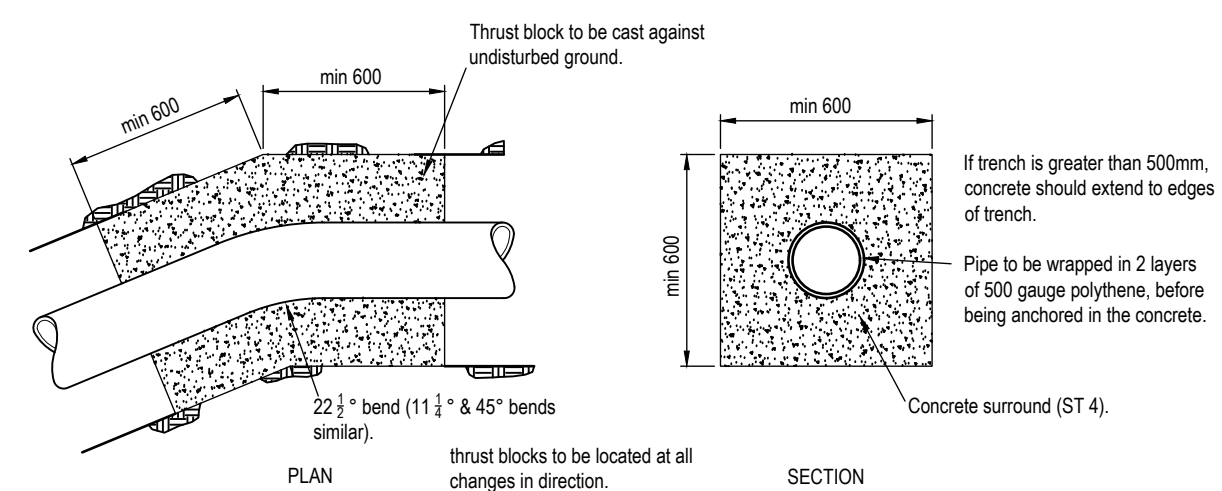
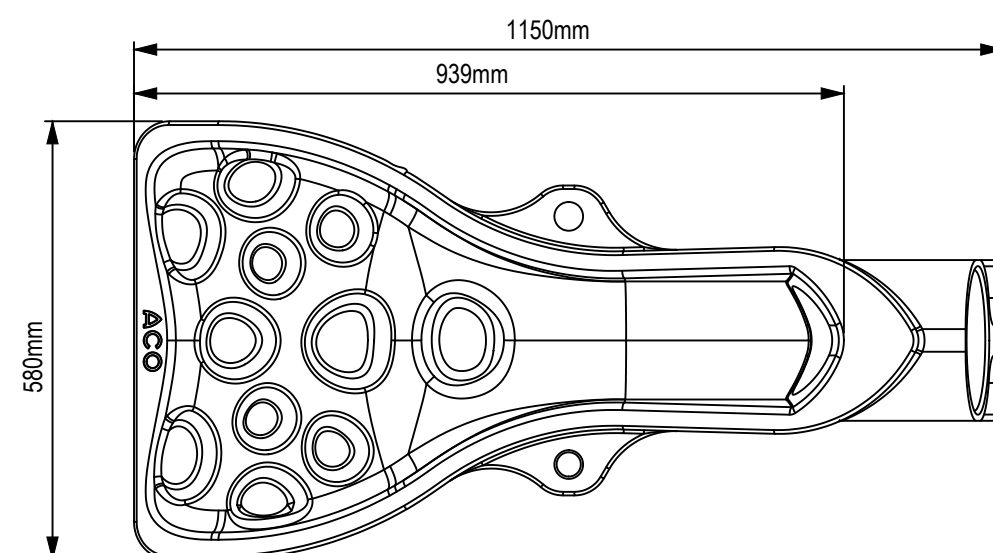
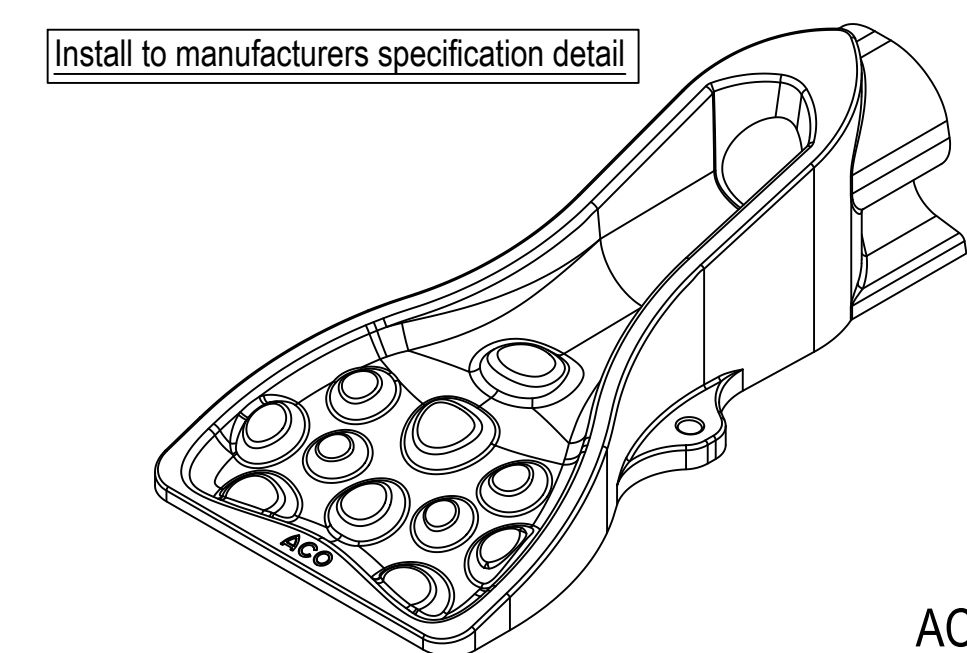
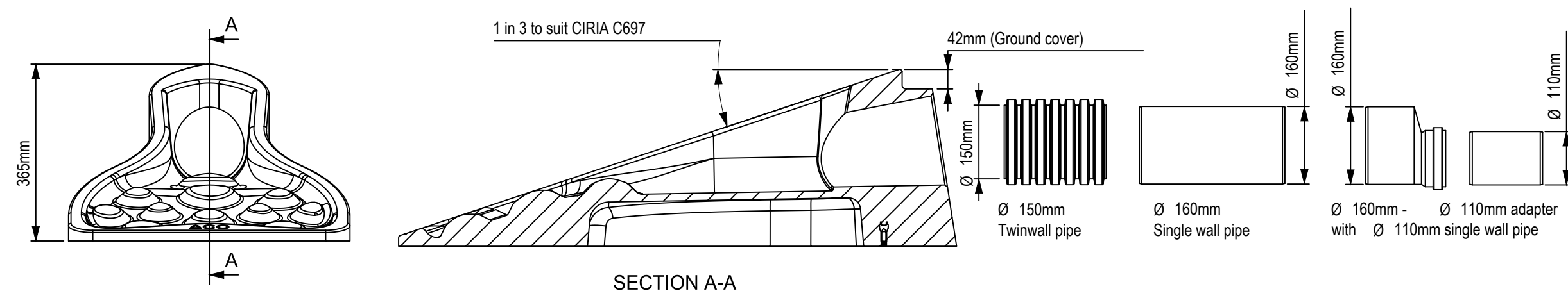
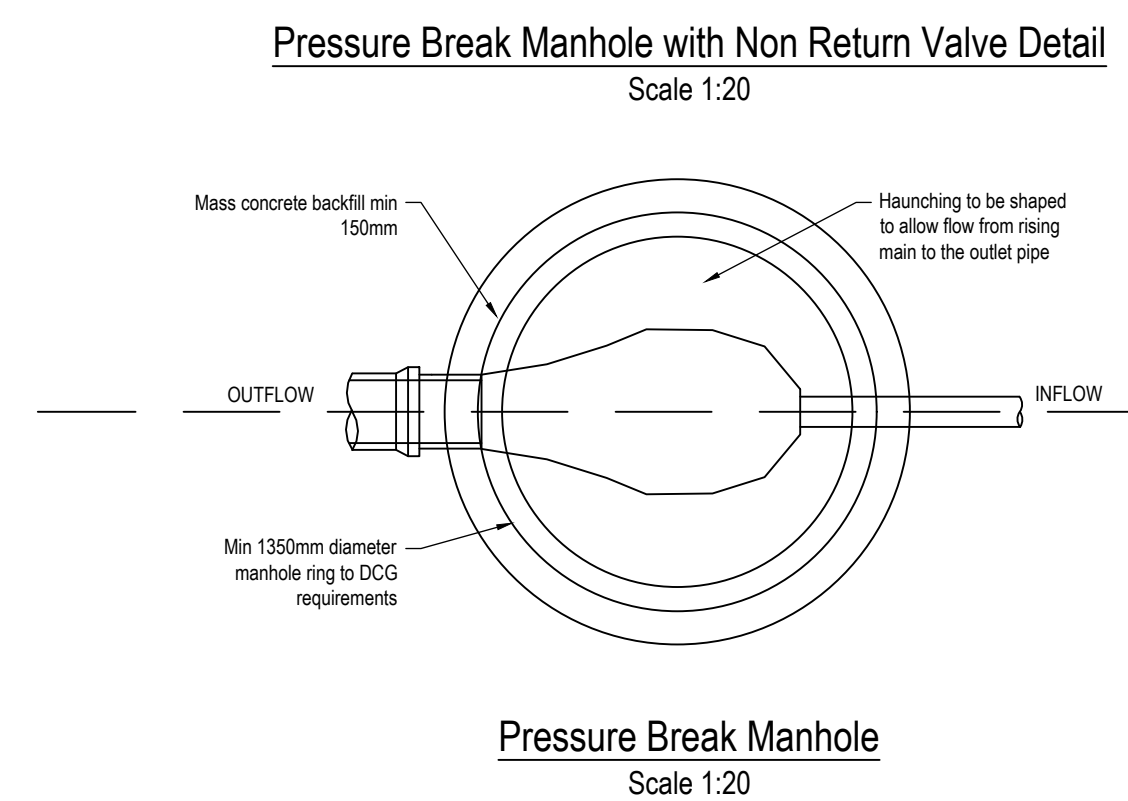
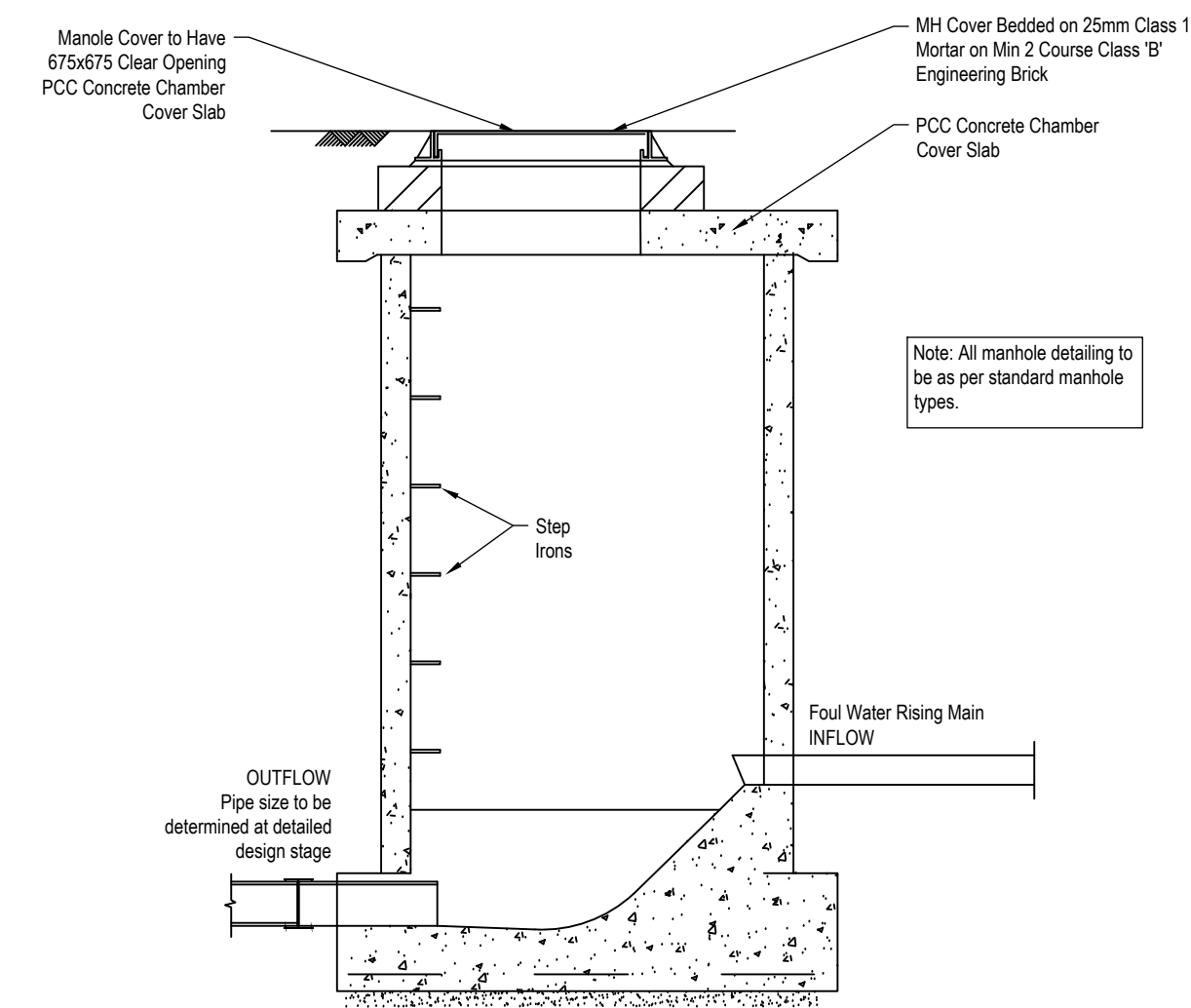
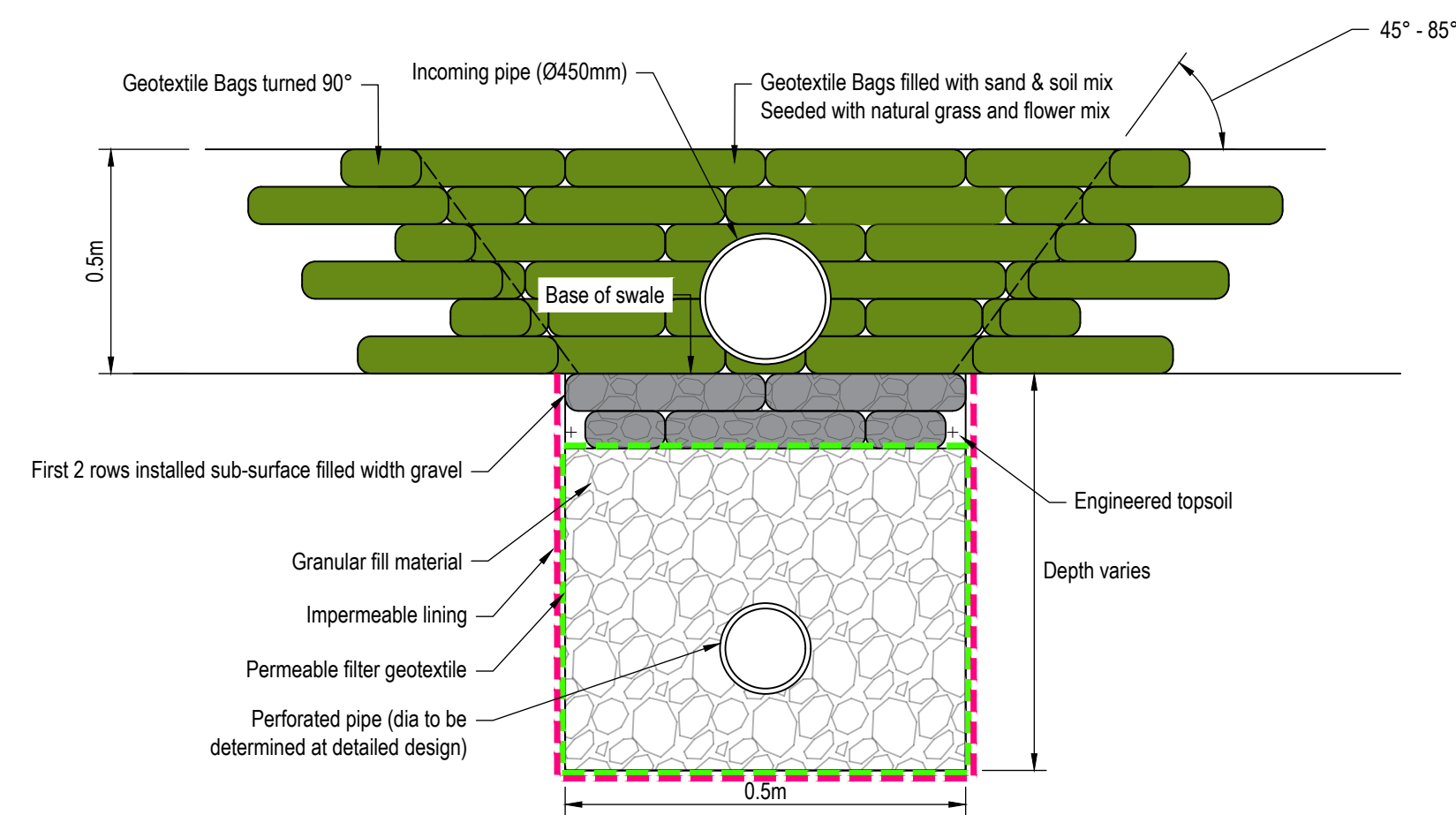
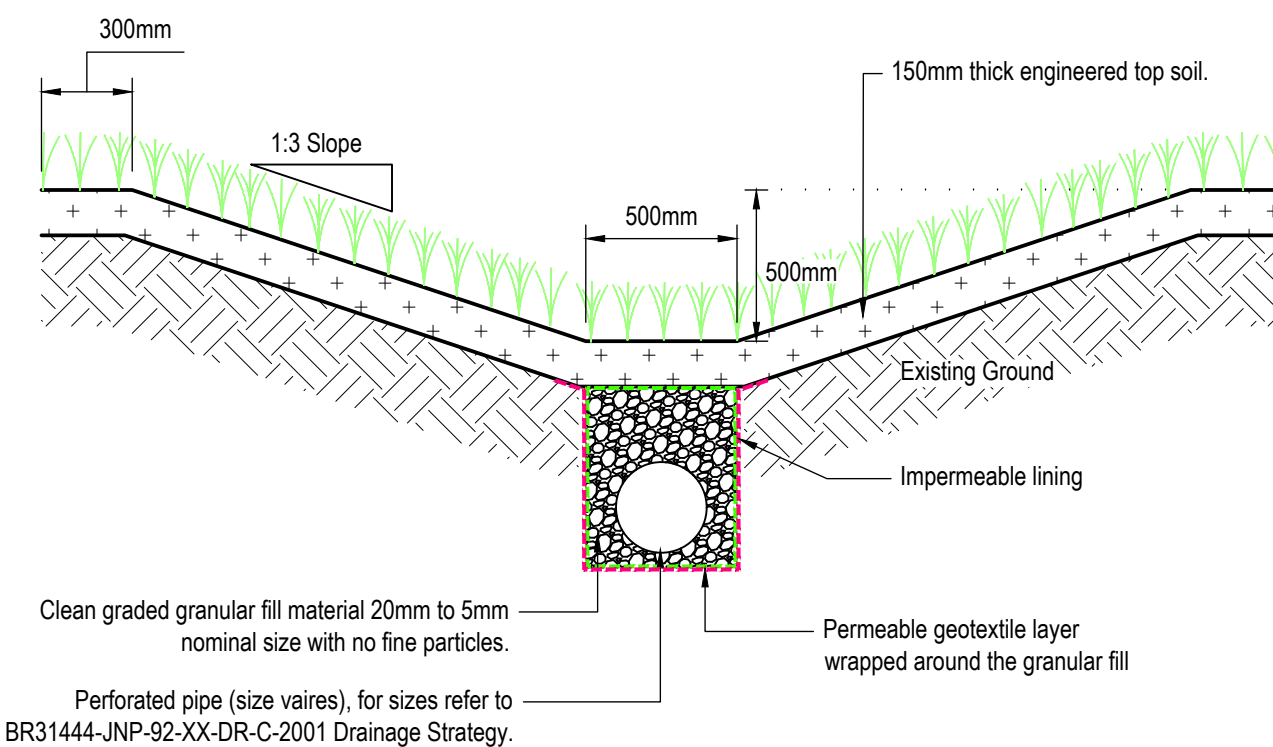
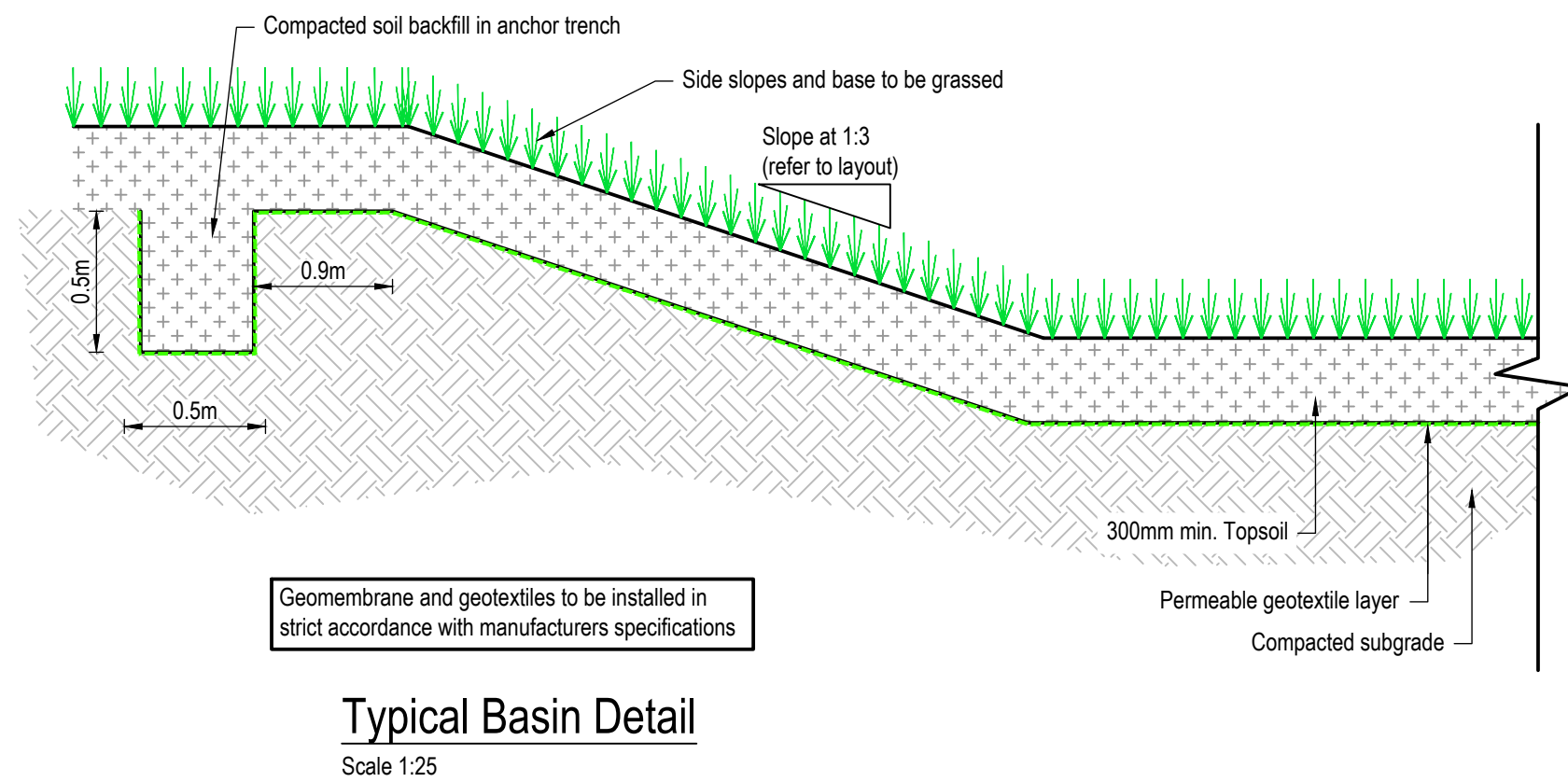
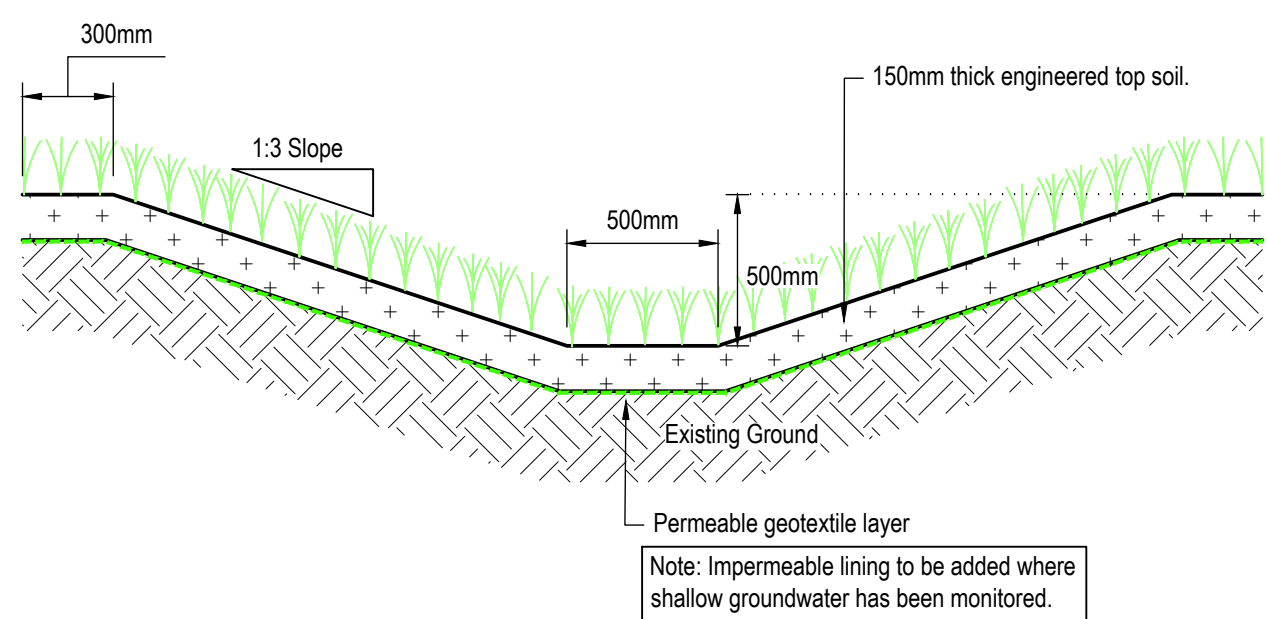




Appendix E

Typical Drainage Construction Details



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P01	24/08/2026	First Issue	KKRSH/RS
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Client: Croudace Homes

Job: Land to the north of School Road, Arborfield Cross

Typical Drainage Construction Details
Sheet 2 of 2

Classification: FI_60_20	    
Scale @ A1: As Shown	   
	Accredited Contractor Part of Capital plc Supplier No. 00

Project - Originator - Volume/System - Level/Location - Type - Discipline - Number	Revision:
BR31444-JNP-92-XX-DR-C-3002	P0

Appendix E

Ground Investigation Report

Land North of School Lane, Arborfield Cross

Phase 2 Ground Investigation Report



Stantec UK Limited

Prepared for:
Croudace Homes

Prepared by:
Emma Raftery

Date:
19 February 2026p

Project/File:
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1 Document control sheet

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Prepared by	Emma Raftery MSc BSc (Hons)	
Checked by	Helen Gardiner MSci CEnv MiEnvSc Kat Barker MSci CGeol FGS RoGEP	
Approved by	Anthony Elkins MSc BSc (Hons) FGS	

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Stantec UK Limited has prepared this report in accordance with the instructions of the above named client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.



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Appendix E Contamination Test Results

Appendix F Geotechnical Risk Register

Appendix G Plausible source-pathway-receptor contaminant linkages

Appendix H Climate Change considerations for CSM



1 Executive Summary

Site Information and setting

Site name and location	Land north of School Lane, Arborfield Cross
Proposed development	The proposed development is to comprise 70 low-rise residential dwellings with associated pavements, services and greenspace
Site Description	The site covers an area of approximately 8.0 hectares and is currently used as agricultural land divided into two fields. The western field is the target of this ground investigation and measures approximately 4.5 hectares. The site slopes generally gently down from south to north, with steeper gradients present at the southern edge of the site.

Desk study information

Site history	Historical records indicate that the site has been used for agricultural purposes since at least 1872. The surrounding area has undergone gradual urban development.
Hydrology	Surface water features include drainage ditches along the site boundaries, and a pond located approximately 100 metres to the southeast. Barkham Brook is located 240m northeast.
Geology	From publicly available information, the site is assumed to be underlain by the London Clay Formation. No superficial deposits are mapped on the site, although alluvium is present immediately to the south.
Hydrogeology	The London Clay Formation is classified as unproductive strata. There are no groundwater abstractions within 500 metres of the site, and no Source Protection Zones are located within 2 kilometres.

Ground model proven by investigation

Ground and groundwater conditions encountered by investigation	The ground conditions as proven by the investigation undertaken at the site comprise: • Topsoil - comprising grass over soft brown sandy clay with frequent rootlets; over • River Terrace Deposits - between 0.15m and 0.7m bgl, comprising slightly clayey sandy gravel and brown clayey sand to a very sandy clay; over • London Clay Formation – between 0.3m and 3.0m bgl, comprising brown mottled orange blueish grey slightly sandy clay becoming stiff dark grey slightly sandy clay with depth. Groundwater was not encountered during the intrusive investigation. Water levels recorded post-fieldwork ranged from 1.83m bgl to 4.5m bgl (52.19m OD to 47.15m OD).
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Summary of geotechnical conclusions



Phase 2 Ground Investigation Report

Groundwork	The site is previously undeveloped and no buried obstructions were encountered by this investigation. Trial pit faces were noted to remain generally vertical without collapse. Water seepages into excavations are likely to be adequately controlled by sump pumping.
Foundations	Foundations are recommended to comprise: • Based on the ground conditions encountered, shallow pad or strip foundations are considered suitable for the proposed development. • Allowable net bearing pressure of 100kN/m² should be available for strip or pad foundations seated on natural ground at a depth of at least 1.00m below ground level. • Deepening of foundations and the use of heave protection is likely to be required near existing trees and new planting.
Floor Slabs	Ground bearing floor slabs may be used in the centre of the site. Suspended floor slabs are likely to be required for structures located close to the perimeter trees. Floor slab design should be undertaken in cognisance of the proposed landscaping scheme for the development.
Roads and pavements	For road / pavement design, an initial CBR of 5% may be used for preliminary design purposes.
Sustainable drainage	Soakaway drainage is considered unsuitable for this site.
Buried concrete	Design Sulphate Class - DS-1 and ACEC Class AC-1.

Summary of geoenvironmental assessment

Human health	No elevated concentrations of contaminants were recorded above the assessment criteria for a residential with plant uptake end use.
Phytotoxicity	No elevated concentrations of phytotoxin contaminants were recorded.
Potable water pipes	Standard pipework is envisaged. However, confirmation should be sought from the water supply company at the earliest opportunity.
Ground gases or vapours	The site conforms to Characteristic Situation 1 and is at low risk from ground gas.
Proposed mitigation measures	No remedial measures are considered necessary at the site.

Future considerations

Further work	Following the ground investigation works undertaken to date, the following further works will likely be required: • discussion and agreement with utility providers regarding the materials suitable for pipework; • discussions with regulatory bodies and the warranty provider regarding the conclusions of this report; • assessment of tree influence on foundations and design of foundations; • Production of a Materials Management Plan relating to reuse of soils and import of soils to the site, if required.
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This Executive Summary forms part of Stantec UK Limited report number 333801775-STN-XX-XX-GE-RP-1000 and should not be used as a separate document.



2 Introduction

2.1 Terms of reference

In September 2025, Stantec UK Limited (Stantec) was commissioned by Croudace Homes, (the Client) to undertake site investigation, comprising a review of existing Phase 1 Desk Study information and a Phase 2 ground investigation at Land North of School Lane, Arborfield Cross. The site is located at Land North of School Road, Arborfield Cross, Wokingham, RG41 4TN.

The site is currently an open agricultural field.

Stantec understands that the proposed development is to comprise 70 low-rise residential dwellings with associated pavements, services and greenspace. An illustrative masterplan (Marrons Drawing 2522477.4), is presented in Appendix A.

The investigation works have been undertaken in accordance with Stantec's proposal referenced (1172184-STN-XX-XX-FP-GE-1000 dated 5th August 2025) and the Client's instructions to proceed (by email 8th October 2025).

2.2 Objectives

The works have been commissioned to support the planning application and to support the preliminary design process.

The objectives of the Phase 2 Ground Investigation are:

- to resolve geotechnical and geoenvironmental uncertainties identified in the Phase 1 Desk Study by refining and updating the preliminary Ground Model, based on the conditions met in accordance with the principles of Environment Agency (EA) 'Land Contamination: Risk Management' (LCRM) (2023);
- to identify geo-environmental mitigation requirements to enable development to progress; and
- to provide preliminary geotechnical recommendations for design and preliminary pavement CBR values.

2.3 Scope

The scope includes a review of an existing Phase 1 Desk Study report and the undertaking of a Phase 2 Ground Investigation.

The scope of the Phase 2 Ground Investigation comprises:

- a preliminary ground investigation including trial pitting and windowless sampling:
 - obtain data on the ground and groundwater conditions of the site;
 - allow collection of samples for geotechnical and chemical laboratory analysis;
 - allow geotechnical field tests to be undertaken;
 - install gas and groundwater wells;
- gas concentration and groundwater level monitoring;



- gas and groundwater sampling (if required);
- geotechnical and chemical laboratory analysis;
- updating of the preliminary Ground Model;
- preparation of a geotechnical risk register;
- presentation of an initial geotechnical design recommendations;
- formulation of an updated Conceptual Site Model (CSM), including identification of plausible contaminant linkages;
- completion of a generic quantitative risk assessment of identified chemical contaminants to establish 'suitability for use' under the current planning regime;
- discussion of potential environmental liabilities associated with land contamination (soil, water and gas); and
- identification of outline mitigation requirements to ensure the site is 'suitable for use'.

2.4 Available information

The following document has been provided to Stantec by the Client for use in the preparation of this report:

- Southern Testing Environmental and Geotechnical (Southern Testing). 8 August 2024. 'Wokingham', Desk Study Report, Ref: JT0584, undertaken for Croudace Homes Ltd (Southern Testing, 2024);

It is understood that the Client commissioned assignment of the above documents and Stantec has assumed full reliance can be placed upon their contents. Should this not be the case, Stantec should be informed at the earliest opportunity.

2.5 Regulatory context and guidance

The investigation work has been carried out in general compliance with recognised good practice, including (but not limited to) BS 5930:2015+A1:2020, BS 10175:2011+A2:2017 and the AGS (2006) 'Good Practice Guidelines for Site Investigations'.

The geo-environmental section of this report is written in broad accordance with BS 10175:2011+A2:2017 and Environment Agency LCRM (2025).

The methods used follow a risk-based approach, the first stage of which is a Phase 1 desk study and field reconnaissance, with potential geoenvironmental risks assessed qualitatively. This is done using the 'source-pathway-receptor contaminant linkage' concept to assess risk as introduced in the Environmental Protection Act 1990 (EPA, 1990). Potential geotechnical risks are also assessed from the Phase 1 desk study and site reconnaissance stage.

Phase 2 comprises intrusive ground investigation work and testing. The factual information from the desk study and the ground investigation are used to develop the Conceptual Site Model (CSM). This CSM is based on a ground model of the site physical conditions and an identification of the possible contaminant linkages. The CSM forms the basis for Generic Quantitative Risk Assessment (GQRA) in accordance with current guidelines. This GQRA might lead to more Detailed Quantitative Risk Assessment (DQRA).



Phase 2 Ground Investigation Report

Professional judgement is then used to evaluate the findings of the risk assessments and to provide recommendations for the development.

The geotechnical section of this report is prepared in general accordance with BS EN 1997-1+A1: 2013, BS EN 1997-2:2007 and BS 8004:2015+A1:2020. This report constitutes a Ground Investigation Report (GIR) as described in Part 2 of Eurocode 7 (BS EN 1997-2) (EC7). However, it is not intended to fulfil the requirements of a Geotechnical Design Report (GDR) as specified in EC7.

Where relevant the relevant requirements of the current edition of NHBC Standards have also been applied.

The geoenvironmental and geotechnical aspects are discussed in separate sections. Throughout the report the term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). The term 'geoenvironmental' is used to describe aspects relating to ground-related environmental issues (such as potential contamination). However, it should be appreciated that this is an integrated investigation, and these two main aspects are inter-related. Designers should take all aspects of the investigation into account.



3 Desk Study Review (Southern Testing, 2024)

In August 2024, Southern Testing were commissioned by Croudace Homes to produce a Phase 1 Desk Study Report. The pertinent information from this report is summarised in the following sections.

3.1 Site Referencing and Description

The site is located north of The Coombes Church of England Primary School in Arborfield Cross, Wokingham, Berkshire, with a National Grid Reference of SU 76624 67114. The nearest postcode is RG41 4TN.

The wider site covers an area of approximately 8.0 hectares and is currently divided into two fields and used as agricultural land. The western field is the target of this ground investigation and occupies approximately 4.5 hectares, however the Desk Study covers both fields.

The proposed development is for residential housing.

3.2 Site History

Historical records indicate that the site has been used for agricultural purposes since at least 1872. The surrounding area has undergone gradual urban development, including the establishment of the school to the south and residential expansion in Arborfield Cross. No significant industrial or contaminative historical uses have been identified on the site.

3.3 Geology

From publicly available information, the site is assumed to be underlain by the London Clay Formation. No superficial deposits are mapped on the site, although alluvium is present immediately to the south. Borehole data confirms the presence of London Clay and indicates that no groundwater was encountered in nearby logs.

3.4 Hydrogeology

The London Clay Formation is classified as unproductive strata. There are no groundwater abstractions within 500 metres of the site, and no Source Protection Zones are located within 2 kilometres.

3.5 Hydrology

Surface water features include drainage ditches along the site boundaries, and a pond located approximately 100 metres to the southeast. The site is at low risk of flooding from surface water and is not within fluvial or reservoir flood zones. However, there is a potential for groundwater flooding at surface level. Stantec note that Barkham Brook is located 240m northeast.



3.6 Waste Management

There are no current or historical landfills within 1 kilometre of the site. One surrendered waste transfer station, operated by Lanstar Ltd, is located within approximately 448m northwest. No significant waste-related hazards have been identified.

3.7 Regulatory Information

Planning history shows several residential and agricultural applications in the vicinity, but none directly affecting the site. There are no environmental permits, such as IPPC or LAPPC consents, within 2 kilometres. A few historical sewage-related pollution incidents have occurred nearby, but none directly impact the site.

3.8 Ground Gas and Radon

The site is located in a low radon area where less than 1% of homes are at risk from radon, and no protection measures are required.

3.9 Unexploded Ordnance (UXO)

A preliminary check using the Zetica UXO website indicated that the site is in a low-risk area. It was recommended that the client considers UXO risk under CDM Regulations.

3.10 Ground Hazards

The site has a low to high potential for swelling and shrinking clays due to the presence of London Clay. There is a moderate potential for compressible ground near mapped alluvium. Other hazards, such as collapsible ground, landslides, running sand, or dissolution, are considered very low or absent.

3.11 Conceptual Site Model

Potential on-site sources of contamination include:

- agrochemicals such as pesticides and herbicides; and
- heavy metals and hydrocarbons from agricultural machinery.

Off-site sources include:

- a nearby used car and salvage dealer located 61 metres east, which poses a very low risk.

Receptors include:

- future site residents.
- the adjacent school; and
- nearby surface water features.



Pathways include:

- ingestion;
- dermal contact; and
- inhalation

Overall, the risk is considered low to very low, and no complete pollutant linkages have been identified.

3.12 Recommendations

It was recommended that an intrusive investigation be carried out, including non-targeted trial pits and soil sampling for chemical analysis. A geotechnical assessment should also be undertaken to inform foundation design, particularly considering the shrink-swell potential of the clay and the influence of trees.



4 Ground Investigation

4.1 Site works

The ground investigation works, including the rationale, which is based on the findings of the preliminary risk assessment, is summarised in Table 4-1.

The fieldwork took place between 13th October and 15th October 2025. The ground investigation locations were surveyed in using a Total Station GPS survey instrument and are shown on the Exploratory Hole Location Plan (Stantec Drawing 333801775-STN-XX-XX-GE-RP-0002) in Appendix B.

Exploratory investigation was concentrated exclusively within the designated development area in the western field.

The logs, including details of ground conditions, soil sampling, in situ testing and any installations, are also presented in Appendix B.

The weather conditions during the Stantec fieldwork and for the previous week were rain showers with small intervals of sun.

Table 4-1: Summary of site works

Activity	Method	No.	Name	Depth Max. (m bgl)	In situ tests	Rationale
Drilling, Pitting and Probing						
Boreholes	Windowless sampler	5	WS01 - WS05	5.0	SPT	For general site coverage and installation of monitoring wells
Trial pits	Machine (13 Tonne Excavator)	8	TP01 – TP08	3.0	Hand shear vane (HSV)	For general site coverage and collection of samples
Probes	TRL dynamic cone penetrometer	5	DCP01 - DCP05		California Bearing Ratio (CBR)	For CBR calculations in areas of proposed hard standing

Wells for monitoring groundwater levels and ground gas concentrations were installed in four of the windowless sampler boreholes. A summary of the monitoring well installations is presented in



Table 4-2.



Table 4-2: Summary of monitoring installations

Location	Ground level (m OD)	Standpipe / piezometer diameter (mm)	Screen top and base depth (m bgl)	Screen top and base elevation (m OD)
WS01	54.02	50	1.00 to 5.00	53.02 to 49.02
WS02	49.43	50	1.00 to 5.00	48.43 to 44.43
WS03	51.44	50	1.00 to 5.00	50.44 to 46.44
WS05	51.70	50	1.00 to 5.00	50.70 to 46.70

4.2 Geo-environmental testing

4.2.1 Sampling strategy and protocols

No specific features were identified during the desk study as requiring targeted investigation and a reasonably even spacing was used. No specific sampling statistics or grid were utilised in this instance.

Samples were taken, stored and transported in general accordance with BS 10175:2011+A2:2017.

4.2.2 Geo-environmental monitoring

Gas monitoring boreholes have been monitored on three occasions. The results are presented in Appendix D.

4.2.3 Geo-environmental laboratory analyses

The chemical test certificates for testing undertaken as part of Stantec's investigation are provided in Appendix E and summarised in the table below. Wherever possible, UKAS and MCERTS accredited procedures have been used.

The geo-environmental analyses undertaken on soils are summarised in Table 4-3.

Table 4-3: Geo-environmental analyses of soils

Determinand Suite	Topsoil	River Terrace Deposits	London Clay
Stantec minimum suite of determinands for solids	4	2	1
Speciated aliphatic and aromatic banding Total petroleum hydrocarbons by HS-GC/MS and GC/FID (Stantec Tier 2 TPH Suite)	4	2	1
Pesticide screen	4	-	-

*Stantec minimum soil suite comprises: As, B (water soluble), Be, Cd, Cr (total), Cr (VI), Cu, Hg, Ni, Pb, S (elemental), Se, V, Zn, cyanide (total), sulfide, pH, asbestos fibres, speciated polynuclear aromatic hydrocarbons (PAH, by GC-FID), total phenols and fraction of organic carbon



4.3 Geotechnical testing

The geotechnical tests undertaken by Stantec are summarised in Table 4-4 and the test certificates are provided in Appendix C. Wherever possible, UKAS accredited procedures have been used.

Table 4-4: Summary of sample numbers for geotechnical tests

Test	River Terrace Deposits	London Clay Formation
Natural moisture content	5	10
Atterberg limits	5	10
Sulfate and aggressive chemical environment classification for buried concrete classification (full BRE SD1 suite)	2	7
Remoulded California Bearing Ratio	-	6

4.4 Constraints

No constraints were noted during the preparation of this report.



5 Ground Investigation Records and Data

5.1 Physical ground conditions

5.1.1 Summary of strata encountered

The following presents a summary of the properties of the ground and groundwater conditions encountered, based on field observations, interpretation of the field data and laboratory test results, taking into account drilling, excavation and sampling methods, transport, handling and specimen preparation.

All relevant data from the Stantec investigation is discussed in Section 6.

Details of the Stantec ground investigation works are provided in the logs in Appendix B, a summary of the ground encountered in the investigation is presented in Table 5-1 and the individual strata are described in the sections below. Relevant cross-sections are presented in Drawings.

Table 5-1: Strata encountered

Stratum	Depth to top (m bgl)	Depth to base (m bgl)	Thickness (m) (range)	Thickness (m) (average)
Surface Cover – Topsoil	0.0	0.15 to 0.40	0.15 to 0.4	0.29
River Terrace Deposits	0.15 to 0.70	0.3 to 3.0	0.10 to 2.7	0.54
London Clay	0.3 to 3.0	>5.0	>1.55	Base not proven

5.1.2 Surface covering

The following surface cover was identified during fieldworks:

- Vegetation (grass, trees, brambles), covering the entire site.

5.1.3 Topsoil

Topsoil was encountered in all exploratory hole locations on site.

Topsoil was between 0.15m and 0.4m thick, with an average thickness of 0.29m. The topsoil comprised grass over soft brown sandy clay with frequent rootlets.

For the purposes of this report, topsoil is defined as the upper layer of an in situ soil profile, usually darker in colour and more fertile than the layer below (subsoil), which is a product of natural chemical, physical, biological and environmental processes, but does not imply compliance with BS 3882:2015. Reuse of topsoil as a growing medium at the site should be determined by the landscape architect or the landscape Contractors.



5.1.4 River Terrace Deposits

River Terrace Deposits were encountered underlying the Topsoil across the site, with the exception of WS03 and WS04, and was recorded to be between 0.1m and 2.7m thick, with an average thickness of 0.54m.

This stratum generally consisted of brown clayey sand to a very sandy clay. The very sandy clay was generally recorded in the southeastern portion of the site. In the centre of the site, WS01, WS02, TP01, TP02, TP03 and TP07 recorded layers of River Terrace Deposits comprising brown slightly clayey sandy gravel. In TP07 the gravel unit extended the full depth of the exploratory hole (3.00m bgl).

The significant thickness of gravel encountered in TP07 and the thinner horizons encountered in the exploratory holes directly downslope of TP07 suggest the presence of a gravel channel within the otherwise predominantly sandy clay/clayey sand stratum. The absence of gravel in WS05 may indicate a meandering gravel channel of limited width.

5.1.5 London Clay Formation

The London Clay Formation was encountered underlying the River Terrace Deposits (where present) in all exploratory hole locations across site with the exception of TP07. The London Clay Formation extended to the base of all exploratory holes in which it was encountered.

The London Clay generally consisted of brown mottled orange blueish grey slightly sandy clay, which became firm to stiff dark grey slightly sandy clay with depth.

5.2 Obstructions

No obstructions were encountered.

5.3 Visual and olfactory evidence of contamination (soil)

No visual or olfactory indicators of contamination was encountered in the soil.

5.4 Soil Organic Carbon Content

The average soil organic matter content for the strata tested is detailed below:

- Three Topsoil samples averaged 2.35%.
- Two River Terrace Deposit samples recorded values of 0.8% and 3.1%.
- One London Clay Formation sample recorded 0.6%.

5.5 Groundwater

5.5.1 Groundwater observations and levels

Groundwater was not encountered during the investigation.



Groundwater levels recorded during post-fieldwork monitoring are summarised in Table 5-2.

Table 5-2: Groundwater level data summary

Stratum	Date range	Location	Post-fieldwork monitoring	
			Depth to groundwater (range) (m bgl)	Groundwater elevation (range) (m bgl)
London Clay Formation	20/10/2025 to 25/11/2025	WS01	1.83 to 2.29	52.19 to 51.73
London Clay Formation		WS02	2.44 to 3.85	46.99 to 45.58
London Clay Formation		WS03	3.09 to 3.16	48.35 to 48.28
River Terrace Deposits/ London Clay Formation		WS05	1.95 to 4.55	49.75 to 47.15

5.6 Ground gases (carbon dioxide and methane)

Records from the gas monitoring boreholes are presented in Appendix D and summarised in Table 5-3. Three monitoring visits have been undertaken, and the monitoring programme is complete

Table 5-3: Range of ground gas data

Stratum	Methane (%)	Carbon dioxide (%)	Oxygen (%)	Steady flow rate (l/hr)
River Terrace Deposits/ London Clay	0.0 to 0.1	0.1 to 4.5	12.8 to 20.7	0.0

5.7 Ground model

The initial ground model has been updated based on the Stantec ground investigation. The strata encountered did not reflect the anticipated model with the presence of River Terrace Deposits recorded across the site. Alluvium was not encountered in any of the exploratory holes. The entire site is underlain by the London Clay Formation, as shown on published records.

The groundwater monitoring shows there is a layer of perched water likely to be in the superficial deposits and London Clay Formation.

Geological cross-sections are shown on Stantec Drawing 333801775-STN-XX-XX-XX-XX-0003 in Drawings.



6 Geotechnical Data

6.1 Introduction

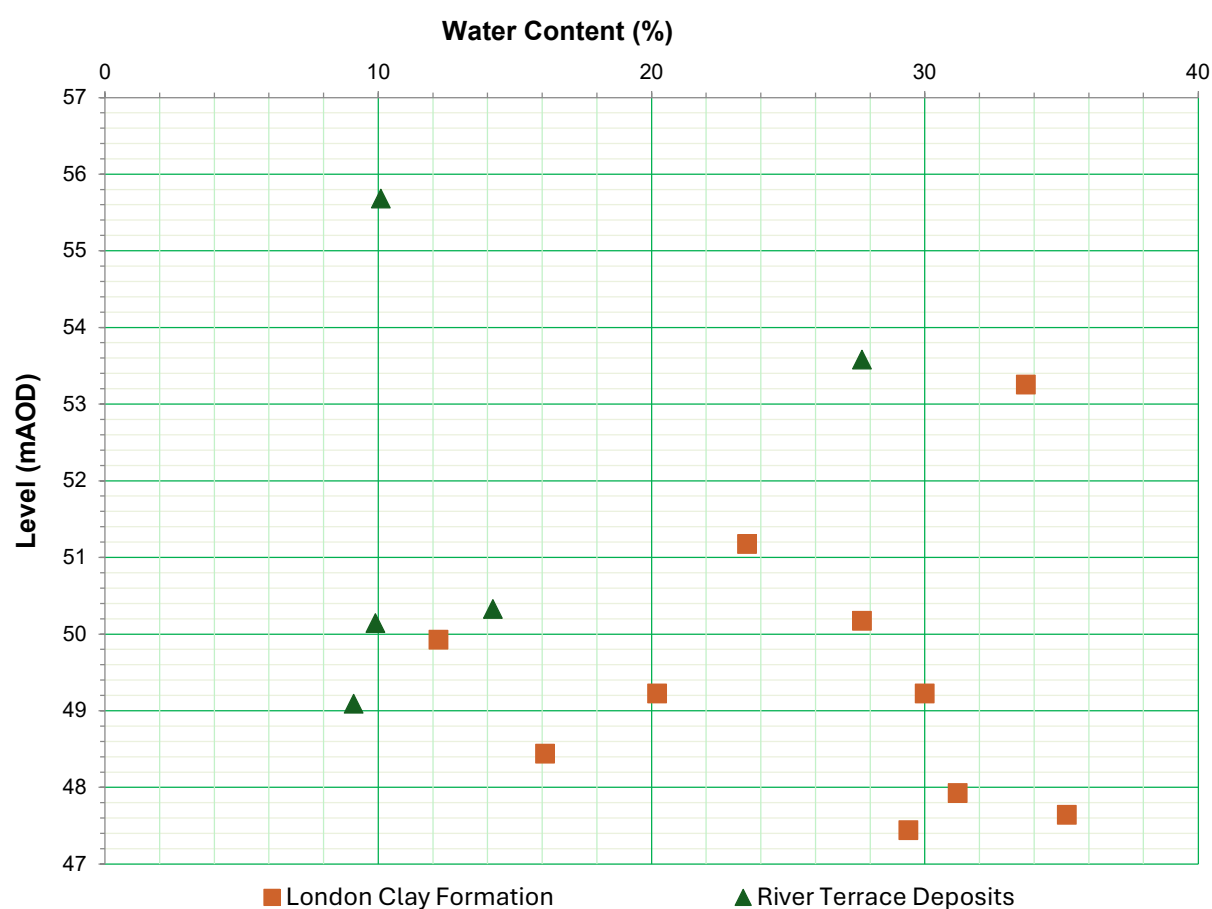
Laboratory test results are contained in Appendix C with in situ test results shown on the relevant exploratory hole log in Appendix B. The following sections summarise the main findings and provide interpretation where appropriate.

6.2 Water Content

Table 6-1: Water Content

Stratum	No of Tests	Natural Water Content Range (%)	Average Water Content (%)
River Terrace Deposits	5	9.1 to 27.7	14.2
London Clay Formation	10	12.2 to 35.2	25.92

Figure 6-1: Water Content Vs Level



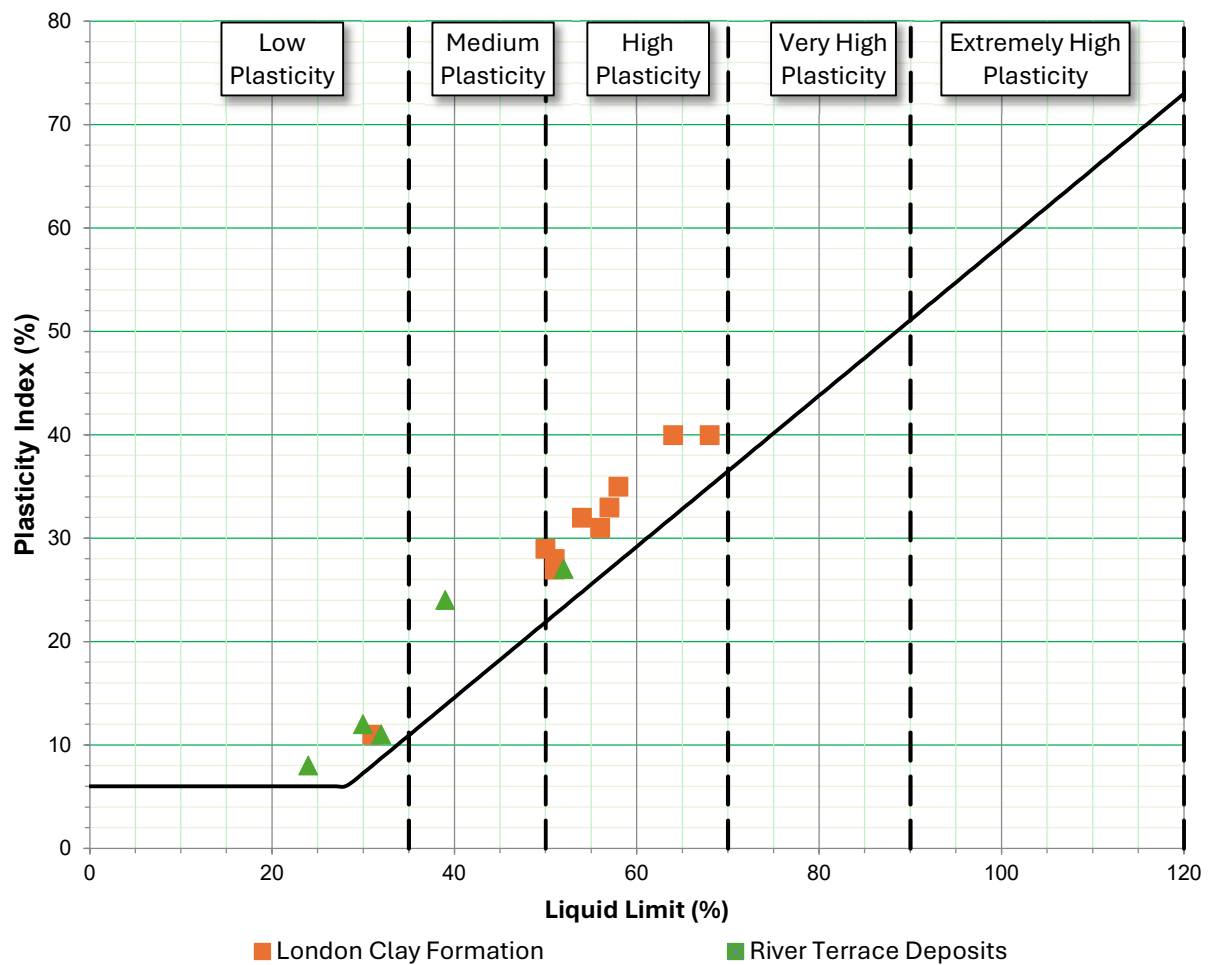
6.3 Plasticity

The volume change potentials in terms of NHBC Standard (Chapter 4.2) with respect to building near trees have been determined from the results of plasticity index tests on samples of soil. These are summarised in Table 6-2.

Table 6-2: Volume change potential

Stratum	No. of tests	Plasticity Index			Modified Plasticity Index			Plasticity designation	Volume Change Potential
		Min.	Max.	Av.	Min.	Max.	Av.		
River Terrace Deposits	5	8	27	16.4	9.13	27	14.322	Low to high	Non-shrinkable
London Clay Formation	10	11	40	30.6	9.79	40	30.026	Low to high	Non-shrinkable to high

Figure 6-2: Volume change potential



6.4 Soil strength

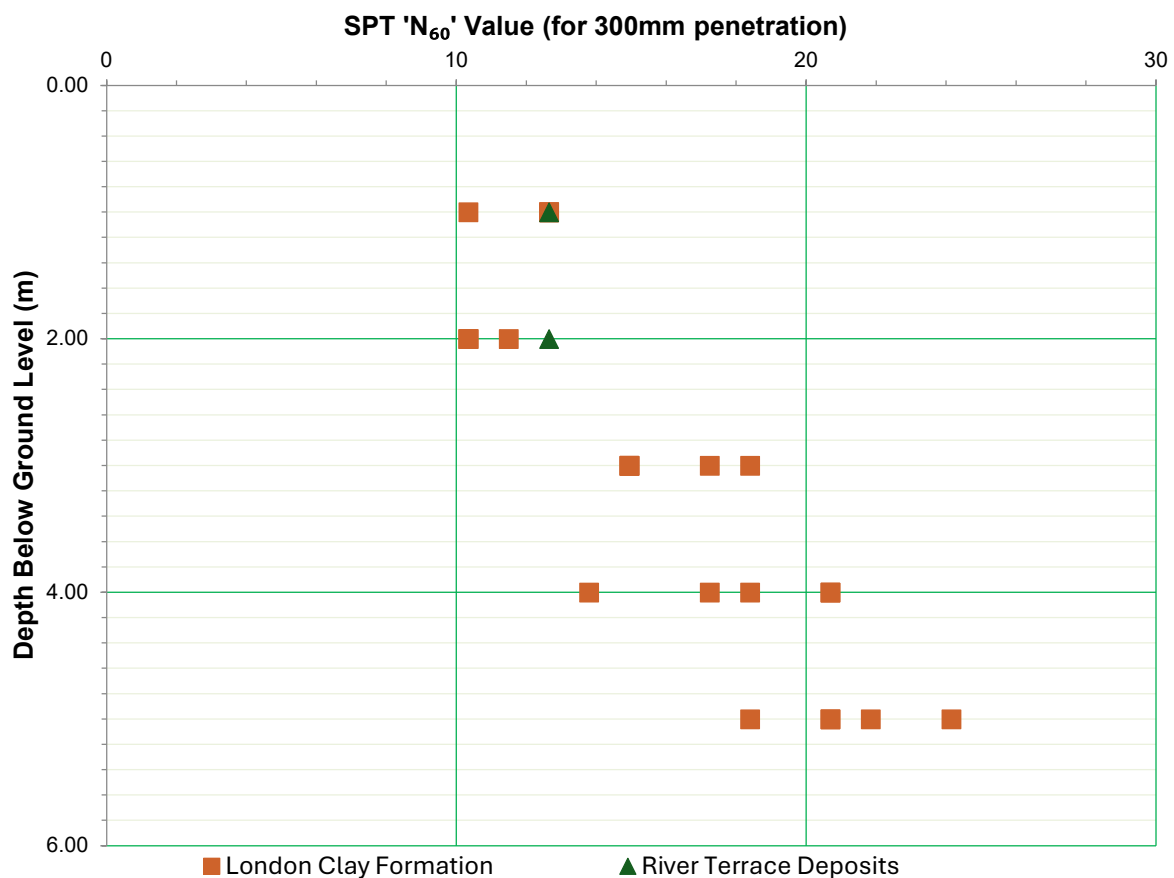
Table 6-3 summarises information pertaining to the shear strength of the soils according to geological stratum. Factual results are summarised for laboratory tests, field tests (e.g. hand shear vane) and uncorrected Standard Penetration Tests (SPT N₆₀). Where the SPT N₆₀ is used to infer shear strength by published correlation, this is also tabulated. A shear strength versus depth profile is summarised in Figure 6-3.

Table 6-3: Soil strength results and derived values

Stratum	No. of tests	SPT N ₆₀ (N-value) (range)	Undrained Shear Strength* c _u (kPa)	Data source
River Terrace Deposits	2	12.65	57	Standard Penetration Test
River Terrace Deposits	2	-	70 to 100	Hand shear vane
London Clay Formation	23	10.35 to 24.15	47 to 109	Standard Penetration Test
London Clay Formation	13	-	90 to 150	Hand shear vane

* Using a F1 value of 4.5 after Stroud (1989) – preliminary assessment only

Figure 6-3: SPT N₆₀ vs Depth



6.5

6.5 Subgrade stiffness

The subgrade stiffness (CBR and Subgrade Surface Modulus) results are summarised in Table 6-4. The equilibrium CBR should be demonstrated on site prior to construction and remedial measures taken if it is not achieved.

Table 6-4: CBR results and derived values

Stratum	No. tests	Method	CBR (%) (Range)	Subgrade Surface Modulus E (MPa) [^] (Range)
River Terrace Deposits	5	in situ TRL probe	5 to 35	49.3 to 86.3*
London Clay Formation	5	in situ TRL probe	9 to 15	71.8 to 86.3*
	6	Laboratory remoulded sample at Natural Moisture Content (NMC)	2.4 to 7.9	30.8 to 75.3

[^] Where using the CD225 method, 'E' has been back calculated from the Equivalent CBR using Equation 2.3.3.

* Equation 2.3.3 applies to CBR values up to 12% only. Therefore, this value is the upper calculated cap and may be higher where higher CBRs are achieved.

CBR values for the Topsoil have not been presented as it is expected that this material shall be removed as part of site preparation.

Areas where the shallow ground contains a higher proportion of gravel, such as TP07, may achieve higher in situ CBR values.

6.6 Sulfate content

In accordance with BRE (Special Digest 1), the Design Sulfate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification are presented in Table 6-5.

Table 6-5: Aggressive chemical environment concrete testing results

Stratum	No. tests	Water Soluble Sulfate (mg/l SO ₄)	Total Potential Sulfate (% SO ₄)	pH
River Terrace Deposits	2	32 to 44	0 to 0.1	8.1 to 8.2
London Clay Formation	7	32 to 400	0 to 0.5	6.9 to 8.2

Table 6-6: Aggressive chemical environment concrete classification

Stratum	No. tests (soil)	DS	ACEC
River Terrace Deposits	2	DS-1	AC-1
London Clay Formation	7	DS-1	AC-1



7 Geotechnical Assessment

7.1 Geotechnical categorisation of the proposed development

Eurocode 7, Section 2 advocates the use of geotechnical categorisation of the proposed structures to establish the design requirements.

The proposed development is to comprise low rise (2 to 3 storey) residential dwellings, with associated gardens, Public Open Space and infrastructure. An initial review of the proposed finished levels indicates minimal cut to fill or retaining is required. A pond is proposed in the north of the site. Details of drainage strategy have not been provided.

Based on the above, for the purposes of this investigation, the proposed structures have been classed as Geotechnical Category 1.

Assessment has been undertaken in accordance with the general requirements of ICE/DETR Document 'Managing Geotechnical Risk' and the HE documents HE-DMRB-G CS 641 and CD 622. The preliminary Geotechnical Risk Register following investigation is provided in Appendix F (Table 12-2) and will need to be updated during future design works.

7.2 Groundwork

7.2.1 Site preparation

The site is previously undeveloped and no buried obstructions were encountered by this investigation. The possibility of buried obstructions being encountered is low.

Topsoil should be removed from beneath all building and hardstanding areas.

7.2.2 Groundworks

Trial pit faces were noted to remain generally vertical without collapse. The faces of shallow, near vertically sided excavations put down at the site are likely to remain stable for short periods of time.

However, the London Clay Formation can be fissured and whilst instability due to fissuring was not noted in the short trial pit excavations, fissuring can cause instability of longer excavations.

Temporary trench support, or battering of excavation sides, is recommended for all excavations that are to be left open for any length of time and will definitely be required where man entry is required. Particular attention should be paid to excavation at, or close to, site boundaries/adjoining existing roads/structures/buildings, where collapse of excavation faces could have a disproportionate effect.

A risk assessment of the stability of any open excavation should be undertaken by a competent person and appropriate measures adopted to ensure safe working practise in and around open excavations. Further guidance on responsibilities and requirements for working near, and in, excavations can be



obtained from the Construction Design and Management Regulations (2015); Construction Information Sheet 47: Inspections and Reports (2005) and HSG47: Avoiding Danger from Underground Services.

To ensure no loads are imposed on the sides of the excavation, spoil should not be placed immediately adjacent to the excavation. Spoil should be placed a suitable distance from the side of the excavation (as assessed by a competent person).

Based on site observations, the rate of water ingress to excavations is likely to be slow. In these circumstances, groundwater control by sump pumping is likely to be sufficient.

It should be recognised that groundwater levels may vary from those at the time of the investigation, for example in response to seasonal fluctuations and the timing of construction may dictate the extent of groundwater control required.

Any water pumped from excavations may need to be passed via settlement tanks (to reduce suspended solids) before being discharged to the sewer. Discharge consents may also be required.

7.2.3 Earthworks/reuse of site-won materials

At this stage, Stantec is not aware of proposals for significant earthworks at the site, although some reprofiling may be necessary to achieve adequate gradients for access road into the site from the south, drainage and to form level building platforms.

Should significant earthworks be required, supplementary earthworks testing and an Earthworks Specification will be necessary to ensure the appropriate management and reuse of the existing soils. The shallow soils (excluding topsoil) are likely to be suitable for re-use as engineered fill.

If significant earthworks are required, the works may be Geotechnical Category 2 in accordance with BS EN ISO 1997-1 (EC7) and further geotechnical design may be necessary.

7.3 Slope stability

The site generally slopes down gently to the north, with steeper gradients present at the southern edge of the site. No level information for the proposed development has been supplied by the client, however, based on a review of the development proposals, it is considered likely that no significant slopes will be created. Therefore, Stantec does not believe the existing or planned slopes will present a significant constraint to the development. However, these preliminary conclusions should be reviewed as part of the separate geotechnical design.

7.4 Retaining walls

Due to the gentle gradients present across much of the site, the inclusion of retaining walls in the proposed development is only anticipated in the south of the site and are not considered to have significant height. It is recommended that all retaining walls are individually designed using site specific design criteria assessed as part of the required geotechnical design. Associated as-built records will be required for verification purposes.

Any retaining wall design must include adequate drainage behind the wall or structure, or for water seepage through the face of the wall.



The stability of any retaining walls should be considered as part of the design process. It may be that retaining walls require this aspect of the site to be classified as Category 2 in accordance with BS EN ISO 1997-1 (EC 7) and further geotechnical design may be necessary.

7.5 Foundation recommendations

This section provides recommendations for the foundations for houses, garages and related buildings as indicated the proposed development plans included in Appendix A.

The structures proposed for the site are considered to be Geotechnical Category 1 (GC1). Preliminary foundation recommendations for the proposed development are based on the geotechnical parameters provided in Section 6.

The safe bearing pressures for foundations quoted for GC1 structures in this report take into consideration traditional factors of safety against the risk of shear failure of the ground and should prevent undue or excessive total and differential settlement from the anticipated structural loadings.

Traditional strip or pad foundations should be constructed a minimum of 1.0m below ground level (bgl) and should bear onto natural soils of the River Terrace Deposits or London Clay. In accordance with NHBC Guidance, this depth may need to be increased in the proximity of existing mature trees or where restricted new planting is proposed, due to the presence of soils with medium volume change potential.

Preliminary assessment suggests that a 0.75m wide strip footing founded at 1.0m bgl could achieve an allowable bearing capacity of approximately 100kPa, with a global factor of safety (FOS) limiting settlements to less than 25mm. It should be noted that footings deeper than 2.5m bgl fall outside the scope of NHBC Standards and would therefore require additional geotechnical design.

If the expected loads require bearing capacities greater than those suggested it may be more efficient to pursue a deep foundation solution such bored or helical piles. These techniques may also be less sensitive to seasonal ground movements associated with trees, both existing and proposed.

7.6 Floor Slabs

The site comprises a field with mature trees surrounding it on all sides and the shallow soils were found to have varying plasticity; from low to high. Buildings located within the influence of these perimeter trees are likely to require suspended floor slabs with a void former, to protect against ground movements associated with the seasonal moisture demand of the trees.

Structures within the centre of the site and outside the zone of influence of the perimeter trees may adopt ground bearing floor slabs. However, floor slab design should take into account new planting schemes and their potential future impact on the structures.

7.7 Roads and pavements

Based on the test results and subject to in situ testing during construction, it is considered likely an equilibrium CBR of 5% will be achievable over the majority of the site may be used for preliminary design purposes.



Proof rolling of the formation level will be required, and any loose or soft spots should be removed and replaced with an engineered fill, in accordance with a suitable Specification. The formation level will also need to be protected during inclement weather from deterioration; all slopes should be trimmed to falls to shed rain water and the surface sealed to limit infiltration.

Prior to the placement of the founding materials and the construction of the road pavement, the sub-formation and formation will need to be inspected and checked in accordance with a suitable specification to ensure the ground conditions are as expected. All testing should be carried out in accordance with DMRB IAN 73/06 to confirm that the ground conditions at time of construction are consistent with the previous design parameters.

Where the in situ CBR is locally found to be less than 2.5%, the sub-grade may be unsuitable for both the trafficking of site plant and as support for a permanent foundation, without improvement works being undertaken. Improvement works should be carried out in accordance with DMRB IAN 73/06 Rev 1 Chapter 5. In summary, consideration may be given to the following potential remedial techniques:

- excavation and re-engineering or replacement of weaker soils;
- the inclusion of geosynthetic reinforcement within the unbound layers of the capping and sub-grade;
- where cohesive soils are present and they are deemed suitable for treatment with hydraulic binders, to employ modification and/or stabilisation techniques on the formation; and
- where granular soils are present, de-watering and re-engineering the formation.

7.8 Drainage

Soakaways (and infiltration to the ground as part of a Sustainable Urban Drainage System) are generally considered unsuitable for the site because of the primarily cohesive strata underlying the site. Although gravel was encountered in one location in the south of the site, its position at a higher elevation on site may cause spring lines to develop downslope due to the underlying impermeable strata. Further investigation would be required to ascertain if this gravel stratum is appropriate for infiltration drainage.

7.9 Buried concrete

Based on guidelines provided in BRE Special Digest 1 (BRE 2005) and the information presented in Section 6.6

- The shallow soils (River Terrace Deposits) can be classified as Design Sulfate Class DS-1 and ACEC Class AC-1.
- The deeper soils (London Clay Formation) can be classified as Design Sulfate Class DS-1 and ACEC Class AC-1 for strip / trench fill / pad foundations.

This equates to a Design Chemical Class of:

- DC-1 for the soils on site (River Terrace Deposits and London Clay Formation).

The designer should check and confirm the classification of concrete using the information.



8 Geo-environmental Assessment

8.1 Objectives

The objectives of the geo-environmental assessment presented in the following sections are to:

- undertake a generic quantitative risk assessment in accordance with LCRM using published generic assessment criteria;
- screen out contaminant linkages that don't potentially pose an unacceptable risk to defined receptors;
- identify whether the ground conditions are suitable for the proposed land use from a land contamination perspective; and,
- identify contaminant linkages that potentially pose an elevated risk or are associated with a level of uncertainty that warrants further consideration.

8.2 Updated conceptual site model

The initial CSM developed from the desk study and field reconnaissance survey has been updated using the findings of the ground investigation. This updated CSM is the basis for the geo-environmental assessment presented in this section.

Following the ground investigation, the plausible contaminant sources, receptors and pathways identified in the preliminary geo-environmental risk assessment (Section 3) have been updated or confirmed as follows.

8.2.1.1 Sources

The following potential sources have been removed from the model:

- Petroleum hydrocarbons within the shallow soils, as no odours or visual indicators of contamination were encountered during investigation works and the laboratory test data indicates no petroleum hydrocarbons were reported above the limit of detection; and,
- Agrochemicals such as pesticides and herbicides.

8.2.1.2 Receptors

No potential receptors have been removed from, or added to, the model.

8.2.1.3 Pathways

No potential pathways have been removed from, or added to, the model.

8.3 Risk assessment approach

Using the updated CSM, a Stage 1 Tier 2 generic quantitative risk assessment (GQRA) for identified receptors based on all media sampled has been undertaken in accordance with the principles of LCRM.



Firstly, the risks associated with the identified potential contaminant linkages have been estimated using standardised methods (typically involving comparison of site data with published 'screening values'). Secondly, where screening values are exceeded, the result has been evaluated in an authoritative review of the findings with other pertinent information to determine whether or not the exceedance is or is not acceptable in the site-specific circumstances.

The data sets used in the assessment comprise the analytical results obtained by Stantec as listed in Section 7 together with any reliable data from previous investigations as listed in Section 3.

The data set(s) used in this report are based on the conceptual site model and the proposed development, and are summarised as:

- Topsoil;
- natural soils of the River Terrace Deposits; and,
- natural soils of the London Clay Formation.

Generic Assessment Criteria (GAC) based on a soil organic matter (SOM) of 2.5% have been adopted for all soils based on the laboratory results summarised in Section Ground Investigation Records and Data.

8.4 Human health risk assessment

8.4.1 Generic Assessment Criteria

The soil screening values used are Generic Assessment Criteria (GAC) (i.e. derived in accordance with EA CLEA guidance (2009) using the updated exposure model detailed in Defra SP1010 (2014), with the exception of published C4SLs. The term 'GAC' used in this report is inclusive of all generic soil screening values.

Based on the proposed development, generic assessment criteria (GAC) based on a default residential with homegrown produce CLEA land use scenarios have been adopted.

GAC are selected based on the following hierarchy:

- Category 4 Screening Levels (C4SL), where available.
- SoBRA Acute GAC for free cyanide, as acute dose toxicity is the primary risk driver.
- Stantec GAC, derived by Stantec as detailed in Appendix G.

The potential risks to human health arising from the presence of volatile contaminants in groundwater have been assessed in accordance with the SoBRA GW GAC guidance (2024). This is a preliminary approach whereby GAC have been developed using the CLEA v1.071 model for indoor air and outdoor inhalation pathways only, assuming a residential or commercial end-use.

Exclusion screening distances for assessing vapour intrusion risk are also considered as an additional line of evidence where appropriate. Human health risk from the consumption of potable water (if relevant) is addressed by the Controlled Waters Risk Assessment with the adoption of drinking water guidelines and standards as the assessment criteria.



The risks to human health arising from vapours in the vapour phase, from soil and groundwater, have been assessed using Stantec's soil vapour GACs (SV GAC). This is a preliminary approach whereby GAC have been developed using the CLEA v1.071 model for indoor inhalation (residential and commercial scenarios) and outdoor inhalation (all scenarios) pathways only, and are based on the default exposure parameters used for derivation of soil GAC. The SV GAC derivation is therefore akin to the approach taken by SoBRA to derive their GW VI GAC.

8.4.2 Assessment results

Soil data assessment sheets are presented in Appendix E. As an initial screen, all soil samples have been compared to the GAC irrespective of depth. It is recognised that depth is a relevant consideration when evaluating the plausibility of exposure, and this is considered in the evaluation of the outcome of the GAC screening. Based on the data comparison against the GAC the results indicate that all chemicals of potential concern (CoPC) are below the relevant GAC and therefore all relevant contaminant linkages are incomplete.

8.4.3 Risk evaluation

No reported concentrations of contaminants in soil exceed the GAC, and no reported visual and/or olfactory evidence of contamination was observed during the ground investigation. On this basis the risk to human health and the environment is considered to be acceptable.

8.5 Ground gas risk assessment

All three rounds of ground gas monitoring have been completed within the programme of works. From analysis of the results the Gas Screening Value is CS1 confirming the dismissal of ground gas as an on-site source.

8.5.1 Data adequacy

As per BS8576:2013 Decision Matrix for Initial Monitoring, it is judged from the available evidence that the gas generation potential at the site is low and as per Tables 5.5a and 5.5b CIRIA C665, the sensitivity of the development is high. Consequently, and in accordance with CIRIA C665 (Table 5.5a and 5.5b) and Figure 6 BS8576:2013, an appropriate minimum monitoring regime is three readings over two months, provided other monitoring requirements are also met, such as prevailing atmospheric pressure conditions (for example, BS 8485:2015 +A1:2019 and CL:AIRE TB17 advocate that monitoring should include a period of rapidly falling atmospheric pressure).

8.5.2 Assessment results

CL:AIRE RB17 (Card et al 2012) states that where only natural soils are present, with no credible methane source, no action is required (monitoring or gas protection measures) as this represents Characteristic Situation 1 (CS1). As such, no ground gas protection is required.



8.5.3 Risk evaluation

The calculated borehole hazardous gas flow rates for carbon dioxide and methane indicates CS1 conditions and methane and carbon dioxide at concentrations are 'typically' below 1% and 5% respectively. As such, the site is provisionally classified as Characteristic Situation 1.

8.6 Phytotoxicity risk assessment

Soil contaminants, if present at sufficient concentrations, can have an adverse effect on plant health. Phytotoxic effects can be manifested by a variety of responses, such as growth inhibition, interference with plant processes, contaminant-induced nutrient deficiencies and chlorosis (yellowing of leaves). Phytotoxicity is a difficult parameter to quantify given that experimental techniques vary widely and variations exist in plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals. Guidelines for phytotoxicity and general plant health have been published for a limited number of substances for topsoil (BS BS3882:2015), for soils used for grazing/landscaping (ICRCL 70/90), and for agricultural uses (MAFF Code of Good Agricultural Practice). Some of these guidelines focus on reduced yield for agricultural crops, and in general do not define concentrations in soil at which plant health is necessarily significantly compromised. The guidelines are not based on plant uptake and human consumption considerations, this is considered as an exposure route in the derivation of human health GAC.

Reported soil sample results have been screened against these guidelines (where available) and the results are provided in the screening tables in Appendix E.

Results indicate that all CoPC are below the relevant phytotoxic GAC, therefore the contaminant linkage is incomplete.

8.7 Construction materials risk assessment

8.7.1 Water Pipelines

A formal water pipe investigation and risk assessment is beyond the scope of this report. However, the findings of this investigation have been compared to the threshold values in Water UK HBF (2014), Table 1 as far as is practicable.

The site is previously undeveloped, and the preliminary risk assessment and investigation has indicated no plausible contaminant sources. It is envisaged that standard pipework will be suitable for the site. However, confirmation should be sought from the water supply company at the earliest opportunity.

8.7.2 Other construction materials

Plastic pipes for drains and sewers are manufactured from unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) or polyethylene (PE). These materials may be affected by the presence of organic compounds in the soil.

In accordance with the British Plastics Federation Guidance (August, 2018), as the concentrations of PAH, and BTEX are below 100mg/kg and the concentrations of petroleum hydrocarbons (TPH) are below 200 mg/kg, PVC-U, PP or PE pipework is considered suitable.



The implications for buried concrete are discussed in Section 7.

8.8 Contamination risk to construction workers

Whilst risks to construction workers are not discussed in detail, the following section discusses potential risks that should be considered in the preparation of Risk Assessments, Method Statements, Plans of Work, or equivalent.

Information presented is provided to assist in managing the risk associated with contamination in soil and groundwater at the site but is not definitive. Contractors are responsible for undertaking their own assessments and assessing what risks are present and what control measures are required.

Task specific risk assessments and method statements should be in place, and risks and required mitigation measures communicated to all relevant personnel prior to the works commencing. Appropriate PPE and, if required, RPE should be provided and utilised.

8.8.1 Ground gas

It is noted that concentrations of carbon dioxide (an asphyxiant) in the soil exceed HSE Workplace Exposure Limits for personnel in the working environment of 1.5% for short term (15 minutes) exposure and / or 0.5% for long term exposure. Furthermore, soil concentrations of oxygen are below the HSE recommendations of 18%.

Soil gas concentrations are not necessarily reflected by those in the breathing zone, as such, all Contractors and maintenance workers should be made aware of the possible presence of carbon dioxide and should take all necessary health and safety precautions when working in trenches or confined spaces.

8.8.2 Asbestos

As no clearly identifiable ACM has been seen during the site walkover or during the ground investigation and no fibres have been detected in soil samples analysed by laboratory testing, CAR2012 does not apply. However, there is always the possibility of unexpected contamination and the Contractors should undertake an asbestos watching brief during the works. If any suspect material is encountered, works in that area of the site should stop, the area fenced off and an asbestos competent person should be notified for advice on next steps.

8.9 Consideration of Climate Change

Climate change has the potential to change the risk profile for conceptual site models and associated contaminant linkages. The impact of climate change on the CSM is site-specific, and a qualitative assessment of the potential impact of climate change on the CSM for this site is summarised below. The assessment has primarily utilised the guidance in Environment Agency (2010) and SoBRA (2022) which set out the UK context to climate change and land contamination. Both guidance documents advocate a “what if” scenario approach in the context of changes in ambient temperatures, an increase in the frequency of extreme rainfall/storm events and heatwaves/droughts, and long-term changes in groundwater and sea levels.



Those “what if” scenarios that are relevant to this CSM are

- Increased long-term rainfall leading to increased infiltration and seasonally higher groundwater and water levels in surface waters.
- Increased frequency and/or magnitude of extreme rainfall events leading to short-term surface flooding, surface water run-off, groundwater flooding, and/or land-based erosion.
- Increased frequency and/or magnitude of storm events leading to short-term drops in barometric pressure and/or high winds.
- Occurrence of extreme cold and hot weather events leading to changes in ground conditions such as soil temperature, evapo(trans)piration, and soil moisture (for example freeze-thaw effects and desiccation), decreased infiltration and fall in groundwater and surface water levels.
- Long-term decrease in rainfall leading to lower infiltration and fall in groundwater and surface water levels.

In considering the potential impact of climate change, the following factors have been considered:

- The design life of the proposed development is 80 years.
- The superficial deposits and underlying geology at the site are unlikely to be physically adversely affected by desiccation, subsidence or erosion.
- The UK Climate Predictions published by the Met Office indicate that over the lifetime of the proposed development average:
 - Precipitation is forecast to decrease by 10%;
 - Temperature is forecast to increase/decrease by 3°C; and,
 - Groundwater recharge is forecast to decrease by 30%.
- Potential changes in soil moisture levels and soil temperature are/are not likely to have a significant impact on contaminant fate and transport (mobility and degradation) noting that a rise in soil temperature will likely increase the volatility and solubility of contaminants and increase the microbial degradation of contaminants. A reduction in soil moisture may decrease microbial degradation and increase vapour and gas diffusion.

The foreseeable potential implications of these scenarios on the CSM are as follows:

No foreseeable impacts of climate change on the CSM have been identified.

For further details on the considerations made, refer to Table 12-5: Possible CSM considerations related to climate change in Appendix H.

8.10 Updated Conceptual Site Model

The potential sources, pathways and receptors identified in the desk study (Section **Error! Reference source not found.**) have been investigated and assessed. There are no Source-Pathway-Receptor contaminant linkages which require mitigation at the risk evaluation stage are confirmed by the regulators and the warranty provider as not requiring further consideration (mitigation). If these assumptions are not agreed during regulatory discussions, the conclusions will need to be updated.



9 Waste and Materials Management

9.1 Introduction

The Waste Framework Directive (WFD) (2009/98/EC) defines waste as ‘any substance which the holder discards or intends to discard.’ In a geo-environmental context, the waste is most often ‘soil’ and the two main scenarios are offsite disposal of the material as a waste and/or reuse of the material on site. For cost and sustainability reasons, reuse is preferred to off-site disposal.

Section Waste disposal below describes the key issues relating to off-site disposal to landfill and Section Materials management considers requirements relating to reuse of soils and materials management.

9.2 Waste disposal

9.2.1 Principles

Based on the WFD, any material excavated on site may be classified as waste and it is the responsibility of the producer of a material to determine whether or not it is waste. Where off-site disposal is undertaken, the following guidance applies.

Classification is a staged process:

- A hazardous waste is defined under the WFD as one which possesses one or more of fifteen defined hazardous properties. If a waste is not defined as hazardous, then it is non-hazardous.
- Where the materials are soil, it is then be assigned using the ‘List of Waste Codes’, which classifies the material as either:
 - hazardous (17-05-03), which is defined as “soil and stones containing hazardous substances”; or
 - non-hazardous (17-05-04), which is defined as “soil and stones other than those mentioned in 17-05-03”.
 - Stantec utilise the proprietary assessment tool, HazWasteOnline™ to undertake this assessment.
- Waste Acceptance Criteria (WAC) testing is then undertaken if required, and are only applicable following classification of the waste, and only where the waste is destined for disposal to landfill. The WAC are both qualitative and quantitative. The WAC and the associated laboratory analyses (leaching tests) are not suitable for use in the determination of whether a waste is hazardous or non-hazardous.

It should be noted that some non-hazardous wastes may be suitable for disposal at an inert landfill as non-hazardous waste, subject to meeting the appropriate waste acceptance criteria.

It should be noted that classification must be undertaken on the waste produced, by the waste producer. Necessary sampling frequency to adequately characterise a soil population is defined within WM3.



9.2.1.1.1 *Topsoil and Peat*

Topsoil and peat are biodegradable, therefore if they are surplus to requirements and cannot be re-used in accordance with a Materials Management Plan, they cannot be classified as inert. As such, topsoil and peat need to be classified by a staged assessment and sampling process and would either be classified as hazardous or non-hazardous, depending upon the results of the assessment.

9.2.1.1.2 *Greenfield sites*

Waste from completely greenfield sites may be accepted at a landfill as inert waste if it meets the requirements of paragraph 10 (wastes acceptable without testing at landfills for inert waste) of the Landfill (England and Wales) (Amendment) Regulations (2005) ('the Regulations') can be met. Paragraph 10 of the Regulations states, "soils may be able to be classified as inert waste without testing, if:

- they are single stream waste of a single waste type;
- there is no suspicion of contamination and they do not contain other material or substances such as metals, asbestos, plastics, chemicals, etc....."

As such, where the site is greenfield and the waste producer is confident about the quality of a soil (i.e. naturally occurring and uncontaminated), further sampling and laboratory testing is not necessary for the Basic Characterisation and this can be undertaken on qualitative Waste Acceptance Criteria testing.

In this instance the waste producer can characterise the waste based on visual assessment and written description of the waste in addition to supporting evidence such as a desk study assessment of the greenfield status. However, it should be noted this characterisation is subject to agreement by the landfill operator who may require testing to be undertaken to confirm classification.

9.2.2 HazWasteOnline™ assessment

As the site is greenfield, and there is no suspicion of contamination and the soils do not contain other deleterious material or substances, HazWasteOnline™ assessment is not required, and as such has not been undertaken at this stage. Assessment may be required during the Basic Characterisation process required by the Landfill operator for the excavated material prior to disposal.

9.2.3 WAC testing

Given the greenfield nature of the site, quantitative WAC testing has not been undertaken at this stage. WAC testing may be required during the Basic Characterisation process required by the Landfill operator for the excavated material prior to disposal.

9.2.4 Preliminary waste disposal options

A preliminary assessment indicates that based on the greenfield status of the site (as proven by the desk study assessment and a visual assessment of the soils), as long as no unexpected contamination is encountered and materials with high organic matter are not due for disposal (e.g. topsoil or peat), the natural subsoils would likely be disposed of as non-hazardous waste at an 'inert' landfill.



It should be noted that the waste producer may need to characterise the waste to be disposed (following excavation) based on visual assessment and written description of the waste.

9.2.5 General waste comments

It should be noted that the preliminary waste assessment presented above is subject to the following:

- Any soils containing > 0.1% asbestos or visible asbestos containing materials would be considered as hazardous.
- It is the waste producer's responsibility to segregate the waste at source and waste producers must not mix waste materials/streams or dilute hazardous components, for example by mixing with less or non-hazardous waste on site to meet WAC limit values.
- Basic Characterisation should be undertaken in accordance with Environment Agency guidance by the waste producer. Stantec can assist if required and this report will assist the characterisation. However, Basic Characterisation does not form part of the current commission and would require further assessment and testing on the wastes actually to be disposed.
- Once the waste producer has undertaken an initial Basic Characterisation on each waste stream, they can manage the soils as part of the on-site processing programme (for example, stockpiling, treatment, screening and separation). The waste producer and landfill operator will then need to agree the suite of compliance testing for regularly generated waste to demonstrate compliance with the initial Basic Characterisation prior to disposal.
- At the time of disposal, additional testing on the excavated soils to be disposed of, will likely be necessary.
- Non-hazardous and hazardous soils require pre-treatment (separation, sorting and screening) prior to disposal.
- The costs for disposal of non-hazardous and hazardous soils are significant compared to disposal of inert material.
- In addition to disposal costs, landfill tax will be applicable. Non-hazardous and hazardous waste will generally be subject to the Standard Rate Landfill Tax. Inert or inactive waste will generally be subject to the Lower Rate Landfill Tax. The landfill tax value changes each April and can be found at <https://www.gov.uk/government/publications/rates-and-allowances-landfill-tax/landfill-tax-rates-from-1-april-2013>.
- Before a waste producer can move waste to a landfill site for disposal, they need to check the landfill site has the appropriate permit and must have completed the following :
 - Duty of care transfer note / Hazardous Waste consignment note, including comment as to if pre-treatment has been undertaken; and
- Basic Characterisation of the waste, to include: description of the waste; waste code (using list of wastes); composition of the waste (by testing, if necessary) and; WAC testing (if required).

9.3 Materials management

9.3.1 Introduction

Soils that are to remain on site, should be managed and reused in accordance with a Materials Management Plan (MMP), prepared in accordance with 'The Definition of Waste: Development Industry Code of Practice', Version 2 (CL:AIRE), known as the DoWCoP. Where all aspects of the DoWCoP are followed the soils are considered not to be waste, because they were never discarded in the first



place. It should be noted that Version 3 of the DoWCoP is undergoing preliminary consultation, and recommendations within this report with regard to waste and re-use of soils will require review when the DoWCoP Version 3 is adopted.

Version 2 of the DoWCoP clearly sets out the principles and an outline of the requirements of a MMP. The following compliance criteria must be seen to apply to the MMP for the site:

- Factor 1: Protection of human health and protection of the environment.
- Factor 2: Suitability for use, without further treatment.
- Factor 3: Certainty of Use.
- Factor 4: Fixed Quantity of Material.

The reuse of soils at sites should be considered during the planning and development design process so that compliance with issues such as fixed quantity and certainty of use clearly relate to agreed site levels. Suitability of Use is normally evident from the remediation strategy or the design statement, which form an integral part of a MMP. However, some soils may need to be tested post-excavation to prove they are suitable for use.

Once the MMP is finalised, it must be declared by a Qualified Person (QP). The Declaration is an on-line submission as part of which the QP is required to confirm that the declaration is being made before the relevant works have commenced (i.e. it is not a retrospective application).

Once all material movements have been completed in accordance with the MMP a verification report must be produced, kept for 2 years and provided to the EA on request.

It should be noted that failure to comply with the requirements of the DoWCoP when re-using materials has potentially significant consequences for the waste holder. The risk is that the reused materials are still regarded as a waste that has been illegally deposited. From 1 April 2018, the scope of Landfill Tax has been extended to sites operating without the appropriate environmental disposal permit, and operators of illegal waste sites will now be liable for Landfill Tax. Further information is available at: <https://www.gov.uk/government/publications/landfill-tax-disposals-not-made-at-landfill-sites/landfill-tax-disposals-not-made-at-landfill-sites>.

If soils are excavated and reused on sites (or moved to another site) without a MMP, exemption, or appropriate Permit in place, anyone who knowingly facilitates the disposal may be 'jointly and severally liable' to any assessment of tax, fines or prosecution.

9.3.2 Materials management scenarios

The materials management scenarios present on site are discussed below.

It should be noted that more than one scenario may apply, dependent upon where the soils are proposed for reuse.

9.3.2.1 Clean, naturally occurring materials – reused on the site of origin.

Where soils are naturally occurring, uncontaminated and are reused on the site they are excavated (i.e. greenfield site with documented site history, with no Made Ground), they will fall outside the Waste



Framework Directive (WFD) by means of Article 2 1(c) (i.e. they will not be a waste when reused on the site of origin).

However, there needs to be certainty of that reuse, and evidence is necessary to support this strategy, for example through information provided during the planning process. The onus is on the developer to demonstrate that the materials are not a waste and will never become a waste. As such, a Materials Re-use Strategy is recommended to show certainty. Alternatively, if the volume of material is under 1,000 tonnes, then a U1 waste exemption may be applied for from the Environment Agency if the use meets the strict re-use requirements of that exemption.

It may be noted that some 'clean naturally occurring materials' may still fail the 'suitable for use' test, for example, soils with a naturally high organic content may not be suitable for use because of their propensity to produce ground gases such as methane. Rules regarding other more unusual circumstances such as where natural soils contain an unacceptably high mineral content are described in the DoWCoP.

9.3.2.2 Clean, naturally occurring materials – transferred to other sites.

Where soils are naturally occurring, uncontaminated and are transferred to other sites (i.e. direct transfer), they will not become waste as long as the transfer is undertaken in accordance with the DoWCoP. A MMP must be prepared for the receiving site and the materials movement must be noted in the MMP of the Donor site. This movement must have been declared to CL:AIRE prior to the works commencing.

9.3.2.3 Recycled materials

All recycled materials (6F2 etc.) must be produced under the 2013 WRAP 'Quality Protocol: Aggregates from inert waste', whether on site or off-site. If they are not, they will be deemed a waste and can only be used on site under a permit. More information can be found at <https://www.gov.uk/government/publications/quality-protocol-production-of-aggregates-from-inert-waste>.

9.3.2.4 Geotechnical improvement requirements

Construction activities carried out on uncontaminated soils solely for the purpose of improving geotechnical properties e.g. lime / cement modification, are not generally regarded as waste treatment operations and do not require a permit.

However, should processing be needed (such as screening, treatment or improvement), that would constitute a waste activity and require a mobile treatment permit. This may be as simple as removing oversize material with an excavator bucket, to using a riddle bucket to remove hardcore to full mechanical screening.



10 Uncertainties and Limitations

10.1 General comments

Stantec UK Limited (Stantec) has prepared this report in accordance with the instructions of client. (the Client), by e-mail dated September 2025 under the terms of appointment for Stantec, for the sole and specific use of the Client and parties commissioned by them to undertake work where reliance is placed on this report. Any third parties who use the information contained herein do so at their own risk. Stantec shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared or for use of the report by any parties not defined in Stantec's appointment.

This report details the findings of work carried out in October 2025. The report has been prepared by Stantec on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, not all potential environmental constraints or liabilities associated with the site may have been revealed.

Stantec has used reasonable skill, care and diligence in the design of the investigation of the site and in its interpretation of the information obtained. The inherent variation of ground conditions allows only definition of the actual conditions at the locations and depths of trial pits and boreholes at the time of the investigation. At intermediate locations, conditions can only be inferred.

Groundwater data are only representative of the dates on which they were obtained and both levels and quality may vary.

Plans that provide assessment of foundation types and depths are indicative and subject to further design. This design should incorporate a detailed assessment of the influence of trees, influence of cut to fill proposals and geological conditions.

Unless otherwise stated, the recommendations in this report assume that ground levels will remain as existing. If there is to be any re-profiling (e.g. to create development platforms or for flood alleviation) then the recommendations may not apply.

Information provided by third parties has been used in good faith and is taken at face value; however, Stantec cannot guarantee its accuracy or completeness.

Where the existing report(s) prepared by others have been provided by the Client, it is assumed that these have been either commissioned by the Client, or can be assigned to the Client, and can be relied upon by Stantec. Should this not be the case Stantec should be informed immediately as additional work may be required. Stantec is not responsible for any factual errors or omissions in the supplied data, or for the opinions and recommendations of others. It is possible that the conditions described may have since changed through natural processes or later activities.

The work has been carried out in general accordance with recognised best practice. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance. Where the phrase 'suitable for use' is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Stantec.



The chemical analyses reported were scheduled for the purposes of risk assessment with respect to human health, plant life and controlled waters as discussed in the report. Whilst the results may be useful in applying the Hazardous Waste Assessment Methodology given in Environment Agency Technical Guidance WM3, they are not primarily intended for that purpose and additional analysis will be required at the time of disposal to fully classify waste. Discussion and comment with regards to waste classification are preliminary and do not form the requirements of 'Basic Characterisation' as required.

Unless otherwise stated, at the time of this investigation the future routes of water supply pipes had not been established. This investigation and sampling strategy may not be fully compliant with UKWIR recommendations. Consequently, a targeted investigation and specific sampling and chemical testing may be required at a later date once the routes of the supply pipes are known. In addition, it is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds, this report does not constitute a formal survey of these potential constraints and specialist advice should be sought.

Any site boundary line depicted on plans does not imply legal ownership of land.



11 Recommendations for Further Work

Following the ground investigation works undertaken to date, the following further works will be required:

- discussion and agreement with utility providers regarding the materials suitable for pipework;
- discussions with regulatory bodies and the warranty provider regarding the conclusions of this report;
- assessment of tree influence on foundations and design of foundations;
- discussions with piling Contractors regarding conclusions of this report and design of the piles;
- production of a Materials Management Plan relating to reuse of soils at the site and import of soils to the site;
- writing of a Materials Management Strategy relating to reuse of soils at the site; and
- verification of the earthworks and mitigation works.
- Upon completion of monitoring regimes, site investigation boreholes should be decommissioned in line with relevant guidance where deemed appropriate by a qualified professional (for example the Environment Agency's Good Practice for Decommissioning Redundant Boreholes and Wells, 2012 or section 2.4.3.2 of NHBC NF94, 2023).



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Appendices



Appendix A Drawings





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KEY PLAN Site Boundary	NOTES 1. Contains OS data © Crown copyright and database right (2022)	REVISIONS <table><tr><th>REV</th><th>DRAWN BY INITIALS</th><th>CHECKED BY INITIALS</th><th>DATE</th><th>REVISION NOTES/COMMENTS</th></tr><tr><td>P01</td><td>ER</td><td>HG</td><td>26/11/25</td><td>First issue</td></tr><tr><td colspan="5"></td></tr></table>					REV	DRAWN BY INITIALS	CHECKED BY INITIALS	DATE	REVISION NOTES/COMMENTS	P01	ER	HG	26/11/25	First issue						Stantec			TITLE SITE LOCATION PLAN	
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PROJECT Land North of School Road, Arborfield Cross			DRAWING NO. 333801775-STN-XX-XX-DR-GE-0002			REVISION P01																				



KEY PLAN

Site Boundary

NOTES

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REVISIONS

REV	DRAWN BY INITIALS	CHECKED BY INITIALS	DATE	REVISION NOTES/COMMENTS
P01	ER	HG	26/11/25	First issue

Stantec

TITLE

Cross Section

PROJECT NO.
333801775

SCALE @ A3
1:1

CLIENT
Croudace Homes Limited

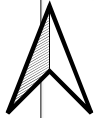
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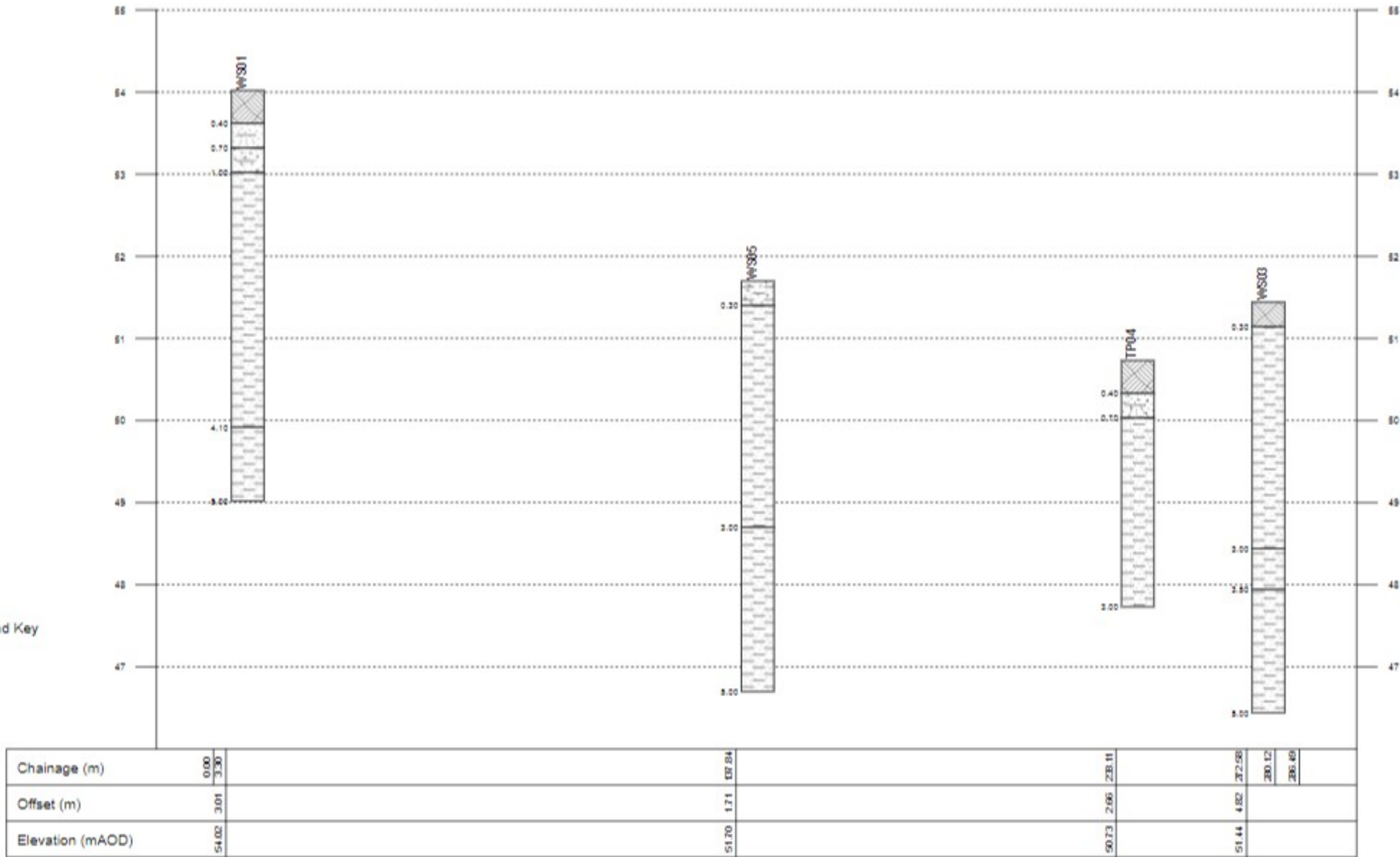
PROJECT
Land North of School Road, Arborfield Cross

DRAWING NO.
333801775-STN-XX-XX-DR-GE-0003

REVISION
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Legend Key



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KEY PLAN Site Boundary	NOTES 1. Contains OS data © Crown copyright and database right (2022)	REVISIONS <table><tr><th>REV.</th><th>DRAWN BY INITIALS</th><th>CHECKED BY INITIALS</th><th>DATE</th><th>REVISION NOTES/COMMENTS</th></tr><tr><td>P01</td><td>ER</td><td>HG</td><td>26/11/25</td><td>First issue</td></tr></table>	REV.	DRAWN BY INITIALS	CHECKED BY INITIALS	DATE	REVISION NOTES/COMMENTS	P01	ER	HG	26/11/25	First issue	Stantec		TITLE Cross Section
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		P01	ER	HG	26/11/25	First issue									
		CLIENT Croudace Homes Limited		PURPOSE OF ISSUE SUITABLE FOR INFORMATION	STATUS S2										
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