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YMCA Hostel
Peartree Lane, Welwyn Garden City
Drainage Design Information

Date: 20.12.22
Project No. 203905
Report Reference: 203905-SWH-ZZ-01-S-RP-0001
Revision: 01

Prepared by: .... [redacted] **..**
Jason Daniels BEng(Hons) CEng MICE MIStructE

- Structural Engineering
- Civil Engineering
- CDM Consultants
- Sustainability and BREEAM
- Traffic and Transport
- Flood Risk Assessments
- Highway Engineering
- Event Engineering

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Issue and Amendment Record:

Revision	Comment/Amendment	Prepared	Reviewed	Approved	Date
01	For Information	JD	JD	JD	20.12.22

Contents

Appendix

1.0 Executive Summary

1.1 **Introduction**

This document summarises the design intent for the proposed drainage from pre planning to the current design.

1.2 **Existing Site Conditions**

The site is centred at 90 Peartree Lane, Welwyn Garden City, AL7 3UL. The site comprises 1 and 2 storey buildings with car parking at the north of the site and therefore is classified as 'brownfield'. The site is underlain by superficial geological deposits of the Lowestoft Formation and bedrock geology of the Lewes Nodular Chalk Formation and Seaford Chalk Formation.

1.3 **Development Proposals**

The proposed development comprises the demolition of all structures on site and the construction of a four-storey YMCA Hostel in the west part of the site (Phase 1) and a 2,3, and 4 storey building providing up to 43 residential apartments in the east part of the site (Phase 2).

1.4 **Flood Risk**

A Flood Risk Assessment (FRA) was prepared by Pinnacle Consulting Engineers in June 2020. The FRA confirmed the site is located in Flood Zone 1: Low probability of flooding. The site has medium to high risk of surface water along the western boundary of the site. Flood Resistant and Resilient measures are therefore proposed to manage the surface water flooding.

1.5 **Original Drainage Strategy**

A separate Drainage Strategy report was prepared by Pinnacle Consulting Engineers in June 2020. A limited ground investigation encompassing infiltration testing was undertaken to support the strategy with infiltration into the ground shown to be viable. For the surface water a hybrid drainage strategy was developed with the runoff from proposed hostel building area infiltrating into the ground and runoff from the residential area infiltrating into the ground with an overflow to the Thames Water surface water sewer located in Peartree Farm at an agreed restricted rate of 5l/s. Geocellular soakaways were proposed to provide the attenuation storage.
Foul water flows discharge proposals are to connect to the existing foul water sewer.

1.6 **Site Investigation**

To inform the detailed design a further intrusive ground investigation (SI) was carried out by Soil Consultants which identified eight records of natural cavities within 500m of the site and gave the opinion that the site is located within an area at 'high risk' of possible ground solutions and potential sinkholes which could present stability issues.

1.7 **Updated Drainage Strategy**

A subsequent drainage strategy report was undertaken by AKSWard Consulting Engineers in October 2021 based on the results of the aforementioned SI. Due to the high risk of solution features on site, AKSWard Consultants ruled out the use of infiltration techniques such as soakaways. The next preferred option following the drainage hierarchy is discharge to a watercourse. There are no watercourses near the site. The next preferred option is discharge to a public sewer.
ASKWard revised the drainage strategy with the whole of the surface water runoff proposed to discharge to the public surface water sewer in Peartree Farm for both development phases. As a discharge rate of 5l/s was already agreed with Thames Water, a discharge rate of 2.5l/s was proposed for each of the two development phases.
Attenuation storage is provided by a lined geocellular tank in the north-west part of the site addition to permeable paving located the car parking areas and around the YMCA Hostel building.

1.8 **Updated Drainage Strategy**

A subsequent drainage strategy report was undertaken by AKSWard Consulting Engineers in October 2021 based on the results of the aforementioned SI. Due to the high risk of solution features on site, AKSWard Consultants ruled out the use of infiltration techniques such as soakaways. The next preferred option following the drainage hierarchy is discharge to a watercourse. There are no watercourses near the site. The next preferred option is discharge to a public sewer.
ASKWard revised the drainage strategy with the whole of the surface water runoff proposed to discharge to the public surface water sewer in Peartree Farm for both development phases. As a discharge rate of 5l/s was already agreed with Thames Water, a discharge rate of 2.5l/s was proposed for each of the two development phases.
Attenuation storage is provided by a lined geocellular tank in the north-west part of the site addition to permeable paving located the car parking areas and around the YMCA Hostel building.

Scott White and Hookins

London
Bedford
Winchester

Appendix A
AKS Ward Drainage Strategy Statement

AKSWard

CONSTRUCTION CONSULTANTS

One YMCA
Pear Tree Farm
Welwyn Garden City

Drainage Strategy Report

Prepared for

YMCA
Charter House
Charter Place,
Watford
WD17 2RT

October 2021

Job No: L211016
Document name: 1200-AKS-ZZ-XX-RP-C-0001_DSR

Rev: P01

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Contents

Appendices

Revision	Amendments	Prepared By	Checked	Date
P01	Issued for Planning	CGS	SG	29 Oct 2021

1.0 Introduction

1.1 AKSWard have been commissioned to undertake a Drainage Design and Drainage Statement (DSS) to demonstrate how the impermeable area can be satisfactorily drained without increasing flood risk onsite and elsewhere.

1.2 This strategy has been developed in full accordance with Hertfordshire County Council and National Standards as well as best practice Design Guidance and also in accordance with:

- Drainage Strategy Report by Pinnacle Consulting Engineer ref; C190906 version 3.3 dated 03.12.2020
- Flood Risk Assessment by Pinnacle Consulting Engineer ref; C190906 version 2.0 dated 06.06.2020
- Surface Water Modelling Study Rerpot by JBA Consulting ref; CXB-JBAU-XX-XX-RP-HM-0001-S0-P01.01 rev. A1-P04 dated May 2020

1.3 The proposed development has been divided for two phases. The total site red line boundary is 0.671ha, 0.34ha in Phase I and the remaining 0.331ha in Phase II.

1.4 The scheme proposes 100 bed YMCA hotel (Phase I) and block of 43 residential flats (Phase II) with the demolishment of existing development. The plans of the proposed development are contained within **Appendix A.**

2.0 Proposed Drainage Strategy

2.1 Ground Investigation and SuDS Hierarchy

Two intrusive ground investigations were conducted:

- Environmental Report by Delta Simons (ref; 20-0093.01 dated; April 2020)
- Supplementary Ground Investigation Report – Soil Consultants (ref; 10637/AOC – Rev0 dated; 03/08/2021)

Both reports has been discussed and referred within Drainage Strategy Report prepared for planning application purposes by Pinnacle Consulting Engineers ref; C190906 dated; 05 June 2020.

Two options for surface water disposal has been proposed, infiltration and attenuation storage due the proposed site being located within area at risk of solution features.

2.2 Solution Features

An intrusive ground investigation undertaken by Soil Consultants ref; 10637/AOC-rev0 identified number of solution features reported between 70m and 495m generally to the west, north-west, north and north-east.

Ground investigation report confirms that *'given the occurrence of solution features relative close to the site in similar ground condition, our opinion is that the site should be classified as '**High Risk' .***

Based on ground specialist recommendation and site being classified as at 'HIGH RISK' surface water drainage has been designed with infiltration being ruled out.

It is therefore proposed that surface water runoff is collected and attenuated on site before being discharged into the existing public surface water sewer at a restricted rate.

The GI extract is contained within **Appendix B.**

2.3 SuDS Hierarchy

All options for the destination of run-off generated on site have been assessed in Drainage Strategy Report ref. C190906 prepared by Pinnacle Consulting Engineers for Planning Application purposes.

Due to the site being classified at **High Risk** of solution features, surface water runoff will be attenuated and discharged into public surface water sewer at restricted discharge.

3.0 Surface Water Drainage Runoff and Strategy

3.1 Surface Water Runoff Rate and Volume

It is proposed all parking, private patio and roof areas of the site will be discharged into the permeable paving and collected using perforated pipes prior runoff being discharged into the onsite attenuation storage.

It is then proposed that surface water runoff from the site is discharged at 2.5l/s into the public surface water sewer.

The maximum discharge rate of 5l/s has been agreed with Thames Water for the whole site, during planning application consultation. It is therefore proposed that each phase will have a surface water runoff rate restricted to 2.5l/s.

The proposed attenuation storage has been designed to a Critical 1 in 100 year + 40% climate change storm event and also includes for a surface water runoff from the areas prone to flooding risk around the southern boundary which were identified in Surface Water Modelling Study prepared by JBA (ref; CXB-JBAU-XX-XX-RP-HM-0001-S0-P01.01 dated; May 2020).

Based on the above, the total storage provided is **161.5m^3** which account for surface water runoff from the site (111.5m^3),a also allowing for the predicted flood waters storage of 50m^3.

The proposed porous areas voided subbase storage has been excluded from the storage calculation which based on 475m^2 and 250mm subbase depth will provide a **35.6m^3** of additional storage.

The proposed contributing area plan, drainage plan and drainage calculations are attached in **Appendix C.**

4.0 Water Quality

A key requirement of any SuDS system is that it protects the receiving water body from the risk of pollution.

Frequent and short duration rainfall events are those that are most loaded with potential contaminants (silts, fines, heavy metals and various organic and inorganic contaminants) therefore the first 5-10mm of rainfall should be adequately treated with SuDS.

The new SuDS Manual (Ciria C753, November 2015) introduces slightly different approach compared to the previous version for the water quality management of surface water. The Manual describes risks posed by the surface water runoff to the receiving environment as a function of:

- The pollution hazard at a particular site (i.e. the pollution source)
- The effectiveness of SuDS treatment components in reducing levels of pollutants to environmentally acceptable levels

- The sensitivity of the receiving environment

The recommended approaches for water quality risk management are given in the SuDS Manual Table 26.1.

Approaches to Water Quality Risk Management			
Design method	**Hazard Characterisation**	**Risk Reduction**	
		For Surface Water	**For Groundwater**
Simple Index Approach	Simple pollution hazard indices based on land use (Table 26.2)	Simple SuDS hazard mitigation indices (Table 26.3)	Simple SuDS hazard mitigation indices (Table 26.4)
Risk Screening	Factors characterising traffic density and extent of infiltration likely to occur (Table 26.5)	N/A	Factors characterising unsaturated soil depth and type, and predominant flow type through the soils (Table 26.5)
Detailed Risk Assessment	Site specific information used to define likely pollutants and their significance	More detailed, component specific performance information used to demonstrate that the proposed SuDS components reduce the hazard to acceptable levels	
Process-based treatment modelling	Time series rainfall used with generic pollution characteristics to determine statistical distributions of likely concentrations and loadings in the runoff	Models that represent the treatment processes in the proposed SuDS components give estimates of reductions in even mean discharge concentrations and total annual load reductions delivered by the system	

Figure 1: Approaches to Water Quality Risk Management

As per Table 26.1 Simple Index approach will be used as a design method for this site.

Table 26.2 will provide hazard classification of different land uses. The land uses for the surface water drainage for this site are:

- Residential Roofs
- Low traffic roads and residential car parks

To deliver adequate treatment, the selected SuDS components should have a total pollution mitigation index for each contaminant type that equals or exceeds the pollution hazard index for each contaminant type.
Therefore, the following must be achieved for the surface running off the site.

Total SuDS mitigation index >=pollution hazard index

Pollution Hazard Indices are given for different land uses in Table 26.2 of the SuDS manual;

Pollution Hazard Indices				
Other roofs (Typically commercial/industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g., cul-de-sacs, homezones and general access roads) and non-residential car parking with infrequent change (e.g., schools, offices) i.e., < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g., hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g., haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

Figure 2: Pollution Hazard Indices

Pollution Hazard Index and Destination of runoff for the proposed Site					
Land Use	**Destination of Runoff**	**Pollution Hazard Level**	**Total Suspended Solids**	**Metals**	**Hydrocarbons**
Residential Roof	Surface Water Sewer	Very Low	0.2	0.2	0.05
Car parks and low traffic roads	Surface Water Sewer	Low	0.5	0.4	0.4

Figure 3: Pollution Hazard Index and Destination of Runoff for the Proposed Site

The SuDS mitigation index will be obtained from Table 26.4 (for discharges to surface waters) of the SuDS manual.

Table 26.4 Indicative SuDS mitigation indices for discharges to surface waters			
	Mitigation Indices		
Type of SuDS Components	**TSS**	**Metals**	**Hydrocarbons**
Filter Strip	0.4	0.4	0.5
Filter Drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention System	0.8	0.8	0.8
Permeable Pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Proprietary treatment systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

Figure 4: Indicative SuDS mitigation indices

Mitigation Indices						
Runoff Source	**Destination of Runoff**	**Mitigation Index Source**	**Type of SuDS Component**	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Residential car parks	Surface Water Sewer	Table 26.4 (for ground waters) Table 26.3 (for surface waters)	Permeable Pavement	0.7	0.6	0.7
Residential Roof	Surface Water Sewer	Table 26.4 (for ground waters) Table 26.3 (for surface waters)	Attenuation Tank / Catchpit Chambers	0.2	0.2	0.05
Access Road	Surface Water Sewer	Table 26.4 (for ground waters) Table 26.3 (for surface waters)	Proposed Bypass Separator i.e. Downstream Defender	0.5	0.4	0.8

Figure 5: SuDS mitigation index for site

Suds mitigation index for Downstream Defender taken from manufacturer specification.

The above analysis demonstrates that the SuDS devices within the design will mitigate any pollution present within the surface water system.

4.2 Exceedance Events

Whilst is it a requirement to fully attenuate the 1 in 100 year critical storm event plus 40% climate change, it is also necessary to ensure storms which exceed this severity do not cause flooding to building areas or exacerbate flooding elsewhere.

Due to the proposed development site providing betterment to runoff rates when compared to the existing (based on topographical survey information) impermeable area, the proposed development will further reduce surface water flooding.

Due to the site proposed site plan arrangement and the only available location for attenuation storage being the proposed car parking area the final hardstanding levels has been designed to provide conveyance routes taking storm flows away from building areas to less vulnerable area, in this case courtyard, car parking and access road areas.

It will also be ensured that all final building floor levels will be build a minimum of 300mm above the critical 1:100 year plus 40% climate change storm event flood level elevation.

5.0 Foul Water Drainage

It is proposed foul water flows from the proposed development will be conveyed into the existing public foul sewer via a gravity connection. The nearest public foul sewer is located in Peatree Farm road to the east of the site.

Based on OFWOT guidance, any connection to the public sewer should be agreed with the Statutory Undertaker under a Section 106 (of the Water Industry Act 1991) as part of detailed design.

6.0 Maintenance

6.1 Introduction

During construction, the Contractor will be responsible for maintaining the drainage and SuDS (Sustainable Drainage Systems). Upon handover, the developer will appoint a maintenance firm to take on the responsibility of these duties as laid out in this report.

The maintenance schedule for the proposed development will be split down into two separate categories; SuDS features and regular private drainage.

6.2 SuDS at YMCA, 90 Peatree Lane, Welvyn Garden City

As listed above, in Section 4, the SuDS features used on site will be geo-cellular attenuation and permeable paving.

The SuDS features have been designed for easy maintenance and comprise:

- Regular Day-to-Day care – litter collection, regular gardening to control vegetation growth and checking inlets where water enters the SuDS features
- Occasional tasks – checking the SuDS features and removing any silt that builds up in the SuDS feature
- Remedial work – repairing damage where necessary

6.3 SuDS Drainage Maintenance Specification

- Attenuation Tank

In order to maintain the functioning of the attenuation tanks, the following maintenance requirements should be adhered to:

Operation and maintenance requirements for attenuation storage tanks		
Maintenance Schedule	**Required Action**	**Typical Frequency**
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae, or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from per-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

- Permeable Paving

In order to maintain the functioning of the permeable paving, the following maintenance requirements should be adhered to:

Operation and maintenance requirements for permeable		
Maintenance Schedule	**Required Action**	**Typical Frequency**
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth – if required take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rate and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

6.4 General Drainage Maintenance Specification

Inlet Structures and Inspection Chambers:

- Inlet structures such as rainwater downpipes, road gullies and channel drains should be free from obstruction at all times to all free flow through the SuDS
- Inspection Chambers and Rodding Eyes are used on bends or where pipes come together. They allow access and cleaning to the system if necessary.

Inlet Structures and Inspection Chambers	
Regular Maintenance	**Frequency**
Inlet Structures Inspect rainwater downpipes, channel drains and road gullies, removing obstructions and silt as necessary. Check that there is no physical damage. Strim vegetation 1m min surround to structures and keep area free from silt and debris	Monthly
Inspections Chambers and below ground control chambers. Remove cover and inspect, ensuring that the water is flowing freely and that the exit route for water is unobstructed. Remove debris and silt. Undertake inspection after leaf fall in Autumn	Annually
Occasional Maintenance Check topsoil levels are 20mm above edges of chambers to avoid mower damage.	As necessary
Remedial Work Repair physical damage if necessary	As required

Below ground drainage pipes:

Below ground drainage pipes convey water to the SuDS system. They should always be free from obstruction to allow free flow.

Below Ground Drainage Pipes	
Regular Maintenance	**Frequency**
Inspect and identify any areas that are not operating correctly. If required, take remedial action. Remove debris from the catchment surface (where it may cause risks to performance) Remove sediment from pre-treatment inlet structures and inspection chambers. Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks.	Monthly for 3 months then annually Monthly Annually or as required Monthly or as required
Remedial Work Repair physical damage if necessary	As required
Monitoring Inspect all inlets, outlets and vents to ensure that they are in good conditions and operating as designed. Survey inside of pipe runs for sediment build up and remove if necessary.	Annually Every 5 years or as required

7.0 Conclusion

This report demonstrates how construction of a new hostel and associated external hard standing areas can be implemented which satisfactory manages and mitigates flood risk.

The drainage strategy proposed is in full accordance with Local and National best practice drainage guidance, Drainage Strategy Report, Flood Risk Assessment and Surface Water Modelling Study Report all prepared to support for a new planning application.

Intrusive ground investigation identified site being located within the area of **High Risk** possible ground solutions features and creation of potential sink holes, therefore the site is not suitable for traditional infiltration disposal of surface water.

It is proposed all roof, car parking runoff is conveyed to a geo-cellular tank via permeable paving before it is discharged into public surface water sewer at restricted discharge.

Attenuation storage will be provided in the geo-cellular storage and permeable paving to allow fowls to be controlled to 2.5l/s for up to critical 1:100 year + 40% climate change event.

All the areas identified being affected by surface water flooding has been designed using permeable block paving and additional flood storage has been provided within on-site attenuation tank.

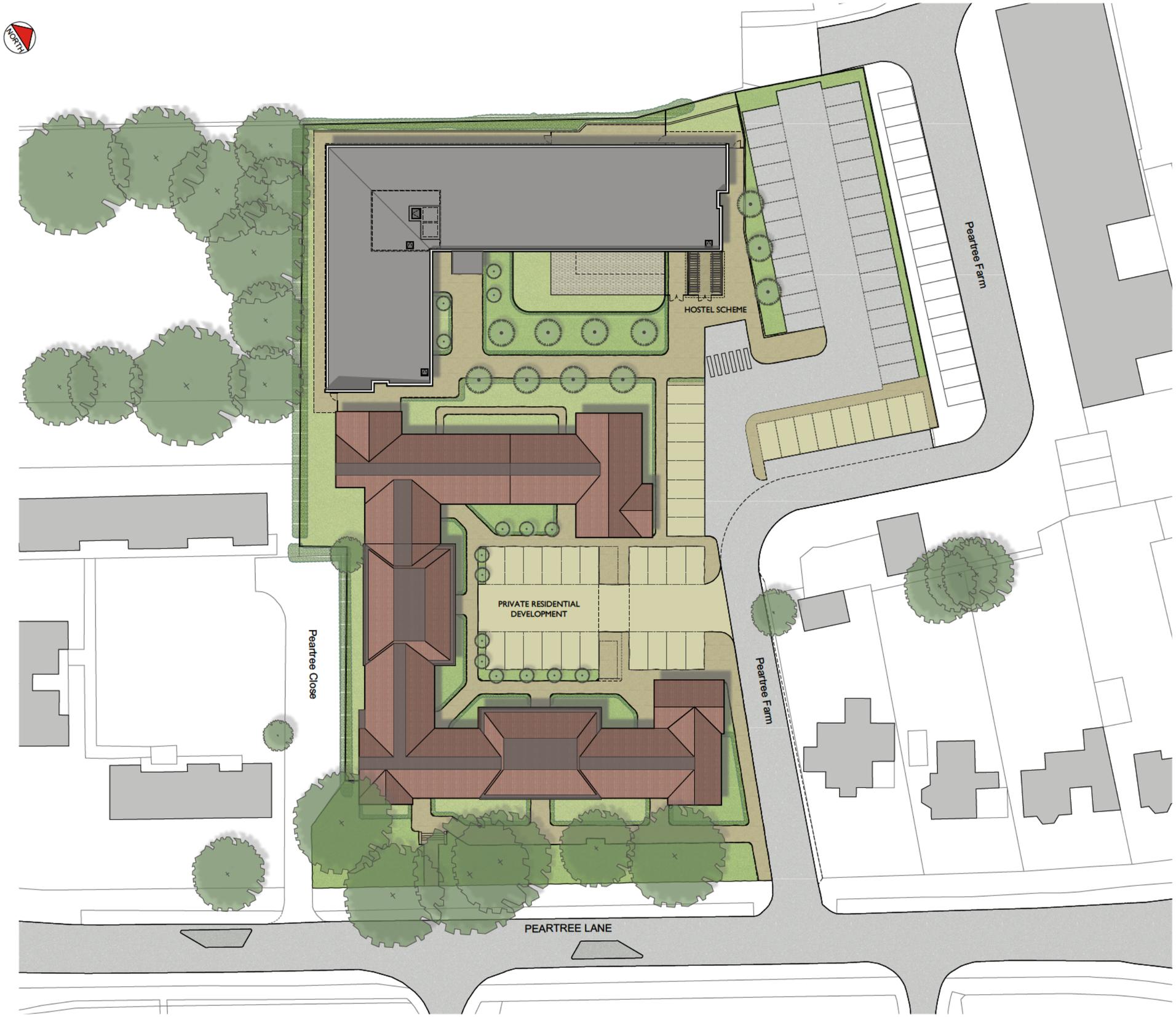
The total storage provided is **161.5m^3** which account for surface water runoff from the site (111.5m^3) and also allowing for the predicted flood waters storage of 50m^3.

The proposed porous areas voided subbase storage has been excluded from the storage calculation which based on 475m^2 and 250mm subbase depth will provide a **35.6m^3** of additional storage.

It is proposed foul water flows from the proposed development will be conveyed into the existing public foul sewer via a gravity connection. The nearest public foul sewer is located in Peatree Farm road to the east of the site.

Appendix A

Proposed Development Plan



NOTES ©

This drawing to be read in accordance with the specification/Bills of Quantities and related drawings. No Dimensions to be scaled from this drawing. All stated dimensions to be verified on site and the Architect notified of any discrepancies.

0 50

Scale bar 50mm at 1:1

FOR PLANNING

REV	DATE	NOTE	IN
A	06/12	DRAWINGS UPDATED TO REFECT CURRENT DRAINAGE STRATEGY. ROOFSCAPE TO RESIDENTIAL DEVELOPMENT UPDATED.	AE

Project

YMCA
PEARTREE LANE
WELWYN GARDEN CITY

Title

PROPOSED SITE LAYOUT

Scale 1:500 @A3	Date SEPT 2019
Drawn SD	Checked AL
Drawing Number 8057 / P101	Revision A

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Architecture + Urban Design
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Appendix B

GI Report Extract

SUPPLEMENTARY GROUND INVESTIGATION REPORT

PROPOSED REDEVELOPMENT:

One YMCA, 90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL

Client:	**One YMCA,** **Charter House** **Charter Place, Watford** **Hertfordshire WD17 2RT**
Consulting Engineers:	**AKSWard Limited** **10 Bonhill Street** **London EC2A 4PE**
Report ref:	**10637/AOC – Rev0**
Date:	**03/08/2021**

SUPPLEMENTARY GROUND INVESTIGATION REPORT

PROPOSED REDEVELOPMENT:

ONE YMCA, 90 PEARTREE LANE, WELWYN GARDEN CITY, HERTFORDSHIRE AL7 3UL

DOCUMENT ISSUE STATUS:

Issue	Date	Description	Author	Checked/approved
Rev0	03/08/2021	First issue	Alex O Connor BSc(Hons), FGS	Stuart Wagstaff BSc(Hons), MSc, FGS, CGeol, RoGEP

This report has been undertaken within the constraints of the client's instruction/contract, together with those set out in the 'General information, Limitations and exceptions' section at the end of this report. The SCL 'Standard Terms of Appointment' are also included at the end of this report and these identify the contractual arrangements for the investigation. Conclusions or recommendations made in this report are limited to those which can be reasonably based upon the research and/or intrusive investigation work carried out. Any comments which rely on third-party information which has been provided to us are made in good faith and on the assumption that such information is accurate. SCL have not carried out independent validation of any third-party information.

Soil Consultants Ltd (SCL) has prepared this Report for the Client in accordance with the Terms of Appointment under which our services were performed. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by us. This Report may not be relied upon by any other party without the prior and express written agreement of SCL.

APPENDIX A

Fieldwork, in-situ testing and monitoring

- Foreword
- Borehole records
- Standard Penetration Test results
- SPT hammer calibration certificates
- Trial Pit records
- Pavement construction records
- Groundwater and gas monitoring results

Laboratory testing

- Index property testing
- Plasticity chart
- Unconsolidated Undrained triaxial test result (QUT)
- Particle Size distribution tests

Ground profiles

- Plot of SPT 'N' value versus depth

Contamination and chemical testing

- Foreword
- General soil suite
- WAC test results
- General water suite
- Soluble Sulphate/pH results

Plans, drawings & photographs

- Site photographs
- Proposed development plan
- Site Plan
- Location Plan

Delta Simons borehole records

- DS101 - DS103

APPENDIX B

- Argyll Environmental Desk Study Report (Ref AEL-04460TSC-959119, Dated 7th December 2018)

APPENDIX C

- Delta Simons Environmental Report (Ref 20-0093.01, Dated April 2020)

APPENDIX D

- Delta Simons Soakaway Infiltration Report (Ref 20-0093.01, Dated April 2020)

APPENDIX E

- Groundsure Report: Ground Stability and Mining Search (Ref SCL-7926557)

1.0 INTRODUCTION

Consideration is being given to the redevelopment of One YMCA in Welwyn Garden City. The proposals are to demolish the existing buildings and construct a new residential/youth hostel development. Whilst the overall YMCA campus is to be re-developed, this report is limited to the northern area only. This new building is to be of four storey height and of 'L' shaped configuration, housing a one hundred room youth hostel facility.

Initial environmental reports have been produced for the site (Reproduced as appendices to this report for completeness) and Soil Consultants Ltd (SCL) were commissioned by AKS Ward on behalf of the client (One YMCA) to carry out additional ground investigation works including the following elements:

- Review of existing Stage 1 Tier 1 Preliminary Risk Assessment (Desk Study) and Generic Quantitative Risk Assessment
- Provision of advice on solution feature risks, piled foundation design and the options for surface water dispersal
- Additional sampling, contamination risk assessment and refined Conceptual Site Model (CSM)

The following reports, which are included as separate appendices, have been provided and these should be read in conjunction with this report:

- Argyll Environmental Desk Study Report (Ref AEL-04460TSC-959119, Dated 7th December 2018)
- Delta Simons Environmental Report (Ref 20-0093.01, Dated April 2020)
- Delta Simons Soakaway Infiltration Report (Ref 20-0093.01, Dated April 2020)

This SCL report includes a summary of the initial environmental reports and provides further generic quantitative risk assessment for the proposed development along with a revised conceptual model. The ground conditions are summarised with regards to the design of piled foundations and risks from solution features.

2.0 SITE DESCRIPTION

Site location and setting	↓ Located in Welwyn Garden City, Hertfordshire, with a predominantly residential area to the south and mixed commercial/residential area to the north ↓ Accessed via a small road named Peartree Farm off the west side of Peartree Lane ↓ Site centre is at approximate NGR 524388E 212601N
Site dimensions	↓ Site is roughly rectangular in shape with dimensions 75m (NE-SW) x 30m (NW-SE)
Site boundaries	↓ Car mechanics and bodywork repair garages to the north (Photos 1 & 2) ↓ Peartree Lane is to the east with residential housing beyond (Photo 3) ↓ Residential flats and a small densely wooded area to the south (Photo 4) ↓ Storage yard for road maintenance company to the west (Photos 5 & 6)
Site description	↓ Hostel buildings comprising an L-Shaped block and a rectangular block. Generally of brick and concrete construction and of two storey height although some sections are of single storey height (Photos 7 to 11) ↓ Central courtyard garden surrounded by hostel accommodation, mainly lawn but with paved paths and raised planter beds (Photo 11) ↓ Car parking area on northern side of the site which is asphalt-surfaced and raised above the ground floor level of the buildings ↓ Small brick outbuilding / store located in north-eastern corner of car park (Photo 12)
Topography and site levels	↓ Topographic drawing supplied (Malcolm Hughes, Ref: 53948-1, June 2019). General area slopes from approx. +84.50mOD in northern corner to approx. +82.90mOD in the main courtyard, level then rises to approx. +83.30mOD along southern boundary ↓ Spot levels indicate road level at front is approx. +83.50mOD ↓ Some landscaping is present in the northern part of the site where the ground slopes down from around +84.00mOD at the car park to around +83.50mOD the hostel building ↓ Roughly 0.75m embankment contained (in part) by a masonry retaining wall along the north-western boundary with the southern section being a battered slope (Photo 10)
Existing vegetation within site and adjacent properties	↓ Hedges and bushes line the northern boundary (Photo 10). ↓ A wooded area is present to the south/south-west containing semi-mature and mature deciduous trees including sycamore and willow, elder, lime species (Photo 4) ↓ Silver birch (6m heigh) and possibly lime trees located in the central courtyard area along with several shrubs (Photo 11)

The current site features are shown on the site plans/aerial photographs and site photographs which are included in Appendix A.

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3.0 REVIEW OF DESK STUDY REPORTS

The following third party information has been used in formulating this summary with regards to historical land use and environmental risk.

- Argyll Environmental Desk Study Report (Ref AEL-04460TSC-959119, Dated 7th December 2018)
- Delta Simons Environmental Report (Ref 20-0093.01, Dated April 2020)

These reports should be read fully and understood in the context of the summary below.

Historically the area formed part of Peartree Farm comprising farmyard buildings in the northern area of the site from the earliest map edition dated 1878. The site remained in agricultural use until circa 1938 when a building is noted in the southern area, mapped as a Youth Hostel and Club. Alterations to the farm buildings in the north of the site are noted circa 1985. The farm buildings are assumed demolished prior to 1990 as they are no longer mapped, and the Youth Hostel is noted to occupy the majority of the site, with no significant change to the present day.

The surrounding area has historically comprised a number of industrial uses with associated tanks, most notable a chemical works located 30m to the north, a garage warehouse and corporation yard.

There are five licensed water abstractions located within 1km of the site, the closest of which is located approximately 360m west, relating to the abstraction from groundwater for chemicals (process water).

The nearest surface water feature is located approximately 240m south-west of the site. Aquifer designations for the Superficial Deposits are Secondary Undifferentiated for the majority of the site with the north-western most corner classified as Secondary A Aquifer. The solid geology (Chalk) is considered as a Principal Aquifer. The site was also considered at low to moderate risk of flooding. The EA data also indicate that the site is located within a Zone III Total Catchment Source Protection Zone (SPZ).

Pertinent entries within 250 m of the site include:

- Historical Potentially Contaminative Uses, Tanks / Potential Tanks are records, 95m/105m north-west, 109m west, 169m north-west and 234m north;
- Six Registered Radioactive Substances, all of which relate to Roche Products Ltd, the closest is located approximately 180m west;
- A Registered Landfill Site located approximately 200m northwest relating to a Landfill accepting aqueous effluent waste and industrial effluent treatment sludge, the input rate is noted as small (<10,000 tonnes per year);
- One Registered Waste Treatment or Disposal Site located approximately 160m west relating to the above Landfill Site;
- Thirty-eight Contemporary Trade Directory Entries, the closest of which is an active tyre repair and re-treading entry located approximately 25m north;
- Five areas of potentially infilled land (water), the closest of which is located approximately 30m south-west, recorded in 1939 mapping;
- Natural and Mining Related Hazards, all categories considered as No Hazard, Very Low Hazard or Low Hazard. It is noted that a number of solution features are reported between 70m and 495m generally to the west, north-west, north and north-east – this aspect is further discussed in Section 4.

The site was considered to have a moderate to high environmental sensitivity and the risk of contaminants being present was considered low to moderate. No further recommendations were required in terms of contamination.

4.0 WALK-OVER SURVEY

A site walk-over survey was undertaken in conjunction with the investigation works in June 2021. A description of the general features of the site and the topography is provided in Section 2.0 above. From inspection of visible and accessible areas, a summary of specific features relevant to the land quality assessment is as follows:

Feature	Commentary
Electricity substations and transformers	Transformer located within light industrial units just beyond NW corner of site. Good condition and appears to be a relatively recent installation (not recorded on mapping or data set) - Photo 14
Fuel storage tanks	None observed
Fuel interceptors	None observed
General waste	Bin area to south of main building; clean and tidy – Photo 13
Invasive species	None observed
Evidence of gas protection	None observed
Surface water contamination	None observed
ACMs	None identified as cladding or roofing to structures although due to the age of the building ACM cannot be discounted as part of the building fabric
Other	Small light industrial units to the north of the site are typical of this type and age. Several of the units are occupied by vehicle maintenance businesses with areas generally tidy and no significant surface (oil) staining evident in close proximity to the units. Roofing of these structures appears to be largely ACM – Photos 1 & 2

5.0 PRELIMINARY RISK ASSESSMENT AND INITIAL CONCEPTUAL SITE MODEL

The information in the preceding sections has been used to undertake the Preliminary Risk Assessment specific to this development and to compile the Initial Conceptual Site Model (CSM) below. The assessment follows as risk-based approach, with the potential risks determined qualitatively using the 'source-pathway-receptor' linkage concept; a risk of harm may only exist where a plausible linkage is present. The assessment has been formulated based on the following table:

		Consequences			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High likelihood**	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Definitions of the risks are summarised as follows:

- **Very high:** high probability that severe harm could occur, or there is evidence that it is currently occurring. If realised, the risk could result in substantial liability. Urgent investigation/remediation
- **High:** harm is likely to occur, realisation is likely to present substantial liability. Urgent investigation required. Remedial works may be required in short-term, will be in long-term
- **Moderate:** possible that harm could arise, but unlikely to be severe. Investigation normally required to clarify risk and liability. Remedial works may be necessary in long-term
- **Low:** possible that harm could occur, but this would at worst be mild
- **Very low:** low possibility of harm, unlikely to be severe

The assessment has been carried out by identifying and evaluating the potential sources of contamination, the potential receptors and the plausible pathways for contamination migration are summarised as follows:

5.1 Potential sources of contamination

A summary of potential sources identified by our review of the above information is as follows:

- **Light industrial units, and former chemical works:** vehicle maintenance units identified to the north along with historical chemical and metal works in the wider area
- **On site oil/fuels:** small-scale oil/fuel spills associated with former farm building and agricultural use and boiler rooms which may/may not have been present on site
- **Asbestos:** buildings pre-2000 could contain ACMs
- **Made Ground:** associated with historical use and development. This will probably be of uncertain or unknown origin and may contain contaminants that have not been specifically identified
- **Infilled ground:** infilled ground reported as accepting aqueous effluent and industrial effluent/sludge recorded 200m north-west. There are several entries for infilled land associated with water features recorded within 250m of the site

The assessed risks from these potential sources are summarised in the Initial Conceptual Site Model below.

5.2 Potential receptors

In the context of the proposed development, the following potential receptors have been identified:

- Human health: inhabitants/users of building, construction workers, adjacent site users
- Controlled waters: Principal Chalk aquifer and Secondary 'A' and Secondary Undifferentiated aquifer beneath site. Surface stream approximately 3m from northern site boundary. The site is assessed as being of **moderate to high environmental sensitivity**
- Building fabric and services: buried foundations, potable water pipes

5.3 Plausible pathways

- Ingestion of soil, dust or water
- Inhalation of dust, gas or vapours
- Direct physical contact with contaminated soil/water
- Vertical and lateral migration of contamination including leaching
- Chemical attack of building infrastructure, including water supply pipes
- Migration of ground gas/vapour through permeable soils or open pathways

5.4 Initial Conceptual Site Model

The initial site-specific Conceptual Site Model and an assessment of the risk associated with each potential linkage is shown in the following table:

Source	Pathway	Receptor	Assessed risk and commentary/justification
On-site: contaminated soil and groundwater	Ingestion, contact, inhalation	End user, construction workers and infrastructure	**Low risk:** no significant specific contamination sources identified on site. Pre-2000 buildings and potential made ground giving potential asbestos risk
	Leaching from contaminated soils and migration in groundwater	Aquifer and surface water	**Low risk:** there is a Secondary Aquifer beneath the site, which lies within a Zone 3 Total catchment Source Protection Zone. The nearest abstraction point is 361m west. No potential onsite contamination sources were, however, identified and therefore the risk to the aquifer is expected to be relatively low
Off-site: contaminated soil	Lateral migration of contaminants to site in groundwater	End user	**Moderate risk:** main potential sources are the adjacent light industrial units including vehicle servicing garages; these could have caused contamination of the groundwater with migration beneath the site
On-site and off-site: ground gas and vapours	Lateral and vertical migration of gas/vapour	End-user and buildings	**Low to Moderate risk:** there will be a risk of ground gas/vapours associated with the potentially infilled ground around the site/ migration of gases from spillages associated with the nearby vehicle maintenance buildings. The site is deemed not to be in a radon affected area

The overall risk rating for the site is assessed as being **Low to Moderate**.

5.5 Recommendations for intrusive investigation

The Initial Conceptual Site Model identified potential pollution linkages resulting in the overall assessed risk rating of low to moderate. The following programme of intrusive investigation is considered:

- Suitable intrusive investigation to confirm the ground sequence, allow soil/water sampling and the installation of monitoring pipes
- Potential sources to be targeted which have been identified by the PRA and sampling to provide a general coverage; include sampling along the northern part of the site closest to the light industrial units
- Soil and groundwater samples should be recovered where relevant, PID head space measurements taken and analysed for a range of general contaminants to include petroleum hydrocarbons, asbestos screening and quantification
- A programme of groundwater and gas monitoring

The Initial Conceptual Site Model should then be revised to include complete pollution linkages and outline mitigation/remedial measures should be identified, together with any requirements for additional investigation.

6.0 EXPLORATORY WORK

The ground investigation, specified by the structural engineers AKSWard Ltd, was carried out in June 2021. This phase of work supplements an earlier phase of work undertaken by Delta Simons, specifically with regards to providing geotechnical information for the proposed scheme. As part of this work, additional sampling was also undertaken for further contamination testing. For this particular development area, three boreholes were constructed by Delta Simons (DS101 to DS103) to a depth of 5.0m below ground level during the earlier phase of work. We have included the relevant factual information from the Delta Simons report in our Appendix A.

6.1 Constraints

The building was occupied and fully operational during the course of the investigation. The locations of the exploratory holes were as close as possible to the scheduled points although some were moved due to the presence of buried services. Work in external areas only was permissible at this time and therefore the ground within the building footprint could not be investigated.

6.2 Rotary auger boreholes

Two solid-stem rotary auger boreholes (BH1 and BH2) were completed using a tracked rig under the supervision of a geotechnical engineer and taken to depths of 12m and 25m respectively. BH2 was terminated above the 15m target depth due to the presence of large gravel and cobbles, preventing advancement of the drilling tools.

In-situ SPTs (Standard Penetration Tests) were performed at regular intervals and representative samples were taken for geotechnical testing. The hammer energy ratio (E_r) for the equipment used was 81%; the relevant test certificate is appended.

6.3 Trial Pits

Five pits were excavated by hand adjacent to the existing structures to expose the foundation details. In addition, two pits were excavated though the car park surfacing to establish the make-up and also to obtain samples for contamination testing.

6.4 CBR Testing

Two CBR tests were performed using TRL Dynamic penetrometer techniques.

6.5 Groundwater and gas monitoring

Groundwater/gas monitoring was carried out on three occasions following completion of the site works. All boreholes for this site read dry conditions at this time.

6.6 Geotechnical laboratory testing

The following geotechnical laboratory testing was completed:

- Moisture content tests
- Plasticity index tests
- Particle size distribution
- Soluble sulphate/pH analyses (DETS Ltd)

6.7 Chemical and contamination testing

Selected soil samples were delivered to a specialist laboratory (DETS Ltd) and the following testing was carried out:

General soil/water suite	-	7no samples
PCB		2no samples
Waste Acceptance Criteria (WAC)	-	2no samples
Soluble sulphate/sulphur/pH analyses	-	10no samples

The exploratory hole records, in-situ test results and laboratory testing results are included in Appendix A. The relevant results from Delta Simons Report is also presented.

7.0 GROUND CONDITIONS

Published BGS information (1:50,000 and 1:10,000 scale maps) indicates that the site is underlain the Lowestoft Formation (glacial sand and clay) resting upon the Lewes Nodular Chalk Formation. Below a surface layer of made ground our investigation has confirmed the presence of variable deposits associated with the Lowestoft Formation with the Lewes Nodular Chalk lying at depth below.

Detailed descriptions are presented on the borehole records in Appendix A and a brief summary of the geological sequence is presented below (including the relevant boreholes from the Delta Simons investigation).

7.1 Made ground

Generally, below a nominal thickness of turf and topsoil, made ground was present and identified to depths of between about 0.50m and 1.40m. The soils generally comprised brown gravelly clay with varying amounts of man-made material such as brick and ceramics. In TPs 1, 2, 5 and 6, the made ground was recorded to depths of between 1.20m and 1.40m; this is suspected to represent backfill against the shuttered formations of the concrete footings and thus may not represent the actual depth of made ground in the surrounding soils.

7.2 Lowestoft Formation

The Lowestoft Formation is a glacial deposit and typically has lateral and vertical variability over short distances. These deposits are present directly below the made ground and the full thickness was only proven in BH 1 where the base was at 9.50m. It should be noted that the base was not encountered in BH2 which extended to 12m depth and this exemplifies the eroded and probable karstic nature of the underlying Chalk.

Whilst variable in composition, comprising both cohesive and granular deposits, the sequence was dominated by clay soils. The fine-grained deposits largely comprise orange brown slightly sandy clay with variable proportions of gravel. Granular horizons were present typically between about 2.00m and 3.00m and also in BH1 between 5.70m and 8.00m. These horizons are considered to be laterally impersistent, of variable thickness and comprised either slightly clayey sand or slightly clayey gravel/sand and gravel.

The clay soils had a soft consistency at shallow levels becoming firm with depth. Plasticity index testing shows the clay to be largely of low to intermediate plasticity with a corresponding low to medium volume change potential on the NHBC classification. It should however be noted that taking the proportion of gravel into account, the modified classification for the majority of samples classify as ‘Non Plastic’ with the remaining samples showing low to medium volume change potential classification.

Particle size analysis of the granular horizons indicates the deposits in BH1 to comprise clayey sandy gravel to slightly clayey sand and gravel.

SPT N-values in the upper granular soils were recorded between 9 and 23, indicating loose to medium dense state of compaction with the lower granular deposits in BH1 giving N-values between 43 and >50 indicating a dense/very dense state. The clay horizons recorded a SPT N-values of between 5 and 22. Notably, the shallow soils exhibited low strength characteristics becoming medium to high strength with depth. A single triaxial test gave a Cu value of 77kPa indicating this clay to be of high strength.

7.3 Lewes Nodular Chalk Formation

The Chalk was encountered below the Lowestoft Formation at 9.50m depth in BH1 and extended to the full depth investigated (25.00m). The upper Chalk strata was assessed as being in a highly weathered state however, due to the nature of drilling, the samples recovered comprised a melange of chalk gravel in a matrix of comminuted chalk silt and consequently accurate grading was not possible. With depth, the effects of weathering appeared to lessen (based on the SPT N values), albeit recovery of intact undisturbed samples was not possible.

SPT N-values at the top part of the formation measured between about 18 and 25, and below about 18.00m resistance values increased to >30. This could signify either a change in weathering state or a variation in lithological unit.

7.4 Groundwater

During the course of drilling all boreholes remained dry although it was noted that the Chalk below 24.50m depth was damp in BH1. Whilst not directly on this development area, the Delta Simons Borehole DS105 reported groundwater within a granular horizon at 3.50m depth on two occasions and dry on a third occasion. This groundwater is likely to be perched and contained within the more granular stratum at this depth / location.

Monitoring visits conducted in March 2020 by Delta Simons indicated groundwater levels of around 1.50m in DS105, whilst visits carried out by SCL in June/July 2021 in the same borehole showed water levels at depths of 3.02m and 3.56m, followed by a dry reading; this substantiates our view that this groundwater reflects a perched water.

Monitoring of DS103 and BH1 revealed no groundwater to be present within the depths installed.

Groundwater levels can of course vary seasonally and with prevailing weather conditions.

7.5 Environmental observations

No obvious olfactory or visual signs of soil or groundwater contamination were encountered in the boreholes or trial pits during our fieldwork or subsequently during on the monitoring visits during June and July 2021.

PID headspace testing (for VOC concentrations) undertaken on samples of made ground and natural soils and groundwater in the installed monitoring pipe during our phase of work. This screening has shown there to be no significantly elevated levels.

8.0 GROUNDSURE NATURAL CAVITIES, MINING AND LAND STABILITY REPORT

The independent report commissioned from Groundsure (Geo Insight Report ref: SCL-7926557) collates information on the geology, historical mining and natural cavities recorded on site and within the immediate vicinity and this is included in Appendix E.

Summary of Groundsure Geo Insight Report (SCL-7926557)

- Artificial / made ground: none recorded.
- Superficial Deposits/Drift Geology: Lowestoft Formation (moderate permeability) and Kesgrave Catchment Subgroup (very high permeability) on site.
- Bedrock/Solid Geology: Lewes Nodular Chalk Formation and Seaford Chalk Formation – undifferentiated (very high permeability) on site.
- Radon: the property is in a Radon Affected Area (less than 1% of properties are above action level) - no protective measures required.
- Natural Ground Subsidence: low to negligible risks were identified for all the categories listed.
- Borehole Records Map: none within 250m.
- Estimated Background Soil Chemistry (on site): Arsenic 15-25mg/kg, Lead 100mg/kg, Bioaccessible Lead 60mg/kg, Cadmium 1.8mg/kg, Chromium 60-90mg/kg, Nickel 15-30mg/kg.

The Groundsure report indicates there to be eight records of natural cavities within 500m of the site, with the closest being 69m to the west; all are referred to as ‘sinkholes’. Despite this, the report classifies the site is at ‘very low’ risk of subsidence due to ground dissolution and this is regarded as anomalous – this is discussed further in Section 9.1 below.

With regards to mining, the report indicates that sporadic chalk mining of restricted extent could have occurred at the site.

9.0 GEOTECHNICAL ASSESSMENT

The proposed development includes the demolition of the existing structures and the construction of a new four storey building having and 'L' shaped configuration as shown on the appended Site Plans. Landscaping is proposed within the central area and the existing car park is to be retained but re-surfaced.

The investigation works have revealed largely clay soils are present at shallow depth which also contain horizons of granular deposits which are unlikely to attain lateral continuity. Chalk is present at depth and a number of solution features have been reported in relatively close proximity to the site; some of which are within the same geological conditions as the site. Woodland is present beyond the south western boundary and potential desiccation issues will also need to be addressed. These aspects are discussed in Section 9.1 and 9.2 below respectively.

9.1 Ground stability and chalk dissolution

The presence of dissolution features in the White Chalk Subgroup which underlies the Lowestoft Formation is a well-known characteristic feature of this deposit in this area of Hertfordshire. These features occur due to erosional processes during the last periglacial period/environment and can be mobilised by groundwater changes and construction activity. A summary of mining / quarrying risks and natural cavities risks is as follows:

Mining / quarrying: The Delta Simons / Argylle PRA noted the 'Sporadic *underground mining of restricted extent may have occurred. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered*'. The report also concluded that there were no chalk workings or man-made cavities within 1000m of the site.

Natural cavities/dissolution features: The GroundSure report appended, indicates a low risk for ground dissolution for the site, even though it identified eight records of natural cavities within 500m of the site. We have undertaken a natural cavities risk assessment using Edmunds' procedure (Engineering Geology Special Publications No.18, 2001) and this indicates the site to have a 'Moderate Risk' subsidence hazard classification. However, given the occurrence of solution features relatively close to the site in similar ground conditions, our opinion is that the site should be classified as **'High Risk'**.

The chalk was only encountered in one borehole at a depth of 9.50m and was not present in the second borehole drilled to 12.00m. This shows that there is a significant change to the level of rockhead and thus indicates a karstic nature to the interface with the superficial deposits. Whist the borehole which penetrated the chalk did not show indications of voids being present, clearly this is only a very small proportion of the site and, as already indicated, solution features are a common occurrence where chalk bedrock is present and can occur randomly. Precautionary measures to mitigate this potential risk should be considered during foundation selection/design and appropriate contingencies put in place for the construction phase should such features be encountered.

9.2 Desiccation and shallow foundations

The exploratory work has indicated that the shallow soils are locally shrinkable and would be prone to the effects of desiccation in proximity to nearby trees. The soils within Trial pit 1, which was closest to these trees, exhibited a highly desiccated state and roots were observed throughout the soils.

Whilst a significant proportion of the soils classify as non shrinkable to low shrinkage potential with regards to the NHBC Standards Chapter 4.2, there are horizons of medium volume change potential clays present. High water demand trees are present with the wooded area (see key features plan) to the south-west and it is likely that desiccation effects would be increased due to the density of the woodland. On the basis that medium volume change potential deposits are present, the NHBC considers that foundation depths in excess of 2.50m would be required along this south-western elevation of the building.

With the high probability of variable ground conditions being present and the disturbance of the ground through removal of the existing structures and foundations, we consider that a piled foundation would be more practical than shallow spread foundations and this is discussed in more detail in Section 9.3 below.

9.3 Piled Foundations

For the ground conditions encountered, we consider that CFA piles may present the optimum type. Other pile types, for example screw/helical displacement piles or driven piles could also be considered, subject to specialist advice.

The following table of coefficients are considered for the preliminary determination of CFA pile resistance. The deposits are highly variable and interbedded in nature. The sequence comprises predominantly cohesive deposits and hence this is reflected in our example below.

Shaft friction/adhesion

Stratum	Depth (Level)	Undrained cohesion (from SPT Depth Graph)	Ultimate unit shaft friction, 'q_s' (kN/m²)
Made ground and potentially desiccated soils	Up to 3.0m (+80.50mOD)	Ignore	Ignore
Lowestoft Formation	3.00m to 12.0m (+80.50mOD to +71.50mOD)	Increases linearly from 43kN/m² at a rate of 6.36kN/m²/m	Increases linearly from 21.5kN/m² at a rate of 3.18kN/m²/m (incorporates α = 0.50)
Lewis Nodular Chalk Formation	Below 12.00m (+71.50mOD)		0.45 to 0.8 x $\sigma v'$

Notes:

a) Shaft friction in the Chalk is calculated as $qs = \sigma v' \times \beta$, where β = 0.45 for CFA piles with part of the shaft in weak soils (N<20). For well-constructed rotary bored piles a β value of 0.8 may be used in the Chalk and the above shaft friction values in the Chalk may be increased by about 80%

b) Levels are based on a ground level of +83.5mOD - this is approximate and should be confirmed

Base resistance

Stratum	Depth (Level)	Ultimate unit base resistance, 'q_b' (kN/m²)
Lewis Nodular Chalk Formation	Below 12.00m (+79.50mOD)	'q_b' = 200 x N = 2400kN/m² Note that CIRIA C574 also recommends that the allowable base resistance (q_{all}) should not exceed 1000-1800kN/m² for SPT 'N' >25. We recommend that q_{all} = 1000kN/m² is adopted for preliminary design

For small diameter piles, end bearing resistance may be ignored by the designer dependent on chosen installation method. For mini driven piles, these will act primarily on base resistance subject to specialist design

Under EC7 (BS EN 1997-1:2004 and UK National Annex) the limit states GEO and STR must be verified using Design Approach 1, which checks reliability with two different combinations of partial factors. The following partial factors are applicable to bored and CFA piles, to be used in conjunction with a Model Factor of 1.4:

Parameter			Combination 1			Combination 2			
			A1	M1	R1	A2	M1	R4	R4+
Permanent actions (G)	Unfavourable	γ_G	1.35			1.0			
	Favourable	$\gamma_{G,fav}$	1.0			1.0			
Variable actions (Q)	Unfavourable	γ_Q	1.5			1.3			
	Favourable	$\gamma_{Q,fav}$	0			0			
Material properties (X)		γ_M		1.0			1.0		
Base resistance (R_b)		γ_b			1.0			2.0	1.7
Shaft resistance (R_s)		γ_s			1.0			1.6	1.4
Total resistance (R_t)		γ_t			1.0			2.0	1.7
Tensile resistance ($R_{s,t}$)		$\gamma_{s,t}$			1.0			2.0	1.7

For guidance purposes, indicative pile resistances for bored piles are presented in the table below:

Pile diameter (mm)	Pile toe depth (m)	Compressive resistance (kN) Combination 1	Combination 2
300	12.00	310	190
	14.00	490	310
	16.00	725	525
	18.00	965	755
	20.00	1215	1010
450	12.00	500	300
	14.00	740	460
	16.00	1115	800
	18.00	1485	1150
	20.00	1865	1530

Notes:

a) Concrete stress should be considered in the final design
b) Pile toe depth is relative to existing ground level (approximately +83.50mOD)
c) Pile resistances are given as a guide and do not constitute design recommendations
d) The above pile resistances incorporate factors of 1.0/1.6 on ULS shaft resistances, and 1.0/2.0 on ULS base resistances Combination 1 and 2 respectively
e) The above examples assume clay is present at toe level at 12m depth. The pile designer should select an appropriate ground model and appropriate contingencies against solution features

The final design should be undertaken in full accordance with EC7; the above resistances have been calculated in line with this guidance. The design engineer must ensure the correct comparisons are made between the properly factored Design Actions and Design Resistances.

The carrying capacity of driven piles is dependent on the pile type and ground/groundwater conditions, together with factors such as pile geometry, the effects of installation on the ground (i.e. loosening or compactive effects) and hammer energy. Piles may be driven to a set or to refusal and assessment of their capacity is often calculated by dynamic formulae and confirmed by driving records.

Although dissolution features have not been identified during completion of the two boreholes, consideration must be given to the possibility of their presence and design must include options to manage the discovery of any unknown features and differing ground conditions. The piling contractor should assess the risk and prepare appropriate mitigation options.

Heave precautions should be used for piles and ground beams in accordance with NHBC Standards Sitework clause S4(c). In addition, NHBC recommend that the following should be taken into account in the selection and design of piles:

- piles should be designed with an adequate factor of safety to resist uplift forces on the shaft due to heave by providing sufficient anchorage below the depth of desiccated soil. Slip liners may be used to reduce the uplift but the amount of reduction is small, as friction between materials cannot be eliminated
- piles should be reinforced for the length of the pile governed by the heave design
- a sufficient thickness of compressible material or void former should be provided beneath ground beams

A piling specialist must be consulted at an early stage to advise on the most appropriate pile type and to ultimately provide the final pile design. This should address issues such as the potential relative performance differences of the clay and sand layers within the sequence. Over-flighting risks should also be carefully considered and mitigated against.

9.4 Ground floor slab

There is potential for the growth of roots to affect a significant proportion of the development area particularly adjacent to the wooded area. We consider that ground floor slabs should be fully suspended on the new foundations, with a suitable void beneath as recommended by NHBC Chapter 4.2 'Building near trees' to accommodate future swelling of desiccated clay based on medium volume change potential soils.

Pile caps and ground beams should also be similarly protected with placement of void forming materials in accordance with good building practice where potentially desiccated and or root infested soils are present or within influential distance from nearby trees.

9.5 Pavement construction

It is understood that resurfacing of the car park is proposed. Two shallow excavations (P1 and P2) were carried out through the car park surfacing to provide detail on the make-up of the asphalt surfacing and sub-base material; the records of these excavations are appended.

In addition, two TRL Dynamic Cone Penetration tests were undertaken within other areas of the site to provide a CBR profile of the soils. Variable estimated CBR values were recorded in the shallow soils which are likely to be attributable to variable made ground. Below a depth of about 0.8m the CBR value is generally between 1.5 and 2.0 which are most likely to represent the natural clay deposits.

9.6 Soakaways

As established above, this site is assessed as being high risk with respect to solution features. The guidance contained within CIRIA C574 should be followed and therefore soakaways should be avoided if possible but, if unavoidable, should be sited a minimum distance of 20m from any proposed or existing structure. It is noted that space may therefore be limited at the site to maintain a suitable distance. In this circumstance, it may be possible to adopt a soakaway closer to the structures, subject to approval from the local authority/regulators and provided the ground between the structures and the soakaway is proven to be stable. Typically, a grid of probes could be undertaken on a 3m spacing to assess the feasibility of this option.

Delta Simons have undertaken some initial soakage testing within this development plot (SA01) which yielded a soakage rate of $4.5x10^{-5}$m/s. If the use of soakaways is deemed possible, then full-scale testing should be conducted at the location of the proposed soakaways. It is also noted that the soils have a variable composition both laterally and vertically and thus infiltration rates could differ and we consider a conservative approach to design should be adopted.

9.7 Foundation concrete

Low concentrations of water-soluble sulphates (2:1 water/soil extract) were measured in selected soil samples and a groundwater sample with near neutral to slightly alkaline pH reactivity values. The results fall into Site Design Class DS-1 of Table C2 given in BRE Special Digest 1 (2005). We assess the site as having ‘static’ groundwater and this would result in an ACEC Site Class of AC-1s. It should be noted that one sample yielded a slightly elevated sulphate concentration but this does not seem representative for the site and localised to the made ground at this locality.

10.0 STAGE 1 TIER 2 ENVIRONMENTAL ASSESSMENT

This appraisal is generally based on the Environment Agency's 'Land contamination: risk management', 2020, adopting current UK practice which uses the Source-Pathway-Receptor methodology to assess contamination risks. For a site to be designated as contaminated a plausible linkage between any identified sources and receptors must be identified, i.e. whether significant pollution linkages (SPLs) are present. In considering the potential for contamination to cause a significant effect, the extent and nature of the potential source are assessed and pathways/receptors identified; without an SPL there is theoretically no risk to the receptors from contamination. The assessed risks to the various potential receptors are summarised in the tabulated Conceptual Site Model which forms Section 10.6 of this report.

10.1 Environmental setting and context

The site is underlain by a superficial secondary aquifer within the Lowestoft Formation with a principal aquifer within the Chalk. The site lies within a Source Protection Zone and the nearest abstraction point is about 361m from the site (used for industrial processes).

The site is assessed as being of **High Environmental Sensitivity.**

10.2 Contamination sources and testing

The Delta Simons report identified the main potential risks of contamination to be that related to the unknown nature of any made ground associated with historical construction/demolition, potential small-scale oil/fuel spills from parked/agricultural vehicles, potential plant/boiler rooms within existing buildings and potential asbestos within existing building construction. The intrusive investigation has provided a general coverage of the site and we have targeted testing along the northern boundary close to the small industrial units and electrical transformer. The testing comprised analysis of 16 soil samples, including those tested as part of Delta Simons' Environmental Report, for a range of contaminants which were considered to reflect the potential historical/current site usages and the potential on-site/off-site sources. Specifically, analysis for polychlorinated biphenyl was commissioned in response to the identification of a transformer just off the northern corner of the site. Whilst not directly on our site, a water sample from shallow strata was obtained from a borehole (DS105) just to the south located within the wider YMCA campus. This was also tested for a range of commonly occurring contaminants.

The soil test results have been assessed where relevant against the DEFRA Soil Guideline Values (SGV) and Category 4 Screening Levels (C4SLs), together with the LQM/CIEH Suitable 4 Use Level (S4UL) for Human Health Risk Assessment in which Generic Assessment Criteria (GACs) have been derived from the CLEA Model (2nd Edition, 2009). For Extractable/Total Petroleum Hydrocarbons, the results have been compared with the frequently used EA remedial target of 1,000mg/kg. The contamination testing was carried out specifically for the purpose of providing a general guidance evaluation for the proposed development. Reference should be made to the foreword to the appended contamination test results to fully understand the context in which this discussion should be viewed.

The redevelopment will include hard cover by the new building and paved areas with a central landscaped area. In line with the Delta Simons report, we have used the trigger levels for **Residential development (without home-grown produce)** to assess the results of the contamination testing and found the majority of the results fell below threshold values with the exception of a marginal exceedance of arsenic at three locations which reported a concentration of 41mg/kg with a threshold value of 40mg/kg (DS101 at 0.15m and TP5 at 0.7m) as well as a concentration of 49mg/kg reported within sample E1 at 1.00m. This sample also recorded a concentration of 0.55mg/kg for the PAH dibenz(a,h)anthracene, the threshold of which is 0.3mg/kg. Lead also marginally exceeded the threshold value of 310mg/kg in DS101 with a measured value of 330mg/kg.

Two samples (TP5 at 0.70m and ES1 at 1.0m) were shown to contain small concentrations of chrysotile asbestos. Asbestos quantification carried out TP5 sample was less than the practical limit of detection (i.e. <0.001% w/w) and with reference to the Control of Asbestos Regulations, the industry guidance (CAR-SOIL) would define this as a 'trace' amount of asbestos in bulk soil. At time of issue of this report ,we are awaiting quantification analysis of the sample at ES1 and will revise this section once the results are available.

Dependent on what is considered 'reasonably practicable, the guidance advises that:

a) if any clearly visible asbestos containing products are absent, and
b) that a suitable/sufficient investigation has been completed and
c) that assessment of the site has been carried out,

then asbestos below such concentrations would not strictly fall under the Control of Asbestos Regulations. Whilst this may suggest that, under these conditions, the implementation of a health and safety regime or dust suppression measures would not necessarily be required, we recommend that the main contractor provides the assessment of appropriate risk mitigation measures to be taken during construction.

10.3 Ground gas/vapour monitoring

Delta Simons' Preliminary Risk Assessment identified infilled/made ground as a potential gas risk. Gas monitoring was undertaken twice by Delta Simons in March 2020 and further monitoring has been carried out during this current phase of investigation. No elevated levels of methane, carbon dioxide, carbon monoxide or hydrogen sulphide were measured. PID readings in the borehole installations were all <1ppm.

On the basis of these results, we consider that Characteristic Situation 1 (very low risk) is appropriate (as described in CIRIA C665 "Assessing risks posed by hazardous ground gases to buildings", 2007) and this suggests that no gas protection measures will be required. No Radon protection measures are deemed necessary.

10.4 Risk to controlled waters

With the exception of one borehole just off the subject site, groundwater was not encountered at shallow depth. The contamination testing has indicated that there is no discernible widespread contamination within the shallow soils which could potentially leach and become mobile. Further, it is noted that shallow sequence predominantly comprises clay deposits which would inhibit lateral and vertical movement of contaminants.

The sample of water taken from the adjacent area (DS105 at 3.56m) indicated that no elevated concentrations of contaminants were present at this locality thus suggesting that leaching and mobility is relatively inactive. A soil sample was tested from the base of BH1 at 25m which again showed no elevated concentrations of contaminants. The Delta Simons report concludes the risks in this regard should be negligible.

With respect to risks from piling, we consider that CFA type piles would be most appropriate as discussed in Section 9.3. The installation process would result in a constant upwards movement of soil thus not resulting in cross contamination in a downwards direction. The bore is immediately filled with concrete under pressure which would form an intimate contact between the soils and the pile and thus prevent preferential pathways through the ground to the groundwater at depth.

On this basis, we consider that the risks from this site and its redevelopment to controlled water is negligible and no further action would be required in this regard.

10.5 Disposal of excavated soils

A rigorous hazard assessment of the results was not within the scope of our investigation, but our preliminary conclusion from the contamination is that the made ground will probably classify as either “inert” or ‘stable non-reactive hazardous waste in non-hazardous landfill’ with an ‘inert’ classification for natural soils. The presence of Asbestos may result in made ground being classified as Special Waste requiring further, more detailed analysis. Early consultations should be made with appropriate waste facilities or regulators to confirm the off-site disposal requirements.

10.6 Refined Conceptual Site Model

Considering the above discussion, the assessed risks to potential receptors identified in the PRA are summarised in the refined Conceptual Site Model (CSM) below. This includes recommendations for appropriate mitigation measures to render any SPLs inactive and reduce the risks to receptors to acceptable levels:

Source	Pathway	Receptor	Assessed risk, justification and measures to mitigate the risk to acceptable levels
On site: contaminated soil/water	Ingestion & direct contact	End user	**Low** • Levels of contamination are very low with regards to the proposed end use. Two samples showed a slight exceedance of arsenic, one a slight exceedance of lead and one slight exceedance of dibenz(a,h)anthracene - we consider that these marginal values should generally not be of concern for the proposed end use. It is noted that two samples contained small concentrations of Asbestos which could become air-borne. As a precautionary measure, landscaped areas should be created using a suitable thickness of clean imported certified soils. The SPL to human health will be inactive • The near-surface soils were free from visual/olfactory evidence of volatile compounds/vapours; this was corroborated by analysis (TPH/PAHs) with the exception of a slight exceedance at one location of dibenz(a,h)anthracene. In landscaped areas where imported soils are to be provided, the SPL to human health will be inactive. • Careful inspection/testing of any re-used soils should be undertaken and if any contamination or soils suspected of being contaminated are identified these should be re-assessed or removed from site. The source and pathway will be removed in this scenario and the SPL to human health will then be inactive. • A careful watching brief should be kept during the overall construction and if obvious or suspected contamination is encountered this should be dealt with prescriptively. This would be especially relevant to areas where buildings are currently occupying land coverage
	Ingestion, contact & inhalation	Construction workers and third parties	**Low:** • The SPL to human health created by the potential presence of ACMs (TP5 & ES1) will be active during construction. The risks to these receptors will be managed through health & safety procedures and CDM regulations. • No other SPL to human health has been identified. Any residual risks to these receptors will be managed through health & safety procedures and CDM regulations.

Source	Pathway	Receptor	Assessed risk, justification and measures to mitigate the risk to acceptable levels
	Leaching from contaminated soils and migration in groundwater	Aquifer and surface water	**Very Low** - The desk study classifies a Secondary Aquifer of the Lowestoft Formation is present above the Principal Aquifer of the Chalk. The site lies within a Source Protection Zone. Our sampling points have shown there to be a reasonable thickness of clay soils above the Chalk which would inhibit migration of contaminants into the aquifer. Sampling of transient shallow water has shown there to be no elevated concentrations of contaminants. Piling works would offer minimal risk with regards to preferential pathways from shallow levels to the deep aquifer - Contamination was not measured in the soil or water samples including the sample from 24.55mbgl in BH1 suggesting that there is no current leaching into the Chalk on site.
	Direct contact with soil/water	Building fabric and infrastructure	- The effects of soluble sulphates and alkali/acidic ground are discussed in Section 9.7 of this report. - Detailed assessment of soil/groundwater contamination with respect to water supply pipes is outside the scope of this report. See the relevant water authority requirements and UKWIR 'Guidance for the selection of water supply pipes to be used in brownfield sites', 2010.
Off site: contaminated soil/water	Lateral migration of contaminants in groundwater	- End-user and buildings	**Low:** - No contamination measured in soils which may be associated with off-site sources. - PID screening of groundwater in monitoring pipes indicated no elevated volatile hydrocarbon concentrations.
On-site and off-site: ground gas & vapour	Lateral migration through strata, service runs and cracks in buildings	End-user and buildings	**Very Low:** - Little made ground was met with an absence of obviously degradable material - Gas monitoring in March 2020 (Delta Simons) and June/ July 2021 (SCL) suggests CIRIA 665 CS1 applies and that gas protection measures will not be required. - Radon protection measures are not required according to the desk study report.

In conclusion, based upon the information reviewed and the results of the investigation, our assessment is that the with appropriate mitigation measures described above, it should be possible to reduce the risks to acceptable levels. A reasonable area of the site is occupied by building and these areas were not available for testing.

The investigation has provided a reasonable general coverage of the site and it is self-evident that there may be zones of contamination within the site which were not encountered including those that could not be accessed due to the existing buildings. A careful watching brief should be kept during construction to ensure that any potentially contaminated soil encountered is disposed of in a safe and controlled manner. Site workers should observe normal hygiene precautions when handling soils and if material suspected of being contaminated is identified during construction, this should be set aside under protective cover and further tests undertaken to verify the nature and levels of contamination present. If contamination is present, a full site re-assessment may be required, and a contingency should be in place in this regard.

GENERAL INFORMATION, LIMITATIONS AND EXCEPTIONS

Unless otherwise stated, our Report should be construed as being a Ground Investigation Report (GIR) as defined in BS EN1997-2. Our Report is not intended to be and should not be viewed or treated as a Geotechnical Design Report (GDR) as defined in EN1997-2. Any 'design' recommendations which are provided are for guidance only and are intended to allow the designer to assess the results and implications of our investigation/testing and to permit preliminary design of relevant elements of the proposed scheme.

The methods of investigation used have been chosen taking into account the constraints of the site including but not limited to access and space limitations. Where it has not been possible to reasonably use an EC7 compliant investigation technique we have adopted a practical technique to obtain indicative soil parameters and any interpretation is based upon our engineering experience and relevant published information.

The Report is issued on the condition that Soil Consultants Ltd will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the exploratory points which differ from those identified during our investigation. In addition, Soil Consultants Ltd will not be liable for any loss arising directly or indirectly from any opinion given on the possible configuration of strata between the exploratory points, below the maximum depth of the investigation or where site conditions have changed since the exploratory work; such opinions, where given, are for guidance only and no liability can be accepted as to their accuracy. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in using this Report.

Comments made relating to ground-water or ground-gas are based upon observations made during our investigation unless otherwise stated. Ground-water and ground-gas conditions may vary with time from those reported due to factors such as seasonal effects, atmospheric effects and and/or tidal conditions. We recommend that if monitoring installations have been included as part of our investigation, continued monitoring should be carried out to maximise the information gained.

Specific geotechnical features/hazards such as (but not limited to) areas of root-related desiccation and dissolution features in Chalk/soluble rock can exist in discrete localised areas - there can be no certainty that any or all of such features/hazards have been located, sampled or identified. Where a risk is identified the designer should provide appropriate contingencies to mitigate the risk through additional exploratory work and/or an engineered solution.

Where a specific risk of ground dissolution features has been identified in our Report (anything above a 'low' risk rating), reference should be made to the local building control to establish whether there are any specific local requirements for foundation design and appropriate allowances should be incorporated into the design. If such a risk assessment was not within the scope of our investigation and where it is deemed that the ground sequence may give rise to such a risk (for example near-surface Chalk strata) it is recommended that an appropriate assessment should be undertaken prior to design of foundations.

Where spread foundations are used, we recommend that all excavations are inspected and approved by suitably experienced personnel; appropriate inspection records should be kept. This should also apply to any structures which are in direct contact with the soil where the soil could have a detrimental effect on performance or integrity of the structure.

Ground contamination often exists in small discrete areas - there can be no certainty that any or all such areas have been located, sampled or identified.

The findings and opinions conveyed in this Report may be based on information from a variety of sources such as previous desk studies, investigations or chemical analyses. Soil Consultants Limited cannot and does not provide any guarantee as to the authenticity, accuracy or reliability of such information from third parties; such information has not been independently verified unless stated in our Report. No liability will be accepted for changes to the ground and groundwater conditions which occur post investigation.

Our Report is written in the context of an agreed scope of work between Soil Consultants Ltd and the Client and should not be used in any different context. In light of additional information becoming available, improved practices and changes in legislation, amendment or re-interpretation of the assessment or the Report in part or in whole may be necessary after its original publication.

Unless otherwise stated our investigation does not include an arboricultural survey, asbestos survey, ecological survey or flood risk assessment and these should be deemed to be outside the scope of our investigation.

We will identify tree and plant species if possible, but a suitably qualified arboriculturalist/botanist should be consulted to provide definitive identification

STANDARD TERMS OF APPOINTMENT OF SOIL CONSULTANTS LTD FOR GEOTECHNICAL SERVICES

1 Unless previously withdrawn, our offer remains valid for a period of sixty days from date of offer. If an instruction is given after the sixty days we reserve the right to reasonably adjust any cost associated with the project to reflect any variance on the original offer. In placing an instruction to proceed with exploratory work, whether directly from the Client or Client's representative, the Client is deemed to have accepted our Terms of Appointment.

2 Our offer is on the basis that free, unhindered access and working conditions are available and that the investigation can be completed in one visit, if applicable. Delays beyond our control will incur additional charges. If additional works outside our offer are required to facilitate the investigation these will be advised and any costs will be passed on to the Client.

3 In our quotation we will provide an estimate of any mobilisation period following an instruction to proceed. This estimate will be accurate at the time of quotation, but it should be noted that the mobilisation period may vary at a later date due to factors such as sub-contractor availability and workload.

4 In commissioning this work, the Client has a responsibility for the health, safety and welfare of operatives invited to undertake work on their site. The Client shall indemnify us in respect of any failure to fulfil their obligations in connection with all relevant and current Health and Safety Regulations.

5 The methods of investigation used have been chosen taking into account the constraints of the site including but not limited to access, space and budgetary limitations. Where it has not been possible to reasonably use an EC7 compliant investigation technique, or where a non-compliant technique has been specified, we will adopt practical and appropriate techniques to obtain indicative soil parameters.

6 Unless otherwise stated, our Report should be construed as being a Ground Investigation Report (GIR) as defined in BS EN1997-2. Our Report is not intended to be and should not be viewed or treated as a Geotechnical Design Report (GDR) as defined in BS EN1997-2. Any interpretation which is provided is for guidance only and must not be regarded as design or design recommendation.

7 Where excavation is required as part of the exploratory work, the Client shall provide drawings or plans showing accurate and complete locations of all underground services and structures. In performing our service, we shall take reasonable precautions to avoid damage to underground services or structures. We will not be responsible for any damage caused to underground services or structures and will not be liable for any claims for damage, expenses arising or losses unless the location of all underground services or structures are accurately shown on drawings and those plans have been provided to us in good time prior to commencement of the exploratory work. Risk to the Client can be further reduced by undertaking a scan of the site using a specialist underground scanning service which would be intended to identify traceable services at shallow depth.

8 With some sites, especially those in certain areas of London and other large towns and cities, there may be a risk of unexploded ordnance (UXO) being present. Unless otherwise stated our offer is on the basis that the Client or their representative provides a preliminary UXO risk assessment for the site. It should be noted that if the site is deemed to be in an area of risk then further measures will be required. These would normally comprise either a more detailed risk assessment and/or specialist site attendance by an EOD engineer. These measures can be commissioned either by the Client or Soil Consultants Ltd. If the Client requires, we would be pleased to obtain a preliminary risk assessment at cost+10%.

9 The Client will supply a site plan (to a rational scale), an indication of the scope and type of the proposed development and an indication of any relevant structural loading information.

10 Should the Client terminate the contract after instruction, we reserve the right to recover costs associated to work carried out between the time of instruction and the point of termination. Cancellation fees, and material costs shall be charged at cost plus 20% (+VAT). Engineer/technician time shall be charged at £95+VAT per hour and principal consultant/director time shall be charged at £125+VAT per hour.

11 The Report is issued on the condition that Soil Consultants Ltd will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the exploratory points which differ from those identified during the investigation. In addition Soil Consultants Ltd will not be liable for any loss arising directly or indirectly from any opinion given on the possible configuration of strata both between the exploratory points and/or below the maximum depth of the investigation; such opinions, where given, are for guidance only and no liability can be accepted as to their accuracy. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in using this Report.

12 If and when instructed, an agreed number of contamination tests will be carried out to give an outline assessment of potential contaminants. In some circumstances it may be necessary to recommend further monitoring, contamination testing and assessment and the scope of this work would be agreed with the Client. Notwithstanding this additional scope, local regulatory authorities may have specific requirements which need to be addressed. Unless otherwise agreed or stated our reporting will constitute neither a Quantitative Risk Assessment nor a Remediation Statement or Strategy.

13 Our reports are counter-checked by one of our suitably qualified and experienced engineers/geologists.

14 Notwithstanding anything to the contrary contained in these terms, our liability under or in connection with these terms whether in contract or in tort, in negligence, for breach of statutory duty or otherwise (other than in respect of personal injury or death) shall not exceed the sum equivalent to ten times our contract fee or £100,000 whichever is less in the aggregate for geotechnical and environmental matters unless otherwise agreed.

15 Without prejudice to any other exclusion or limitation of liability, damages, loss, expense or costs our liability for any claim or claims under this agreement be further limited to such sum as it would be just and equitable for us to pay having regard to the extent of our responsibility for the loss or damage giving rise to such claim or claims ("the loss and damage") and on the assumptions that:

(a) All other consultants, contractors, sub-contractors, project managers or advisers engaged in connection with the Project have provided contractual undertakings to the Client on terms no less onerous than those set out in the original contracts in respect of the carrying out of their obligations in connection with the Project; and

(b) There are no exclusions of or limitations of liability nor joint insurance or co-insurance provisions between the Client and any other party referred to in this clause and any such other party who is responsible to any extent for the loss and damage is contractually liable to the Client for the loss and damage; and

(c) All such other consultants, contractors, sub-contractors, project managers or advisers have paid to the Client such proportion of the loss or damage which it would be just and equitable for them to pay having regard to the extent of their responsibility for the loss and damage.

16 Further and notwithstanding anything to the contrary contained in this agreement and without prejudice to any provision in this agreement whereby liability is excluded or limited to a lesser amount, our liability under or in connection with this agreement whether in contract or in tort, in negligence, for breach of statutory duty or otherwise for any claim shall not exceed the amount, if any, recoverable by us by way of indemnity against the claim in question under professional indemnity insurance taken out by us and in force at the time that the claims or (if earlier) circumstances that may give rise to the claim is or are reported to the insurers in question. The limitation shall not apply if no such amount is recoverable due to us having been in breach of our obligations or the terms of any insurance maintained in accordance therewith or having failed to report any such claim or circumstances to the Insurers in question timeously.

17 Whilst our investigation may include asbestos screening/quantification on selected samples, this must not be deemed to constitute a full asbestos survey or be taken as sufficient to definitively identify the presence or quantity of asbestos within or on the ground. We will not accept responsibility if asbestos is encountered during any subsequent construction or development works and in placing a contract with us the Client accepts this condition. Where the fabric of a building is to be disturbed, the Client shall provide an appropriate asbestos survey to us prior to exploratory work and make adequate provision to allow us to provide relevant protective/remedial measures to progress the work safely.

18 The Client agrees that they shall not bring any claim personally against any director/employee of Soil Consultants Ltd or consultant to us in respect of loss or damage suffered by the Client arising out of this contract.

19 Our appointment shall be under simple agreement and our liability under this contract shall be for a period of six years from date of appointment.

20 Our reports are non-assignable and are prepared for the benefit of the Client. No reliance can be assumed by others without written agreement from Soil Consultants Ltd. We will provide a letter of reliance at our discretion and this will be subject to payment of our fee, which will be 10% of contract value, subject to a minimum fee of £750 plus VAT. The terms of our letter of reliance are non-negotiable and the beneficiary should be aware that the information shall only apply to the scheme for which the report was originally produced and the original rights and benefits will apply.

21 A VAT invoice (at current rate) will be presented in respect of the work undertaken. Payment of our account is to be made within twenty-eight days of issue of our invoice unless otherwise agreed. On no account shall payment be on a ‘pay-when-paid’ basis. The information contained within our report remains the property of Soil Consultants Ltd and no reliance may be assumed by any party with an interest in the project until payment has been received in full. After one calendar month interest shall be chargeable at 10% above the Bank of England Rate and compensation claimed in accordance with ‘Late Payments of Commercial Debts (Interest) Act 1998 and subsequent revisions. If the debt is referred to a debt collection agency then we have the right to recover associated fees under the terms of our contract.

APPENDIX A

Fieldwork, in-situ testing and monitoring

- Foreword
- Borehole records
- Standard Penetration Test results
- SPT hammer calibration certificates
- Trial Pit records
- Pavement construction records
- Groundwater and gas monitoring results

Laboratory testing

- Index property testing
- Plasticity chart
- Unconsolidated Undrained triaxial test result (QUT)
- Particle Size distribution tests

Ground profiles

- Plot of SPT 'N' value versus depth

Contamination and chemical testing

- Foreword
- General soil suite
- WAC test results
- General water suite
- Soluble Sulphate/pH results

Plans, drawings & photographs

- Site photographs
- Proposed development plan
- Site Plan
- Location Plan

Delta Simons borehole records

- DS101 - DS103

FOREWORD FOR DYNAMIC SAMPLER DRILLING - GUIDANCE NOTES

GENERAL

The Borehole Records are compiled from the driller's description of the strata encountered, an examination of the samples by our Geotechnical Engineer and the results of in-situ and laboratory tests. Based on this data, the report presents an opinion on the configuration of strata within the site. However, such reasonable assumptions are given for guidance only and no liability can be accepted for changes in conditions not revealed by the boreholes.

BORING METHODS

The Cable Percussion technique of boring is normally employed and allows the ground conditions to be reasonably well established. However, some disturbance of the ground is inevitable, particularly some "softening" of the upper zone of clay immediately beneath a granular soil. The presence of thin layers of different soils within a stratum may not always be detected.

GROUND WATER

The depth at which ground water was struck is entered on the Borehole Records. However, this observation may not indicate the true water level at that period. Due to the speed of boring and the relatively small diameter of the borehole, natural ground water may be present at a depth slightly higher than the water strike. Moreover, ground water levels are subject to variations caused by changes in the local drainage conditions and by seasonal effects. When a moderate inflow of water does take place, boring is suspended for at least 10 minutes to enable a more accurate short-term water level to be achieved. An estimate of the rate of inflow is also given. This is a relative term and serves only as a guide to the probable flow of water into an excavation.

Further observations of the water level made during the progress of the borehole are shown including end of shift and overnight readings and the depth at which water was sealed off by the borehole casing, if applicable.

Whilst drilling through granular soils, it is usually necessary to introduce water into the borehole to permit their extraction. When additional water has been used a remark is made on the Borehole Record and the implications are discussed in the text.

SAMPLES

Undisturbed samples of the predominantly cohesive soils are obtained using a 100mm diameter open-drive sampler. In granular soils, disturbed bulk samples are taken and placed in polythene bags. Small jar samples are taken at frequent intervals in all soils for subsequent visual examination. Where ground water is encountered in sufficient quantity, a sample of the ground water is also taken.

IN-SITU STANDARD PENETRATION TESTS

This test is performed in accordance with the procedure given in B.S.1377:1990. The individual blow count record for each test is given on a separate table. The 'N' value is normally the number of blows to achieve a penetration of 0.3m following a seating distance of 0.15m and is quoted at the mid-depth of the test zone. However if a change of stratum occurs within the test zone then a revised 'N' value is calculated to assess one layer in particular. In hard strata full penetration may not be obtained. In such cases the suffix + indicates that the result has been extrapolated from the limited penetration achieved. Where ground water has affected the measured values, the resultant 'N' values have been placed in brackets since it is unlikely to represent the true in-situ density of the soil.

Site & Location:	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Borehole No:	**BH1**
Client:	**One YMCA**	Coordinates: 524410E, 212628N	Sheet 1 of 2
Engineer:	**AKSWard Ltd**	Ground Level: +83.50mOD	Report No: 10637/AOC

Progress & Observations	Samples & Tests: Type	Samples & Tests: Depth (m)	Field Test Results	Strata: Depth (m)	Strata: Level (m)	Legend	Strata Descriptions	Backfill / Installation
BH commenced: 15/06/2021	D	0.25						
	PID	0.25	0.0	0.40	83.10		MADE GROUND: brown sandy gravelly friable clayey topsoil. Gravel is fine to coarse angular to subangular flint, chalk, brick and concrete.	
	D	0.50		0.70	82.80		MADE GROUND: orange brown/brown gravelly clayey sand with occasional pockets of dark brown clay. Gravel is fine to coarse angular to subrounded flint, chalk, brick and tile.	
	PID	0.50	0.1					
	D	0.75		1.10	82.40		MADE GROUND: soft brown/red brown sandy becoming slightly sandy gravelly clay. Gravel is fine to coarse angular to subrounded flint and brick.	
Inspection pit to 1.20m	PID	0.75	0.0					
	D	1.00						
	PID	1.00	0.0					
	D	1.20						
	SPT/C	1.20	N=11				Firm becoming stiff orange brown/brown slightly silty slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded flint and quartz.	
	PID	1.20	0.1					
	D	1.85						
	PID	1.85	0.0					
	D	2.00						
	SPT/C	2.00	N=14					
	PID	2.00	0.0					
	D	2.75						
	PID	2.75	0.0					
	D	3.00						
	SPT/C	3.00	N=17					
35mm ID monitoring pipe installed to 4.00m	PID	3.00	0.0					
	D	3.75						
	PID	3.75	0.0	4.50	79.00		Stiff brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded flint and chalk. Rare iron and manganese staining and rare pockets of grey clay.	
	D	4.00						
	SPT/C	4.00	N=18					
	PID	4.00	0.0					
	D	4.75						
	PID	4.75	0.0					
	D	5.00		5.70	77.80		Medium dense orange brown slightly clayey slightly silty SAND & GRAVEL. Gravel is fine to coarse subrounded to rounded flint and quartz.	
	SPT/S	5.00	N=21					
	PID	5.00	0.2					
	D	6.00						
	PID	6.00	0.1					
	D	6.50						
	SPT/C	6.50	N=47					
	PID	6.50	0.0	7.00	76.50		Medium dense brown slightly clayey silty sandy GRAVEL. Gravel is fine to coarse subrounded to rounded flint and quartz.	
	D	7.50						
	PID	7.50	0.0					
	D	8.00						
	SPT/C	8.00	N=28					
	PID	8.00	0.0					
				8.80	74.70		Firm brown slightly silty slightly sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded flint.	
	D	9.00						
	PID	9.00	0.0					
	D	9.50		9.50	74.00		CHALK recovered as off-white slightly gravelly silt with occasional pockets of brown clay and light brown clay staining. Gravel is fine to coarse angular to subrounded weak chalk with rare flint nodules.	
	SPT/S	9.50	N=18					
	PID	9.50	0.5					
	D	10.50						
	PID	10.50	0.2					
	D	11.00						
	SPT/S	11.00	N=21					
	PID	11.00	0.1					
	D	12.00						
	PID	12.00	0.0					
	D	12.50						
	SPT/C	12.50	N=23					
	PID	12.50	0.1					
	D	13.50						
	PID	13.50	0.0					
	D	14.00						
	SPT/C	14.00	N=15					
	PID	14.00	0.1					
	D	15.00		15.00	68.50			

Continued on next sheet

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Borehole type: Cable Percussion

Remarks: Coordinates and ground levels extrapolated from topographical survey provided by Malcolm Hughes (Ref: 53948-1).

Borehole No: **BH1**

Site & Location:	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Borehole No:	**BH1**
Client:	**One YMCA**	Coordinates: 524410E, 212628N	Sheet 2 of 2
Engineer:	**AKSWard Ltd**	Ground Level: +83.50mOD	Report No: 10637/AOC

Progress & Observations	Samples & Tests Type	Samples & Tests Depth (m)	Field Test Results	Strata Depth (m)	Strata Level (m)	Legend	Strata Descriptions	Backfill / Installation
	PID	15.00	0.1				CHALK recovered as off-white slightly gravelly silt with occasional pockets of brown clay and light brown clay staining. Gravel is fine to coarse angular to subrounded weak chalk with rare flint nodules.	
	D	15.50						
	SPT/C	15.50	N=21					
	PID	15.50	0.0					
	D	16.50						
	PID	16.50	0.1					
	D	17.00						
	SPT/C	17.00	N=25					
	PID	17.00	0.0					
	D	18.00						
	PID	18.00	0.0					
	D	18.50						
	SPT/C	18.50	N=30					
	PID	18.50	0.0					
	D	19.50		19.50	64.00			
	PID	19.50	0.1				CHALK recovered as white/off-white slightly gravelly silt with rare pockets of brown clay. Gravel is fine to coarse angular to subangular flint nodules.	
	D	20.00						
	SPT/C	20.00	N=34					
	PID	20.00	0.1					
	D	21.00						
	PID	21.00	0.1					
	D	21.50						
	SPT/C	21.50	N=43					
	PID	21.50	0.1					
	D	22.50						
	PID	22.50	0.0					
	D	23.00						
	SPT/C	23.00	N=45					
	PID	23.00	0.0					
	D	24.00						
	PID	24.00	0.0					
	D	24.55						
	SPT/C	24.55	N=51					
BH complete: 16/06/2021 BH depth: 25.00m Water depth: increased dampness at 24.50m	PID	24.55	0.0	25.00	58.50		End of hole at 25.00m	

Backfill / Installation: 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Borehole type: Cable Percussion

Remarks: Coordinates and ground levels extrapolated from topographical survey provided by Malcolm Hughes (Ref: 53948-1).

Borehole No: **BH1**

Site & Location:	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Borehole No:	**BH2**
Client:	**One YMCA**	Coordinates: 524380E, 212608N	Sheet 1 of 1
Engineer:	**AKSWard Ltd**	Ground Level: +82.90mOD	Report No: 10637/AOC

Progress & Observations	Samples & Tests: Type	Samples & Tests: Depth (m)	Field Test Results	Strata: Depth (m)	Strata: Level (m)	Legend	Strata Descriptions	Backfill / Installation
BH commenced: 14/06/2021	D	0.25					MADE GROUND: brown gravelly friable clayey topsoil. Gravel is fine to coarse angular to subrounded flint, brick, glass and concrete.	
	PID	0.25	0.0	0.50	82.40			
	D	0.50					Soft orange brown gravelly CLAY. Gravel is fine to coarse subangular to rounded flint.	
	PID	0.50	0.1					
	D	0.75						
Inspection pit to 1.20m	PID	0.75	0.2	1.20	81.70		Soft orange brown slightly gravelly silty CLAY with rare pockets of black organic material. Gravel is fine to medium angular to subrounded flint with rare ironstone fragments.	
	D	1.00						
	PID	1.00	0.1					
	D	1.20						
	SPT/C	1.20	N=6					
	PID	1.20	0.2					
	D	1.85						
	PID	1.85	0.1				*becoming slightly silty below 2.50m*	
	D	2.00						
	SPT/S	2.00	N=7					
	PID	2.00	0.0					
	D	2.75						
	PID	2.75	0.0					
	U	3.00						
	PID	3.00	0.2					
	D	3.75					*rare pockets of grey brown clay and rare black manganese staining below 4.00m*	
	PID	3.75	0.2					
	D	4.00						
	SPT/S	4.00	N=8					
	PID	4.00	0.1					
	D	4.75					*occasional black manganese staining below 5.00m*	
	PID	4.75	0.1					
	D	5.00		5.50	77.40			
	SPT/S	5.00	N=10				Firm orange brown slightly silty slightly sandy gravelly CLAY with occasional pockets of brown clay. Gravel is fine to coarse angular to rounded flint.	
	PID	5.00	0.0					
	D	6.00						
	PID	6.00	0.1					
	D	6.50						
	SPT/C	6.50	N=21					
	PID	6.50	0.0					
	D	7.50						
	PID	7.50	0.0					
	D	8.00					*becoming slightly sandy below 8.00m*	
	SPT/C	8.00	N=14					
	PID	8.00	0.1					
				8.70	74.20			
	D	9.00					Firm brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded flint with rare ironstone fragments.	
	PID	9.00	0.1					
	D	9.50		9.50	73.40			
	SPT/C	9.50	N=19				Stiff orange brown silty gravelly CLAY. Gravel is fine to coarse angular to subrounded flint.	
No mon toring pipe installed	PID	9.50	0.1					
	D	10.50						
	PID	10.50	0.1					
BH terminated due to large gravels preventing advancement	D	11.00					*becoming slightly sandy below 11.00m*	
	SPT/C	11.00	N=21					
	PID	11.00	0.0					
							with flint cobbles at 12.00m	
BH complete: 14/06/2021 BH depth: 12.00m Water depth: dry	D	12.00		12.00	70.90		End of hole at 12.00m	
	PID	12.00	0.1					

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water ES = glass jar & plastic tub E = glass jar SPT/S = split spoon SPT/C = solid cone PP = Pocket Penetrometer [kg/cm²] HV = Hand Vane [kPa] PID = Photo Ionisation Detector [ppm - Isobutylene Equivalent, PhoCheck Tiger, 10.6eV lamp] * = full SPT penetration not achieved - see summary sheet

Borehole type: Cable Percussion

Remarks: Coordinates and ground levels extrapolated from topographical survey provided by Malcolm Hughes (Ref: 53948-1).

Borehole No: **BH2**

Site & Location	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Report No:	**10637/AOC**

STANDARD PENETRATION TEST SUMMARY

BH ID	Depth (m)	Test type	N value (Note b)	Blow-counts and penetration						Casing depth (m)	Water depth (m)	Remarks
				Seating blows		Test blows						
BH1	1.20	C	N=11	1	2	2	3	3	3		Dry	
BH1	2.00	C	N=14	2	3	3	4	3	4		Dry	
BH1	3.00	C	N=17	3	3	4	4	4	5		Dry	
BH1	4.00	C	N=18	4	4	4	5	4	5		Dry	
BH1	5.00	S	N=21	4	5	5	5	5	6		Dry	
BH1	6.50	C	N=47	8	10	12	12	11	12		Dry	
BH1	8.00	C	N=28	8	7	6	8	8	6		Dry	
BH1	9.50	S	N=18	3	3	4	4	5	5		Dry	
BH1	11.00	S	N=21	4	4	5	5	5	6		Dry	
BH1	12.50	C	N=23	4	5	5	6	6	6		Dry	
BH1	14.00	C	N=15	4	5	4	4	4	3		Dry	
BH1	15.50	C	N=21	4	5	5	5	5	6		Dry	
BH1	17.00	C	N=25	6	5	5	6	8	6		Dry	
BH1	18.50	C	N=30	6	7	7	7	8	8		Dry	
BH1	20.00	C	N=34	7	8	8	9	8	9		Dry	
BH1	21.50	C	N=43	8	9	9	11	11	12		Dry	
BH1	23.00	C	N=45	9	9	10	12	11	12		Dry	
BH1	24.55	C	N=51	9	10	11	11	14	15		Dry	
BH2	1.20	C	N=6	1	1	1	2	1	2		Dry	
BH2	2.00	S	N=7	1	2	1	2	2	2		Dry	
BH2	4.00	S	N=8	1	2	2	2	2	2		Dry	
BH2	5.00	S	N=10	1	2	2	2	3	3		Dry	
BH2	6.50	C	N=21	3	4	5	5	5	6		Dry	
BH2	8.00	C	N=14	3	4	4	3	4	3		Dry	
BH2	9.50	C	N=19	4	4	5	5	5	4		Dry	
BH2	11.00	C	N=21	4	5	5	5	5	6		Dry	

a) Standard Penetration Test : BS EN ISO 22476:2005 Part 3

b) Where full penetration was not achieved, the total test blow-counts are reported

c) Hammer Energy Ratio, Er = 81%

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Unit 11
Charlwood Road
East Grinstead
West Sussex
RH19 2HU

SPT Hammer Ref: 110RP113
Test Date: 21/09/2020
Report Date: 21/09/2020
File Name: 110RP113.spt
Test Operator: NPB

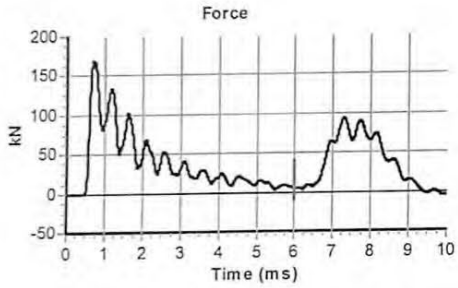
Instrumented Rod Data

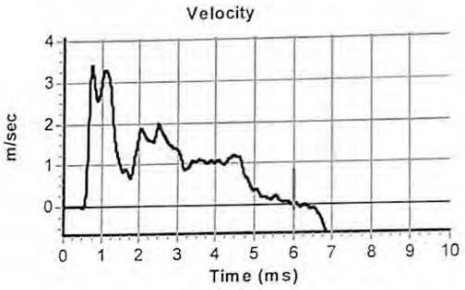
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.3
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	6458
Accelerometer No.2:	9607

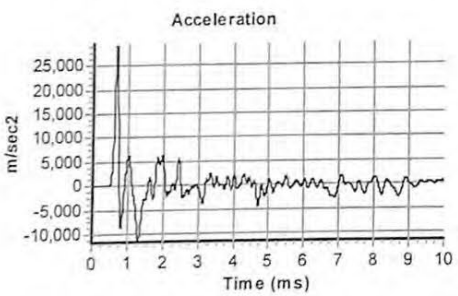
SPT Hammer Information

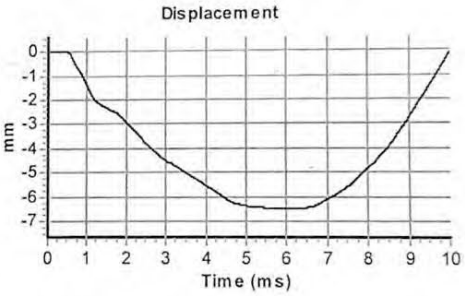
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	14.5

Comments / Location
CHARLWOODS









Calculations

Area of Rod A (mm2):	944
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	384

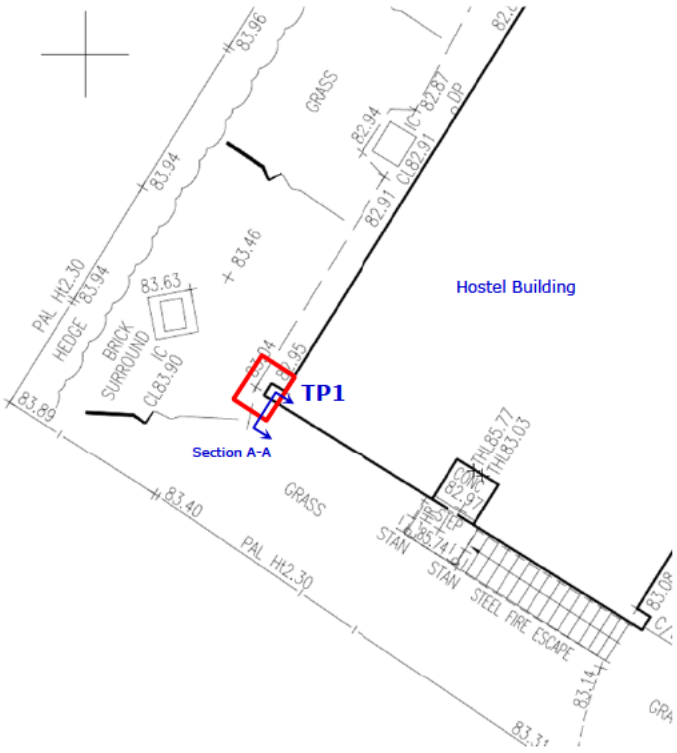
Energy Ratio E_r (%): 81

Signed: Neil Burrows
Title: Field Operations Manager

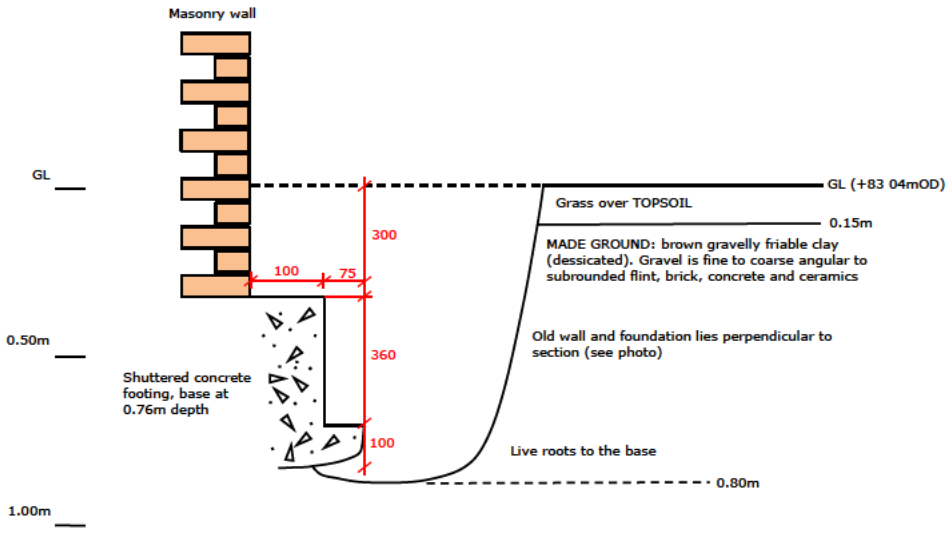
The recommended calibration interval is 12 months

Site & Location:	**One YMCA, 90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP1** (1 of 2)
Client:	**One YMCA**	Report No: **10637/AOC**
Engineer:	**AKS Ward**	

PLAN



SECTION A-A (looking SE)



Note: foundation dimensions in millimetres

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	D – 0.40m PID= 0.0ppm
Stability:	Stable		
Remarks:	Ground levels obtained from topographical survey provided by Malcolm Hughes (Ref: 53948-1)		**Logged by:** AO'C

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP1** (2 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PHOTOGRAPHS

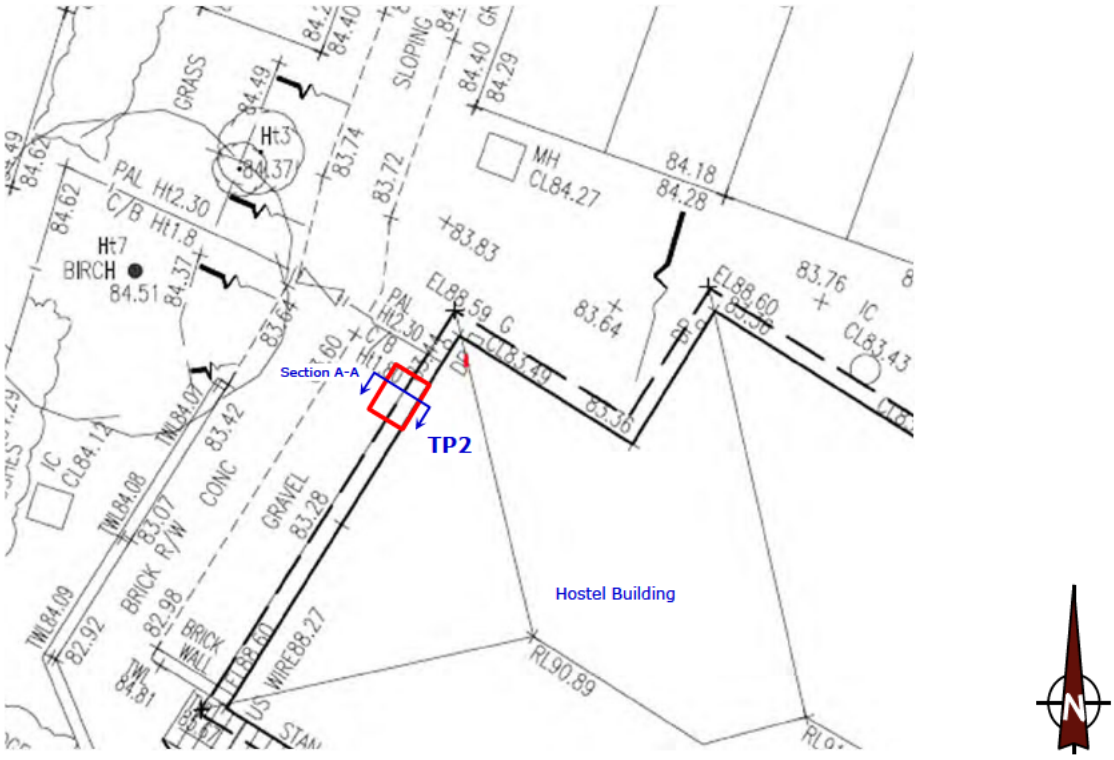
D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:			**Logged by:** AO'C

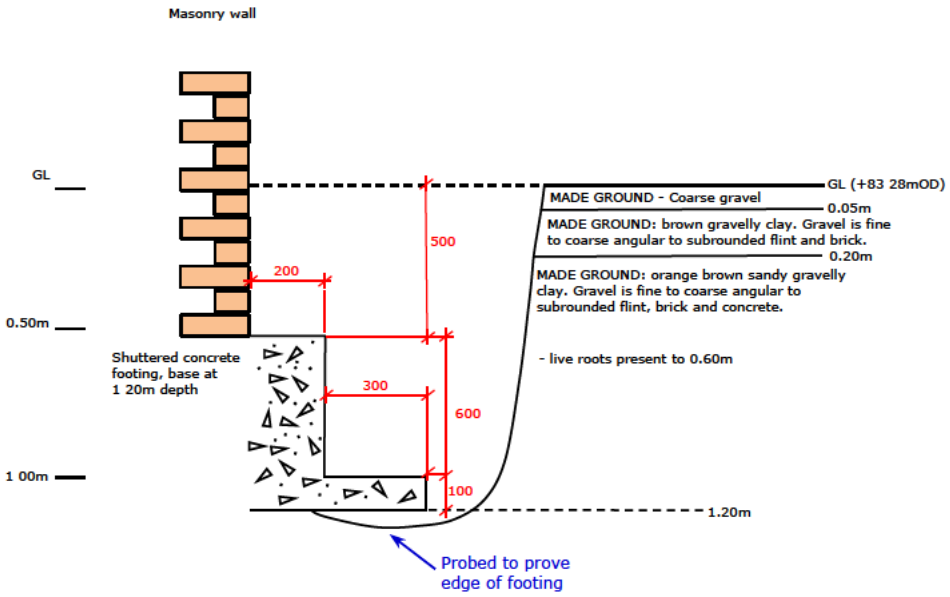
Soil Consultants

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP2** (1 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PLAN



SECTION A-A (looking SW)



Note: foundation dimensions in millimetres

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	D @ 0.50m PID = 0.2ppm
Stability:	Stable		
Remarks:	Ground levels obtained from topographical survey provided by Malcolm Hughes (Ref: 53948-1)		**Logged by:** AO'C

Soil Consultants

S te & Locat on	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial P t No: **TP2** (2 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PHOTOGRAPHS

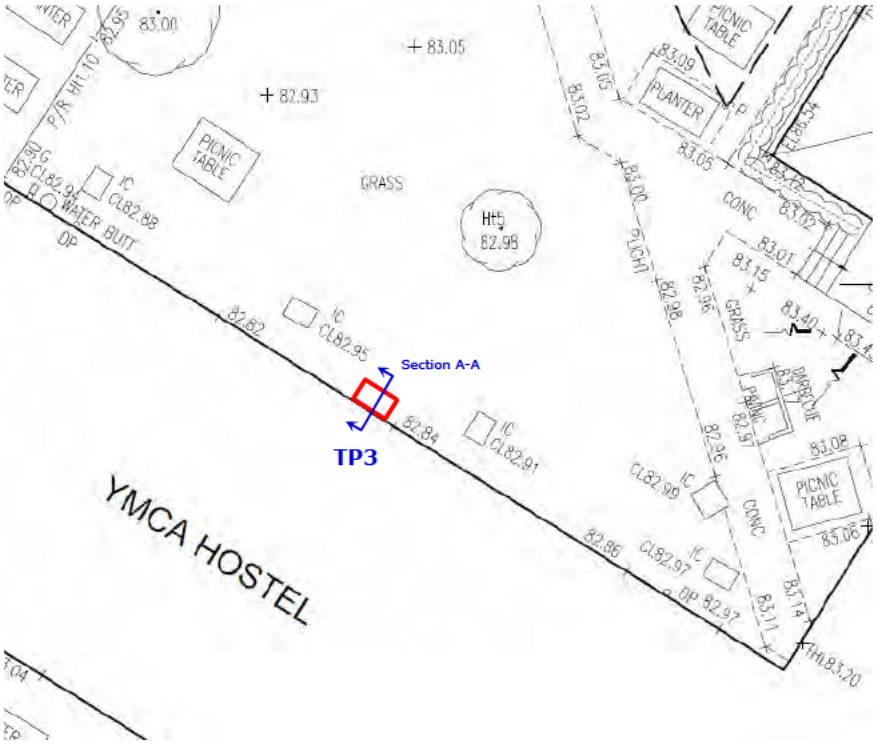
D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:			**Logged by:** AO'C

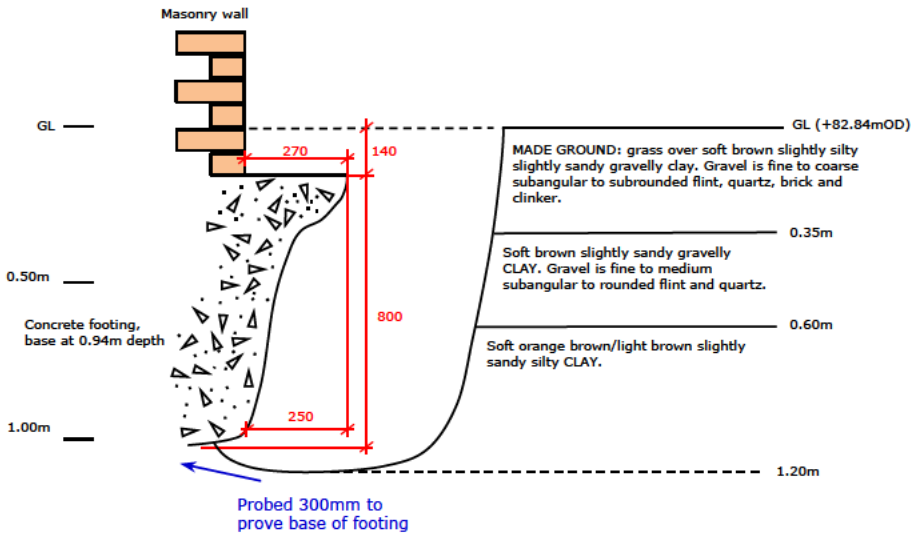
Soil Consultants

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP3** (1 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PLAN



SECTION A-A (looking Nw)



Note: foundation dimensions in millimetres

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	D @ 0.20m PID = 0.1ppm D @ 0.40m PID = 0.2ppm D @ 0.65m PID = 0.1ppm
Stability:	Stable		
Remarks:	Ground levels obtained from topographical survey provided by Malcolm Hughes (Ref: 53948-1)		**Logged by:** AO'C

Soil Consultants

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP3** (2 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

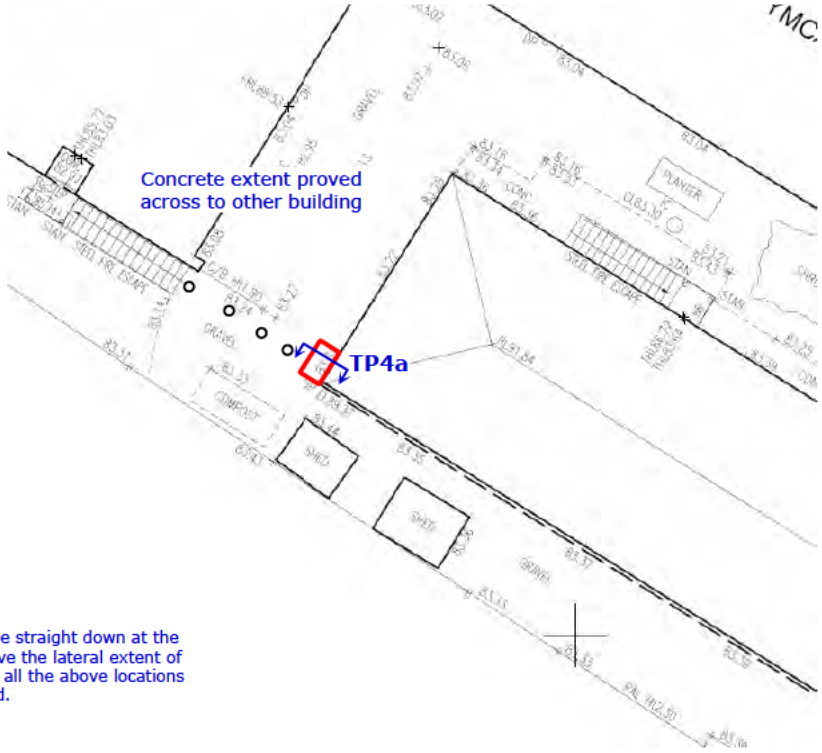
PHOTOGRAPHS

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:			**Logged by:** AO'C

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP4a** (1 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

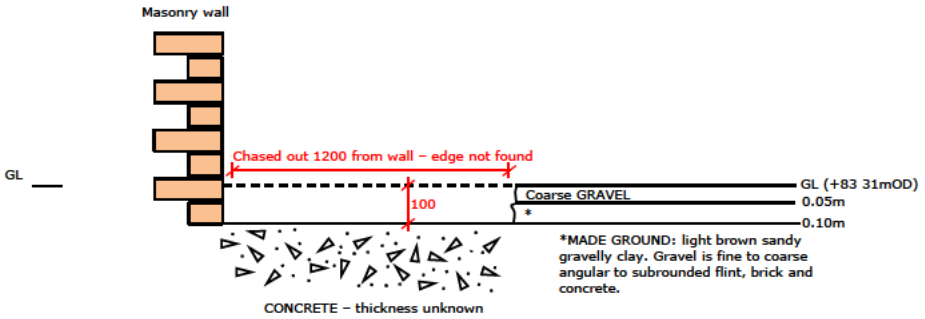
PLAN



o = probe location

NB: a road pin was used to probe straight down at the marked locations in order to prove the lateral extent of concrete. Concrete was found at all the above locations thus; the trial pit was abandoned.

SECTION A-A (looking SW)



Note: foundation dimensions in millimetres

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:	Ground levels obtained from topographical survey provided by Malcolm Hughes (Ref: 53948-1)		**Logged by:** AO'C

Soil Consultants

S te & Locat on	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial P t No: **TP4a** (2 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PHOTOGRAPHS

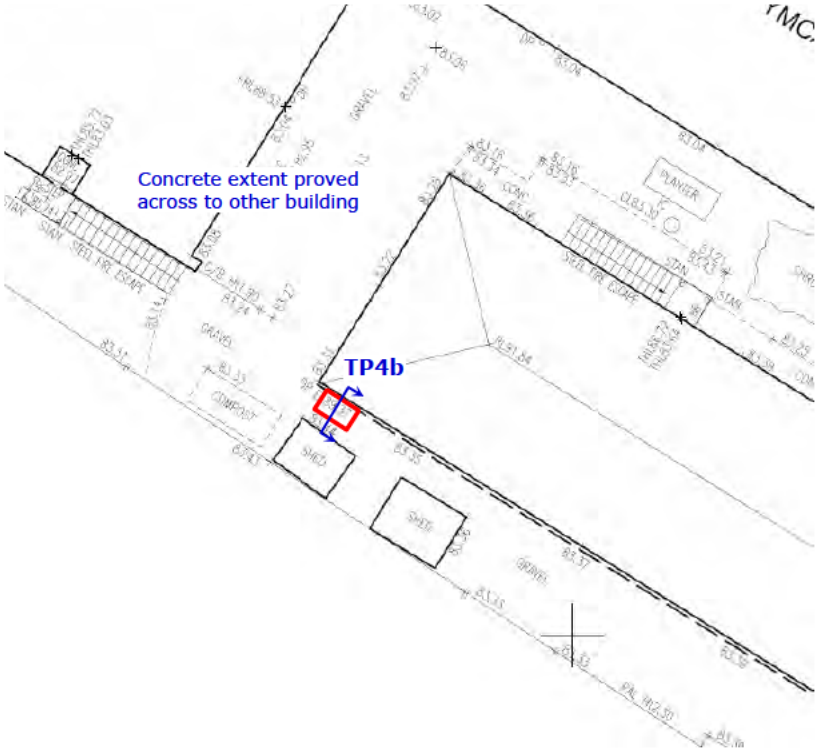
D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:			**Logged by:** AO'C

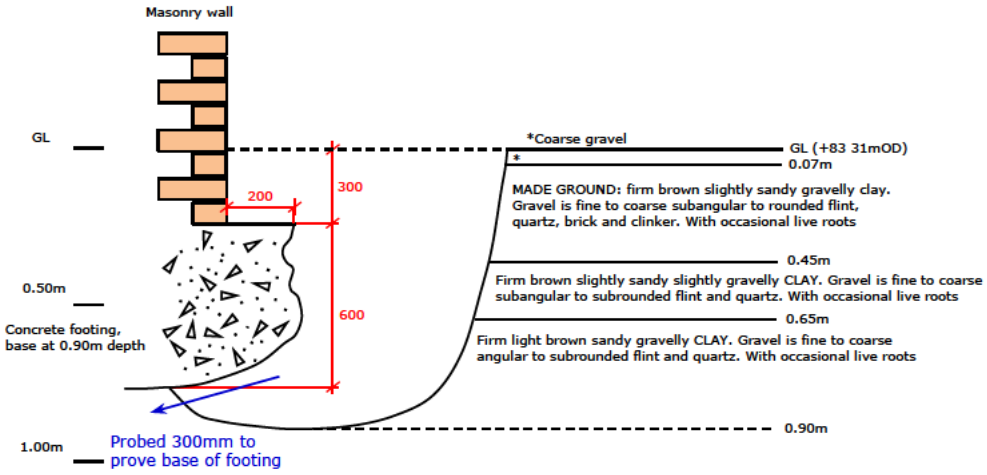
Soil Consultants

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP4b** (1 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PLAN



SECTION A-A (looking SE)



Note: foundation dimensions in millimetres

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	D @ 0.20m PID = 0.1ppm D @ 0.50m PID = 0.2ppm D @ 0.70m PID = 0.3ppm
Stability:	Stable		
Remarks:	Ground levels obtained from topographical survey provided by Malcolm Hughes (Ref: 53948-1)		**Logged by:** AO'C

Soil Consultants

S te & Locat on	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial P t No: **TP4b** (2 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

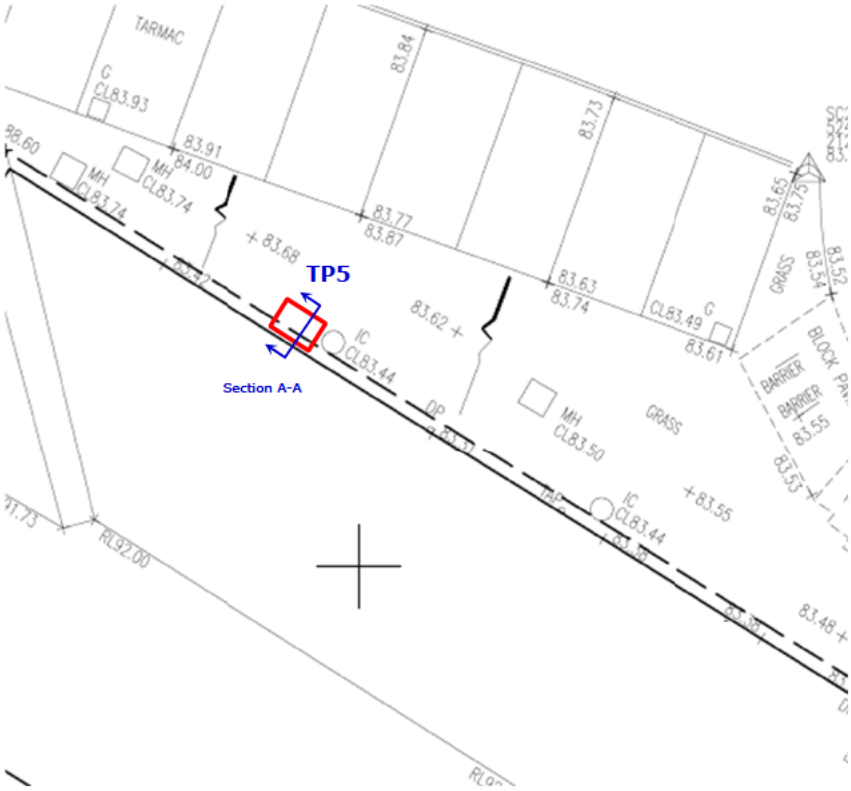
PHOTOGRAPHS

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

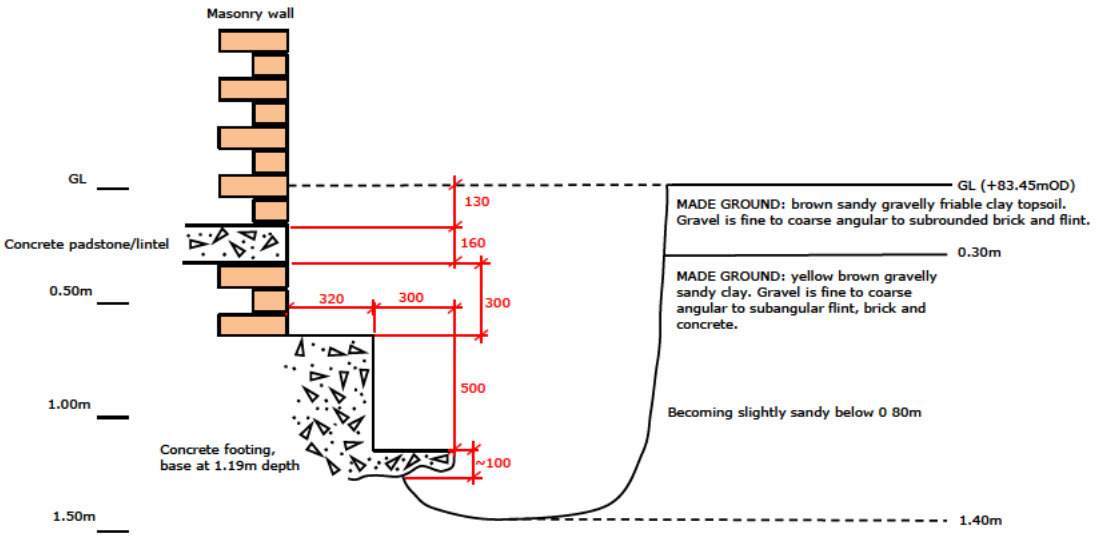
Date:	14/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:			**Logged by:** AO'C

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP5** (1 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PLAN



SECTION A-A (looking NW)



Note: foundation dimensions in millimetres

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	15/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	D @ 0.20m PID = 0.2ppm D @ 0.70m PID = 0.7ppm
Stability:	Stable		
Remarks:	Ground levels obtained from topographical survey provided by Malcolm Hughes (Ref: 53948-1)		**Logged by:** AO'C

Soil Consultants

S te & Locat on	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial P t No: **TP 5** (2 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PHOTOGRAPHS

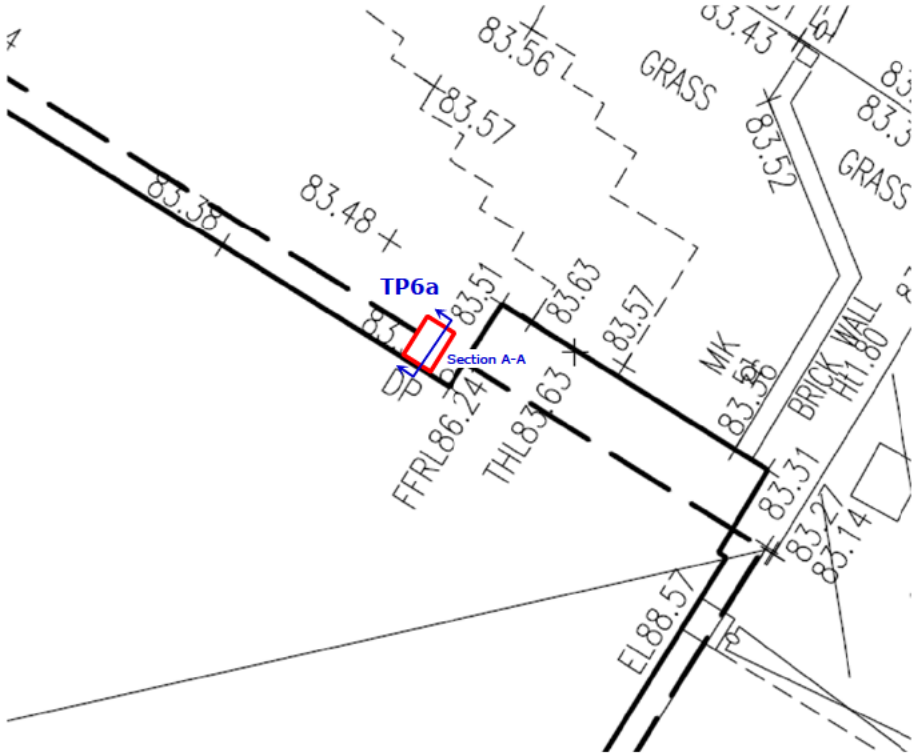
D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	15/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:			**Logged by:** AO'C

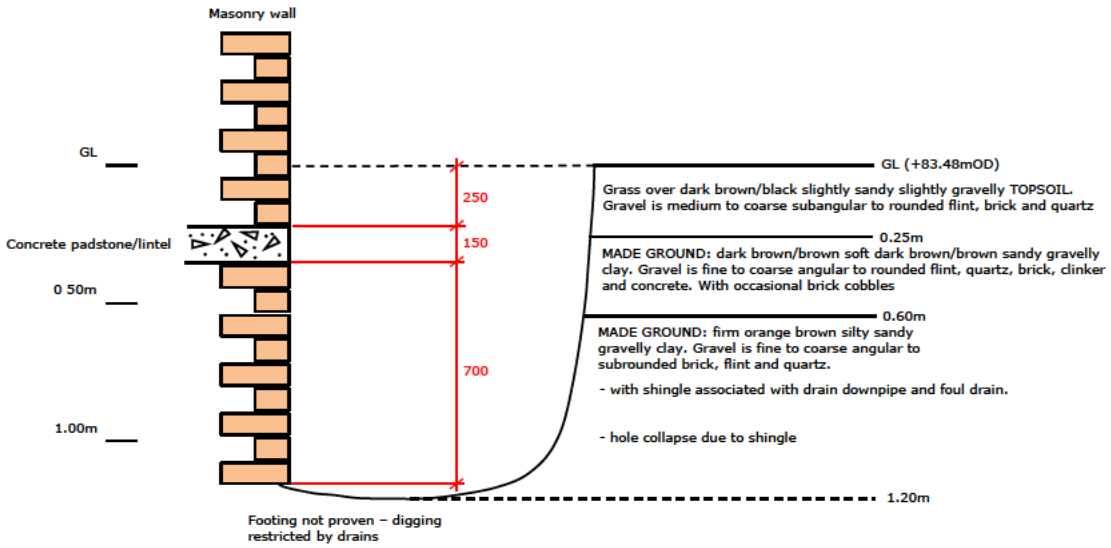
Soil Consultants

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP6a** (1 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PLAN



SECTION A-A (looking NW)



Note: foundation dimensions in millimetres

D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	15/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	D @ 0.10m PID = 0.0ppm D @ 0.40m PID = 0.0ppm D @ 0.70m PID = 0.0ppm
Stability:	Stable		
Remarks:	Ground levels obtained from topographical survey provided by Malcolm Hughes (Ref: 53948-1)		**Logged by:** AO'C

Soil Consultants

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP6a** (2 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PHOTOGRAPHS

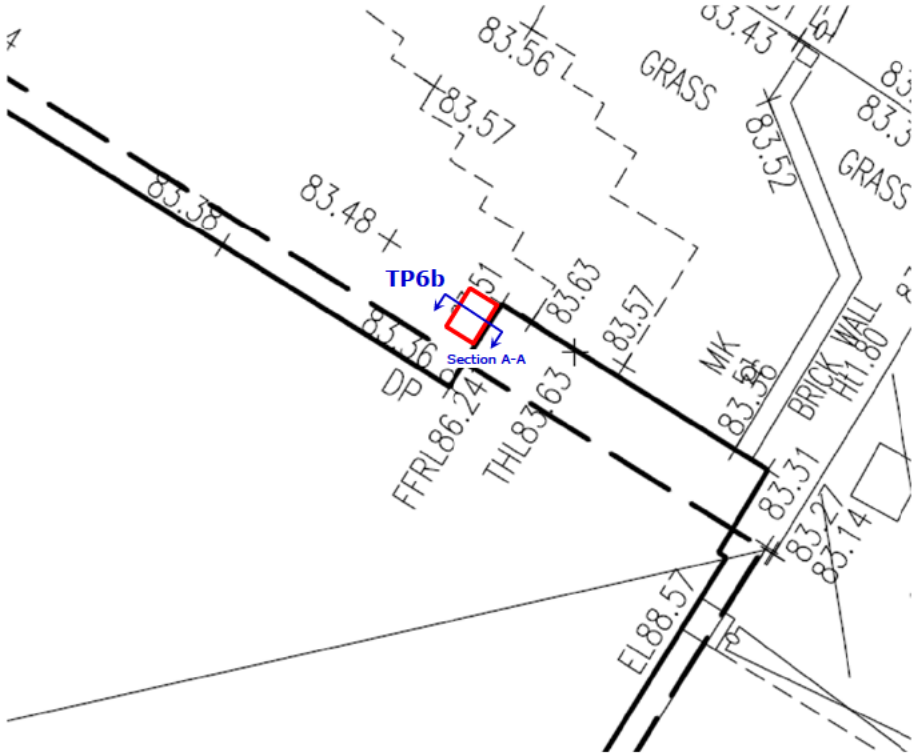
D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	15/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:			**Logged by:** AO'C

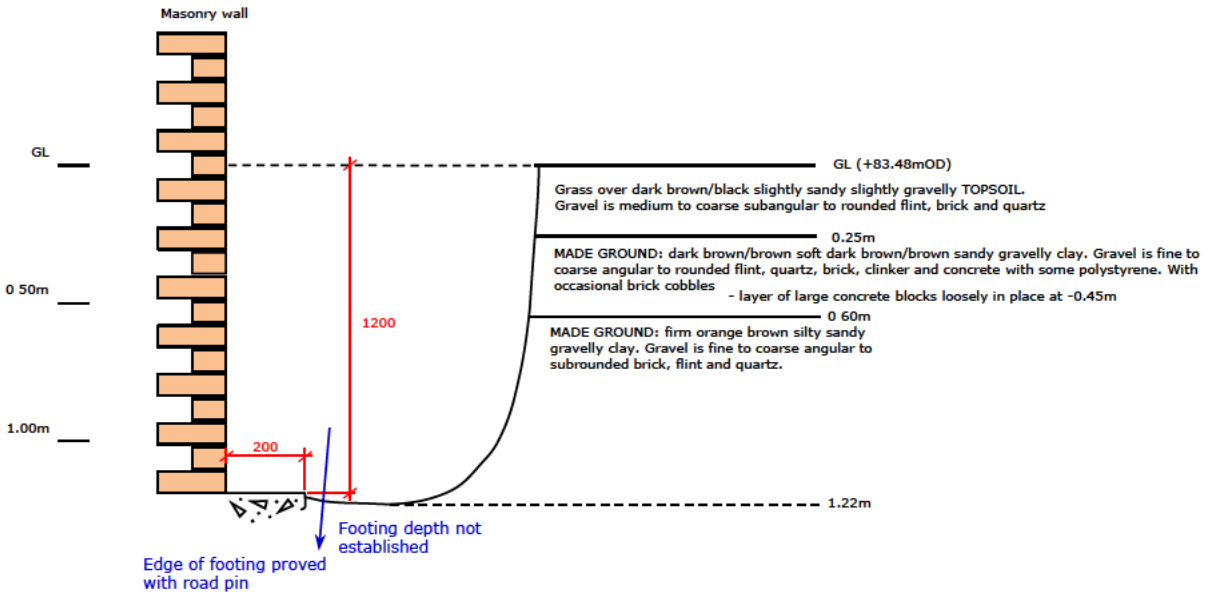
Soil Consultants

Site & Location	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial Pit No: **TP6b** (1 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PLAN



SECTION A-A (looking SW)



Note: foundation dimensions in millimetres

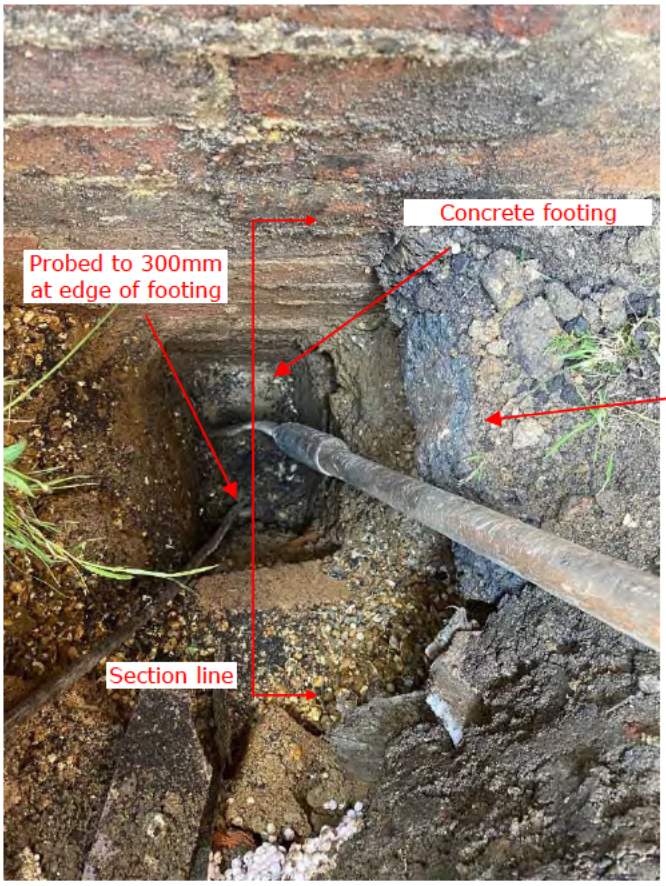
D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	15/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:	Ground levels obtained from topographical survey provided by Malcolm Hughes (Ref: 53948-1)		**Logged by:** AO'C

Soil Consultants

S te & Locat on	**One YMCA,** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Trial P t No: **TP6b** (2 of 2)
Client: Engineer:	**One YMCA** **AKS Ward**	Report No: **10637/AOC**

PHOTOGRAPHS



D = small disturbed sample, E = environmental sample (glass jar and tub), HV = hand shear vane test (kPa), pp = pocket penetrometer (kg/cm²)

Date:	15/06/2021	**Groundwater details**	**Samples**
Equipment:	Hand excavat on	• Dry	
Stability:	Stable		
Remarks:			**Logged by:** AO'C

Site & Location		Trial Pit No:
	One YMCA **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	**P1**
Client: **One YMCA** Engineer: **AKS Ward**	**Coords: 524389E 212651N** **Level: +84.39mOD**	Report No: **10637/AOC**

Depth (m)	Strata description	Samples/tests		
		Depth (m)	Type	Test results
GL to 0.10m	Asphalt			
0.10m to 0.15m	MADE GROUND: yellow brown slightly silty sandy gravel (sub-base). Gravel is fine to coarse angular to subangular flint and brick.			
0.15m to 0.26m	MADE GROUND: orange brown slightly clayey gravelly silty sand. Gravel is fine to coarse subangular to rounded flint with rare brick.	0.25m	E	PID at 0.25m = 0.4ppm

Date of excavation:	15th June 2021	Groundwater:			
Equipment:	Handheld breaker				
Stability:	Stable	Logged by:	AOC	Checked by:	SCW

Remarks:
Coordinates and ground level data extrapolated from topographical survey provided by Malcolm Hughes (Ref: 53948-1)

Key: D = Small disturbed sample; B = Bulk disturbed sample; HV = Hand Shear Vane test (kN/m²); P = Pocket Penetrometer (kg/cm²)

Site & Location	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**		Trial Pit No: **P2**
Client:	**One YMCA**	**Coords: 524404E 212635N**	Report No: **10637/AOC**
Engineer:	**AKS Ward**	**Level: +83.80mOD**	

Depth (m)	Strata description	Samples/tests		
		Depth (m)	Type	Test results
GL to 0.05m	Asphalt – fine aggregate			
0.05m to 0.10m	Asphalt – coarse aggregate			
0.10m to 0.30m	MADE GROUND: brown slightly silty sandy gravel (sub-base). Gravel is fine to coarse angular to subangular concrete, brick and flint.	0.31m	E	PID at 0.31m = 0.2ppm
0.30m to 0.32m	MADE GROUND: brown slightly clayey gravelly sand. Gravel is fine to coarse angular to subrounded flint and brick.			

Date of excavation:	15th June 2021	Groundwater:			
Equipment:	Handheld breaker				
Stability:	Stable	Logged by:	AOC	Checked by:	SCW

Remarks:
Coordinates and ground level data extrapolated from topographical survey provided by Malcolm Hughes (Ref: 53948-1)

Key: D = Small disturbed sample; B = Bulk disturbed sample; HV = Hand Shear Vane test (kN/m²); P = Pocket Penetrometer (kg/cm²)

Soil Consultants

Site & Location: **One YMCA**
90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL

Report No: **10637/AOC**

Results of groundwater/gas monitoring

Date:	25 Jul 21	02 Jul 21	09 Jul 21
Barometric pressure:			
a) Trend (24hrs):	Falling	Falling	Rising then falling
b) At start (mB):	1018	1016	1020
c) At end (mB):	1018	1016	1020
Recorded by:	AOC	AOC	AOC
Surface ground conditions:	Damp	Dry	Dry
Weather conditions:	Drizzle	Sunny	Sunny with cloud
Ambient air temp (oC):	17	23	20

Monitoring equipment

Instrument: GA5000. Serial No. G505055
Calibration check details: See note 2 below
Next calibration date: Sep 2021

Notes:

1) Barometric pressure trend and ambient air temperature is recorded from metoffice.gov.uk website on the day of the monitoring visit

2) Calibration check is performed at start of monitoring against ambient air and also periodically with a 5% CH_4, 5% CO_2 and 6% O_2 gas mixture

3) CH_4 = methane; CO_2 = carbon dioxide; CO = carbon monoxide; O_2 = oxygen; H_2S = hydrogen sulphide

Results

Date	Time (24hr)	Borehole ID	GW depth (m)	Depth to base (m)	CH_4 (%)		CO_2 (%)		O_2 (%)		Highest (ppm)		Emission rate (l/hr)	Relative pressure (mb)	PID (ppm)
					Max	Steady	Max	Steady	Min	Steady	CO	H_2S			
25/06/2021	16:30	DS105	3.02	4.93	0.0	0.0	1.2	1.2	19.9	19.9	0	0	0.0	0.02	0.4
	16:40	DS103	dry	4.90	0.0	0.0	0.5	0.5	20.1	20.1	0	0	0.0	0.09	0.6
	16:50	BH1	dry	3.94	0.0	0.0	1.5	1.5	20.2	20.2	0	0	0.0	0.01	0.8
02/07/2021	08:10	DS105	3.56	4.93	0.0	0.0	1.3	1.3	20.2	20.2	0	0	0.0	0.08	0.5
	08:25	DS103	dry	4.90	0.0	0.0	0.8	0.8	21.5	21.5	0	0	0.1	0.02	0.3
	08:40	BH1	dry	3.94	0.0	0.0	1.8	1.8	20.1	20.1	0	0	0.0	0.01	0.5
09/07/2021	08:10	DS105	dry	4.94	0.0	0.0	1.4	1.4	21.2	21.2	0	0	0.0	0.00	0.5
	08:20	DS103	dry	4.90	0	0	0.9	0.9	19.5	19.5	0	0	0.0	0.02	0.7
	08:35	BH1	dry	3.94	0	0	1.7	1.7	20.3	20.3	0	0	0.0	0.01	0.8

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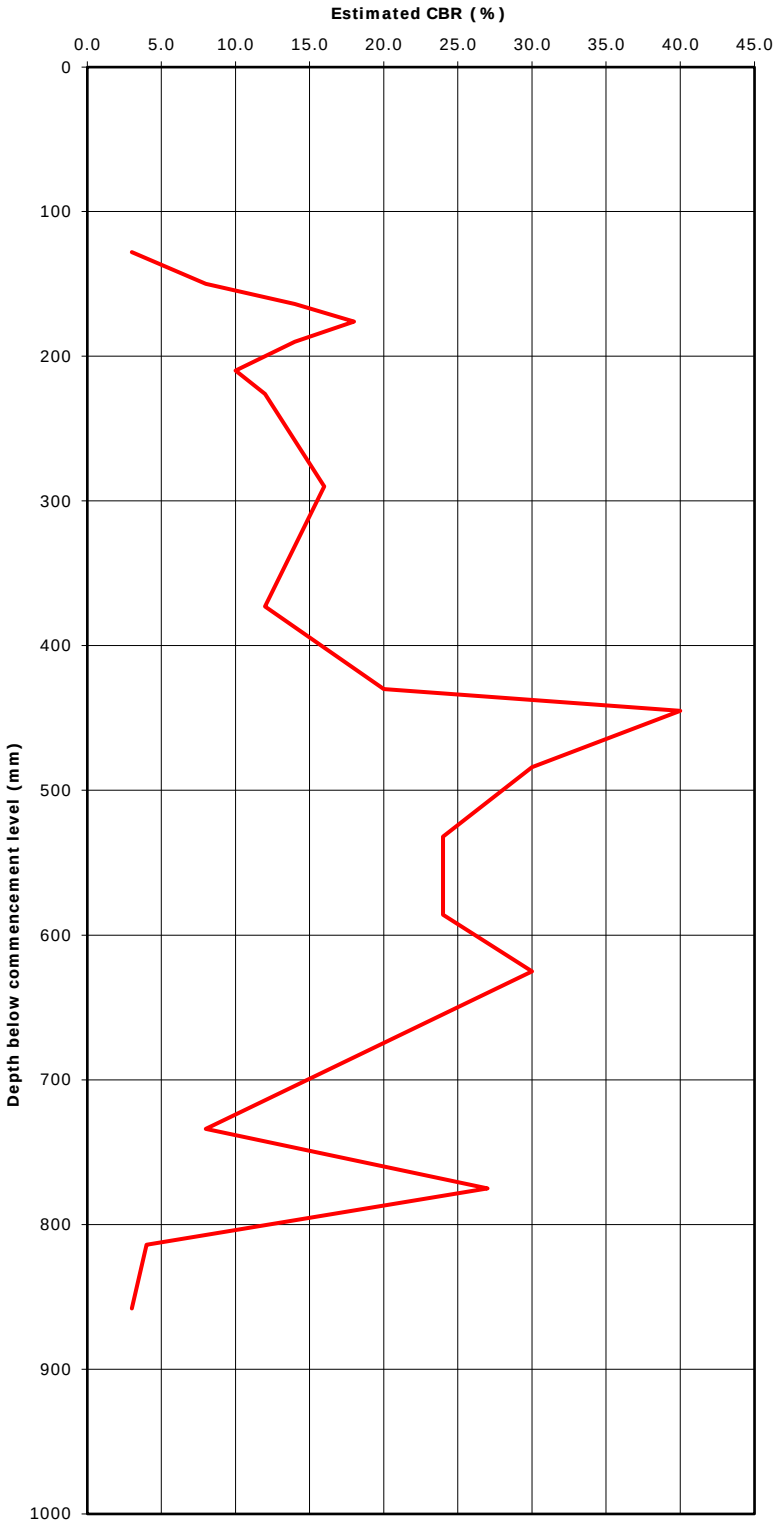
S te & Location	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	TRL Probe No:	**TRL1**
Client:	**One YMCA**	(Sheet 1 of 1)	
Engineers:	**AKS Ward**	Report No:	**10637/AOC**

TRL Dynamic Cone Penetration test result

Blow Count	Depth (mm)	mm per blow	CBR (%)
0	84	0	
1	128	44.0	3.0
2	150	22.0	8.0
3	164	14.0	14.0
4	176	12.0	18.0
5	190	14.0	14.0
6	210	20.0	10.0
7	226	16.0	12.0
12	290	12.8	16.0
17	373	16.6	12.0
22	430	11.4	20.0
27	445	3.0	40.0
32	484	7.8	30.0
37	532	9.6	24.0
38	541	9.0	24.0
43	586	9.0	24.0
48	625	7.8	30.0
53	734	21.8	8.0
58	775	8.2	27.0
59	814	39.0	4.0
60	858	44.0	3.0
61	888	30.0	5.0
62	920	32.0	5.0

PLOT OF CBR VS DEPTH



Date of test:	**15/06/21**
Depth test commenced (mm bgl):	**84**

Remarks:

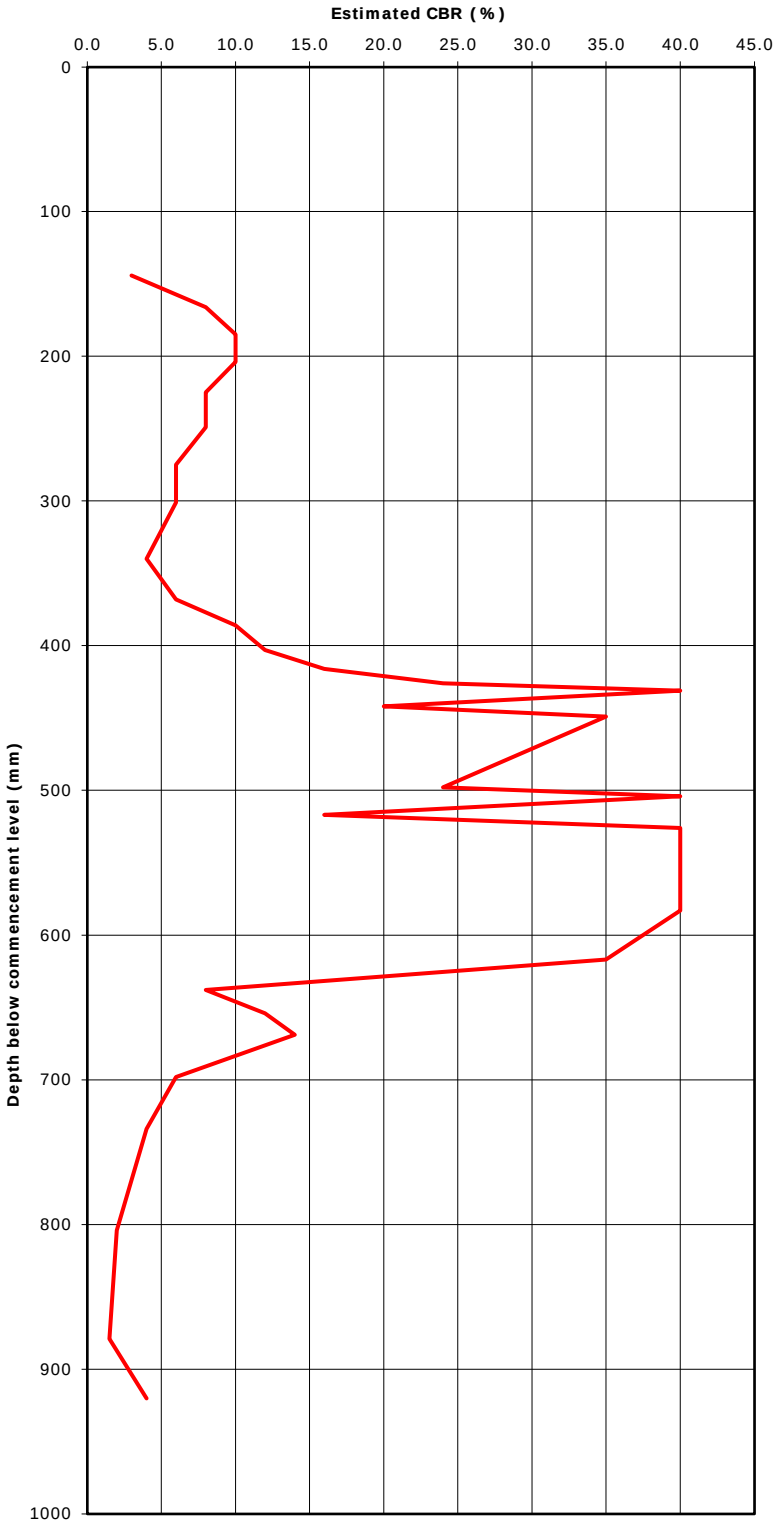
Soil Consultants

S te & Location	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	TRL Probe No:	**TRL2**
Client:	**One YMCA**	(Sheet 1 of 1)	
Engineers:	**AKS Ward**	Report No:	**10637/AOC**

TRL Dynamic Cone Penetration test result

Blow Count	Depth (mm)	mm per blow	CBR (%)
0	95	0	
1	144	49.0	3.0
2	166	22.0	8.0
3	185	19.0	10.0
4	204	19.0	10.0
5	225	21.0	8.0
6	249	24.0	8.0
7	275	26.0	6.0
8	301	26.0	6.0
9	340	39.0	4.0
10	368	28.0	6.0
11	386	18.0	10.0
12	403	17.0	12.0
13	416	13.0	16.0
14	426	10.0	24.0
15	431	5.0	40.0
16	442	11.0	20.0
17	449	7.0	35.0
22	498	9.8	24.0
23	504	6.0	40.0
24	517	13.0	16.0
29	526	1.8	40.0
34	547	4.2	40.0
39	563	3.2	40.0
44	583	4.0	40.0
49	617	6.8	35.0
50	638	21.0	8.0
51	654	16.0	12.0
52	669	15.0	14.0
53	698	29.0	6.0
54	734	36.0	4.0
55	804	70.0	2.0
56	879	75.0	1.5
57	920	41.0	4.0

PLOT OF CBR VS DEPTH



Date of test:	**15/06/21**
Depth test commenced (mm bgl):	**95**

Remarks:

Soil Consultants

Site & Location: **One YMCA** — **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**

Report No: **10637/AOC**

SUMMARY OF CLASSIFICATION TEST RESULTS

BH ID	Depth (m)	Type	w (%)	w_L (%)	w_P (%)	Pass 425 (%)	I_P (%)	Mod I_P (%)	I_L (%)	LOI (%)	Description
BH1	3.00	D	17	42	22	31.4**	20	6	-0.26		Orange brown/brown slightly silty slightly sandy gravelly CLAY.
BH1	4.75	D	17	52	20	91**	32	29	-0.09		Brown slightly gravelly CLAY.
BH1	9.00	D	5	34	18	21.4**	16	3	-0.80		Brown slightly silty slightly sandy gravelly CLAY.
BH2	0.75	D	12	27	19	42.4**	8	3	-0.88		Orange brown gravelly CLAY.
BH2	3.00	U	20								Orange brown slightly gravelly silty CLAY.
BH2	3.75	D	20	31	18	>95	13		0.14		Orange brown slightly gravelly silty CLAY.
BH2	6.50	D	17	41	21	39.9**	20	8	-0.22		Orange brown slightly silty slightly sandy gravelly CLAY.
BH2	9.00	D	18	46	19	79**	27	21	-0.03		Brown slightly gravelly CLAY.
BH2	11.00	D	14	36	18	52.9**	18	10	-0.24		Orange brown silty gravelly CLAY.
TP1	0.40	D	11	31	21	50**	10	5	-1.00		MADE GROUND: Brown gravelly clay
TP2	1.00	D	12	33	21	44**	12	5	-0.75		Orange brown sandy gravelly CLAY

Testing in accordance with BS EN ISO 17892 unless specified otherwise

Date: 14 Jul 21

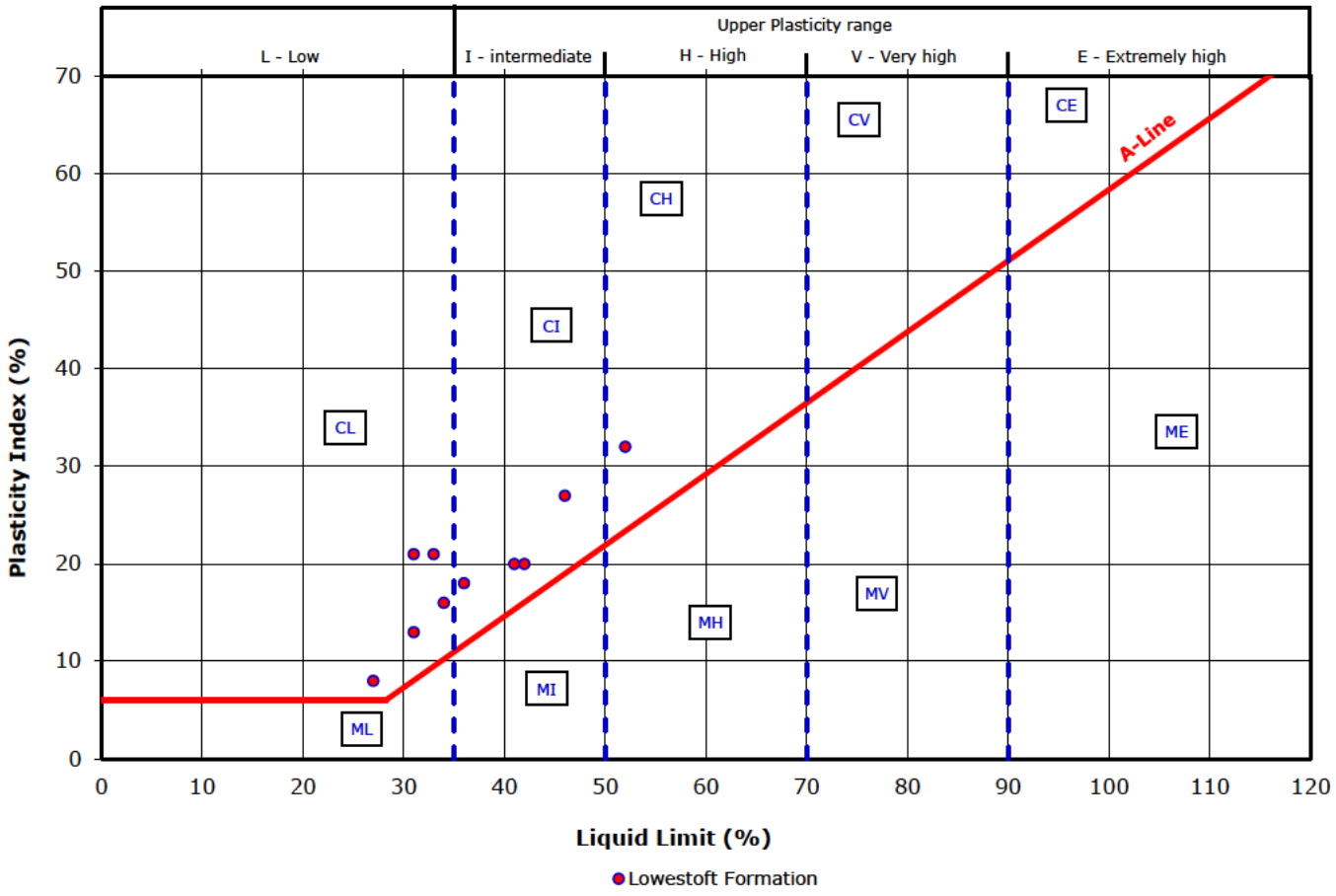
Modified Plasticity Index calculated in accordance with NHBC Standards Chapter 4.2 (reported if %passing 425mm <95%)

Percent passing 425μm: by estimation, by hand* or by sieving**

Soil Consultants

Site & Location	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Report No:	**10637/AOC**

Plasticity Chart



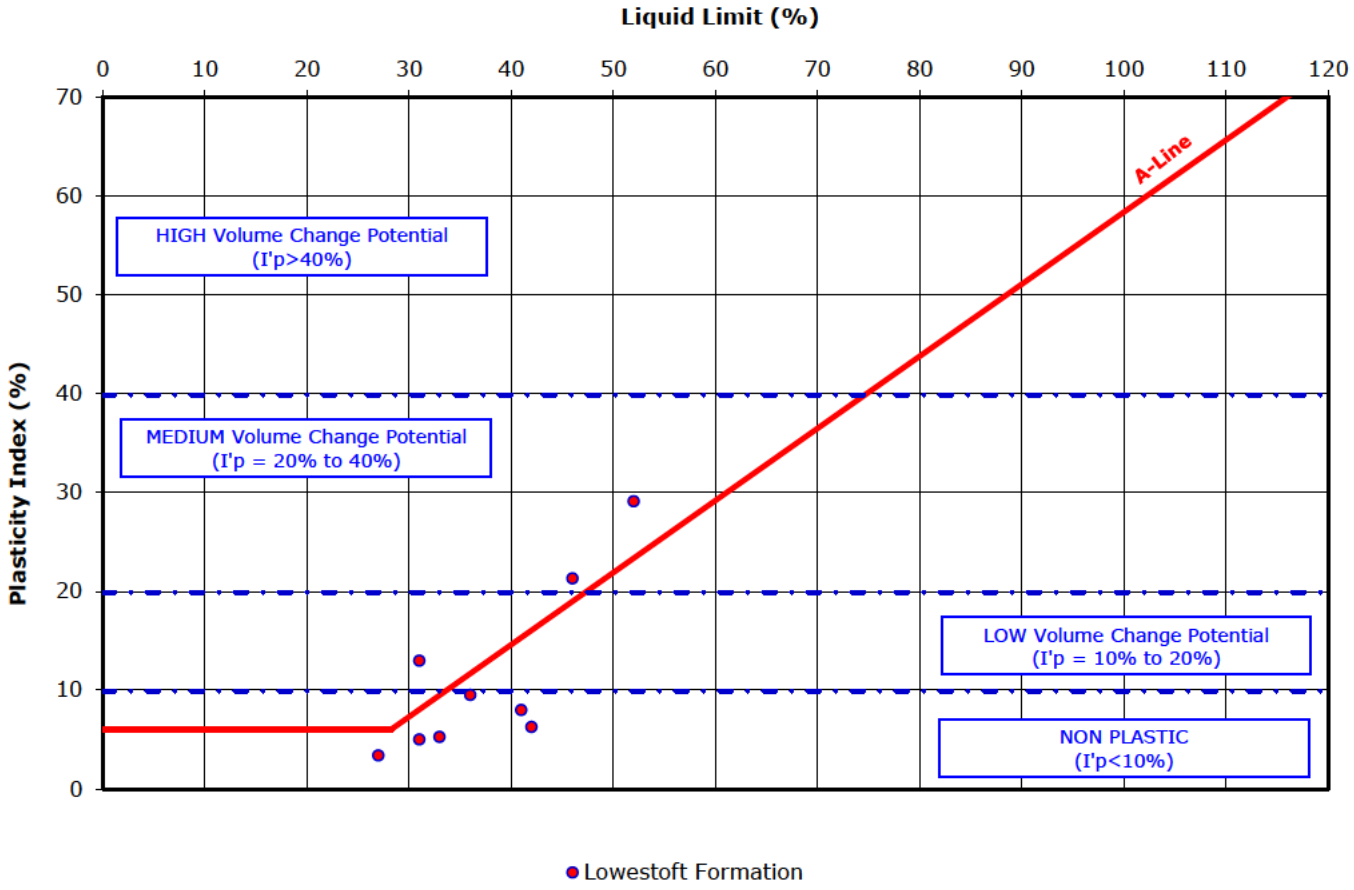
M - SILT [plots below the A-Line}
C - CLAY [plots above the A-Line]

Classification in accordance with BS5930:2015 "Code of practice for site investigations"

Soil Consultants

Site & Location	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Report No:	**10637/AOC**

Plasticity Chart



Modified Plasticity Index, I'p:

$$I'p = \frac{Ip \times (\%\ \text{passing 425mm})}{100\%}$$ (where Ip = Plasticity Index)

Classification in accordance with NHBC Standards, Part 4 'Foundations', Chapter 4.2 'Building near trees'

Soil Consultants

Site & Location	**One YMCA** **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	Report No:	**10637/AOC**

SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

BH ID	Depth (m)	Moisture content (%)	Bulk density (Mg/m^3)	Dry density (Mg/m^3)	Cell pressure (kPa)	Deviator stress (kPa)	Failure strain (%)	Failure mode	Undrained cohesion (kPa)	Remarks
BH2	3.00	20	2.12	1.77	60	154	12.00	I	77	

Testing in accordance with BS EN ISO 17892. UU = unconsolidated, undrained; MUU = multistage, unconsolidated, u Date: 13 July 21

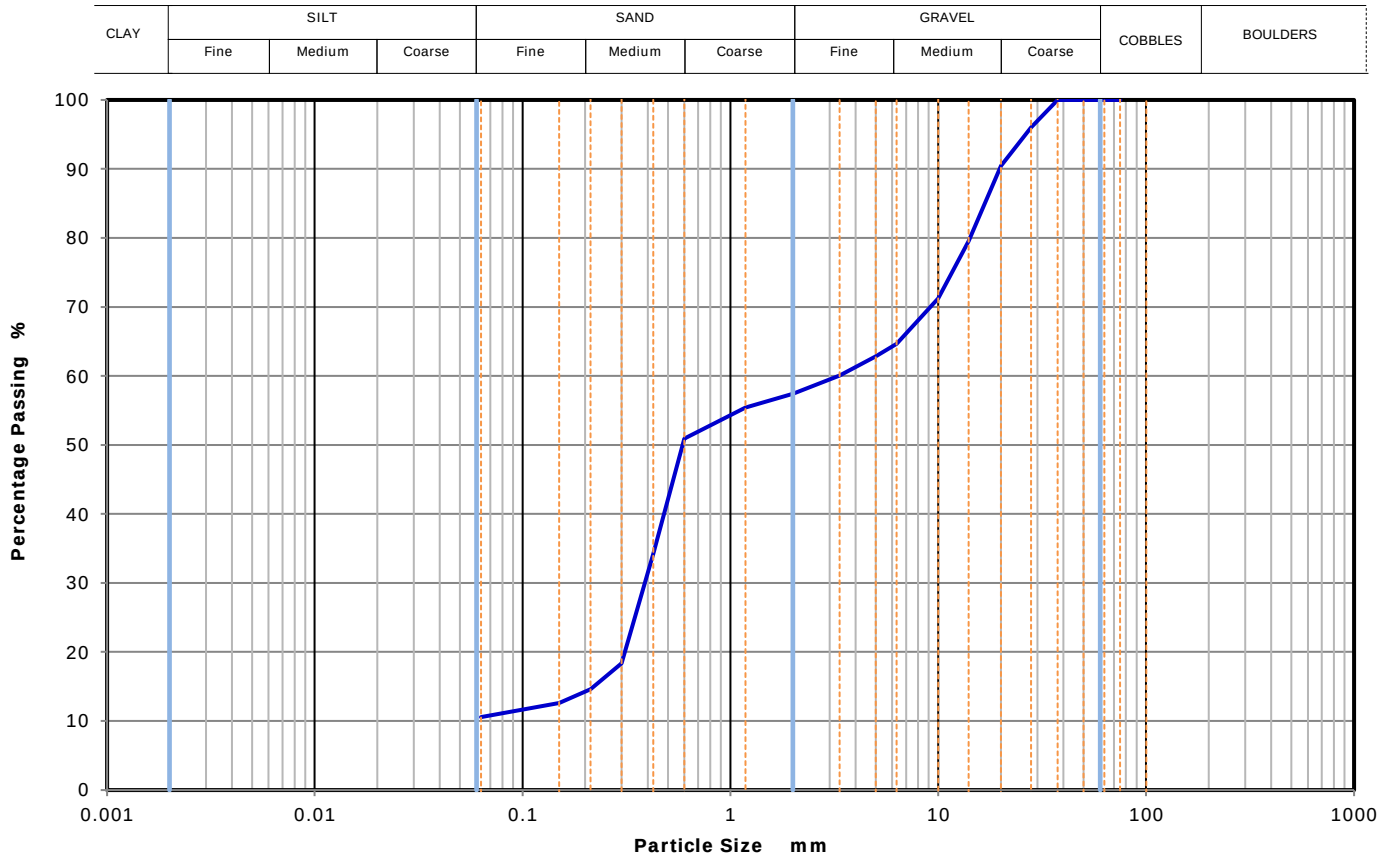
Unless stated otherwise: a) Rate of strain = 2mm/min and b) Standard latex membrame used with thickness = 0.5mm

Failure modes: B = brittle, I = intermediate, P = plastic

Site	One YMCA	Report No:	10637/AOC
Locat on	90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL		

PARTICLE SIZE DISTRIBUTION

Hole ID: BH1 Depth (m): 6.50	Description: Orange brown slightly clayey slightly silty SAND & GRAVEL



Sieving	
Size (mm)	% passing
75	100.0
63	100.0
50	100.0
37.5	100.0
28	96.0
20	90.4
14	79.5
10	71.3
6.3	64.7
5	62.8
3.35	60.0
2	57.4
1.18	55.4
0.6	50.9
0.425	34.2
0.3	18.3
0.212	14.6
0.15	12.6
0.063	10.6

Sedimentation	
Size (µm)	% passing

Sample proportions	%
Cobbles	0
Gravel	43
Sand	47
Fines (<0.063mm)	11

Grading analysis		
D60	mm	3.33
D30	mm	0.388
D10	mm	N/A
Uniformity Coefficient		
Curvature Coefficient		

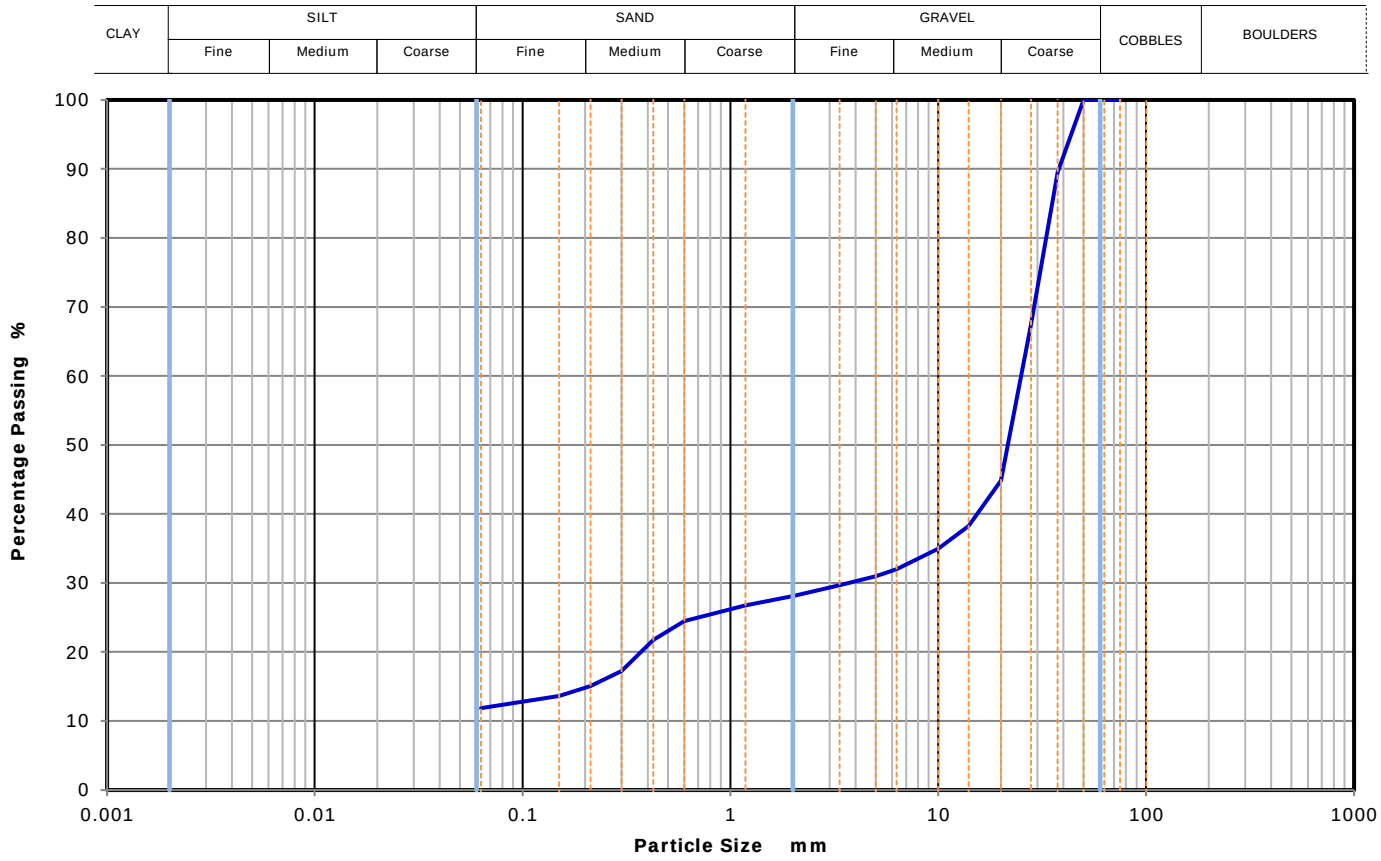
Test method and date	
Testing in accordance with BS EN ISO 17892:	
- Wet sieving method	
Reporting date:	13 Jul 21

Soil Consultants

Site	**One YMCA**	Report No:	**10637/AOC**
Locat on	**90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**		

PARTICLE SIZE DISTRIBUTION

Hole ID: **BH1** Depth (m): **7.50**	Description: **Brown clayey slightly sandy GRAVEL.**



Sieving	
Size (mm)	% passing
75	100.0
63	100.0
50	100.0
37.5	89.5
28	67.5
20	44.8
14	38.2
10	35.0
6.3	32.0
5	31.0
3.35	29.7
2	28.1
1.18	26.7
0.6	24.4
0.425	21.7
0.3	17.2
0.212	15.1
0.15	13.6
0.063	11.9

Sedimentation	
Size (µm)	% passing

Sample proportions	%
Cobbles	0
Gravel	72
Sand	16
Fines (<0.063mm)	12

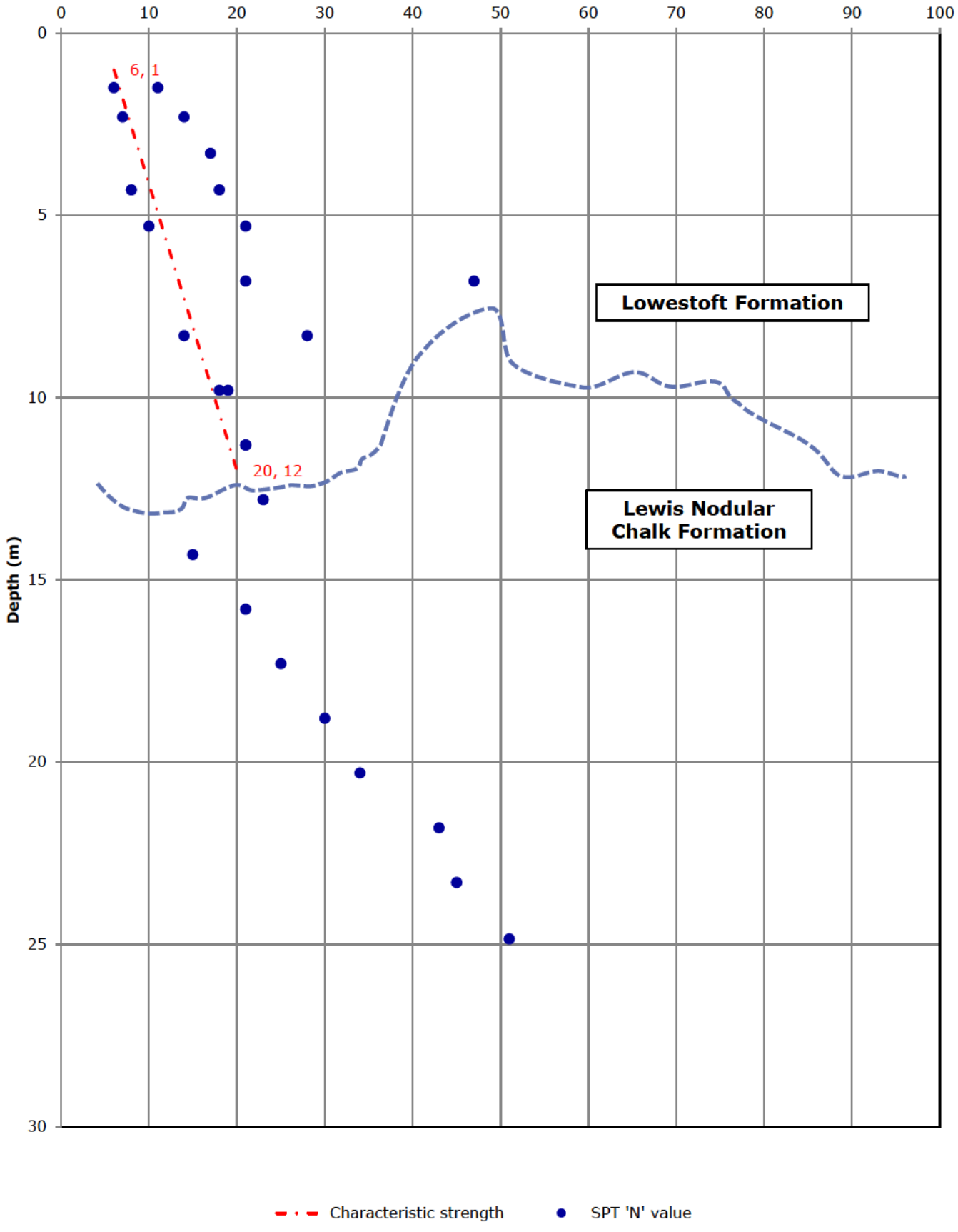
Grading analysis		
D60	mm	25.06
D30	mm	3.722
D10	mm	N/A
Uniformity Coefficient		
Curvature Coefficient		

Test method and date	
Testing in accordance with BS EN ISO 17892: - Wet sieving method	
Reporting date:	13 Jul 21

Soil Consultants

Site & Locat on	One YMCA 90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL	Report No:	10637/AOC

SPT-N vs depth



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FOREWORD TO CONTAMINATION TESTING AND ASSESSMENT

The following statements are designed to inform and guide the Client and other potential parties intending to rely upon this report, with the express intent of protecting them from misunderstanding as to the extent and thus the potential associated risks that may result from proceeding without further evaluations or guidance.

1) Unless otherwise stated in this report, the testing of soils and waters is based on a range of commonly occurring potential contaminants for the specific purpose of providing a general guidance evaluation for the proposed form of development. Thus, the range of potential contaminants is neither exhaustive nor specifically targeted to any previous known uses or influences upon the site.

2) The amount and scope of the testing should not be assumed to be exhaustive but has been selected, at this stage, to provide a reasonable, general view of the site ground conditions. In many cases this situation is quite sufficient for the site to be characterised for the purposes of development and related Health and Safety matters for persons involved in or directly affected by the site development works. It must be understood, however, that in certain circumstances aspects or areas of the site may require further investigation and testing in order to fully clarify and characterise contamination issues, both for regulatory compliance and for commercial reasons.

3) The scope of the contamination testing must not automatically be regarded as being sufficient to fully formulate a remediation scheme. For such a scheme it may be necessary to consider further testing to verify the effectiveness of the remedial work after the site has been treated. It must be understood that a remediation scheme which brings a site into a sufficient state for the proposed development ("fit for purpose") under current legislation and published guidance, may result in some contamination being left in-situ. It is possible that forthcoming legislation may result in a site being classified by the Local Authority and assigned a "Degree of Risk" related to previous use or known contamination.

4) The scope of the environmental investigation and contamination testing must not be automatically regarded as sufficient to satisfy the requirements in the wider environmental setting. The risks to adjacent properties and to the water environment are assessed by the regulatory authorities and there may be a requirement to carry out further exploration, testing and, possibly monitoring in the short or long term. It is not possible to sensibly predict the nature and extent of such additional requirements as these are the direct result of submissions to and liaison with the regulatory authorities. It is imperative, therefore, that such submissions and contacts are made as soon as possible, especially if there are perceived to be critical features of the site and proposed scheme, in this context.

5) New testing criteria have been implemented by the Environment Agency to enable a waste disposal classification to be made. The date of implementation of this Waste Acceptance Criteria (WAC) was July 2005. It is this testing that will be used by the waste regulatory authorities, including waste disposal sites, to designate soils for disposal in landfill sites. In certain circumstances, to satisfy the waste regulations, there may be the necessity to carry out additional testing to clarify and confirm the nature of any contamination that may be present. If commercial requirements are significant then this process may also necessitate further field operations to clarify the extent of certain features. Thus, the waste classification must be obtained from the waste regulation authorities or a licensed waste disposal site and we strongly recommend that this classification is obtained as soon as possible and certainly prior to establishing any costings or procedures for this or related aspects of the scheme.

Site & Location	One YMCA 90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL	Report No: 10637/AOC

Site photographs

Photo No 1

Description:

General view of workshops beyond the northern boundary

Direction:
Looking NW

Date:
June 2021

Photo No 2

Description:

General view of workshops beyond the northern boundary

Direction:
Looking NW

Date:
June 2021

Site & Location	One YMCA 90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL	Report No: 10637/AOC

Site photographs

Photo No 3

Description:

General view of residential area to the east of the site

Direction:
Looking NNE

Date:
June 2021

Photo No 4

Description:

View from Peartree Lane of Flats and wooded area

Direction:
Looking NW

Date:
June 2021

Site & Location	One YMCA 90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL	Report No: 10637/AOC

Site photographs

Photo No 5

Description:

View of road maintenance contractors yard

Direction:
Looking W

Date:
June 2021

Photo No 6

Description:

View of road maintenance contractors yard

Direction:
Looking W

Date:
June 2021

Site & Location	One YMCA 90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL	Report No: 10637/AOC

Site photographs

Photo No 7

Description:

General view of YMCA Buildings and car park

Direction:
Looking NW

Date:
June 2021

Photo No 8

Description:

View from courtyard towards western boundary (retaining wall in middle distance)

Direction:
Looking NNW

Date:
June 2021

Site & Location	Report No:
One YMCA **90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL**	**10637/AOC**

Site photographs

Photo No 9

Description:

General view of northern rectangular block

Direction:
Looking NW

Date:
June 2021

Photo No 10

Description:

View along western boundary; battered slope and retaining wall in distance

Direction:
Looking NNE

Date:
June 2021

Site & Location	One YMCA 90 Peartree Lane, Welwyn Garden City, Hertfordshire AL7 3UL	Report No: 10637/AOC

Site photographs

Photo No 11

Description:

General view of central courtyard

Direction:
Looking W

Date:
June 2021

Photo No 12

Description:

Outbuilding / Store in north eastern corner of car park

Direction:
Looking N

Date:
June 2021