Information

2.1.1 Reference has been made to the following sources of information:

- An Envirocheck Report and historical map records, presented as Appendix I.
- British Geological Survey (BGS) GeoIndex – Onshore database.
- BGS Sheet 239 (Scale 1:50 000) – Hertford (1978).
- Ordnance Survey OpenData.
- Coal Authority Development and Specific Risk databases.
- Environment Agency open-source databases.
- Google mapping services.
- Interrogation of search engines for anecdotal information on the site history and other readily available online resources.

2.2 Site Description

2.2.1 The site is located to the northeast of the village of Welwyn, Hertfordshire and the approximate post code for the site is AL6 9SS. The site is accessed from Danesbury Park Road which lies adjacent to the site's northwestern boundary.

2.2.2 An aerial image showing the approximate site boundary is presented below, followed by a table summarising the key site features. A site plan is provided within Appendix A and photographic records are presented in Appendix C.



Figure 2-A: Aerial photograph and approximate site boundary

Theme	Feature
Current site use	The site is undeveloped land but appears to be partially used as a commercial space/vehicle parking. The north of the site is surfaced in gravel and contains temporary buildings. This area is separated from the remainder of the site by timber fencing.
Local area land use	A Park Homes site is present to the southwest of the site. Land to the northwest and northeast is residential. The A1 borders the site to the southeast, beyond which lies an area of woodland.
Topography	Local topography generally falls to the southeast. The southwestern section of the site contains part of a former quarry, which has not been fully infilled. The ground levels at the base are approximately 4m below the rest of the site. Outside of the quarry, site levels are relatively flat and are similar to surrounding areas, although the undeveloped area undulates significantly. The eastern boundary falls relatively steeply to the A1(M) running parallel below.
Buildings, surfacing and other permanent features	The north of the site is laid to gravel and contains a number of temporary buildings/offices. The remainder of the site is unsurfaced and there are no other buildings on site.
Boundary features	Site boundaries are generally defined by fencing.
Vegetation	Mature and semi-mature trees are present along the southwest and southeastern site boundaries. Low-level vegetation is present across the centre and south of the site and is particularly dense within and immediately surrounding the former quarry. A bank of mature trees is present adjacent to the site's eastern and southern boundary.
On-site / adjacent surface water features	None observed.
Injurious and invasive weeds	None observed.
Asbestos containing material (ACM) in buildings	No permanent buildings present on site.
ACMs on site	No suspected ACMs were observed in any surface debris.
Potential sources of contamination	Evidence of localised burning observed. Stockpile of construction waste (bricks, concrete, plastic) present along the southeastern edge of the former quarry.
Evidence for ground instability	None observed.

Table 2-A: Site description

- 2.2.3 The observations provided above are made by a Geoenvironmental Engineer, who is not a specialist in asbestos surveying or invasive weed identification. Any associated comments are intended for use by this report only, and not for any other purpose.

2.3 Environmental Designations

- 2.3.1 The site is reported to be within Adopted Greenbelt Land. An area of Ancient Woodland and a Local Nature Reserve are recorded 76m to the east of site.

2.4 Planning Records

- 2.4.1 A search of online planning records held for the site by Welwyn Hatfield Borough Council reveals no previous planning applications for the site.

2.5 Previous Reports

- 2.5.1 Soiltechnics have previously undertaken the following report in relation to the site. A brief summary of pertinent information is provided below. The Client does not have reliance on the report and thus information is provided for reference only.

Author	Document Title	Date & Document Reference	Report Context
Soiltechnics	Ground Investigation Report	January 2018 R-STP4221-G01	Investigation for residential development.

Table 2-B: Summary of previous reports

- 2.5.2 At the time of the investigation, the site comprised disused land and comprised three distinct areas.
- 2.5.3 To the north-east, the site was largely surfaced in gravel and stockpiles of waste materials including timber, metal, old appliances and bituminous bound material were present. A number of large metal containers and a wooden structure were present, below which was a 2.5m deep pit the use and extent of which is unknown but which was considered to be a buried shipping container. The central area of the site was surfaced in grass and low-lying vegetation and was not used for storage of materials. The south-western section of the site comprised a former quarry which extended some 4m below surrounding ground level.
- 2.5.4 The report notes that anecdotal information suggested the site was previously occupied by a landscape gardening business (Carden Gardens) and subsequently a poultry farm (Corner Wood Poultry).
- 2.5.5 Enquiries were also made with the Local Authority Environmental Health Officer who advised that they had no records on the extent of the activities or whether any landfilling subsequently occurred. They advised there had been seven recorded bonfire complaints since 2011 with one positively confirmed and described as a large bonfire for the disposal of wood and garden waste. An explosion was recorded at the site in 2008 and a burnt-out vehicle, burning wood pallets and dumped material was recorded on site.
- 2.5.6 In addition, the report identified pre-application advice from a previous planning application, which suggested that the site has a history of having waste material brought on to site, which was unregulated by either the Environment Agency or the Local Authority.
- 2.5.7 Eleven boreholes were excavated across the site to depths between 1.0-6.0m. Ground conditions comprised Made Ground to depths between 3.3-5.7m over Glaciofluvial Deposits. Made Ground was variable in nature but generally comprised orangish brown, brown and grey slightly gravelly, silty clay with some layers comprising dark brown, dark grey and orangish brown, gravelly sand. The gravel generally consisted of brick, flint and ash. A fragment of Asbestos Containing Material (ACM) was observed within shallow soils in one location, confirmed as chrysotile cement by laboratory testing. Some localised hydrocarbon odours and staining were also observed.
- 2.5.8 Laboratory testing was undertaken and identified concentrations of PAH above the screening values for a residential end use. No asbestos fibres were identified in nine samples tested. Concentrations of hydrocarbons were low and below screening values. A capping layer was recommended within all gardens/soft landscaping to reduce the risk to end users.

- 2.5.9 Leachate testing identified exceedances of PAH and TPH, when compared to guideline values at the time and further testing/assessment was recommended.
- 2.5.10 Six gas monitoring visits were undertaken and recorded concentrations of methane in the range of 0.0-0.2% and concentrations of carbon dioxide in the range of 0.5 to 13.8%. Flow was relatively low and did not exceed 0.4%.

2.6 Site History

- 2.6.1 Based on historical maps, the site comprised woodland until the site was quarried in the 1930s. Aerial photographs from early 2000s onward and site reconnaissance indicate the site has been partially infilled although the date of infilling is unknown. The extent of the historical gravel pit in relation to the site is shown in the map extracts in Figure 2-B.
- 2.6.2 Based on information obtained from the planning portal, and anecdotal evidence from the previous report the site was formerly occupied by a landscape gardening business (Carden Gardens) and subsequently a poultry farm (Corner Wood Poultry). The site has also been used for unpermitted waste dumping in the past.
- 2.6.3 Surrounding land has typically comprised woodland, later with some residential development. Localised quarrying has occurred in the area.

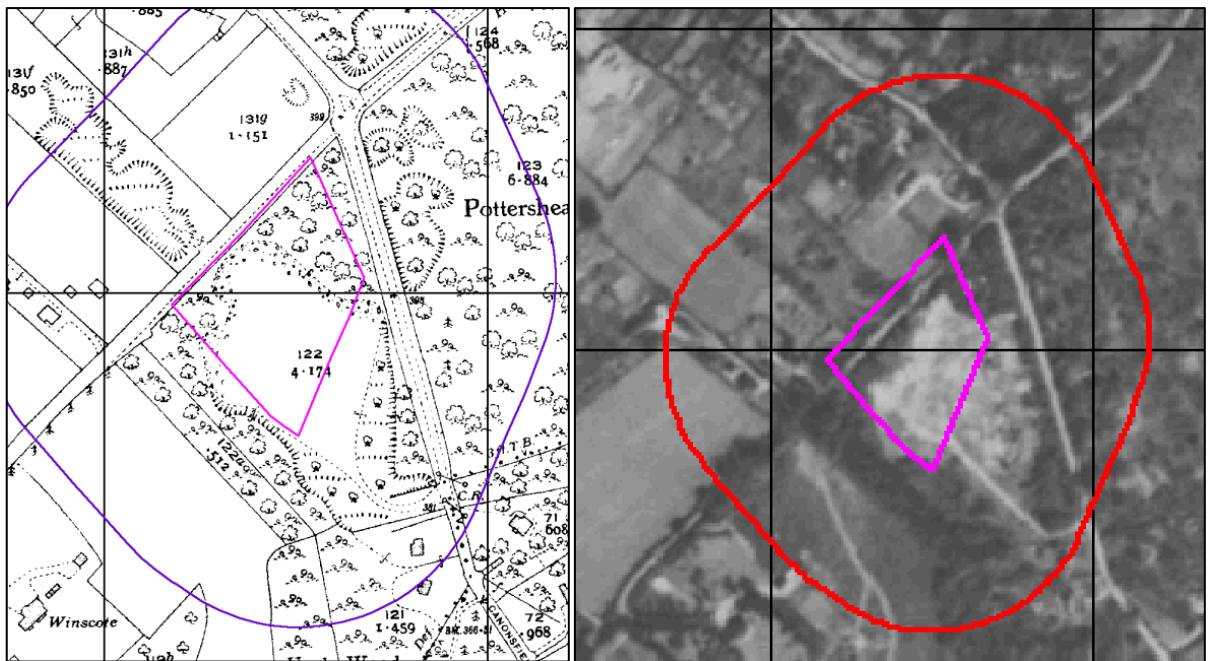


Figure 2-B: Historical Gravel Pit partially occupying site shown on historical map dated 1937(L) and 1949(R)

2.6.4 A chronological summary of the site's history is provided below.

Date	On-site	Off-site
Late 1800s	Open field.	Surrounding land is generally undeveloped with the exception of some sporadic suspected residential houses some 100m to the north. Road borders the site to the northeast. Woodland (Pottersheath Plantation) lies to the east and includes "old gravel pits" some 30m to the east of the site.
1920s	Site recorded as woodland. Assumed path/track recorded crossing the southern half of the site.	The assumed path/track connects the road to the north-west to a gravel pit located 30m to the south-east of the site.
1930s	Central and southern area of the site recorded within a quarry/pit, which extends beyond the site boundaries to the southeast.	Quarry recorded beyond the road to the northwest and some 50m to the north. Some sporadic residential development has occurred in the local area and a nursery, including suspected glasshouses, which are present some 190m to the northwest.
1940s to 1960s	No significant change.	No significant change.
1970s to 1980s	Wooded area shown in the far western corner of the site. Quarry is no longer recorded on site.	The A1 has been constructed along the south-eastern boundary of the site. Residential development has occurred beyond the A1 to the south-east. Caravan park is recorded some 20m to the south-west. Quarry to the north is no longer present and the area has been redeveloped for low-density residential housing. The nursery to the northwest is no longer present.
Late 1980s to 1990s	Site appears to be heavily wooded with some areas of more open grassland to the centre.	No significant change.
Early 2000s	No significant change.	No significant change.
2010s	Aerial photographs show the central part of the site has been cleared. An access road is present and a number of vehicles and small buildings are shown.	Land to the immediate northwest appears to have been partially surfaced and contains a number of residential buildings.
2020s	The previous buildings have been removed and the centre of the site has been cleared of vegetation. The north of the site has been surfaced in gravel. The residual part of the former quarry are apparent to the southwest and remain vegetated.	No significant change.

Table 2-C: Summary of site history

2.7 Regulatory Enquiries

2.7.1 Soiltechnics have commissioned the Local Authority Environmental Health department to conduct a search of their records for any pertinent information they may hold for the site and surrounding area. At the time of issue, the information had not been received. This report will be updated on receipt.

2.8 Anticipated Geology

2.8.1 Based on a review of geological mapping records and other desk study information, a summary of the anticipated geology underlying the site is summarised as follows:

Stratum	Bedrock / superficial	Anticipated thickness (m)	Typical description
Made Ground	-	Up to 6m	Based on previous ground investigation records, likely clays and sands with significant anthropogenic material.
Glaciofluvial deposits	Superficial	5-8m	Sands and gravels
Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated)	Bedrock	>50m	Chalk

Table 2-D: Summary of anticipated geology at the site

2.9 Hydrogeology and Groundwater Sensitivity

2.9.1 The general hydrogeological profile of the site is provided in the table below.

Stratum	Aquifer Designation	Groundwater commentary
Glaciofluvial deposits	Secondary A	Local borehole records indicate groundwater is absent and is likely in continuity with underlying Chalk aquifer.
Lewes Nodular Chalk Formation and Seaford Chalk Formation (undifferentiated)	Principle Aquifer	Groundwater present within interconnected network of fractures. Local borehole records suggest groundwater is approximately 30-50m below ground level.

Table 2-E: Preliminary hydrogeological model

2.9.2 The site is located within a Source Protection Zone III (Total Catchment), likely associated with abstraction points located 1766-2000m to the southwest. It is anticipated that the wells are abstracting from the Principal Aquifer within the Chalk bedrock which is expected at a depth of ~50m below site.

2.9.3 There are no recorded groundwater abstraction points within 1km of the site.

2.10 Hydrology and Surface Water Sensitivity

2.10.1 There are no watercourses or significant water features within 1km of the site.

2.10.2 There are no active surface water abstraction licenses within 1km of the site.

2.11 Flood Risk

2.11.1 The site falls within a Flood Zone 1 area. This designation indicates there is less than a 0.1% chance of flooding from rivers or the sea in any year.

2.11.2 The site is not recorded in an area with the potential for surface water flooding.

2.11.3 The site is recorded to be in area with a limited potential for groundwater flooding to occur.

2.11.4 It should be noted that this information does not constitute a site-specific Flood Risk Assessment and one may be required for the scheme.

2.12 Non-Mining Ground Instability Hazard

2.12.1 The Envirocheck Report includes hazard ratings due to natural ground instability, which have been derived by the BGS. These hazards have been summarised in the table below.

Hazard	Hazard Potential
Collapsible ground	Very Low
Compressible ground	No Hazard
Ground dissolution	Low
Landslide	Very Low
Running sand	Very Low
Shrinking or swelling clay	No Hazard

Table 2-F: Non-mining ground stability hazards

2.13 Quarrying and Mining

2.13.1 The site falls outside of a Coal Mining Reporting Area.

2.13.2 A former gravel pit is shown to have occupied the site from ~1930 and was subsequently partially backfilled (date unknown). In addition, there are several historical quarries/pits in the local area, which were for the extraction of gravel and chalk.

2.14 Landfill and Infilled Ground

2.14.1 The following table summarises current and historical landfill sites, mineral sites, and infilled ground records within 250m from the site to the site.

Name	Distance from site (m)	Type of record	Waste deposited / resource extracted	Further information
Unknown filled ground	On site	Potentially infilled land	N/A	Mapped in 1992
Unknown filled ground (likely Pottersheath Plantation Gravel Pit)	44m NE	Potentially infilled land/BGS recorded mineral site	N/A	Mapped in 1992
Uncle Wood Gravel Pit	46m SE	BGS recorded mineral site	Extracting sand and gravel	Operations ceased.
Mardley Heath	127m E	Historical landfill.	Included inert waste	Revoked – last input 1976
Roebuck Farm, Potters Heath	206m NW	Local Authority recorded landfill.	Not recorded	Unknown

Table 2-G: Summary of landfill, mineral site and infilled ground records

2.15 Recent Industrial Activity

2.15.1 There are no Integrated Pollution Controls (IPC), Integrated Pollution Prevention Controls (IPPC) or Local Authority Pollution Prevention Controls (LAPPC) recorded within 250m of the site and no registered radioactive substances.

2.15.2 The site is in a primarily residential area and there are no potentially contaminating Contemporary Trade Directory entries within 250m of the site.

2.15.3 As the site is not located in close proximity to a watercourse, records held of discharge consents and pollution incidents to controlled waters are not considered relevant to this desk study.

- 2.15.4 There are no recorded pollution incidents and one discharge consent to land or groundwaters within 250m of the site, as follows.

Discharge Type	Distance from site (m)	Description
Discharge Consent	94	Sewage, Final/Treated Effluent via land or Soakaway

Table 2-H: Summary of discharge consents

2.16 Radon

- 2.16.1 The site is in an area where the above ground radon Affected Area status is classed as an Intermediate Probability Radon Area.

2.17 Underground Infrastructure

- 2.17.1 Copies of all utility plans obtained are presented as Appendix H. The plans are provided for information only and should not be relied upon to be accurate. In addition, it is worth noting that the public utility plans provided by the asset owners typically exclude private service runs.
- 2.17.2 A review of the plans indicates a foul sewer drain runs parallel with the eastern boundary beneath site, with an extract presented as Figure 2-C. The asset holder should be consulted at the earliest opportunity to identify any construction constraints that may apply.

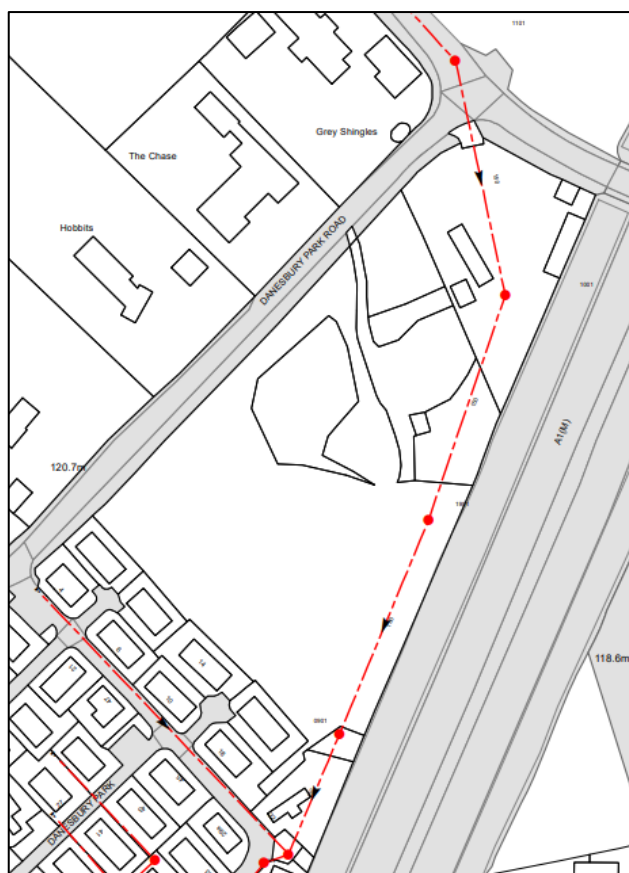


Figure 2-C: Foul Sewage Drain located within the site area.

2.18 Unexploded Ordnance (UXO) Hazard Screen

- 2.18.1** A preliminary risk review has been undertaken by a UXO specialist to assess the risk of encountering UXO during ground investigation works undertaken by Soiltechnics only and to identify any precautionary measures required. It should be noted that the risk assessment has not been carried out fully in accordance with CIRIA report C785 'Unexploded Ordnance (UXO) A guide for the construction Industry'.
- 2.18.2** The risk review concluded that there is a credible risk of encountering UXO during the ground investigation.

3 Tier 1 Preliminary Contamination Risk Assessment

3.1 Objectives

- 3.1.1 The objective of this preliminary risk assessment (PRA) is to determine the suitability of the site for the proposed redevelopment and end users, in terms of the risk from contamination. The assessment comprises the following steps:
- Identify potential contaminant linkages (PCLs) between sources, pathways and receptors.
 - To provide data to assist in the design of potential exploratory and detailed intrusive investigations and to give an early indication of possible remedial requirements, if necessary.

3.2 Evaluation Criteria

- 3.2.1 The following assessment is undertaken within the legislative framework of the planning system. Therefore, the assessment needs to identify if land contamination could pose an unacceptable risk to human health or the environment, within the context of the proposed development site. In the context of the existing site use, as a minimum, land should not be capable of being determined as 'contaminated land' under Part IIA of the Environmental Protection Act 1990.
- 3.2.2 The risk criteria for the proposed development is based on a 'minimal risk' approach, whereas under the existing land use a designation of 'contaminated land' would only apply if there is a significant possibility of significant harm (SPOSH).

3.3 Methodology

- 3.3.1 The objectives listed above are achieved by utilising the information presented within the desk study to develop an initial conceptual site model (iCSM) and identification of potential unacceptable risks. Depending upon the outcome of the Tier 1 assessment, it may be necessary to undertake a Tier 2 generic quantitative risk assessment (GQRA).
- 3.3.2 An iCSM relies upon the identification and assessment of PCLs. A contaminant linkage comprises of three key components:
- Source – a contaminant or pollutant that is in, on or under the land and that has the potential to cause harm or pollution.
 - Pathway – Current and post-development routes by which a receptor is, or could be, affected by a contaminant.
 - Receptor – Something that could be adversely affected by a contaminant, for example a person (current and proposed end users or neighbours), controlled waters and ecosystems.
- 3.3.3 The Tier 1 risk assessment has been produced with reference to the following guidance:
- ['Land contamination risk management'](#) (EA, 2021).
 - BS 10175:2011+A2:2017 'Investigation of potentially contaminated sites – Code of Practice'.
 - CIRIA C552 'Contaminated land risk assessment- a guide to good practice', 2001.
 - BS EN ISO 21365:2020 'Soil quality – Conceptual site models for potentially contaminated sites'
 - BS 8576:2013 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOC)'.

3.4 Source Assessment

3.4.1 The table below summarises identified sources based on the findings of the desk study. Where appropriate, further discussion has been provided in the paragraphs which follow.

Potential Sources	Contaminant(s) of concern	Detail	Viable source?
On-site sources			
Made Ground/Quarry backfill	Metals, polycyclic aromatic hydrocarbons (PAH), asbestos	Likely deep Made Ground will be present on site, the source of which is unknown. Based on a previously ground investigation at the site, anthropogenic materials, including fragments of ACM are anticipated.	Y
	Permanent ground gases (CH ₄ and CO ₂)	Elevated concentrations of ground gas could be generated from thick Made Ground with high levels of putrescible material.	Y
	Acids, PAH, hydrocarbons, pyrites and sulphates	Given the unknown nature of the Made Ground, it is possible it could contain contaminants that are aggressive to concrete or potable water pipes.	Y
Various historical site uses.	Metals, PAH, hydrocarbons, asbestos, Microorganisms, ammonia	Anecdotally, the site has been used as a landscape garden business and poultry farm. Historically, it has also been subject to unregulated waste disposal/storage. Photographic evidence within the 2018 report detailed in Section 2.5 shows stockpiles of waste material across the site and evidence of underground structures of unknown use.	Y
Burning/bonfires	PAH	Evidence of burning on site both historically and more recently.	Y
Carbonate rich deposits (chalk)	Permanent ground gases (CO ₂)	Carbonate rich materials can generate carbon dioxide due to natural geochemical and weathering processes. Typically, volumes generated are low and do not pose a viable risk for developments.	N
Natural ground	Radon	The site is recorded as being in an Intermediate Probability Radon Area but concentrations are <3% therefore radon protection measures are not considered necessary. In addition, development proposals are for Park Homes rather than traditional buildings, which will have a void beneath and therefore radon protection measures would not be required.	N
	Pyrite and sulphates	Unlikely Glaciofluvial deposits or Chalk will contain high concentrations of pyrite and sulphate. However, if concrete is to be in contact with the ground, testing is recommended to determine an appropriate concrete classification.	N
Off-site sources			
Historical landfill (Mardley Heath) recorded 127m to the east	Permanent ground gases (CH ₄ and CO ₂)	Landfill recorded as accepting inert waste with final deposit 1976. Possible unrecorded risk of other waste deposits but inert landfills generally do not contain significant putrescible/organic material. BS:8576 indicates low gas generation potential for landfills of similar age but given the size of the landfill and distance from the site, the possibility of the landfill being a source of ground gas cannot be discounted at this stage.	Y

Potential Sources	Contaminant(s) of concern	Detail	Viable source?
Backfilled quarries/infilled land	Permanent ground gases (CH ₄ and CO ₂)	A number of backfilled quarries are recorded locally and within 50m of the site. Source of backfill is unknown and could be a potential source of landfill gas. Again, landfill gas generation is considered to be low due to the age of the backfill, but at this stage, the possibility of them being a source of ground gas cannot be discounted.	Y

Table 3-A: Contamination source assessment

3.5 Receptor Assessment

3.5.1 The following table summarises the identified receptors based on current site conditions and our understanding of the proposed end use:

Receptor Category	Principal Receptor	Receptor present?	Detail
Human health	Users of the current site	Yes	Evidence that part of the site is being used due to the presence of temporary buildings and vehicles.
	End user of the developed site	Yes	Proposed park homes, potentially with soft landscaping/garden areas.
	Construction operatives and other site investigators	Yes	Site to be developed.
	Adjacent site users and off-site members of the public	Yes	Residential properties present adjacent to site.
Controlled waters	Surface waters	No	Surface waters are remote from the site, in excess of 500m distance.
	Groundwater	Yes	Site is within a source protection zone III and overlies a secondary A aquifer (superficial) and principal aquifer (bedrock).
Sensitive ecosystems and species	Current site	No	Site is within adopted greenbelt but is not within, or proposed to form, a designated environmentally sensitive area (e.g. SSSI, RAMSAR, AONB, SPA, SAC).
	Developed site	No	
Property	Soft landscaping (current)	Yes	Majority of the site is currently unsurfaced and contains trees and vegetation.
	Soft landscaping (proposed)	Yes	Soft landscaping and potentially gardens are anticipated to form part of the development proposals.
	Building materials	Yes	Park homes proposed. Spread foundations unlikely to be required but could be supported off a concrete slab (proposals currently unknown). Potable water pipes likely to be required.

Table 3-B: Receptor assessment

3.6 Pathway Assessment

3.6.1 The following table summarises the generic human health pathway assessment for the site, assuming a range of contaminant sources within the underlying soils. Source-specific pathways are considered within the iCSM in subsequent report sections.

3.6.2 The following pathways are based on the current site proposals for mobile park homes. Such buildings are typically constructed off a steel chassis to allow them to be moved/transported. The presence of a void space between the ground and the building will restrict a number of pathways for internal exposure, though external pathways are considered relevant. If proposals are altered during final design to include permanent buildings without a void space, a reassessment will be required.

Human Health Exposure Pathway	Commercial land use (current)	Park Homes (proposed)	Construction operatives	Adjacent Site Users
Ingestion, inhalation and dermal contact with soils and dusts	✓	✓	✓	✓ (inhalation only)
Ingestion, inhalation and dermal contact with site derived dusts indoors	✓	✓	✓	✗
Ingestion of home-grown vegetables	✗	✓ (possible)	✗	✗
Inhalation of vapours in outside spaces	✓	✓	✓	✓
Intrusion and inhalation of vapours indoors	✗	✗	✓	✗
Accumulation and Inhalation of ground gas in enclosed structures	✗	✗	✓	✗
Permeation into below-ground drinking water pipes	✗	✓	✗	✗

Table 3-C: Generic pathway assessment

3.6.3 The following table summarises generic pathways for the site which could be viable for the identified controlled water receptors, given our understanding of the hydrogeological model and assuming a range of contaminants in the sub-surface.

Controlled Water Exposure Pathways	Current Setting	Proposed Setting	Mechanism
Site characteristics			
Leaching via infiltration through unsurfaced areas, and surface run-off	✓	✓	Mobilisation
Leaching via infiltration through cracks/joints in hardstanding areas and drainage infrastructure	✗	✓	Mobilisation
Leaching via saturation from groundwater flooding and shallow/perched groundwater bodies	✗	✗	Mobilisation
Infiltration through sustainable drainage systems	✗	✓ (subject to proposals)	Mobilisation
Preferential lateral pathways (e.g. underground services)	✗	✓	Migration
Preferential vertical pathways (e.g. piling, vibro-stone columns)	✗	✗	Migration
Hydrogeological characteristics			
Vertical migration through permeable strata into shallow aquifers and perched groundwater bodies	✓	✓	Migration
Vertical migration through permeable strata into sensitive aquifers at depth	✓	✓	Migration
Lateral migration within shallow and perched groundwater bodies into surface waters	✗	✗	Migration

Table 3-D: Generic pathway assessment

3.7 Initial Conceptual Site Model (iCSM)

3.7.1 The table below presents our approach to the assessment of risks associated with PCLs. The categories below are based upon the definitions within CIRIA C552 (2001), with the addition of a 'negligible likelihood' scenario, which is to be used where there is no realistic scenario in which harm could occur.

3.7.2 The initial conceptual site model (iCSM) is presented within the following tables overleaf.

		Consequence of harm			
		Severe	Medium	Mild	Minor
Probability of harm	High likelihood	Risk: Very high (high – severe)	Risk: High (high – medium)	Risk: Moderate (high – mild)	Risk: Moderate/Low (high – minor)
	Likely	Risk: High (likely – severe)	Risk: Moderate (likely – medium)	Risk: Moderate/Low (likely – mild)	Risk: Low (likely – minor)
	Low Likelihood	Risk: Moderate (low – severe)	Risk: Moderate/Low (low – medium)	Risk: Low (low – mild)	Risk: Very low (low – minor)
	Unlikely	Risk: Moderate/Low (unlikely – severe)	Risk: Low (unlikely – medium)	Risk: Very low (unlikely – mild)	Risk: Very low (unlikely – minor)
	Negligible Likelihood	Risk: Low (negligible – severe)	Risk: Very Low (negligible – medium)	Risk: Very Low (negligible – mild)	Risk: Negligible (negligible – minor)

Table 3-E: iCSM risk ratings

RECEPTOR: PROPOSED END USERS				
Potential Source	Contaminants of Concern	Pathway	Tier 1 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	Metals and polycyclic aromatic hydrocarbons (PAH)	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Moderate (likely – medium)	Elevated levels of inorganic and organic contaminants could be present in the Made Ground deposits due to large quantity of historic quarry infill material, and due to potential unknown historical activities and incidents on site (such as through the storage and use of fuels/ chemicals and waste materials).
	ACMs and asbestos	Inhalation of dusts	Risk: Moderate/Low (low – medium)	Nature of Made Ground unknown and therefore could include ACMs and asbestos fibres. Previous report in 2018 indicates the presence of ACM fragments (one of which was confirmed chrysotile cement) within the Made Ground although no asbestos fibres were reported within nine samples of the Made Ground tested.
	Permanent ground gases (CH ₄ and CO ₂)	Migration through the sub-surface into enclosed spaces	Risk: Low (unlikely – medium)	Degradation of organic-rich fill materials, if present, could pose a potential risk of ground gas generation and migration. However, the development comprises park homes, which are typically constructed with a void space below. On this basis, the risk is considered low.
	PAH and TPH	Permeation into drinking water pipes	Risk: Moderate/Low (low – medium)	Organic contaminants could be present in the shallow soils at depths and concentrations which could pose a risk of penetrating drinking water pipes.
Various historical site uses.	Metals, PAH, hydrocarbons, asbestos, Microorganisms, ammonia	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Moderate (likely – medium)	Elevated levels of inorganic and organic contaminants could be present associated with historical activities, particularly any unregulated waste disposal. Vapour risk likely to be low assuming proposed park homes are ventilated below. Given the time since the site was likely a poultry farm, the risk from microorganisms and similar organic contaminants is considered low. Ammonia in the ground is not considered to pose a significant risk to human receptors.
Burning/bonfires	PAH	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Moderate/Low (low – medium)	Evidence of burning both recently and historically on the site. Can be a source of localised PAH contamination within shallow soils.
Historical landfill (Mardley Heath) recorded 127m to the east	Permanent ground gases (CH ₄ and CO ₂)	Lateral migration through the sub-surface into enclosed spaces	Risk: Low (unlikely – medium)	Considered a possible source of ground gas in the local area. However, the development comprises park homes, which are typically constructed with a void space below. On this basis, the risk would be considered low.
Backfilled quarries/infilled land	Permanent ground gases (CH ₄ and CO ₂)	Lateral migration through the sub-surface into enclosed spaces	Risk: Low (unlikely – medium)	

Table 3-F: iCSM – proposed end users

RECEPTOR: CONSTRUCTION WORKERS				
Potential Source	Contaminants of Concern	Pathway	Tier 1 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	Metals and polycyclic aromatic hydrocarbons (PAH)	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Moderate/Low (low – medium)	No gross contamination of high-risk contaminants anticipated (e.g. cyanide, benzene, and vinyl chloride) although localised hydrocarbons and potentially other contaminants may be present.
	ACMs and asbestos	Inhalation of dusts	Risk: Moderate/Low (low – medium)	If present, asbestos in soils can present an acute risk to construction workers, particularly during the enabling works phases. Very low and trace concentrations often pose a low risk if appropriate controls are put in place.
	Permanent ground gases (CH4 and CO2)	Migration through the sub-surface into enclosed spaces	Risk: Moderate (likely – medium)	Elevated concentrations of ground gas and low oxygen concentrations could pose a risk to construction workers during sub-surface excavation works.
Various historical site uses.	Metals, PAH, hydrocarbons, asbestos, Microorganisms, ammonia	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Moderate/Low (low – medium)	No gross contamination of high-risk contaminants anticipated (e.g. cyanide, benzene, and vinyl chloride) although localised hydrocarbons and potentially other contaminants may be present.
Burning/bonfires	PAH	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Low (unlikely – medium)	Concentrations of PAH unlikely to be capable of causing an acute risk to construction workers. Likely to be relatively localised.
Historical landfill (Mardley Heath) recorded 127m to the east	Permanent ground gases (CH4 and CO2)	Lateral migration through the sub-surface into enclosed spaces	Risk: Moderate/Low (low – medium)	Elevated concentrations of ground gas and low oxygen concentrations could pose a risk to construction workers during sub-surface excavation works.
Backfilled quarries/infilled land	Permanent ground gases (CH4 and CO2)	Lateral migration through the sub-surface into enclosed spaces	Risk: Moderate/Low (low – medium)	

Table 3-G: iCSM – acute exposure to construction workers

RECEPTOR: ADJACENT SITE USERS FOLLOWING COMPLETION				
Potential Source	Contaminants of Concern	Pathway	Tier 1 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	ACMs and asbestos	Ingestion of dusts	Risk: Moderate/Low (low – medium)	Areas of soft landscaping/gardens anticipated to be present, although likely to be relatively limited. Potential risk associated with generation of air-borne asbestos fibres and dust during general use if asbestos is present in shallow soils, although significant concentrations of asbestos not anticipated. Whilst there is a low likelihood of harm occurring due to the likely concentrations and the effect of fresh-air dilution, the risk cannot be discounted at this stage.
All other on-site sources	Metals, PAH, hydrocarbons, asbestos, Microorganisms, ammonia	Ingestion of dusts	Risk: Low (unlikely – medium)	Potential risk for various contaminants to be present locally in Made Ground/shallow soils based on site history although significant, sitewide contamination is not anticipated. Soft landscaping areas are likely to be present but based on the anticipated contaminants of concern, likely concentrations and potential pathways, risk to adjacent site users is ultimately considered low.

Table 3-H: iCSM – chronic exposure to adjacent site users

RECEPTOR: ADJACENT SITE USERS DURING THE CONSTRUCTION PHASE				
Potential Source	Contaminants of Concern	Pathway	Tier 1 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	ACMs and asbestos	Inhalation of dusts	Risk: Moderate/Low (low – medium)	Potential risk associated with generation of air-borne asbestos fibres and dust during construction main earthworks phase. Whilst there is a low likelihood of harm occurring due to the effect of fresh-air dilution, the risk cannot be discounted at this stage.
All other on-site sources	Metals, PAH, hydrocarbons, asbestos, Microorganisms, ammonia	Ingestion of dusts	Risk: Low (unlikely – medium)	Potential risk for various contaminants to be present locally in Made Ground/shallow soils based on site history although significant, sitewide contamination is not anticipated. Unlikely to be at concentrations capable of posing a viable, acute risk to off-site receptors.

Table 3-I: iCSM – acute exposure to adjacent site users

RECEPTOR: PROPOSED PLANTING				
Potential Source	Contaminants of Concern	Pathway	Tier 1 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	Metals, pH and inorganics	Direct contact and root uptake	Risk: Very low (low – minor)	Surface material and underlying Made Ground may have been impacted by contaminants (e.g. lead) due to the site's location history and location adjacent to a major road. However, no significant barren areas, signs of poor growth, or evidence of significant vegetative stress was noted during the site reconnaissance.

Table 3-J: iCSM – phytotoxic risk to proposed planting scheme

RECEPTOR: CONTROLLED WATERS				
Potential Source	Contaminants of Concern	Pathway	Tier 1 Risk Assessment (probability of harm x consequence)	Discussion
All on site sources	Metals, PAH, hydrocarbons, ammonia	Leaching and vertical migration (Groundwater)	Risk: Moderate/Low (low – medium)	Potential leachable contaminants associated with the Made Ground and historic site uses. There is a potential for contaminants to be mobilised through the infiltration of rainwater and the vertical migration of contaminants into the underlying secondary aquifer within the River Terrace and ultimately the principal aquifer of the Chalk, as they are likely in hydraulic connectivity with each other. Desk study information suggests groundwater is likely to be relatively deep beneath the site (30-50m) and based on the concentrations of contaminants anticipated, it is unlikely they would pose a significant risk to the principal aquifer. However, the site is within a Source Protection Zone and the presence of groundwater within the River Terrace Gravels cannot be fully discounted at this stage without intrusive works.

Table 3-K: iCSM – controlled waters risk

RECEPTOR: PROPERTY				
Potential Source	Contaminants of Concern	Pathway	Tier 1 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/landfill	Pyrite/sulphates, hydrocarbons, acids	Direct contact	Risk: Low (low – mild)	Made Ground and contaminated ground can pose a potential risk to concrete and given the site history, aggressive ground conditions could be anticipated.
Natural soils	Pyrite/sulphates	Direct contact	Risk: Very low (unlikely – mild)	River Terrace Deposits and Chalk Formation are generally low in pyrites/sulphates and therefore are unlikely to pose a significant risk. Testing of soils would be recommended to support the development if any foundations are proposed.

Table 3-L: iCSM – Risk to Property

- 3.7.3 The risk to identified receptors from the proposed developments under the planning regime are assessed under a ‘minimal risk’ approach. Whereas, the risk to receptors under the current and continued use of the site is dealt with under the regulatory framework of the Part IIA regime, where Soiltechnics consider if there is a reasonable chance of a ‘significant potential of significant harm’ (SPOSH) occurring. This is not equivalent to a due diligence assessment for the continued use of the site to aid in determining potential contaminated land liabilities or land valuations.
- 3.7.4 The following table sets out the risk to current users considering a SPOSH approach:

Receptor	Potential Source	Contaminants of Concern	Pathway	Preliminary Assessment: Is their reasonable evidence of SPOSH?	Discussion
Human Health (Current and adjacent site users)	All potential contaminant sources identified above	Various Contaminants	Inhalation, ingestion and contact with soils, dusts and vapours.	No	Whilst potential contamination sources have been identified, Soiltechnics have not encountered any evidence which indicates there could be a significant possibility of significant harm to human health occurring from contamination on site.
Controlled Waters (Surface water and groundwater)	All potential contaminant sources identified above	Various Contaminants	Mobilisation and migration	No	Whilst potential contamination sources have been identified, Soiltechnics have not encountered any evidence which indicates there could be a significant possibility of significant harm to controlled waters occurring from contamination on site.
Ecosystems	All potential contaminant sources identified above	Various Contaminants	Direct contact and root uptake	No	The site does not fall within a relevant designation for environmentally sensitive land (e.g. SSSI, NRA, Ramsar).
Property	All potential contaminant sources identified above	Various Contaminants	Various pathways	No	Through undertaking the desk study, no evidence of potentially significant harm occurring to property has been identified.

Table 3-M: iCSM – current site risks (part IIA)

3.8 Preliminary Risk Assessment Conclusions and Recommendations

- 3.8.1 In summary, the PRA has not highlighted any potential contaminant linkages (PCL) which could pose a significant possibility of significant harm under the current land use. In terms of the proposed development scheme, a minimal risk approach applies, and PCLs have been identified which require further consideration.
- 3.8.2 In particular the potential for Made Ground deposits and the partially unknown history of the site, could give rise to a wide range of contaminants. Further intrusive investigation works are recommended to further refine the assessment and to determine if any remedial measures are necessary.
- 3.8.3 No radon protection measures are necessary, and it is unlikely that the site is at risk from vapour or ground gas intrusion based on development proposals (assumed park homes will have a void space below). However, the risk to construction operatives during sub-surface works requires consideration. It is recommended that intrusive fieldworks include a limited gas monitoring regime to further refine the risk.
- 3.8.4 Overall, each PCL identified as posing a risk of 'Moderate/Low' or higher should be considered as part of an intrusive Tier 2 generic quantitative risk assessment (GQRA). The following table summarises the principal receptors at risk which require further investigation to support the proposed development.

Receptor Category	Principal Receptor	PCL Present Requiring Further Investigation?
Human health	Current site users	No
	Proposed site users (soils, dusts, and vapour)	Yes
	Proposed site users (permanent ground gas)	Yes
	Proposed site users (radon)	No
	Adjacent site users and off-site members of the public (during the long-term use of the site)	Yes
	Adjacent site users and off-site members of the public (during the construction phase)	Yes
	Construction operatives	Yes
Controlled waters	Surface waters	No
	Groundwater	Yes
Property	Soft landscaping (current)	No
	Soft landscaping (proposed)	No
	Potable infrastructure	Yes
	Building materials	Yes

Table 3-N: Receptors at risk under the proposed scheme

4 Ground Investigation

4.1 Objectives

- 4.1.1 The ground investigation scope and location of exploratory holes was determined by Soiltechnics Ltd, based upon our overall brief outlined in Section 1.
- 4.1.2 The objectives of the fieldwork were to:
- i) Establish ground and groundwater conditions at the site.
 - ii) Obtain samples for subsequent laboratory testing.
 - iii) Install gas and groundwater monitoring wells and undertake a programme of monitoring visits.

4.2 Fieldwork Summary

- 4.2.1 Fieldwork was undertaken between 23rd July and 24th July 2025.
- 4.2.2 A summary of the works completed is set out in the table below, along with the location of the exploratory logs. The exploratory hole location plan is presented within Appendix A.

Location of Exploratory Hole Logs	Method	Qty	Final Depth Range (m bgl)	Comments
Appendix B	Dynamic windowless sampling boreholes	9	2.10 – 5.45	WLS01 to WLS09

Table 4-A: Summary of fieldwork undertaken

- 4.2.3 All soils encountered were described in accordance with BS EN ISO 14688 'Identification and Classification of soil'.

4.3 Unexploded Ordnance (UXO)

- 4.3.1 The site was assessed to have a credible risk of encountering UXO and the works were supervised by a UXO specialist.
- 4.3.2 No ferrous anomalies or items of possible UXO were observed during fieldwork.

4.4 Sampling

- 4.4.1 Samples collected for chemical analysis have been taken and handled in accordance with BS ISO 18400-105:2017 'Soil quality — Sampling Part 105: Packaging, transport, storage and preservation of samples'.
- 4.4.2 Various sampling and sub-sampling methodologies have been adopted as appropriate, with the primary aim of obtaining the highest quality sample class practicable.
- 4.4.3 Untested chemical and geotechnical samples will be held for a period of 4 weeks from the date of the first report issue, after which they will be disposed of.

4.5 In-situ Testing

- 4.5.1 The following table summarises the field testing carried out. The results are summarised on individual exploratory hole logs where appropriate and detailed within the Appendices indicated.

Tests	Qty	Applicable standard / guidance	Location of Results
Standard penetration test (SPT)	18	BS EN ISO 22476-3	Included within logs Detailed in Appendix D

Table 4-B: Summary of field testing undertaken

4.6 Monitoring Installations

- 4.6.1 Instrumentation installed within exploratory holes during the fieldwork are shown on the logs within Appendix B and are summarised below:

Installation type	Target Stratum	Qty	Exploratory hole ID
Combined gas and groundwater well	Made Ground	3	WLS02, WLS05 & WLS06

Table 4-C: Summary of monitoring installations

4.7 Monitoring Visits and Groundwater Sampling

- 4.7.1 A summary of the gas and groundwater spot monitoring visits undertaken is outlined in the table below. Results of the post fieldwork monitoring are presented in Appendix E.
- 4.7.2 Overall, three ground gas monitoring visits were undertaken at fortnightly intervals.

Date	Purpose
18/07/2025	Gas and groundwater monitoring.
05/08/2025	
21/08/2025	

Table 4-D: Summary of post fieldwork spot monitoring

4.8 Investigation Constraints

- 4.8.1 The table below outlines restrictions and constraints to the investigation methods which either limited the design of the original scope of work or resulted in a deviation from the agreed scope.

Detail	Impact
Fieldwork constraints	
The site was previously quarried and there remains a large pit in the south of the site.	Exploratory boreholes were not possible in the south of the site as area was inaccessible to drilling rig.
Foul sewer recorded along eastern boundary.	No works were undertaken in close proximity to the service. No discernible affect on assessment.

Table 4-E Table of site restrictions

5 Laboratory testing

5.1 Overview

5.1.1 Samples obtained from exploratory holes were sent to independent accredited laboratories for chemical testing.

5.2 Chemical Testing

5.2.1 The chemical testing schedule was prepared by Soiltechnics using a targeted and judgemental approach, based upon the initial conceptual site model and fieldwork observations. This is further elaborated on within subsequent report sections.

5.2.2 Chemical laboratory test results are presented in Appendix F, and the total number of chemical tests undertaken is summarised below:

Sample Type	Qty	Testing	Suite Name
Soil	5	Basic Metals Suite + PAHs + Asbestos screen + pH + SOM + total cyanide + total phenol + TPH CWG	STS Basic Brownfield
	4	Full Metals Suite + PAHs + Asbestos screen + pH + SOM + total & free cyanide + WS Sulphate (2:1) + ammoniacal nitrogen + total phenol + TPH CWG + VOCs+TICs & SVOCs+TICs	STS Full Brownfield
Leachate	3	BS EN 12457-1 2:1 prep, Basic Metals Suite + PAHs + pH + SOM + total cyanide + total phenol + TPH CWG	STL Basic Brownfield

Table 5-A: Summary of chemical laboratory testing

6 Ground Investigation Findings

6.1 Ground Model

- 6.1.1 Ground conditions encountered were broadly in line with those anticipated from the desk study and comprised Made Ground over Glaciofluvial Deposits.

6.2 Made Ground

- 6.2.1 Made Ground was encountered in all exploratory locations and generally varied in thickness between 3.4m and >5.45m. However, within the far northern corner, Made Ground was more limited and extended to a depth of 1.1m. Based on historical maps, this area is likely to be outside of the former quarry.
- 6.2.2 Made Ground comprised both coarse-grained and fine-grained deposits. Generally, the coarse-grained soils were found within the top 1m of Made Ground and typically comprised a brown, grey or dark brown clayey gravel of concrete, flint, brick, clinker, glass, asphalt and metal, wood and plastic fragments. Fine-grained Made Ground typically comprised brown sandy, gravelly clay with occasional fragments of plastic and wood. Gravels consisted of brick, chalk, flint and rare concrete.
- 6.2.3 Photographs of the typical Made Ground are presented below.



Figure 6-A: Coarse-grained Made Ground encountered in WLS05 (left) and WLS07 (right)



Figure 6-B: Fine-grained Made Ground encountered in WLS03 from 1.2m to 3m bgl.



Figure 6-C: Fine-grained Made Ground encountered in WLS06 from 1.2m to 4.85m bgl.

6.3 Glaciofluvial Deposits

6.3.1 Glaciofluvial Deposits were encountered below the Made Ground, where the base was determined, and extended beyond the termination depth of the boreholes. The Glaciofluvial Deposits were generally encountered as firm to stiff, orangish brown clay with varying proportions of sand and gravel of flint, and medium dense to dense orangish brown, slightly clayey, sandy, fine to coarse gravel of flint.

6.3.2 A photograph of the typical Glaciofluvial Deposits encountered is presented below.



Figure 6-D: Glaciofluvial Deposits excavated from WLS01



Figure 6-E: Glaciofluvial Deposits excavated from WLS02

6.4 Groundwater

- 6.4.1 Groundwater was not observed in any of the exploratory holes during the fieldworks, with the maximum depth achieved being 5.45m bgl. During the subsequent monitoring phase, all boreholes remained dry.

6.5 Evidence of Possible Contamination

- 6.5.1 During the ground investigation works, no significant visual or olfactory evidence of contamination was noted. Anthropogenic materials were present throughout the Made Ground (brick, clinker, glass and metal, wood and plastic).

6.6 Obstructions and Instability

- 6.6.1 The progress of the ground investigation works was not generally affected by below ground obstructions or instability. However, WLS04 was terminated at 2.1m in the Glaciofluvial Deposits due to their competency.

7 Tier 2 Generic Quantitative Risk Assessment

7.1 Objectives

7.1.1 The objective of this generic quantitative risk assessment (GQRA) is to further assess the potential contaminant linkages (PCLs) identified by the preliminary risk assessment using the following:

- The findings of the intrusive site investigation and resulting site specific ground and hydrogeological model.
- Laboratory analysis of soils and groundwater.
- Monitoring of ground gases.

7.2 Fieldwork Observations

7.2.1 Fieldwork observations on the potential for contamination and the underlying ground conditions did not identify any new contaminant sources or significant pathway alterations to the anticipated ground model. Therefore, no PCL additions or amendments are required to be made to the CSM at this stage.

7.3 Laboratory Testing Rationale

7.3.1 Laboratory testing has been scheduled by targeting potential contaminant linkages identified within the iCSM and observations made during fieldworks. The sampling and testing strategy is based on a judgemental approach.

7.3.2 The testing of the general Made Ground deposits was undertaken across various locations to gain spatial coverage over the site and to characterise the strata encountered. Testing included a broad suite of analysis due to the potential for unknown contamination to be present.

7.3.3 The general testing of the shallow Made Ground soils is also considered sufficient to determine the potential for contamination to have arisen from historical and recent contaminative activities as described in the iCSM for the site.

7.4 Generic Assessment Criteria

7.4.1 Assessment of laboratory test data has been carried out using published generic assessment criteria (GACs). The GACs act as screening values to provide a 'trigger' to an assessor that soil concentrations above these limits might present an unacceptable risk.

7.4.2 Various GAC sources are used within this report. Key assumptions are made in the derivation of screening values in regard to their use and application, and exposure modelling is based on precautionary national scenarios. This generic approach can result in an overly conservative assessment; therefore, the assessor is required to review the outcome of the GQRA screening in the context of the site specific CSM and identified potential contaminant linkages.

7.4.3 Asbestos does not currently have published GACs which can be used for generic assessment purposes, at this stage a present / absent trigger limit has been adopted.

7.4.4 Specific details regarding the published GAC sources chosen and any parameter refinements made are summarised within Appendix G, along with the order of preference where multiple GAC sources are available. The exposure models adopted are discussed in the relevant sections below.

7.5 Human Health GQRA (Soils and Vapour)

7.5.1 The results of the human health screening assessment for soils and vapours are detailed in Appendix G. The following table outlines the exposure models adopted, along with summarising the outcome of each screening assessment.

Receptor	Exposure Model	Outcome
All human health receptors	Presence of asbestos	No suspected ACMs observed during fieldworks. No fibres detected through laboratory analysis.
Proposed users	Residential with plant uptake	3 samples showing multiple PAH exceedances. All other results below GAC screening values.
Construction operatives	Acute occupational exposure (assumed no PPE worn)	No exceedances.
Adjacent site users and the public	Acute off-site public exposure during construction phase	No exceedances.

Table 7-A: Human health GQRA models and outcomes

7.5.2 The table below summarises the instances where contaminants have exceeded the generic screening criteria.

Receptor	Strata	Contaminant	Locations & Depths	Test Result / Range (mg/kg)	GAC (mg/kg)
Proposed users	Made Ground	Benzo(a)anthracene	WLS09 at 0.8m	21	7.2
		Benzo(a)pyrene	WLS05 at 0.80m WLS09 at 0.8m	6.1-28	5.0
		Benzo(b)fluoranthene	WLS05 at 0.80m WLS07 at 0.30m WLS09 at 0.8m	5.1-31	2.6
		Chrysene	WLS09 at 0.8m	19	15
		Dibenzo(a,h)anthracene	WLS05 at 0.80m WLS07 at 0.30m WLS09 at 0.8m	0.57-3.6	0.24

Table 7-B: Human health GQRA exceedances

7.6 Proposed Site Users Risk Assessment (Soils and Vapour)

7.6.1 All reported concentrations of contaminants are below the relevant generic assessment criteria for human health receptors with the exception of elevated PAHs in three locations. The sample taken from WLS09 contained significantly higher concentrations of PAH than elsewhere, which is considered likely to be associated with the presence of clinker and evidence of burning locally on site.

7.6.2 With regard to potential vapour risk, PAHs are not considered to be volatile and therefore the risk is considered low.

7.6.3 It is noted that during the previous investigation in 2018, an ACM fragment (chrysotile cement) was encountered within the Made Ground in one location. No fibres were detected during screening of nine samples. During this investigation, no ACM was identified and again, no fibres were detected in a further nine samples. On this basis, the risk from asbestos is considered low.

- 7.6.4 Where present, the provision of hardstanding areas (concrete/asphalt) will negate the requirement for a clean cover system, and no action is considered necessary. Within areas of proposed soft landscaping/gardens, a clean capping layer will be required to an appropriate thickness in order to reduce the risk.
- 7.6.5 An alternative cover system comprising a geotextile membrane and gravel surfacing (min 100mm) is considered appropriate for any driveways/pathways or beneath buildings if hardstanding is not used.
- 7.6.6 Depending on final development proposals and the extent of hardstanding, it may be considered more appropriate to reduce levels across the site as a whole (potentially using the material as backfill for the existing quarry) and install a clean capping layer across the entire site.

7.7 Construction Workers Risk Assessment

- 7.7.1 Analysis indicates that contaminant levels do not pose an acute risk to construction workers. In general, standard PPE and hygiene protocols for working on brownfield sites is considered adequate to mitigate against the potential risk from contaminants on site, and no special precautions are required.
- 7.7.2 However, the site is a backfilled quarry and there is a potential of encountering unexpected contamination in unexplored areas of the site. Good working practices for working on brownfield sites and for dust mitigation should be adhered to at all times, including.
- Asbestos awareness training.
 - A watching brief during enabling works/earthworks.
 - Establishing an appropriate action plan in the event of encountering unexpected contamination and suspected asbestos containing materials.
 - Control of material movements to minimise dust generation, for example by reducing drop heights and ensuring buckets are not over-loaded.
 - Materials should be dampened down.
- 7.7.3 A contamination discovery strategy should also be in place.

7.8 Adjacent Site Users Risk Assessment

- 7.8.1 Based upon the laboratory results and our understanding of the site, there is not considered to be an unacceptable level of risk to adjacent site users, both during construction and following completion of the development.
- 7.8.2 Good working practices for working on brownfield sites (as detailed above) would further reduce the risk and any nuisance from dust/odours during any excavation works.

7.9 Controlled Waters GQRA

- 7.9.1 The results of the GQRA screening for controlled waters are detailed in Appendix G. The following table outlines the exposure models adopted, along with the outcome of the assessment.

Receptor	Exposure Model	Outcome
Groundwaters	Drinking water guidelines	No exceedances.

Table 7-C: Controlled water GQRA models and outcomes

7.10 Controlled Waters Risk Assessment

- 7.10.1 The site is underlain by Glaciofluvial Deposits, which are recorded as a secondary A aquifer, and are likely in hydraulic connectivity with the underlying Chalk (principal aquifer). The site is also within a source protection zone III. However, groundwater is anticipated to be at a depth of around 30-50m within the Chalk although the presence of groundwater within the River Terrace Gravels cannot be fully discounted.
- 7.10.2 No gross contamination was encountered within the soils on site and leachate testing has not identified any exceedances of drinking water guideline values. On this basis, ground conditions encountered are not considered to present an unacceptable contamination risk to controlled waters.

7.11 Ground Gas Monitoring Rationale

- 7.11.1 Although no significant ground gas risk was identified within the iCSM based on current development proposals, three gas monitoring rounds were undertaken to provide a quantitative analysis of the assessment and assess the potential risk to construction workers during any subsurface excavations.
- 7.11.2 Ground gas sources which were identified in the iCSM as potentially posing an unacceptable risk to development were as follows:
- Deep, potentially organic-rich Made Ground
 - Off-site landfill (127m from the site)
 - Nearby infilled quarries
- 7.11.3 3No. gas monitoring wells were installed at the site, and a total of 3 visits were undertaken over a period of 2 month.
- 7.11.4 All gas monitoring wells were installed within the Made Ground and two were located on the northwestern and northeastern site boundaries to detect any landfill gases migrating onto site.

7.12 Ground Gas Monitoring Results

- 7.12.1 A summary of the gas monitoring results follows, with the full results detailed within Appendix E.
- Gas flow rates were detected up to 0.4 l/hr.
 - Steady concentrations of methane were recorded below the limit of detection pf 0.1%.
 - Concentrations of carbon dioxide were in the range of <0.1% to 11.5%.
 - Steady concentrations of oxygen were marginally depleted within all locations, down to concentrations of 14.2% (WLS01), 1.6% (WLS05) and 12.1% (WLS06) and 14.2%.
- 7.12.2 Based on the above, significant concentrations of ground gas have not been identified. However, there is the possibility for reduced levels of oxygen within sub-surface excavations which we recommend be monitored should they require entry.
- 7.12.3 Should development proposals change to include permanent buildings, further assessment will be required.

7.13 Risks to Soft Landscaping Vegetation

- 7.13.1 To help determine the risk to vegetation from potentially phytotoxic contaminants, screening values presented within the British Standard '*Specification for Topsoil*' (BS 3882:2015), and the Environment Agency online guidance '*Sewage Sludge in Agriculture: Code of Practice*' have been adopted.
- 7.13.2 Analysis indicates that the near-surface soils are unlikely to contain metal concentrations at levels which could pose a potential phytotoxic risk to vegetation in the proposed planting scheme. However, Topsoil is absent on site but providing a clean cover system is installed to mitigate against the human health risks already identified, this will also serve as a growth medium for proposed planting.

7.14 Water Supply Pipes

- 7.14.1 A full site investigation as set out in the UK Water Industry Research (UKWIR) document '*Guidance for the selection of Water supply pipes to be used in Brownfield sites*' has not been undertaken.
- 7.14.2 The UKWIR document advises a trigger concentration of 0.125mg/kg for the 'extended VOC (volatile organic compounds) suite', which includes the PAH (polycyclic aromatic hydrocarbons) suite that has been included in the soil analysis during this investigation.
- 7.14.3 The maximum summed concentration of PAH congeners from individual samples obtained from the site at likely pipe depths (0.50m to 1.50m bgl) exceeds the trigger concentration of 0.125mg/kg in 8 out of 9 samples and low-level TPH has also been identified locally. On this basis the installation of protective barrier-pipes in below ground water infrastructure is recommended as a precaution, unless service trenches are over-dug and backfilled with suitable clean materials.
- 7.14.4 In all instances, it is advised to consult the water company for advice to determine if protective pipe is necessary or if further assessment and investigation works are warranted. Irrespective of the assessment made here, water companies may insist on barrier pipe being installed. Once the initial consultation has taken place, Soiltechnics can support you in any further assessments that may be required.

7.15 Updated Conceptual Site Model (uCSM)

- 7.15.1 Following on from the discussions above, an updated conceptual site model has been tabulated overleaf.
- 7.15.2 The table below presents our approach to the assessment of risks associated with potential contaminant linkages. The categories are based upon the definitions within CIRIA C552 (2001), with the addition of a 'negligible likelihood' scenario, which is to be used where there is no realistic scenario in which harm could occur.

		Consequence of harm			
		Severe	Medium	Mild	Minor
Probability of harm	High likelihood	Risk: Very high (high – severe)	Risk: High (high – medium)	Risk: Moderate (high – mild)	Risk: Moderate/Low (high – minor)
	Likely	Risk: High (likely – severe)	Risk: Moderate (likely – medium)	Risk: Moderate/Low (likely – mild)	Risk: Low (likely – minor)
	Low Likelihood	Risk: Moderate (low – severe)	Risk: Moderate/Low (low – medium)	Risk: Low (low – mild)	Risk: Very low (low – minor)
	Unlikely	Risk: Moderate/Low (unlikely – severe)	Risk: Low (unlikely – medium)	Risk: Very low (unlikely – mild)	Risk: Very low (unlikely – minor)
	Negligible Likelihood	Risk: Low (negligible – severe)	Risk: Very Low (negligible – medium)	Risk: Very Low (negligible – mild)	Risk: Negligible (negligible – minor)

Table 7-D: CSM risk ratings

RECEPTOR: PROPOSED END USERS				
Potential Source	Contaminants of Concern	Pathway	Tier 2 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	Metals and polycyclic aromatic hydrocarbons (PAH)	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Moderate/Low (low – medium)	Sporadic exceedances of PAH have been identified within the Made Ground. Pathways will be severed where buildings/hardstanding are proposed. Within proposed areas of soft landscaping, a clean capping layer of Topsoil will be required.
	ACMs and asbestos	Inhalation of dusts	Risk: Low (unlikely – medium)	No ACM fragments were observed during fieldwork and laboratory testing did not detect any asbestos fibres.
	PAH and TPH	Permeation into drinking water pipes	Risk: Moderate/Low (low – medium)	Organic contaminants are present in the shallow soils at depths and concentrations which could pose a risk of penetrating drinking water pipes. Barrier pipe is recommended for potable water pipes.
Various historical site uses.	Metals, PAH, hydrocarbons, asbestos, Microorganisms, ammonia	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Moderate/Low (low – medium)	Sporadic exceedances of PAH have been identified within the Made Ground, which could be associated with historical activities. Pathways will be severed where buildings/hardstanding are proposed. Within proposed areas of soft landscaping, a clean capping layer of Topsoil will be required.
Burning/bonfires	PAH	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Moderate/Low (low – medium)	Evidence of burning both recently and historically on the site. Sporadic exceedances of PAH have been identified within the Made Ground, which could be associated with burning activities. Pathways will be severed where buildings/hardstanding are proposed. Within proposed areas of soft landscaping, a clean capping layer of Topsoil will be required.

Table 7-E: uCSM – Proposed end users

RECEPTOR: CONSTRUCTION WORKERS				
Potential Source	Contaminants of Concern	Pathway	Tier 2 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	Metals and polycyclic aromatic hydrocarbons (PAH)	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Low (unlikely – medium)	No gross contamination of high-risk contaminants anticipated (e.g. cyanide, benzene, and vinyl chloride). Standard PPE and hygiene protocols for working on brownfield sites are likely to be sufficient to mitigate risk. Good working practices for dust mitigation should be adhered to at all times. There is a potential for unknown contamination to be identified and a watching brief and contamination discovery strategy should also be in place.
	ACMs and asbestos	Inhalation of dusts	Risk: Low (unlikely – medium)	No ACM fragments were observed during fieldwork and laboratory testing did not detect any asbestos fibres.
	Permanent ground gases (CH ₄ and CO ₂)	Migration through the sub-surface into enclosed spaces	Risk: Low (unlikely – medium)	Significant concentrations of ground gas have not been identified. However, there is the possibility for reduced levels of oxygen within sub-surface excavations which we recommend be monitored should they require entry.
Various historical site uses.	Metals, PAH, hydrocarbons, asbestos, Microorganisms, ammonia	Ingestion, inhalation and contact with soils, dusts and vapours	Risk: Low (unlikely – medium)	No gross contamination of high-risk contaminants anticipated (e.g. cyanide, benzene, and vinyl chloride). Standard PPE and hygiene protocols for working on brownfield sites are likely to be sufficient to mitigate risk. Good working practices for dust mitigation should be adhered to at all times. There is a potential for unknown contamination to be identified and a watching brief and contamination discovery strategy should also be in place.
Historical landfill (Mardley Heath) recorded 127m to the east	Permanent ground gases (CH ₄ and CO ₂)	Lateral migration through the sub-surface into enclosed spaces	Risk: Low (unlikely – medium)	Significant concentrations of ground gas have not been identified. However, there is the possibility for reduced levels of oxygen within sub-surface excavations, which we recommend be monitored should they require entry.
Backfilled quarries/infilled land	Permanent ground gases (CH ₄ and CO ₂)	Lateral migration through the sub-surface into enclosed spaces	Risk: Low (unlikely – medium)	

Table 7-F: uCSM – acute exposure to construction workers

RECEPTOR: ADJACENT SITE USERS FOLLOWING COMPLETION				
Potential Source	Contaminants of Concern	Pathway	Tier 2 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	ACMs and asbestos	Ingestion of dusts	Risk: Low (unlikely – medium)	No ACM fragments were observed during fieldwork and laboratory testing did not detect any asbestos fibres.

Table 7-G: uCSM – chronic exposure to adjacent site users

RECEPTOR: ADJACENT SITE USERS DURING THE CONSTRUCTION PHASE				
Potential Source	Contaminants of Concern	Pathway	Tier 2 Risk Assessment (probability of harm x consequence)	Discussion
Made Ground/Quarry backfill	ACMs and asbestos	Inhalation of dusts	Risk: Low (unlikely – medium)	No ACM fragments were observed during fieldwork and laboratory testing did not detect any asbestos fibres.

Table 7-H: uCSM – acute exposure to adjacent site users

RECEPTOR: CONTROLLED WATERS				
Potential Source	Contaminants of Concern	Pathway	Tier 2 Risk Assessment (probability of harm x consequence)	Discussion
All on site sources	Metals, PAH, hydrocarbons, ammonia	Leaching and vertical migration (Groundwater)	Risk: Low (unlikely – medium)	No significant contamination has been identified at the site, which could pose a risk to groundwater.

Table 7-I: uCSM – controlled waters risk

7.16 Risk Assessment Conclusions

- 7.16.1 The updated CSM has identified potential contaminant linkages which exceed the low-risk threshold and require further investigation, mitigation, or remediation. These are discussed in further detail below.

Contaminant Source	Receptor	Recommended Action	Discussion
Made Ground/Quarry Backfill	Proposed end users	Remediation	Elevated PAH has been identified and remediation is required. There are a number of potential options that could be adopted once design proposals are finalized, as detailed in 7.6.4 to 7.6.6. These include a clean soil cover system in all soft landscaping areas, geotextile membrane and gravel surface or a full site strip and introduction of a capping layer across the site.
	Construction workers	Mitigation	The site is a backfilled quarry and there is a potential of encountering unexpected contamination in unexplored areas of the site. Good working practices for working on brownfield sites and for dust mitigation should be adhered to at all times, which should include asbestos awareness training and a watching brief during enabling works/earthworks.
Elevated organic contaminants within the Made Ground	Drinking water infrastructure	Remediation	There is a requirement for installation protective barrier pipes for drinking water.

Table 7-J: GQRA risk assessment conclusions

- 7.16.2 A Remediation Strategy must be established to detail the measures to be taken, along with including the verification plan for all necessary works.
- 7.16.3 As the remedial requirements of the project are not inherently complex, an Options Appraisal is not considered necessary. An Options Appraisal would highlight a range of potential remedial options and then provide a comparison of the options based on their feasibility, cost, sustainability, effectiveness, and operational requirements. This can be undertaken on request.
- 7.16.4 Once all investigations and remedial works are completed, a Verification Report will then be required.

7.17 Ground Gas Protection Measures

- 7.17.1 For clarity, the requirement for ground gas protection measures is summarised in the table below.

Gas Type	Contaminant of Concern	Protection Measures Required?
Permanent Ground Gases	N/A	None required
Hydrocarbon Vapours	N/A	None required
Radon	N/A	None required

Table 7-K: Ground gas protection measures requirement

7.18 Unexpected and Previously Unencountered Contamination

- 7.18.1 With the development of any site, there is a residual risk of contamination being found that is unexpected or has not been encountered during investigation or other siteworks.
- 7.18.2 Should any previously unencountered and unexpected contamination be encountered, works should be temporarily halted and Soiltechnics informed. The Consultant should then assess the situation to determine what remedial action is required and inform the Local Authority at the earliest opportunity.
- 7.18.3 It is often a requirement of Local Authority planning conditions that the building/demolition contractor has a contamination discovery/contingency strategy in place for dealing with unexpected contamination. Soiltechnics are pleased to provide advice on such a strategy if required.

7.19 Soil and Waste Management

- 7.19.1 In terms of the development, where reasonably practicable, landfill disposal should be minimised through the reuse of site-won materials on site, or off-site transfer of surplus soils to other development schemes or Soil Treatment Facilities. Early consideration of the site's overall material balance at the design stage is also critical in reducing the need for off-site disposal, limiting costs, and increasing the overall sustainability of the development.
- 7.19.2 Where Made Ground soils are to be reused onsite or materials transferred between sites, a Materials Management Plan (MMP) or Waste Exemption is recommended.
- 7.19.3 The process of an MMP allows soils that are suitable for reuse and have a certainty of use to not be considered a waste, and therefore not fall under the waste regulations. This scheme is self-regulated within the industry and is supported in principle by the Environment Agency.
- 7.19.4 Where soils require off-site disposal, soils should be classified for disposal to landfill by undertaking testing in accordance with WM3 (v1.2GB), and a Waste Acceptance Criteria assessment (WAC) undertaken in accordance with the limits in Annex II of the Landfill Directive (Directive 1999/31/EC).
- 7.19.5 Based on current development proposals, the residual quarry to the southwest will require infilling prior to redevelopment. This will either require an environmental permit or could be controlled under an MMP in accordance with the CL:AIRE DoW CoP.
- 7.19.6 Soiltechnics can provide additional support and guidance to assist in overall material management and soil waste minimisation upon request.

8 Recommendations for Further Works

8.1.1 The following table summarises the additional works which should be undertaken prior to commencement of any construction works and in support of the planning conditions.

Aspect	Delivered By	Description	Necessity
Remediation Strategy	Soiltechnics	A Remediation Strategy is required to detail the requirements and verification plan for all remedial works including import of soft landscaping soils/capping materials to ensure they are suitable for use.	REQUIRED
Installation barrier pipe	3 rd Party	The Principal Contractor should liaise with the statutory undertaker to confirm the requirement for barrier pipe installation and associated verification.	REQUIRED
Excavation Works Watching Brief	Principal Contractor	Due to the potential for contamination to be encountered, a watching brief should be in place during enabling works/earthwork phases.	RECOMMENDED
Discovery Strategy	Principal Contractor	The Principal Contractor should have a discovery strategy in place in the event of exposing unexpected or previously unencountered contamination. Soiltechnics should be informed at the earliest opportunity to undertake an assessment, and to inform the Local Authority as appropriate.	RECOMMENDED
Detailed UXO Risk Assessment	3 rd Party	The Preliminary Risk Assessment identified that bombing may have occurred in the vicinity of the site, therefore a Detailed UXO Risk Assessment should be undertaken in accordance with CIRIA C785. This must be commissioned directly with a specialist	RECOMMENDED
Materials Management Plan	Soiltechnics	Once the overall designs and cut-and-fill requirements for the scheme have been finalised, and before excavation/infill works commence, an MMP is recommended to facilitate the reuse of soils on site and the transfer of materials on or off-site.	RECOMMENDED

Table 8-A: Recommended further works

Appendix A Drawings



Key:	
	Park Home
	Parking
	Visitor Parking
	Storage Shed
	Refuse Storage
	Gabion Retainment Wall
	Acoustic Fencing
	Pedestrian Footpath
	Electric Vehicle Charging Point
	Assembly Point
	Fire Point
	Low Level Bollard Lighting

Job: Carden Gardens Danesbury Park Road, Welwyn AL6 9SN
Title: Masterplan
Plan Number: P379C16 - 13 - REV A
Checked by: JH
Scale: 1:500@A2
Date: 05.03.2026
Ordnance Survey © Crown Copyright 2025. All Rights Reserved. Licence number 100022432
 park designs 0116 385 3000 www.park-designs.co.uk



Key:

- Site Boundary
- Approximate Area/Zone of Quarry Pit, not backfilled, ~4m deep
- Building Rubble

Exploratory Holes

- Windowless Sampling Borehole
- Monitoring Installation

Notes

1) Base image provided by Google.

2) All drawn features are approximate.

Contains OS data © Crown copyright [and database right] [2024]
Map data © 2024 Google

A	July 2025	First issue
REV	DATE	COMMENT ON VARIATION

soiltechnics
environmental • geotechnical • building fabric

PROJECT
Carden Gardens, Welwyn

TITLE
Exploratory Hole Location Plan

DRAWING No.
STX7068-D01-B



Key:

- Site Boundary
- Approximate Area/Zone of Quarry Pit, not backfilled, ~4m deep
- Site Photos
- Building Rubble

Notes

1) Base image provided by Google.

2) All drawn features are approximate.

Contains OS data © Crown copyright [and database right] [2024]
Map data © 2024 Google

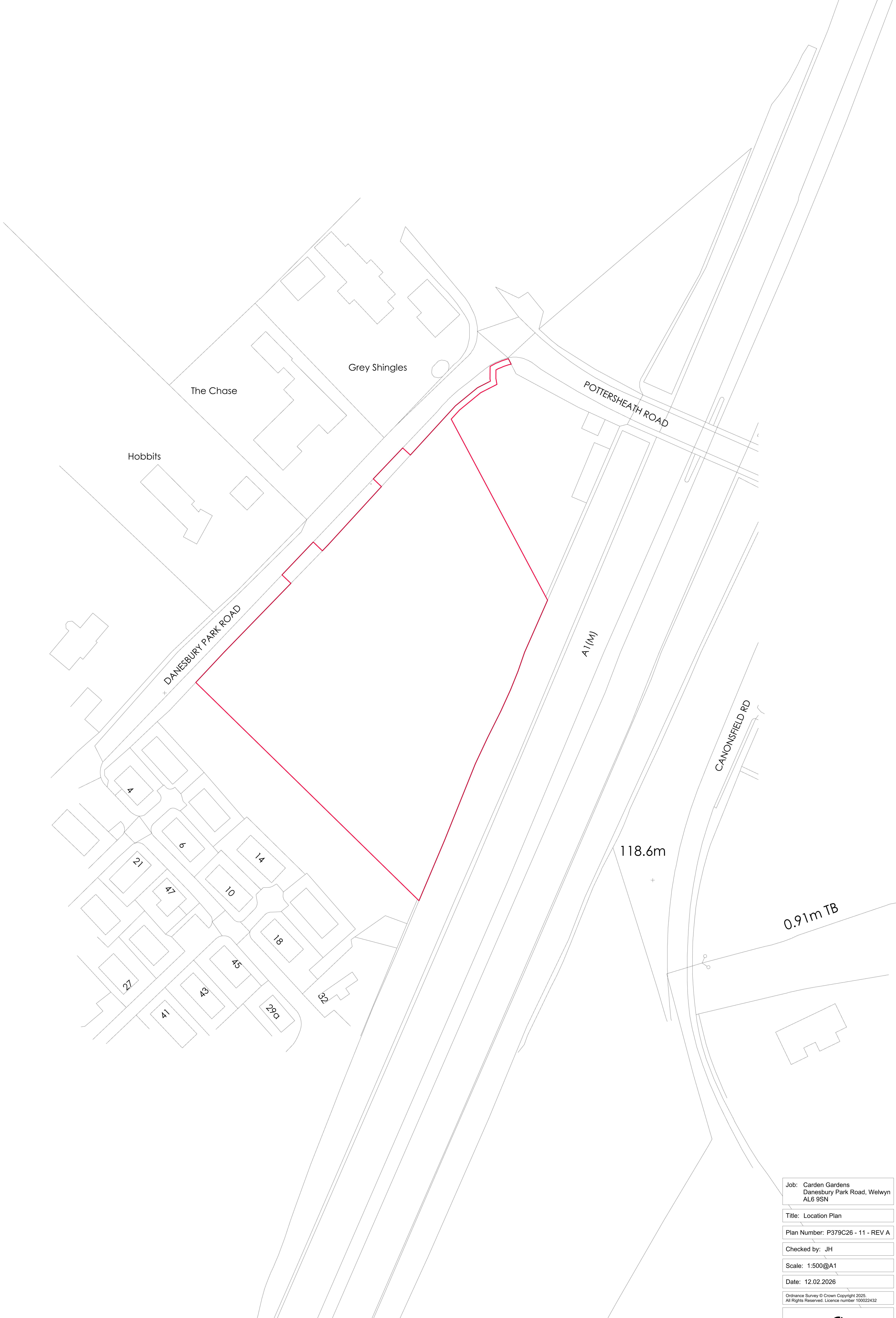
A	July 2025	First issue
REV	DATE	COMMENT ON VARIATION

environmental • geotechnical • building fabric

PROJECT
Carden Gardens, Welwyn

TITLE
Photograph Location Plan

DRAWING No.
STX7068-D02-B



Job: Carden Gardens
Danesbury Park Road, Welwyn
AL6 9SN

Title: Location Plan

Plan Number: P379C26 - 11 - REV A

Checked by: JH

Scale: 1:500@A1

Date: 12.02.2026

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Key:
Application site boundary



park designs
0116 385 3000
www.park-designs.co.uk

0m 25m 50m 75m 100m



Appendix B Exploratory Hole Logs: Boreholes

Key to legends

Composite materials, soils and lithology					
	Topsoil		Made Ground		Boulders
	Clay		Coal		Cobbles
	Gravel		Limestone		Mudstone
	Sand		Sandstone		Silt
					Siltstone
					Peat
					Concrete
					Chalk

Note: Composite soil types are signified by combined symbols.

Key to 'test results' and 'sampling' columns

Test result		From (m) To (m)	Records depth of sampling	
Depth	Records depth that the test was carried out (i.e.: at 2.10m or between 2.10m and 2.55m)		D	Disturbed sample
			B	Bulk disturbed sample
			ES	Environmental sample
			SPTLS	SPT liner sample
		Type	W	Water sample
			U	Undisturbed thick-walled sample 100mm diameter sampler
			UT	Undisturbed thin walled sample 100mm diameter sampler
			UTF	Failed undisturbed sample
Result	PP – Pocket penetrometer result reported as an equivalent undrained shear strength (kN/m²) by applying a factor of 50. SV – Hand held shear vane result reported as an undrained shear strength (kN/m²). Where multiple readings are taken at the same level the average value is shown on the log. * Signifies that instrument limit reached. SPT – Standard Penetration Test result (N value uncorrected)^{1,2,3} SPT(c) – Standard Penetration Test result (solid cone) (N value) (uncorrected)^{1,2,3} * Signifies that the test was terminated before full penetration was achieved. UT – Undisturbed sample 100mm diameter sampler with number of blows of driving equipment required to obtain sample			
Sampling				

Note 1: Total seating blows recorded in brackets.

Note 2: Casing depth records depth of casing when SPT or SPT(c) was carried out.

Note 3: Water depth records depth of water when SPT or SPT(c) was carried out.

Water observations

Described at foot of log and shown in the 'water strike' column.

▼ Water level observed after specified delay in drilling

▽ Water strike

Density

Density recorded in brackets determined by qualitative field assessment or inferred from density testing and soil descriptions from across the site (i.e.: [Medium dense]).

Installation details

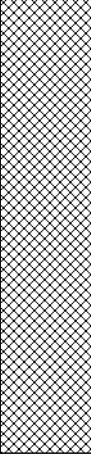
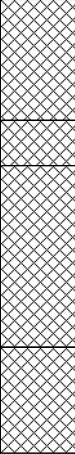
	Gravel filter		Bentonite
	Slotted pipe		Unslotted pipe
	Arisings		Grout
	Extensometer magnet		Vibrating wire piezometer

INSTALL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (mOD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Brown slightly clayey fine to coarse GRAVEL of subangular to rounded concrete and flint. (MADE GROUND)	0.15				S 1.20	(4) 7					0.45	1.90	ES
	Firm brown gravelly CLAY with low cobbles content with fragments of ceramic. Gravel is fine to coarse angular to rounded slate, brick, clinker and flint. Cobbles are concrete. (MADE GROUND)	0.75												
	Light brown sandy fine to coarse GRAVEL of subrounded to rounded flint. (MADE GROUND)	1.10												
	Firm brown slightly sandy gravelly CLAY with fragments of wood. Gravel is fine to coarse angular to subrounded concrete, brick and chalk. (MADE GROUND)					S 3.00	(2) 8					1.60	3.00	ES
	Firm to stiff orangish brown mottled grey slightly sandy gravelly CLAY. Gravel is subangular to rounded chalk and flint. (GLACIOFLUVIAL DEPOSITS)	4.40				S 5.00	(14) 45					4.50		D
	Dense orangish brown slightly sandy clayey fine to coarse GRAVEL. Gravel is angular to subrounded flint. (GLACIOFLUVIAL DEPOSITS)	4.85												
	BOREHOLE TERMINATED AT 5.45m	5.45												

Notes Service avoidance pit to 1.2m bgl. Terminated at scheduled depth.	Groundwater observations						Recovery details		Title		Date(s)
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		23/06/2025
							1.20 - 2.00	100	Method Dynamic Sampling	Plant used Premier 110	Sheet number Sheet 1 of 1
							2.00 - 3.00	100			
							3.00 - 4.00	55	Level (m OD) -	Logged by TB	Revision A
							4.00 - 5.00	95			
	No groundwater strike recorded								Co-ordinates -	Status FINAL	WLS01

[illegible]

Notes Service avoidance to 1.2m bgl. Terminated at scheduled depth.	Groundwater observations					Recovery details		Title		Date(s)	
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		
							1.20 - 2.00	100	Method	Plant used	Sheet number
							2.00 - 3.00	90	Dynamic Sampling	Premier 110	Sheet 1 of 1
							3.00 - 4.00	65	Level (m OD)	Logged by	Revision
							4.00 - 5.00	100	-	TB	A
	No groundwater strike recorded							Co-ordinates	Status	WLS02	
							-	FINAL			

INSTALL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (mOD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Firm brown very gravelly CLAY with low cobble content and occasional fragments of wood. Gravel is fine to coarse angular to rounded slate, brick, clinker and flint. Cobbles are flint. (MADE GROUND)													
	Dense reddish brown fine to coarse slightly clayey GRAVEL. Gravel is subangular to rounded brick, concrete and flint. (MADE GROUND)	0.80										1.00	1.50	ES
	Firm brown becoming dark brown slightly sandy very gravelly CLAY. Gravel is fine to coarse angular to subrounded concrete, brick, flint and occasional chalk. (MADE GROUND)	1.10												
	Soft brown slightly gravelly sandy CLAY. Gravel is medium to coarse subangular to rounded flint and brick. (MADE GROUND)	2.30										2.50	3.00	ES
	BOREHOLE TERMINATED AT 3.00m	3.00												

Notes Service avoidance to 1.2m bgl. Terminated at scheduled depth.	Groundwater observations						Recovery details		Title		Date(s)
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		23/06/2025
							1.20 - 2.00	100	Method Dynamic Sampling	Plant used Premier 110	Sheet number Sheet 1 of 1
							2.00 - 3.00	100		Logged by TB	Revision A
									Co-ordinates -	Status FINAL	WLS03
	No groundwater strike recorded										

[illegible]

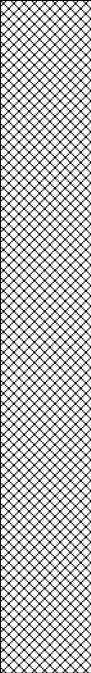
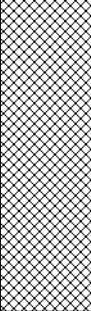
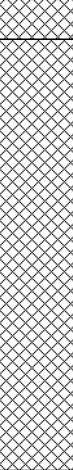
Notes Service avoidance pit to 1.2m bgl. Terminated due to obstruction/competent strata	Groundwater observations						Recovery details		Title		Date(s)
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		23/06/2025
							1.20 - 1.90	75	Method Dynamic Sampling	Plant used Premier 110	Sheet number Sheet 1 of 1
						Level (m OD) -			Logged by TB	Revision A	
									Co-ordinates -	Status FINAL	WLS04
	No groundwater strike recorded										

[illegible]

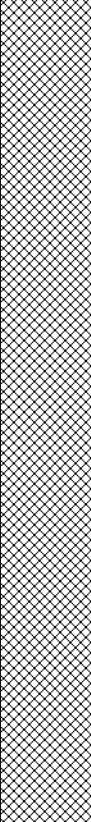
Notes Service avoidance pit to 1.2m bgl. Terminated at scheduled depth.	Groundwater observations						Recovery details		Title		Date(s)
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		23/06/2025
							1.20 - 2.00	60	Method	Plant used	Sheet number
							2.00 - 3.00	95	Dynamic Sampling	Premier 110	Sheet 1 of 1
							3.00 - 4.00	30	Level (m OD)	Logged by	Revision
							4.00 - 5.00	95	-	TB	A
No groundwater strike recorded								Co-ordinates	Status	WLS05	
								-	FINAL		

[illegible]

Notes Service avoidance pit to 1.2m bgl. Terminated at scheduled depth.	Groundwater observations						Recovery details		Title		Date(s)
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		23/06/2025
							1.20 - 2.00	95	Method	Plant used	Sheet number
							2.00 - 3.00	90	Dynamic Sampling	Premier 110	Sheet 1 of 1
							3.00 - 4.00	80	Level (m OD)	Logged by	Revision
							4.00 - 5.00	95	-	TB	A
No groundwater strike recorded								Co-ordinates	Status	WLS06	
								-	FINAL		

INSTALL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (mOD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Brown clayey fine to coarse GRAVEL of subangular to rounded concrete and flint. (MADE GROUND)	0.35				S 2.00	(2) 7					0.30		ES
	Dark brown clayey fine to coarse GRAVEL and fragments of glass, plastic and metal. Gravel is angular to subangular brick, concrete, clinker and flint. (MADE GROUND)											0.75		ES
	Firm brown gravelly CLAY. Gravel is fine to coarse angular to rounded slate, brick, clinker and flint. (MADE GROUND)	0.85										1.80	2.40	ES
	Firm to stiff orangish brown mottled grey slightly sandy gravelly CLAY and occasional fragments of plastic. Gravel is fine to coarse angular to rounded flint. (MADE GROUND)	1.60												
						S 4.00	(5) 24					3.40	3.80	D
	BOREHOLE TERMINATED AT 4.45m	4.45												

Notes Service avoidance pit to 1.2m bgl. Terminated at scheduled depth.	Groundwater observations						Recovery details		Title		Date(s)
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		24/06/2025
							1.20 - 2.00	100	Method Dynamic Sampling	Plant used Premier 110	Sheet number Sheet 1 of 1
							2.00 - 3.00	75			
							3.00 - 4.00	75	Level (m OD) -	Logged by TB	Revision A
							No groundwater strike recorded				

INSTALL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (mOD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Firm brown sandy gravelly CLAY. Gravel is fine to coarse angular to rounded slate, brick and flint. (MADE GROUND)	0.40				S 1.00	(2) 4					1.00	1.40	ES
	Firm brownish grey gravelly CLAY. Gravel is fine to coarse angular to rounded slate, brick, clinker and flint. (MADE GROUND)													
	Firm brown sandy gravelly CLAY and pocket of black organic matter. Gravel is fine to coarse subangular to subrounded flint. (MADE GROUND)	1.45												
	Firm brownish grey gravelly CLAY and pocket of black organic matter. Gravel is fine to coarse angular to rounded flint. (MADE GROUND)	2.35				S 3.00	(2) 5					2.40	3.00	ES
	Firm brown sandy gravelly CLAY and pocket of black organic matter. Gravel is fine to coarse subangular to subrounded flint and brick. (MADE GROUND)	3.10												
	Minimal recovery. (POSSIBLE MADE GROUND)	4.00												
	BOREHOLE TERMINATED AT 5.45m	5.45				S 5.00	(4) 12							

Notes Service avoidance pit to 1.2m bgl. Terminated at scheduled depth. Large flint cobble recovered 4.0-5.0m bgl	Groundwater observations						Recovery details		Title		Date(s)
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		24/06/2025
							1.20 - 2.00	90	Method Dynamic Sampling	Plant used Premier 110	Sheet number Sheet 1 of 1
							2.00 - 3.00	90			
							3.00 - 4.00	85	Level (m OD) -	Logged by TB	Revision A
							4.00 - 5.00	5			
	No groundwater strike recorded								Co-ordinates -	Status FINAL	WLS08

INSTALL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (mOD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Firm brown sandy gravelly CLAY and fragments of metal and porcelain. Gravel is fine to coarse angular to rounded slate, brick and flint. (MADE GROUND)	0.35												
	Dark brown fine to coarse GRAVEL and low cobbles content. Gravel is angular subangular brick, concrete, flint and clinker. Cobbles are brick. (MADE GROUND)	0.90										0.80		ES
	Firm blackish brown gravelly CLAY with occasional pockets of black organic matter and fragments of wood and glass. Gravel is fine to coarse angular to subangular brick, concrete, chalk and flint. (MADE GROUND)	1.50												
	Firm to stiff brown gravelly CLAY. Gravel is angular to subangular flint and occasional chalk. (MADE GROUND)	2.10				S 2.00	(2) 6							
	Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse subangular to rounded flint and occasional chalk and brick. (MADE GROUND)	4.00												
	Soft to firm brownish grey slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded flint. (MADE GROUND)	4.45				S 4.00	(4) 10							
	Stiff orangish brown very sandy CLAY. (GLACIOFLUVIAL DEPOSITS)	4.60										4.60	5.00	D
	Dense orangish brown slighty clayey sandy fine to coarse GRAVEL. Gravel is angular to subrounded flint. (GLACIOFLUVIAL DEPOSITS)	5.00												
	BOREHOLE TERMINATED AT 5.00m													

Notes Service avoidance pit to 1.2m bgl. Terminated at scheduled depth.	Groundwater observations						Recovery details		Title		Date(s)
	Strike (m)	5mins	10mins	15mins	20mins	Comments	Range (m)	% Recv	Dynamic windowless sampling record		24/06/2025
							1.20 - 2.00	100	Method Dynamic Sampling	Plant used Premier 110	Sheet number Sheet 1 of 1
							2.00 - 3.00	100			
							3.00 - 4.00	75	Level (m OD) -	Logged by TB	Revision A
							4.00 - 5.00	70			
No groundwater strike recorded									Co-ordinates -	Status FINAL	WLS09

Appendix C Photographic Records



Photograph 1: View east from site entrance, over northern portion of site, including northern boundary.



Photograph 2: View south from north west of site, including western boundary fence.