S10 Geo-Consulting

Geotechnical & Geo-environmental Ground Investigation

Report prepared for
Leach Pottery
Higher Stennack
St Ives
Cornwall
TR26 2HE

For
Bernard Leach (St Ives) Trust Ltd

Report reference
22-137

Report date
26th October 2022

Prepared by
S10 Geo-Consulting Limited
Consulting Engineering Geologist & Geo-Environmental Engineer

Report Quality Management

Project Name	Leach Pottery, Higher Stennack, St Ives, Cornwall, TR26 2HE		
Project Title	Ground Investigation Report		
Project reference	22-137		
Client	Bernard Leach (St Ives) Trust Ltd		
Version	Issue 1		
Prepared & checked by	Simon A Wilkinson BSc(Geol) FGS	Geologist & Director	26th October 2022

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EXECUTIVE SUMMARY

PHASE 1: DESK STUDY AND WALK-OVER		
Current Land Use	Commercial – Leach Pottery premises	
Site History / Historic Land Use	Commercial & residential land use; historic mining legacy in the wider area may bear some influence upon the site in terms of made ground	
Proposed Land Use / Development	Commercial: new production space, learning studio & café incl. refurbishment / redevelopment of existing buildings incl. surrounding infrastructure	
Unexploded Ordnance	Low risk – no action required	
Geology	MRSL – Mylor Slate Formation; overlying superficial alluvial soils associated with the adjacent Stennack River	
Hydrogeology / Hydrology	Secondary A Aquifers; adjacent Stennack River (southeast boundary); no known nearby surface/groundwater abstractors; Site not in SPZ	
Preliminary Contamination Risk Assessment	Potential risks arising from: • general near-surface made ground • potentially thick mantle of made ground (both on-site & off-site) associated with historic mining legacy of the area, representing possible source of contamination and landfill-type gases • bedrock geology representing potential source of radon gas	
PHASE 2: GROUND INVESTIGATION		
Scope of Intrusive Investigation	The ground investigation comprised: • 4 window sample boreholes to a maximum depth of 5.45m bgl • 2 dynamic probe holes to establish the deeper ground profile – up to 10m depth • 6 manually-excavated trial pits to establish the foundation profiles of existing buildings	
Ground Conditions Encountered	Topsoil / made ground (up to 2.26m) over probable made ground (up to 2.56m) over superficial alluvium (variable silt/clay/sand up to c3.3-3.5m) over highly weathered mantle of the MRSL (as per Geological Mapping), comprising silty clay Despite the presence of made ground, no visual or olfactory evidence of significant contamination was noted during the site works	
	Groundwater:	Despite a wet horizon in WS1/2.62m, all other exploratory holes were recorded as dry upon completion Post-investigation monitoring in WS1 and WS2 also recorded dry conditions
	Roots / Desiccation:	Roots: 0.26m – 1.1m across the site Desiccation: none identified
GEO-ENVIRONMENTAL ASSESSMENT		
Conclusions of Contamination Risk Assessment	**Human Health:**	• No risk identified from laboratory testing
	Controlled Waters:	• Leachate analysis has recorded mild elevations of arsenic, nickel, copper and zinc in made ground at WS4/1.0m (area of proposed soakaway construction). Whilst there could theoretically be a perceived risk to controlled waters (secondary A aquifer and adjacent Stennack River), given the existing/proposed predominance of impermeable hardstand and that the offending made ground beneath the site will differ little to that beneath the wider region outside the site, pre-construction remedial measures in respect of controlled waters are therefore considered unnecessary. However, the siting of soakaways in made ground material should be avoided in order to mitigate risk of unacceptable leachate generation and impaction of groundwater / nearby surface waters.
	Plant Growth:	• No risk identified
	Radon:	• Public Health England UK Radon mapping indicates probability of 10-30% that the Site is above the Action Level and therefore full radon protection measures will be required. It is recommended that local Building Control be consulted to confirm this and to establish specific scope of protection measures required
	Landfill /Ground Gas:	• No risk identified based upon single round of gas monitoring (during a period of favourable falling atmospheric pressure)
	Water Supply Pipes:	• No risk identified
Proposed Remedial/Mitigation Measures	Radon protection measures – specific scope to be determined by local Building Control department The siting of soakaways in made ground material should be avoided in order to mitigate risk of unacceptable leachate generation and impaction of groundwater / nearby surface waters	
GEOTECHNICAL CONCLUSIONS		
Foundations	Strip, pad, raft and pile foundations considered as part of a preliminary appraisal. However, the thickness of loose & locally unstable made ground (up to 2.56m) as well as locally soft underlying alluvial soils (up to c3.5m depth) renders strip, pad & raft foundations unsuitable at this site Mini-pile foundations are therefore recommended as the most viable founding solution, whereby building loads would be transferred into the competent, highly weathered mantle of the MRSL at depth; investigation findings should be provided to a specialist piling contractor for their design	
Floor Slabs	Suspended floor slabs, supported upon the pile cap ring beam	
Soakaways	Whilst soakaway testing at the stipulated location in the centre of the site (WS4) has shown the ground (made ground mantle) to be favorable in terms of infiltration potential, contamination leachate testing has shown that transmission of water through the mantle of made ground could generate arsenic, nickel, copper and zinc leachate, which could pose an unacceptable risk of impaction to groundwater / nearby surface waters.	

	It is recommended therefore that the siting of soakaways in the mantle of made ground be avoided. Alternative measures are therefore discussed in Section 5.
Buried Concrete	Design Sulphate Class DS - 1 and ACEC Class AC – 1 suitable for proposed foundations
FUTURE CONSIDERATIONS	
Uncertainties and Limitations	Subsurface conditions including ground contamination may vary spatially and with time Recommendations made in respect of land quality do not address any potential risks to site operatives or ground workers during the construction stage The groundwater table is subject to seasonal variation, dependent on the prevailing weather conditions Additional assessment may be necessary should a significant delay occur between report date and implementation of the proposed scheme to which it relates
Further Works	The following further works will be required: • Discussions with LA Building Control to confirm the level/scope of radon protection measures required; • Discussion with service providers regarding the materials suitable for water supply pipework etc; • Discussions with LA regulatory bodies and/or warranty providers regarding the conclusions of this report incl. remediation recommendations • Design of drainage strategy (by others) for surface water runoff • Detailed design of foundations (by others)

This Executive Summary forms part of S10 Geo-Consulting Limited report No.22-137 (issue 1), dated 26th October 2022 and should not be used as a separate document

1.0 PROJECT AND SITE INFORMATION

1.1 APPOINTMENT

S10 Geo-Consulting Limited (S10) was instructed by Bernard Leach (St Ives) Trust Ltd (the "Client") to carry out a ground investigation at the following premises:

Leach Pottery, Higher Stennack, St Ives, Cornwall, TR26 2HE (hereafter referred to as the "Site").

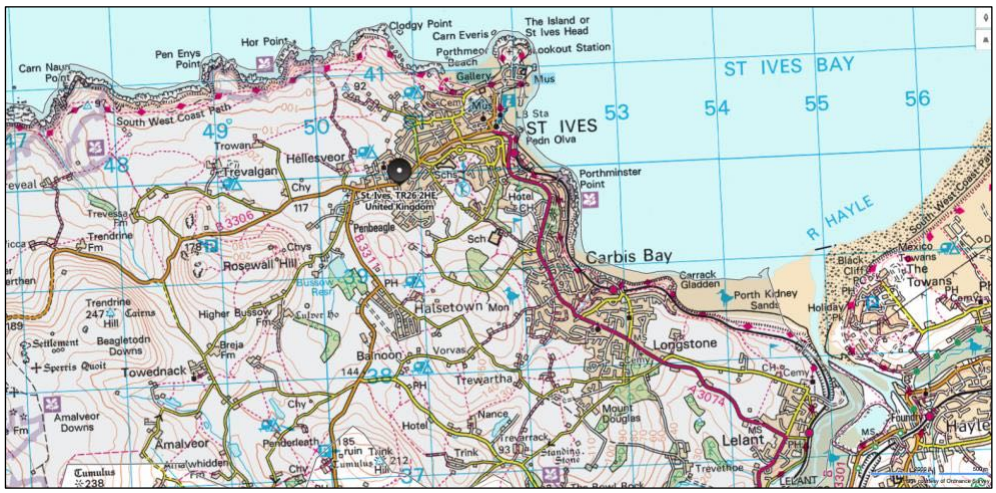
The purpose of this assessment is to report on a ground investigation, itself designed to assess the Site's historical usage and geological setting and to ascertain the ground conditions in order to inform an appraisal of suitable founding options, as well as undertake a detailed quantitative contamination risk assessment. An assessment of the infiltration potential of the ground has also been carried out.

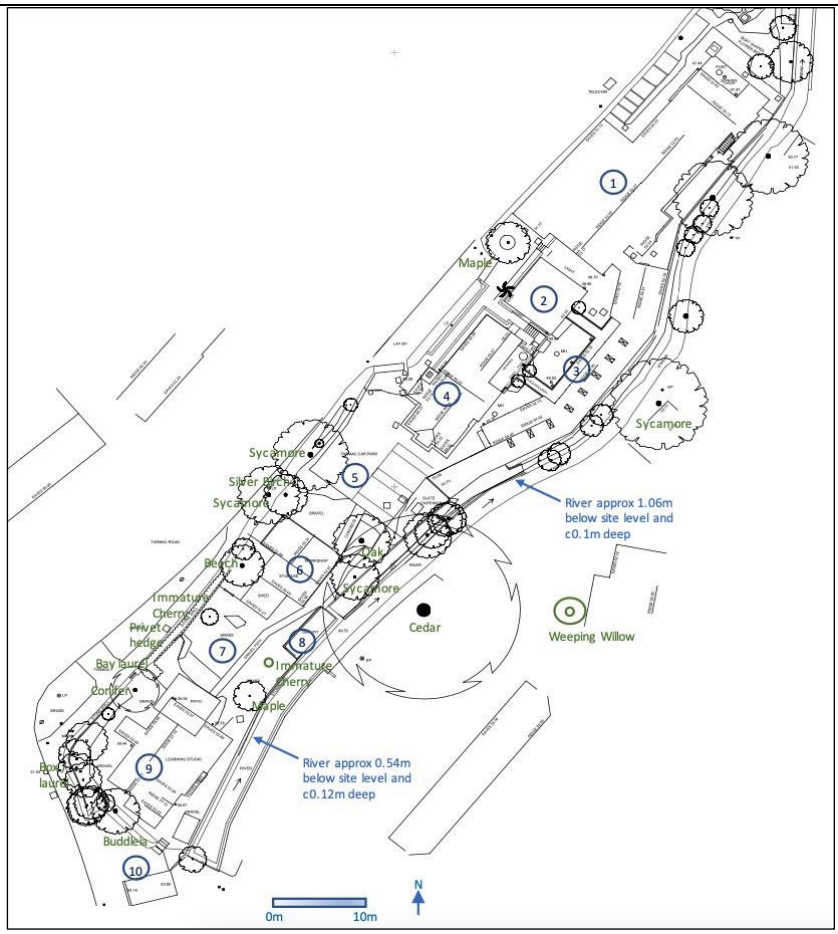
This report has been prepared in line with the agreed scope of works as set out within S10 quotation reference Q22-137 dated 5th August 2022, with e-mail instruction from Josh Yarien at Momentum Engineering, acting on behalf of the Client, received on 23rd August. Reliance on this report is granted to the Client only.

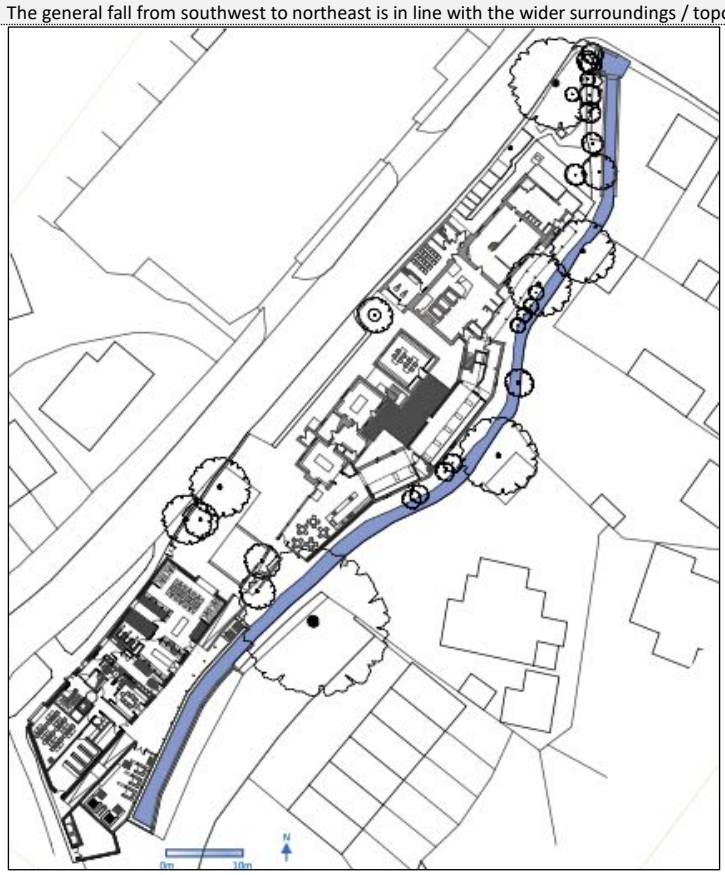
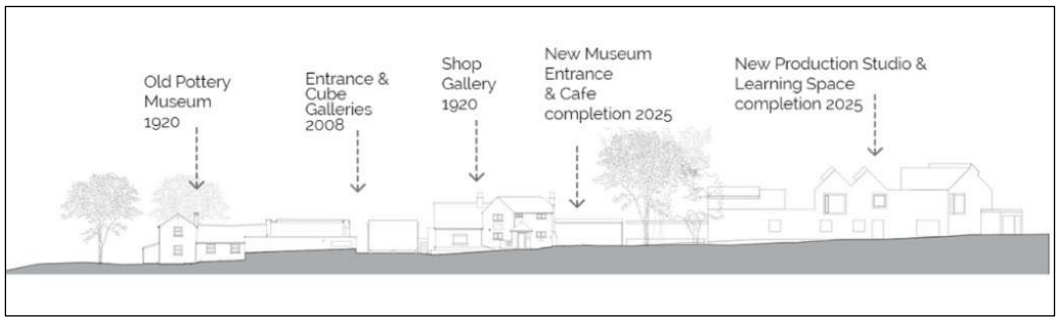
1.2 THE SITE

Table 1.2 below provides a summary of Site details and the surrounding area.

Table 1.2 – Site Details

Site Location	 FIG 1.2a: SITE LOCATION – based upon Bing Maps extract, Copyright 2020 TomTom & 2021 Microsoft
	The Site is located approximately 1.1km WSW of St Ives town centre as shown in Fig 1.2a above.
National Grid Ref.	Centred on National Grid Reference 150840, 39920

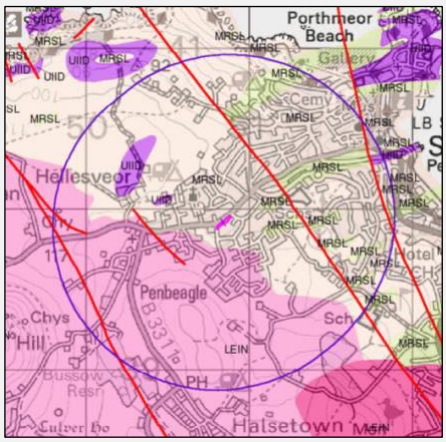
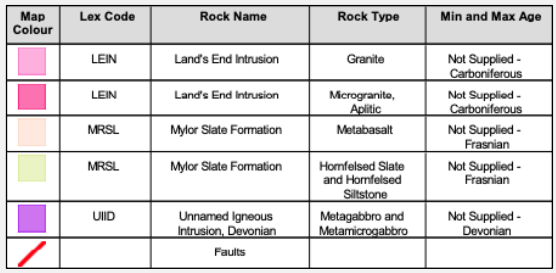
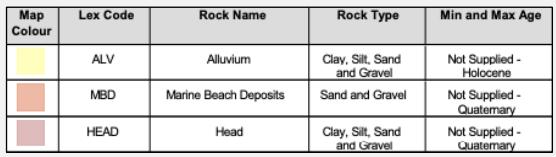
Site Description & Current Land Use	 **FIG 1.2b: EXISTING SITE LAYOUT – based upon Dow Jones Architects Drg No. 488-01-050, dated Feb 22; Scale: as shown** The Site comprises Leach Pottery, a 100 year old pottery including clay room, throwing room, workshops, kilns, museum, galleries and shop. Access can be gained mid-way along the northwest boundary from Higher Stennack (road), itself forming the NW site boundary, whilst the Stennack River forms the SE & NE boundaries. Penbeagle Lane forms the SW site boundary. A site reconnaissance was carried out on 15th September 2022 which identified the following pertinent buildings/features. 1. Original pottery building (1920s) including later museum addition. Two-storey part-rendered stone construction with slate roof tiles and plastic rainwater goods. 2. Single-storey Cube gallery (2008) adjacent to museum entrance. 3. Workshop space with raised wooden walkway connecting to gallery and shop. Single-storey timber frame, cladding & roof construction incl. galvanised rainwater goods around central gravel-surfaced courtyard. 4. Shop & gallery (1920s building). Two-storey rendered stone building with slate roof tiles and plastic rainwater goods. 1st floor of building dedicated to office space. 5. Part tarmac, part gravel-surfaced car park. 6. Single-storey wooden-framed & clad pottery workshop incl. gas-fired kilns. 7. Outdoor grass-surfaced garden incl. picnic benches. 8. Covered area incl. pottery-clay storage and external gas-fired kilns. 9. Learning studio/classroom. Two-storey rendered stone construction with slate roof tiles and plastic rainwater goods. 10. Single-storey, flat-roof (felt) garage of presumed brick / blockwork construction. Unable to access. A number of photographs are presented in Appendix 1, along with a plan showing their positions and orientations. It is worthy of note at this point that there was no obvious visual and/or malodourous evidence of contamination within or surrounding the Site.
Surrounding Land Use	Residential & commercial
Trees	The Site is bordered by a small number of trees (refer to Fig 1.2b), including but not limited to sycamore, oak, cherry, maple, cedar, beech, privet, conifer, laurel and silver birch. Note that identification is based upon what was visible at the time of site inspection; it would be prudent to have trees accurately identified by a qualified arboriculturist.
Ground Levels	Topographical data provided by the project Architect records a site elevation of 49.3m above Ordnance datum (AOD) at the central-western part of the site (proximal to the site entrance), falling gently to the northeast (47.5m AOD at the northern elevation of the original 1920s pottery building), and rising to the southwest (c51m AOD in the road proximal to the single

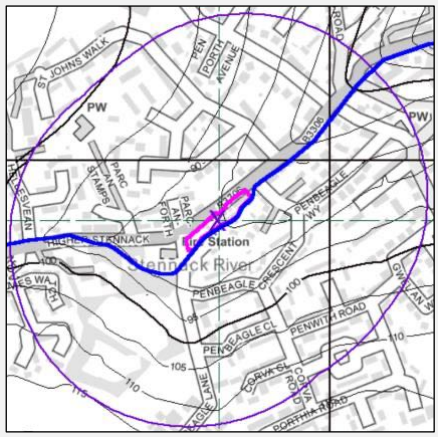
	garage). The Stennack River course, itself coincident with the south-eastern site boundary, resides at approximately 0.54m below site level in the south, and c1.06m below site level in the central part of the site. The general fall from southwest to northeast is in line with the wider surroundings / topography.
Proposed Development / Land Use	 **Fig 1.2e: PROPOSED DEVELOPMENT LAYOUT based upon Dow Jones Architects Drg No. 488-00-050, dated June 22; Scale: as shown**  Proposed development is concentrated in the central and southern parts of the site. Following demolition of the existing learning studio, it is proposed to construct a new production studio and learning space, whilst a new museum entrance and café are proposed to the rear (east) of the existing car park area in the centre of the site. Proposals also include expansion of the raised walkway to include decking over the entirety of the gravel-surfaced courtyard.

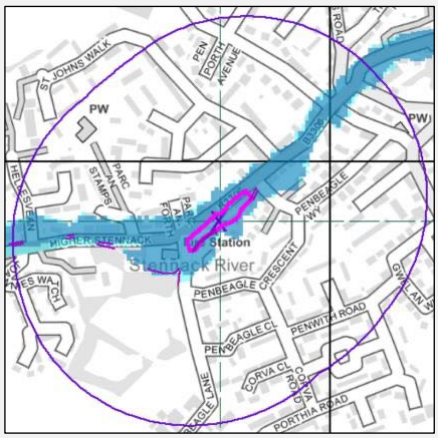
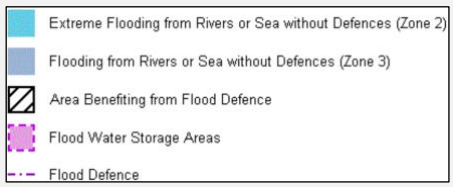
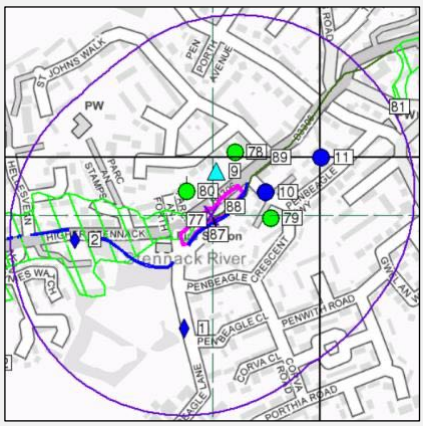
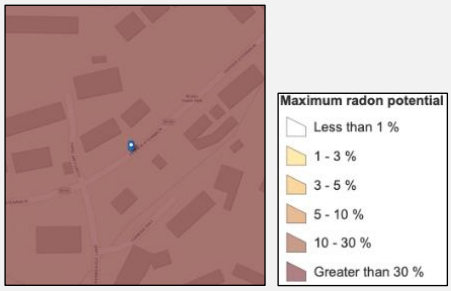
1.3 DESK STUDY RESEARCHES

1.3.1 Summary Findings

Table 1.3.1: Summary Geo-environmental Search Results

Item	Site Affected?	Abnormals for development?
Bedrock geology & Faulting	 Mylor Slate Formation – (MRSL) generally comprising dark grey, locally green-grey slates, interbedded with thin bands and laminae of sandstone, siltstone, basic lavas and sedimentary breccias (the latter are particularly significant in the upper 500m of the formation). Numerous geological faults mapped in the area, though none through the site. The site lies in an area dominated by historic tin and copper ore mining, specifically tin ore mining as part of the St Ives Consols mine, although no actual shafts are recorded on-site or within influencing distance of the site boundary; depth to worked ore seams >100m below ground level	 Any clay/silt beds in the highly weathered mantle of the MRSL may be shrinkable and could therefore influence founding depth in the proximity of surrounding trees Historic mining-related risk – refer to Wheal Jane Consultancy Desktop Mining Search (Appendix 7)
Superficial deposits	 Alluvium mapped coincident with the Stennack River course, likely to underlie the site	 Alluvial clays/silts have the potential to be soft and shrinkable
Artificial Ground and Landslip	No made ground or landslip terrain mapped within influencing distance of the site	No abnormals However, given the developed nature of the site, made ground associated with recent/historic anthropological influence should not be discounted. This may well include made ground / spoil derived from historic tin-ore mining operations.

BGS Borehole Records	No nearby pertinent BGS borehole records	No abnormals
Envirocheck Mining & Ground Stability Search Results	• Not located in a coal mining affected area, although it is located in an area affected by historic tin and copper mining; no actual shafts recorded on-site or within influencing distance; depth to worked ore seams >100m below ground level • Closest man-made mining cavity recorded 90m NW (mineshaft), although other mineshafts recorded 39m E and 53m E, with the Cornish Shaft located 61m NW • Site lies in the St Ives Consols mining area, which ceased operation in 1882 (tin ore) • No nearby natural cavities • Not located within the brine compensation district • Closest extractive industry or potential excavation relates to St Ives Consols Mine (tin) from 1855 to 1909 upon land extending to the immediate west of the site; includes unspecified deposited material 47m NW • Potential for collapsible ground stability hazards = very low / no hazard • Potential for compressible ground stability hazards = moderate (likely attributable to potentially soft alluvial material) • Potential for ground dissolution stability hazards = no hazard • Potential for landslide ground stability hazards = very low • Potential for running sand ground stability hazards = low • Potential for shrinking/swelling clay ground stability hazards = very low	Historic mining-related risk – refer to Wheal Jane Consultancy Desktop Mining Search (Appendix 7) Enquiries also made to Ove Arup & Partners, British Geological Survey & Stantec UK Ltd for further mining-related instability data. Only Ove Arup & Partners responded, although they hold no pertinent data for the site The highly weathered mantle of the MRSL bedrock material, as well as superficial alluvial soils, may be shrinkable; in addition to presence / proximity of nearby trees, such soils may therefore influence founding depths for new development
Hydrogeology	MRSL & Alluvium - Secondary A Aquifers No nearby groundwater abstractors	Comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers
Hydrology	 Closest surface water feature = Stennack River coincident with the SE site boundary; no GQA Grade river quality data available for this water course River is culverted upstream (southwest) and downstream (northeast) of the site No known nearby surface water abstractors	No abnormals
Groundwater Source Protection Zone	No	No abnormals

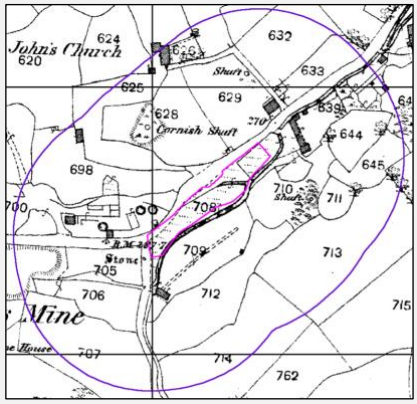
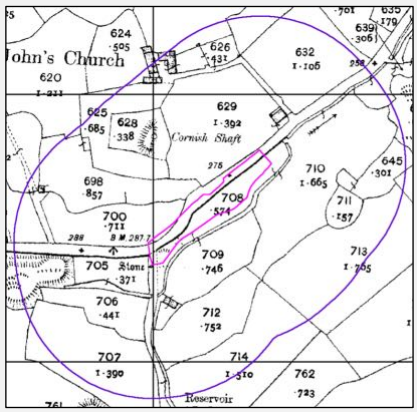
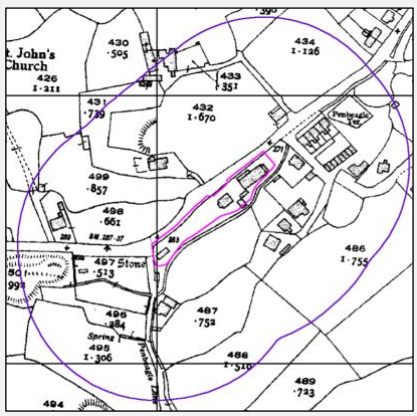
Groundwater vulnerability	High (by virtue of well-connected fractures in bedrock)	Potential transmission of contaminants through the ground
Flooding Potential Susceptibility	 Yes – site lies in area where there is the potential for flooding to occur at surface (area is coincident with Stennack River course)	 Potential flood risk
Recorded landfills <250m and/or Waste Management Facilities	No Closest is Hellesveor historic landfill 487m to the west (last input January 1985; permitted to accept inert, industrial, commercial & household waste) Closest licensed waste management facility located at Penbeagle Industrial Estate 373m to the south	No abnormals
Historic quarries etc	 Large swathe of ground extending to the west of the site recorded as potentially infilled land (green-hatched; unknown filled ground – associated with historic mining legacy) Historic mineshafts (green circles) also shown as potentially infilled land Culverted section of the Stennack River extending to the northeast of the site recorded as potentially infilled land	 Infilled / made-up ground could extend onto the site Potentially thick made ground on-site / off-site could represent potential source of migrating landfill type gas, as well as source of potential contamination
Radon affected	 Yes	Public Health England UK Radon mapping indicates that the site lies in an area where the probability that the Site is above the Action Level is 10-30%; full radon protection measures will therefore be required in new buildings / extensions. It is recommended that local Building Control be consulted to confirm this and to establish specific scope of protection measures required

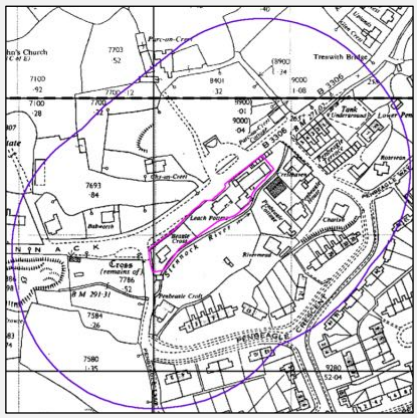
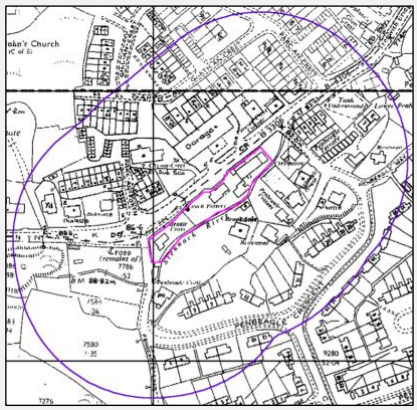
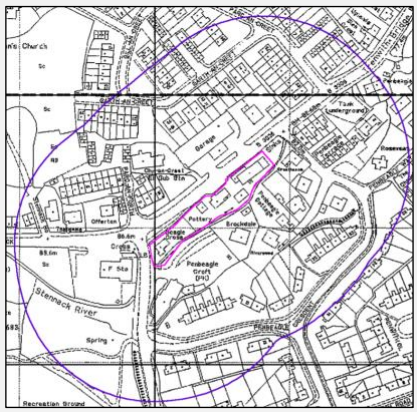
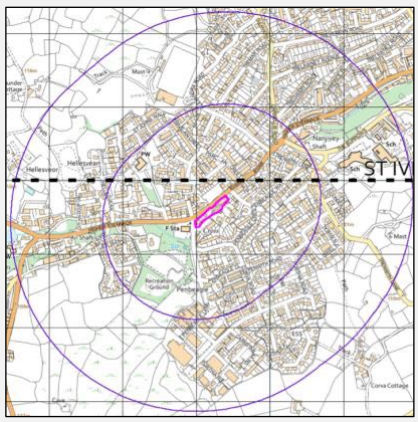
UXO risk	Review of Zetica regional mapping indicates low risk of UXO incidence, suggesting no apparent requirement for progression to a more-detailed assessment	No abnormals
Environmentally sensitive	Environmentally sensitive area 165m south Area Of Outstanding Natural beauty 318m NW Local Nature Reserve 931m SE SSSI 908m north	No abnormals
Surrounding Land Use	Residential & commercial	No abnormals
Estimated Soil Chemistry (Landmark Info)	Arsenic 35-45mg/kg Cadmium <1.8mg/kg Chromium 40-60mg/kg & 60-90mg/kg Lead 200-300mg/kg Nickel 15-30mg/kg	Potentially naturally elevated arsenic and lead concentrations within near-surface ground
Supplementary Envirocheck Searches (<250m)	• No contaminated land register entries/notices • No integrated pollution prevention & controls • Closest pollution incidents to controlled waters recorded 32m NE in August 1991 when an unspecified pollutant was deliberately released into a freshwater stream/river from the public highway • No registered radioactive substances • No Control of Major Accident Hazards (COMAH) sites • No explosive sites • No Notification of Installations Handling Hazardous Substances(NIHHS) • Closest contemporary trade directory entry – onsite Leach Pottery • No fuel station entries; Parc An Creet Garage (fuel filling station incl. repair garage) formerly occupied land 34m north of the site • No nearby, active discharge consents	No

1.3.2 Site History

A selection of relevant historical Ordnance Survey map extracts is presented in Table 1.3.2 below alongside a summary of relevant points of interest that may affect or be affected by the proposed development.

Table 1.3.2: Summary of Site History

Date (Source Map Scale)	OS Map Extract (NTS)	On-Site Features	Off-Site Features
1877 1:2,500		Site comprises unoccupied, elongate plot of rough grassland; partially truncated by channel feeding the Stennack River (east) in the northern half	Immediate E/SE – Stennack River Immediate W/NW – unnamed road (later identified as Higher Stennack) 47m E – mine shaft 50m N – mine shaft 63m NW – mine shaft (Cornish Shaft) 110m W – Stamps Plot Shaft 150m SW – St Ives Consols (tin) Mine incl. engine house (extends to the west)
		Potential Contaminants with Potential To affect Site: Toxic and phytotoxic metals, PAH **Likelihood of Site Impact:** Low	
1908 1:2,500		Channel feeding the Stennack River no longer present	47m E – mine shaft no longer present 50m N – mine shaft no longer present 150m W – St Ives Consols Mine noted as disused 150m S - Reservoir
		Potential Contaminants with Potential To affect Site: As above incl. landfill-type gases derived from potential on-site water channel infill & off-site mine shaft infill **Likelihood of Site Impact:** Moderate	
1936 1:2,500		Buildings constructed in northern half of the site (constituting Leach Pottery) Smaller building constructed in SW corner of the site (unknown usage)	63m N – Cornish Shaft no longer present 110m W – Stamps Plot Shaft no longer present 17m NE – Stennack River partially culverted below newly constructed road/houses (Penbeagle Terrace) 30m SE – new houses constructed 62m W – remnant soil heaps from disused St Ives Consols Mine
		Potential Contaminants with Potential To affect Site: As above **Likelihood of Site Impact:** Moderate	

Date (Source Map Scale)	OS Map Extract (NTS)	On-Site Features	Off-Site Features
1964-1964 1:2,500		Buildings in northern half of site identified as Leach Pottery; some buildings locally extended Building in SW corner extended and identified as Beagle Cross (residence)	111m W – works (unidentified) incl. surrounding residential development (Hellesvean Estate) Extensive residential expansion to the E and S of the site
		Potential Contaminants with Potential To affect Site: As above, possibly including asbestos containing material (ACM) in site buildings / extensions / renovations **Likelihood of Site Impact:** Moderate	
1978 1:2,500		No significant change	25m NW – garage premises, possibly including forecourt Extensive residential expansion to the N and NE of the site
		Potential Contaminants with Potential To affect Site: As above, possibly including hydrocarbons from off-site garage premises **Likelihood of Site Impact:** Moderate	
1995 1:2,500		Addition of small building in central-western part of site (existing car park area)	15m SW – fire station
		Potential Contaminants with Potential To affect Site: As above **Likelihood of Site Impact:** Moderate	
2021 1:10,000 and site walkover		Expansion of Leach Pottery – elongate timber workshop incl. raised walkways in the central-eastern part of the site, and small workshop to the SW of the car park; inclusion of Beagle Cross (former residence) as part of the Leach Pottery premises – learning workshop	25m NW – garage no longer present; site recently cleared and currently being redeveloped for housing (flats) Continued residential expansion to the N, NW, NE and S of the site
		Potential Contaminants with Potential To affect Site: As above, possibly including TPH from vehicle leaks in car park area of the site **Likelihood of Site Impact:** Moderate	

Note that, since Ordnance Survey plans only represent periodic snapshots in time, and do not provide a continuous record of previous Site usage, there is a potential risk that the Site may contain buried remnant foundations of former buildings or waste products associated with unrecorded previous site usage, which may not be evident from the site walkover inspection and desk study researches.

1.3.3 Desk Study Review

In conclusion, given the existing/historic occupancy of the Site as a commercial pottery premises including former residence (Beagle Cross in the SW corner of the site – building now used as learning studio) the potential future risk to human health and/or controlled waters arising from the proposed site redevelopment is generally considered to be low. However, historical Ordnance Survey mapping has shown that the site and immediate surrounding area is likely to have been affected by the historic mining legacy of the region (St Ives Consols Tin Mine); whilst actual mine subsidence risk is highly unlikely (refer to Wheal Jane Consultancy Desktop Mining Search in Appendix 7), the presence of 'general' made ground / spoil arising from historic anthropological actions should be considered as part of any risk assessment. This should include consideration of any landfill-type gas generation / migration arising from potentially deep made ground (possibly on-site/off-site) and off-site infilled mineshafts.

2.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

2.1 METHODOLOGY

The geo-environmental assessment comprising Phase 1 desk study followed by Phase 2 testing and quantitative contamination risk assessment has been carried out in accordance with BS10175:2011 "Code of Practice for the Investigation of Potentially Contaminated Sites" and EA document Land Contamination Risk Management (LCRM), which replaces the outgoing CLR 11 "Model Procedures for the Management of Land Contamination". Based upon the proposed commercial end use for the Site, the critical receptor is identified as a female of working age, aged 16+, and the assessment has been progressed on this basis.

The Site and its immediate surroundings have been assessed in terms of historical and current land use together with the environmental, geological and hydrogeological setting, the findings of which have been used to identify the following potential sources and principal contaminants of concern.

Table 2.1: Potential Sources & Principal Contaminants of Concern

Potential Sources		Principal Contaminants of Concern
ON-SITE	General near surface made ground / topsoil	Toxic and phytotoxic metals, hydrocarbons (PAH & possibly TPH compounds), asbestos
	Thick made ground (potentially infilled ground associated with historic mining legacy of the area)	Landfill-type gases; elevated metals concentrations
	Bedrock Geology	Radon gas
OFF-SITE	Made ground (potentially infilled ground associated with historic mining legacy of the area)	Landfill-type gases
	Former fuel station premises located 34m north	Hydrocarbons *Risk sensibly discounted by virtue of distance & topography – ground level falls to the NE, therefore any contaminants in the ground would sensibly migrate in that direction. Site also currently undergoing residential redevelopment – any old underground fuel storage tanks (USTs) and hydrocarbon-impacted ground, if/where present, likely to have been removed*

2.2 PRELIMINARY CONCEPTUAL SITE MODEL

The resulting preliminary Conceptual Site Model is presented in Figure 2.2 below and illustrates how the presence of principal contaminants of concern, if proven, can be translated into potential pollutant linkages to future site users and local environmental receptors such as groundwater. The potential pollutant linkages are shown in Table 2.2 below.

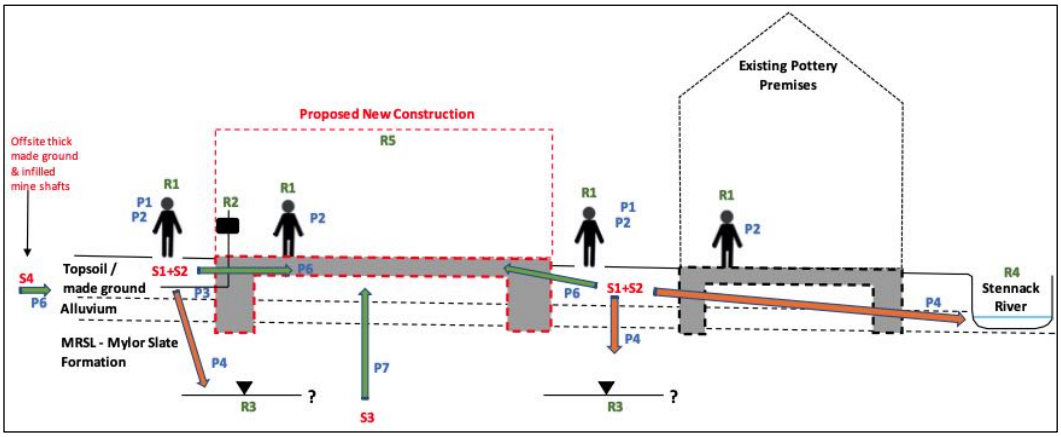


Fig 2.2: Preliminary Conceptual Site Model (NTS)

Table 2.2: Summary of Potential Pollutant Linkages

Potential Sources	Pathways	Receptors						Comments	Preliminary Risk Assessment
		R1	R2	R3	R4	R5	R6		
ON SITE									
S1	**P1**	X						Commercial development - greatest risk in areas of proposed soft landscaping, if/where proposed	Low
	P2	X					X		
	P3		X						
	P4			X	X				
	P5								
	P6								
	P7								
S2	**P1**	X						Commercial development - greatest risk in areas of proposed soft landscaping Thick made ground may also represent a potential source of landfill-type gases, for which gas protection measures may be necessary in new buildings / extensions	Moderate
	P2	X					X		
	P3		X						
	P4			X	X				
	P5								
	P6	X				X			
	P7								
S3	**P1**							Bedrock geology representing potential source of radon gas Public Health England UK Radon mapping indicates that the site lies in an area where the probability that the Site is above the Action Level is 10-30%; full radon protection measures will therefore be required in new buildings / extensions	High
	P2								
	P3								
	P4								
	P5								
	P6								
	P7	X				X			
OFF SITE									
S4	**P1**							Thick made ground may represent a potential source of landfill-type gases, which could migrate into the site Gas protection measures may be necessary in new buildings / extensions	Moderate
	P2								
	P3								
	P4								
	P5								
	P6	X				X			
	P7								
SOURCES	**S1**	General near surface made ground/topsoil							
	S2	On-site thick made ground associated with historic mining legacy of the area							
	S3	Bedrock geology representing potential source of radon gas							
	S4	Off-site thick made ground associated with historic mining legacy of the area							
PATHWAYS	**P1**	Direct dermal contact or ingestion							
	P2	Inhalation of dust and vapours							
	P3	Permeation into new water supply pipework							
	P4	Vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone							
	P5	Direct contact with high sulphate-bearing clay							
	P6	Landfill gas migration through unsaturated zone and accumulation within confined spaces							
	P7	Radon gas migration through unsaturated zone and accumulation within confined spaces							
RECEPTORS	**R1**	Future site users							
	R2	Potable water supply							
	R3	Groundwater (MRSL & alluvium classified as a 'Secondary A' aquifers)							
	R4	Surface waters (closest is Stennack River coincident with SE site boundary)							
	R5	Proposed site buildings incl. concrete foundations							
	R6	Adjacent site occupants / users							

2.3 INVESTIGATION OBJECTIVES

Given the above and preceding discussions, intrusive ground investigation has been undertaken with the following objectives:

- Assess the ground conditions and determine the potential for land contamination, taking due consideration of former/existing site usage as well as the proposed site layout
- Use results as part of risk assessment modelling to determine levels of risk to future site users, groundwater quality and proposed buildings/infrastructure
- Evaluate ground conditions including geotechnical properties & groundwater levels (if applicable) to provide recommendations for appropriate foundations design
- Carry out soakaway testing to establish the infiltration potential of the ground

3.0 GROUND INVESTIGATION

3.1 METHOD STATEMENT & INVESTIGATION APPROACH

A method statement detailing how the Site investigation work was to be conducted was produced in accordance with current statutory guidance and best practice. In addition, a desk-based risk assessment was completed before site work commenced; this was reviewed on-site with contractors, who were briefed on the potential risks/hazards, and the appropriate personal protective equipment (PPE) to be adopted for this type of investigation.

This geotechnical investigation was conducted in general accordance with the requirements of Eurocode 7 'Geotechnical Design', in particular BS EN 1997-1:2004 and BS EN 1997-2:2007 and BS EN ISO 14688-1:2002 and 14688-2:2004. Reference has also been made to BS5930:2015 Code of Practice for Ground Investigation, and NHBC Standards Chapter 4.2 – 'Building Near Trees'.

The proposed development is considered to fall into the Geotechnical Category 2 classification, thus routine field and laboratory testing methods have been adopted.

This geo-environmental assessment has been carried out in accordance with BS10175:2011 "Code of Practice for the Investigation of Potentially Contaminated Sites" and EA document Land Contamination Risk Management (LCRM), which replaces the outgoing CLR 11 "Model Procedures for the Management of Land Contamination".

The investigation focused upon the objectives as set out in Section 2.3, and was completed on 16th September 2022.

3.2 SITE INVESTIGATION

3.2.1 Buried Services Avoidance

In addition to buried services records provided by the project architect and structural engineer, statutory buried services plans were reviewed in advance of attending site; all exploratory holes were sited to avoid possible buried services positions, and were checked on site with a Cable Avoidance Tool (CAT). Where possible, manholes were also traced; no buried services were encountered.

3.2.2 Borehole Drilling, Trial Pitting (manual) and Infiltration Testing: 15th & 16th September 2022

Intrusive investigation was undertaken using a combination of manual-excavation and borehole-drilling techniques. The number and location of all exploratory hole positions were predetermined by the project structural engineer, with the majority of the trial pits sited in order to establish the foundation profiles of the existing buildings. Positions were marked out on site using on and off-site reference points; their positions are indicated on drawing 3.2.2 below.

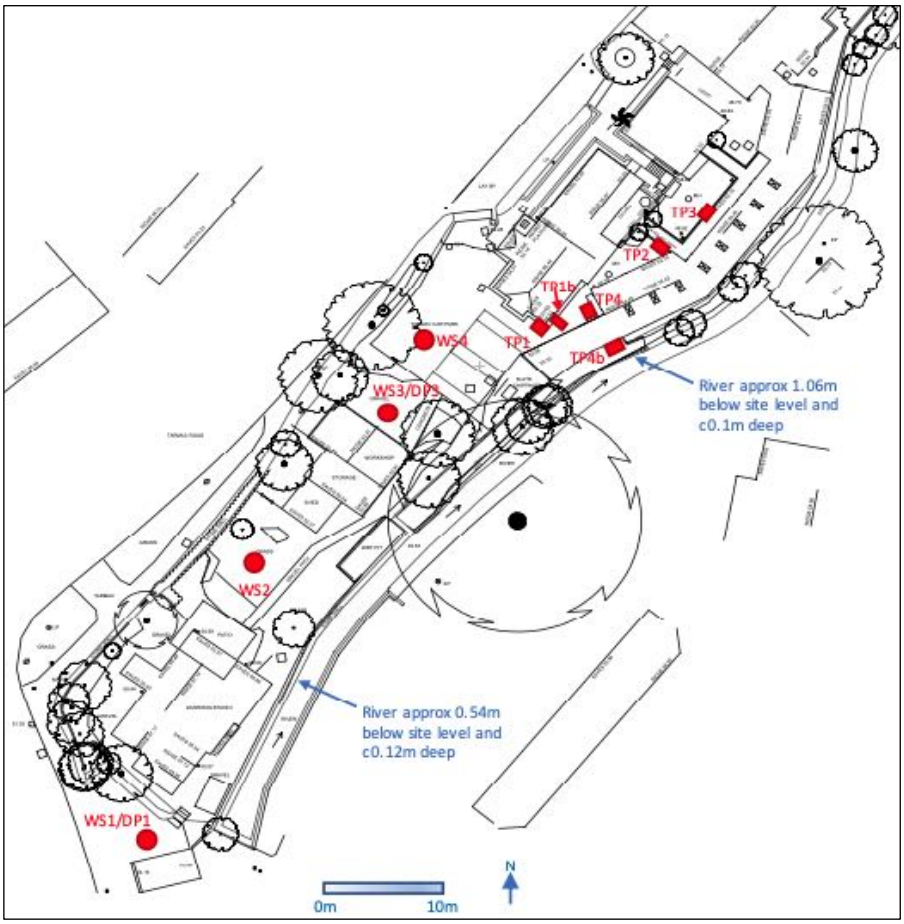


Fig 3.2.2: EXISTING SITE LAYOUT [based upon Dow Jones Architects Drg No. 488-01-050, dated Feb 22; Scale: as shown] SHOWING EXPLORATORY HOLE POSITIONS

Four windowless-sample boreholes (WS1 – WS4) were drilled to depths of up to 5.45mbgl using an Archway Dart window-sampling rig, supplemented by two dynamic probe holes (DP1 – DP2), used to establish the deeper ground profile (though without sample retrieval) up to 10m depth. The boreholes were logged by an engineering geologist from this practice in accordance with Eurocode 7 (BS EN ISO 14688-1:2002 and 14688-2:2004), and representative samples taken for geotechnical and geo-environmental testing as appropriate. In order to assess the relative density of the material penetrated, in-situ standard penetration tests (SPTs) were carried out in all boreholes at 1m depth increments, and the resulting N values (uncorrected) are indicated on the respective borehole logs. Borehole WS4 was used to establish the infiltration potential of the ground; results are presented in Appendix 3 and discussed in Section 5 of this report. Following completion of logging and sampling all boreholes were backfilled with compacted arisings and surface soils replaced to make good.

Boreholes were supplemented by six manually-excavated trial pits (TP1 – TP4b) used to establish near-surface ground conditions and expose the foundations of the existing buildings, as well as obtain samples for contamination analysis, thereby providing good overall site coverage. Foundation profiles are presented upon the respective trial pit logs, to which reference should be made. The full depth of the foundations was not proven in all cases, and therefore where possible, additional pits were excavated to glean further information (TP1b & TP4b). The main limiting factor in proving founding depths was the presence of a thick layer of concrete beneath a large proportion of the site around/between the existing buildings (encountered in TP2 – TP4); in TP3 the concrete was core-drilled as far as possible, though could not be penetrated beyond 0.28m.

A detailed description of all the strata encountered, position and types of samples taken and any groundwater observations are included on the exploratory hole logs presented in Appendix 2, whilst a summary table of observed strata is presented below. The results of geotechnical laboratory analysis upon selected samples are presented in the subsequent tables.

3.3 GROUND CONDITIONS

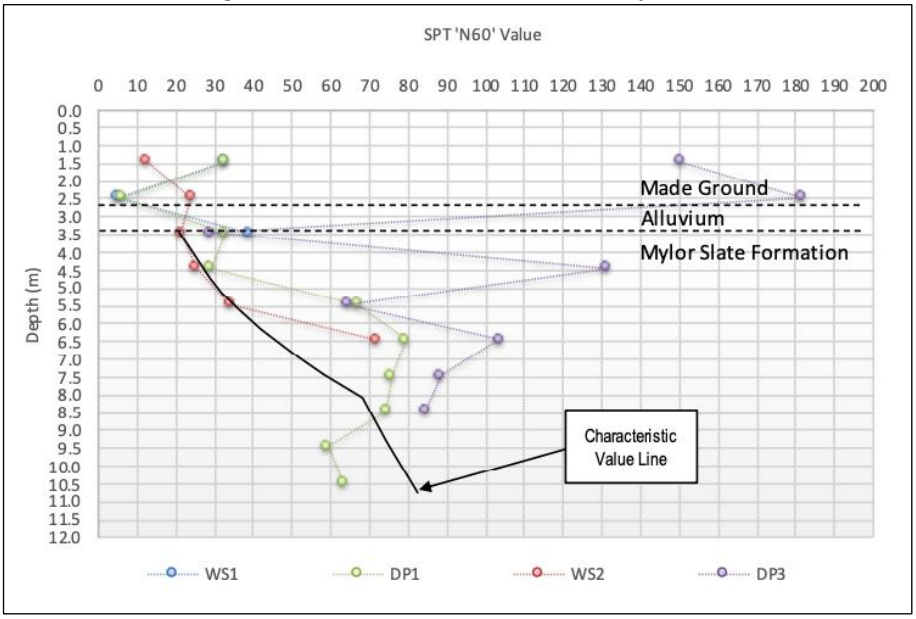
3.3.1 Summary of Ground Conditions Encountered

Table 3.3.1: Summary of Observed Strata

Stratum	Base Depth (m)	Notes
TOPSOIL: rooted, silty loam topsoil	0.25	Encountered in WS2 only
MADE GROUND: generally mid-brown, slightly silty gravelly sand / sandy gravel of igneous rock incl. cobbles; locally containing charcoal fragments (WS4)	>0.41 – 2.26	Encountered in all exploratory holes; encountered to termination in all manually-excavated trial pits & WS3-WS4
PROBABLE MADE GROUND: variable horizons of silty/sandy gravel and silty sand	1.96 – 2.56	Encountered in WS1 & WS2
CLAY / SILT / SAND: variable horizons of silty clay, gravelly silt/clay and slightly silty sand ***(Alluvium)***	3.3 - >3.45	Encountered in WS1 & WS2
CLAY: brownish-grey mottled orange silty clay incl. siltstone/mudstone lithorelicts ***(Highly weathered Mylor Slate Formation)***	>5.45	Encountered to termination in WS2 only; inferred to greater depth (8-10m) in DP1 & DP3
Roots and Desiccation	**Roots**: **WS2**: 0.4m **WS3**: 0.6m **WS4**: 1.1m **TP2**: 0.26m **TP4b**: 0.22m	**Desiccation:** N/A – none identified
Pit / borehole wall instability	Prevalent within near-surface made ground – localised spalling of loose gravel cobbles	
Groundwater N.B It should be remembered that the groundwater table is subject to seasonal variation, dependent on the prevailing weather conditions, and the situation encountered could potentially change in the future, especially in a period of seemingly ever-apparent but unpredictable climate change	**WS1**: wet at 2.62m depth <u>Post Investigation Monitoring</u> **WS1:** Dry at 2.0m **WS2:** Dry at 3.0m	

As previously noted, Standard Penetration Tests (SPT) were undertaken in accordance with BS EN ISO 22476-3:2005 to assess the relative density of the material penetrated; unfactored N-values are presented upon the respective borehole logs in Appendix 2, with 'normalised/factored' results plotted against depth in Fig 3.3.1 below along with dynamic probe results (converted into equivalent SPT N-values).

Fig 3.3.1: 'Normalised' SPT N_{60} Value -v- Depth



3.3.2 Geotechnical Laboratory Testing

Table 3.3.2a: Moisture Content & Index Test Results & Classification

WS No	Depth (m)	Sample of	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Plasticity/ USCS	CI	<425um (%)	Modified PI (%)	VCP (NHBC)
WS1	3.0	Al (clay)	25	39	27	12	Si_M	1.17	100	12	Low
WS5	5.0	MRSL (clay)	28	44	28	16	Si_M	1.0	100	16	Low

Classification to EN ISO 14688-2:2004 *CI: Consistency Index* *VCP: Volume Change Potential*
Al: Alluvium *MRSL: Mylor Slate Formation* *NP: Non-Plastic*

Table 3.3.2b: Chemical Test Results & Classification

WS No	Depth (m)	Sample of	Water soluble sulphate SO_4 (mg/l)	pH value in soil	Total sulphate SO_4 (%)	Total sulphur (%)	Total potential sulphate SO_4 (%)	Oxidisable Sulphides SO_4 (%)	BRE SD1 (2005) Classification DS	ACEC
WS1	2.5-3.0	Al	5.2	8.0	0.014	0.012	0.036	0.022	DS-1	AC-1
WS2	2.0	MG	10.8	7.8	0.025	0.025	0.075	0.05	DS-1	AC-1
WS2	3.0	Al	3.4	7.9	0.005	<0.005	<0.015	0.01	DS-1	AC-1
WS2	5.0	MRSL	7.5	7.0	0.008	0.006	0.018	0.01	DS-1	AC-1

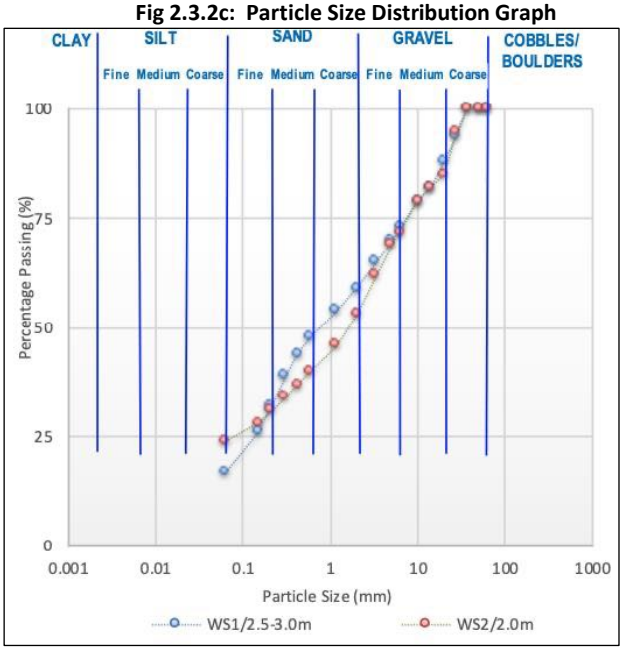
Al: Alluvium *MG: Made Ground* *MRSL: Mylor Slate Formation*

Table 3.3.2c: Particle Size Distribution Results

BH No	Depth (m)	Sample of	Fines (%)	Sand (%)	Gravel (%)	Classification
WS1	2.5-3.0	Al	17	41	41	Clayey GRAVEL & SAND
WS2	2.0	MG	24	30	47	Very sandy very clayey GRAVEL

Al: Alluvium *MG: Made Ground* *Classification to EN ISO 14688-2:2004*

Fig 2.3.2c: Particle Size Distribution Graph



3.3.3 Contamination Laboratory Testing

The contamination sampling scheme was conducted in accordance with BS10175:2011 with sampling providing general spatial coverage across the site, as well as targeting any specific features identified in Phase 1 researches / reconnaissance. Representative samples of made ground and natural undisturbed soil, generally taken from the upper 1m of extracted ground, were sent to UKAS accredited i2 Analytical Environmental Science laboratories in Watford, where analysis selectively comprised the following:

- Toxic and phytotoxic metals
- pH
- Speciated polyaromatic hydrocarbons (PAH)
- Total Petroleum Hydrocarbons (TPH)
- Soil Organic Matter (SOM)
- Asbestos Screen / ID

The potential risk to groundwater resources was determined by leachate analysis upon a sample of near surface made ground, which was tested to determine the leachable content of toxic and phytotoxic metals. The certified laboratory test results are presented in Appendix 4, with findings discussed in Section 6.

4.0 GEOTECHNICAL MODEL & FOUNDATION RECOMMENDATIONS

This section provides a geotechnical assessment in connection with the proposed development works described within this report.

As previously noted, proposed development is concentrated in the central and southern parts of the site. Following demolition of the existing learning studio in the southwest, it is proposed to construct a new production studio and learning space, whilst a new museum entrance and café are proposed to the rear (east) of the existing car park area in the centre of the site. Proposals also include expansion of the raised walkway to include decking over the entirety of the gravel-surfaced courtyard.

Information concerning the envisaged building and foundation construction, as provided by the project structural engineer, is presented below for reference.

- *It is anticipated that extensions will be formed primarily from timber construction with some steel inclusion, where required for larger spans.*
- *Anticipated foundation loads are subject to further detailed design work, but may be in the region of 100kN (point loads) and 65-75kN/m (line loads).*

In the absence of definitive information pertaining to proposed building structure, foundation recommendations at this stage are relatively generic, based upon the above or assumed/envisaged methods of construction within the ground conditions encountered.

4.1 GEOTECHNICAL MODEL

4.1.1 Geotechnical Properties / Classification

Beneath surface topsoil/hardstand, site investigations have proven a thick mantle of made ground comprising variably loose to medium-dense sandy gravel / gravelly sand, containing large quantities of coarse gravel & cobbles up to 2.26m depth (WS2). This was underlain by probable made ground horizons of silty sand / gravel up to 1.96m depth in WS1 and 2.56m depth in WS2. It is worthy of note that excavation and drilling within the made ground mantle was difficult/problematic given the locally loose consistency, and resultant spalling/instability.

Beneath made ground, suspected alluvial material was recorded in WS1 and WS2 to around 3.3 – 3.5m, comprising variable horizons of sand, silt and clay. Whilst attaining a firm consistency in WS2, the more granular, silt/sand material in WS1 was locally loose and low strength, resulting in an SPT N-value of N=4. The same material was identified as wet at 2.62m depth. Laboratory index analysis upon a single sample of alluvium from WS1/3.0m classifies the material as intermediate plasticity silt of low volume change potential in accordance with NHBC Standards, whilst a Consistency Index value of 1.17 suggests no evidence of desiccation, which confirms visual observations.

Beneath alluvial soils, the highly weathered mantle of the mapped Mylor Slate Formation (MRSL) was recorded up to 5.45m depth in WS2, and inferred to in excess of 8-10m in DP1 and DP3. The material comprised firm to stiff silty clay with occasional mudstone / siltstone lithorelicts, which is classified as intermediate plasticity silt of low volume change potential in accordance with NHBC Standards. A Consistency Index value of 1.0 suggests no evidence of desiccation, confirming visual observations.

Based upon the foregoing, it is recommended that a low volume change potential classification be adopted for all natural soils beneath the site (alluvium & MRSL). On this basis, NHBC requires a minimum 0.75m founding depth with

localised deepening, as necessary, to address proximity of nearby trees and/or presence of rooted/desiccated soils and made ground (refer to Table 3.3.1 for the latter).

In terms of material strength / relative density, Fig 3.3.1 shows high variability in the mantle of made ground and underlying superficial alluvium. Within the weathered MRSL, the characteristic value line demonstrates a consistent increase in relative density from N_{60} = 20 at approximately 3.5m depth until SPT refusal (N_{60} = 50) is met at approximately 7m depth.

4.1.2 Appraisal of Founding Options

Consideration has first been given to construction upon conventional strip/trench-fill or pad foundations. Investigations to date have recorded a thick mantle of locally loose made ground / probable-made ground (up to 2.56m) underlain by locally soft and wet alluvial material (to between 3.3m and 3.5m depth). To ensure construction of foundations upon/within competent soils, it is recommended that all made ground and alluvial horizons be penetrated. This would clearly require significant excavation (>3.3-3.5m), which is considered beyond the realms of suitability for conventional strip/trench-fill or pad foundations, especially where excavation within/through loose made ground could be logistically problematic in terms of spalling/instability; this founding solution is therefore excluded as a viable option.

As a potential alternative, consideration has been given to a raft foundation solution, although construction of a raft and underlying granular blanket in such a constrained, narrow site (nearby buildings, roads & watercourse) is likely to prohibit this option from a logistical perspective - in line with NHBC guidance, the granular blanket beneath a raft would need to extend beyond the edges of the foundation by a distance equal to its natural angle of repose, plus 0.5m. Based upon the proximity of nearby existing buildings and infrastructure, this would not be possible. In addition, the construction of a raft upon a mantle of locally variable made ground could result in potentially significant differential settlement. A raft foundation is therefore excluded as a viable founding solution for this site.

Consideration has also be given to a pile foundation solution, whereby building loads would be transferred through near-surface soils to found within competent ground at depth. This requires an understanding of the deeper ground profile, as provided by the borehole drilling and supplementary dynamic probing (refer to Fig 3.3.1 for the strength-depth profile) in order to glean the necessary pile design parameters; this discussed further in Section 4.2 below.

In terms of existing foundations, six manually-excavated trial pits (TP1 – TP4b) were used to establish near-surface ground conditions and expose the foundations of the existing buildings; foundation profiles are presented upon the respective trial pit logs, to which reference should be made. The full depth of the foundations was not proven in all cases, and therefore where possible, additional pits were excavated to glean further information (TP1b & TP4b). The main limiting factor in proving founding depths was the presence of a thick layer of concrete beneath a large proportion of the site (encountered in TP2 – TP4); in TP3 the concrete was core-drilled as far as possible, though could not be penetrated beyond 0.28m. Based upon the wider ground conditions, it is envisaged that this impenetrable concrete slab was constructed upon the mantle of variably loose to medium-dense made ground encountered in the boreholes.

Where existing buildings are to be reconfigured, some buildings may need to be underpinned to avoid potential settlement/subsidence and/or undermining of existing foundations. To enable an assessment of which buildings / walls may need additional support, the structural engineer / architect should refer to the trial pit logs presented in Appendix 2.

4.2 FOUNDING RECOMMENDATIONS & DEPTHS – *Pile foundations*

Foundations should be constructed through any localised softer or disturbed deposits (including any/all made ground) to found in undisturbed, natural material, subject to also penetrating any rooted and/or desiccated soils; refer to Table 3.3.1 for details.

Based upon the foregoing requirements and the recorded ground profile, mini-pile foundations likely represent the most viable founding solution at this site, whereby building loads would be transferred through made ground & alluvial soils to reach a set in the competent MRSL mantle at depth. This approach would address the logistical issues of excavating through thick, loose / unstable made ground and locally soft underlying alluvial material, and would also mitigate the effect of nearby tree influence upon foundations otherwise constructed in shrinkable soils.

In order to establish the parameters necessary for pile design, all ground investigation data, including borehole & dynamic probe logs, should be forwarded to a specialist piling contractor for their advice in terms of pile type, diameter, depth and working load.

4.3 GENERAL RECOMMENDATIONS

4.3.1 Ground Floor Slabs

A suspended ground floor would lend itself well to a pile foundation solution, whereby it would be supported upon the pile cap ring beams.

4.3.2 Buried Concrete Classification

Based upon the results presented in Table 3.3.2b, buried concrete in strip/trench fill foundations can be constructed with a classification of Design sulphate Class DS-1 and Aggressive Chemical Class of AC-1 in accordance with BRE Special Digest 1 (2005) i.e. no special precautions.

4.3.3 Groundwater Considerations

With the exception of a wet alluvial horizon in WS1/2.62m, all exploratory holes were identified as dry upon completion of site work, with post-investigation monitoring also recording dry conditions in WS1/2.0m and WS3/3.0m. The wet horizon does not appear to correspond to the adjacent Stennack River level. Therefore whilst shallow groundwater issues are unlikely to present a widespread logistical issue in terms of excavation/construction, it should nevertheless be remembered that groundwater levels can vary seasonally, reaching their peak during/after traditionally wetter winter months.

4.3 MONITORING OF GROUND CONDITIONS DURING SITE DEVELOPMENT

In view of the importance of founding on natural ground, a careful watch must be maintained during all foundation excavations to ensure that this requirement has been satisfied. If/where existing foundations/structures/obstructions are encountered during excavations, all new foundations should be extended downwards to fully penetrate all redundant former construction.

Care should be taken to ensure that any instability of excavations does not affect existing structures and services (e.g. foundations, roads, boundary walls or buildings), both on and off-site. Where instability is a possibility, temporary

support should be adopted, and further advice should be sought from the appointed structural engineer regarding temporary works.

Care should be taken to ensure that any fall of material from foundation excavation faces does not adversely affect the integrity of the foundation concrete.

Inspection of foundation excavations should ensure that no root activity or evidence of desiccation is visible at foundation depth. Desiccation may vary seasonally, therefore depending upon the time of year at which construction takes place, it may be prudent to perform supplementary inspection/pitting to check for residual desiccation, prior to construction.

In the event of any doubt in the above matters, we would be pleased to attend site as instructed.

5.0 SOAKAWAY DRAINAGE

5.1 TESTING METHODOLOGY

In order to assess the infiltration potential of the ground and thereby the possible viability of a SUDS drainage system to serve the new construction, infiltration analysis performed as falling head tests, was carried out in WS4. The exercise comprised the rapid filling of the borehole using clean water delivered via a 25L drum, and monitoring of subsequent outflow.

Whilst not strictly confirming to BRE365 guidance, which requires large-scale tests to be carried out in machine-excavated pits using a bulk water supply, small-scale falling head tests in boreholes provide a useful indicator of infiltration potential; indeed, in this Practice's experience the calculated infiltration rates obtained via the two methods are often comparable. However it should be noted that, for detailed design of SUDS drainage systems, the Local Authority will often require that full-scale BRE365 compliant tests be carried out.

5.2 TEST RESULTS & RECOMMENDATIONS

Given the made ground thickness across the site (up to 2.26m depth, with probable made ground recorded in boreholes up to 2.56m), it was not viable to target the natural underlying ground for the testing. Notwithstanding, given that the natural underlying soil comprises alluvium containing a predominance of fines (clay/silt – refer to nearby WS2 log), it is expected that the alluvial deposit would nevertheless be largely impermeable and hence not suitable for soakaway adoption.

Repeat testing, in line with BRE guidance, was carried out. Calculated soil infiltration rates are presented in Tables 5.2, with site data and calculation sheets presented in Appendix 3. It should be noted that the made ground within which testing was carried out was unstable in the presence of water, resulting in spalling of loose material; as a result, the available depth of testing (response zone) in the borehole decreased with each of the three tests carried out.

Table 5.2: Infiltration Test Results (BRE365 methodology)

BH No.	Test Depth	Drainage Material	Test No.	Infiltration Rate (m/s)	Time to Drain to 50% Effective Storage Depth (mins)
WS4	0.84-1.5	MG	1	$1.5x10^{-5}$	29
	0.79-1.15	MG	2	$8.1x10^{-5}$	4.5
	0.78-1.07	MG	3	$5.9x10^{-5}$	6

MG: Made Ground

Results show that the testing satisfies the minimum BRE requirement for proposed soakaway drains to drain down to achieve 50% storage capacity within 24 hours; at face value the ground, at the tested location and depth at least, is considered to be suitable for the adoption of a SUDS drainage system. **However, leachate contamination testing (refer to Section 6.3) has recorded mild elevations of arsenic, nickel, copper and zinc in made ground at WS4/1.0m (area of proposed soakaway construction). As such it is recommended that the siting of soakaways in such made ground material should therefore be avoided in order to mitigate the risk of unacceptable leachate generation which could otherwise lead to impaction of groundwater (secondary A aquifer) / nearby surface waters (adjacent Stennack River).**

Alternative measures are therefore recommended, such as transmission of surface water run-off to existing drainage networks and/or existing watercourse(s), (subject to the approval of the relevant Local Authority) possibly in conjunction with some degree of on-site attenuation. Alternatively it may be possible to remove the offending made ground in the area of proposed soakaway construction, and replace it with 'clean', granular material, thereby mitigating the potential for leachate generation. Again, the suitability of this approach is likely to be subject to Local Authority approval. A specialist drainage engineer should be consulted concerning any detailed drainage design as well as the size and capacity of any required attenuation.

6.0 CONTAMINATION RISK ASSESSMENT

6.1 METHODOLOGY & LIMITATIONS

The contamination risk assessment has been carried out in general accordance with the methodology described within Appendix 4.

In line with best industry practice the scope of contamination testing has been based upon the site history, proposed land usage and actual findings, with reference where necessary to DoE Industry Profiles and DEFRA/EA guidance. To the best of our knowledge information concerning the land quality assessment is accurate at the date of issue, however subsurface conditions including ground contamination may vary spatially and with time. There may be conditions pertaining to the site not disclosed by the above sources of information which might have a bearing upon the recommendations made, were such conditions known. Professional judgement has been used in order to limit this during the investigation.

The conclusions and recommendations made in respect of land quality do not address any potential risks to site operatives or ground workers during the construction stage. These issues should be addressed by the Principal Contractor in accordance with the relevant statutory procedures and regulations (CDM Regulations 2015).

It is important that these limitations be clearly recognised when the findings and recommendations of this report are being interpreted. Additional assessment may be necessary should a significant delay occur between report date and implementation of the proposed scheme to which it relates.

6.2 HUMAN HEALTH RISK

Laboratory test results are presented in Appendix 4. Table 6.2 below presents a summary of the findings with comparison against Tier 1 LQM/CIEH S4UL guideline values.

Table 6.2: Comparison of Soil Chemical Test Results with Tier 1 Guideline Values

Determinant	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL Commercial (mg/kg)	Tests Undertaken (No.)	Exceedances (No.)	Notes
Arsenic	140	640	9	0	
Cadmium	<0.2	190	9	0	
Chromium (trivalent)	180	8,600	9	0	
Chromium VI	<1.8	33	9	0	
Lead	280	2330*	9	0	
Mercury	<0.3	1,100	9	0	
Selenium	<1.0	12,000	9	0	
Nickel	98	980	9	0	
Copper	400	68,000	9	0	
Zinc	460	730,000	9	0	
Naphthalene	<0.05	460	2	0	
Acenaphthylene	0.3	97,000	2	0	
Acenaphthene	<0.05	97,000	2	0	

Determinant	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL Commercial (mg/kg)	Tests Undertaken (No.)	Exceedances (No.)	Notes
Fluorene	0.21	68,000	2	0	
Phenanthrene	3	22,000	2	0	
Anthracene	0.45	540,000	2	0	
Fluoranthene	6.4	23,000	2	0	
Pyrene	5.2	54,000	2	0	
Benzo(a)anthracene	4.7	170	2	0	
Chrysene	4.2	350	2	0	
Benzo(b)fluoranthene	5.5	44	2	0	
Benzo(k)fluoranthene	2.7	1,200	2	0	
Benzo(a)Pyrene	5.0	35	2	0	
Indeno(1,2,3-cd)Pyrene	2.9	510	2	0	
Dibenzo(ah)Anthracene	0.88	3.6	2	0	
Benzo(ghi)Perylene	2.7	4000	2	0	
TPH C6 – C8	<0.1	17,000	1	0	
TPH C8 – C10	<0.1	4,800	1	0	
TPH C10 – C12	<1.0	23,000	1	0	
TPH C12 – C16	<4.0	37,000	1	0	
TPH C16 – C21	<10	28,000	1	0	
TPH C21 – C40	<10	28,000	1	0	
Asbestos	ND	N/A – screen / ID	3	0	

Notes:

* provisional C4SL

based upon SOM of 2.5%

<LoD – less than laboratory limit of detection

ND – non-detect

- Concentrations of all individual toxic and phytotoxic metals fall below Tier 1 C4SL/S4UL levels for the existing/proposed commercial end-use, indicating no apparent, significant metals risk to human health. Progression to a Tier 2 assessment is therefore considered unnecessary, with no requirement for remedial measures to address metals concentrations based upon these results.

- Speciated PAH analysis has similarly recorded no elevations above S4UL levels; importantly Benzo(a)Pyrene (main PAH risk driver) analysis records concentrations well below the S4UL threshold. Based upon these findings, there is no requirement for further analysis or remedial measures to address potential PAH risk to human health.

- Given the localised car park usage in the centre of the site, a single sample from WS4 was taken and subjected to precautionary TPH analysis. Concentrations of all individual TPH carbon ranges fall below Tier 1 S4UL levels, indicating no apparent/significant impaction that could warrant further investigation/assessment.

- Whilst no apparent /obvious asbestos containing material (ACM) was identified during the investigation, given the presence of made ground across the site it was thought prudent to carry out screening upon selected samples. All results were returned as 'non-detect' for ACM, confirming visual observations and suggesting no requirement for further analysis or remedial measures to address ACM.

6.3 CONTROLLED WATERS RISK

Table 6.3: Comparison of Soil Leachate Test Results with Guideline Values

Leachable Determinant	Maximum Measured Concentration (µg/l)	WFD 2015 (groundwater) (µg/l)	WFD 2015 (surface water) (µg/l)	UK DWS 2000 (µg/l)	EA EQS (groundwater) (µg/l)
Arsenic	**33**	**7.5**	37.5	**10**	50
Cadmium	<0.08	3.8	0.08	5	0.08-0.25
Chromium (trivalent)	1.0	37.5	3.4	50	4.7
Lead	5.1	7.5	7.2	10	7.2
Mercury	<0.5	0.8	0.07	1	0.07
Selenium	<4.0	75		10	
Nickel	**1.8**	15	**<1**	20	20
Copper	**11**	1,500	**1**	**8-125**	**1-28**
Zinc	**21**		**12.3**	5,000	**8-125**

- Despite generally low total soils concentrations, leachate analysis has recorded mild elevations of arsenic, nickel, copper and zinc in made ground at WS4/1.0m (area of proposed soakaway construction). In consideration of the hydrological / hydrogeological status of the Site, whilst there could theoretically be a perceived risk to controlled waters (secondary A aquifer and adjacent Stennack River), given the existing/proposed predominance of impermeable hardstand and that the offending made ground beneath the site will differ little to that beneath the wider area (extending outside the site), pre-construction remedial measures in respect of controlled waters are therefore considered unnecessary. However, the suggested construction of a new soakaway in this area does raise concerns from a leachable contaminant perspective, since the channelling of surface/roof runoff into made ground could potentially create an unacceptable hotspot of leachate contamination, which could lead to aquifer / surface water impaction. As such, unless the offending made ground in this area can be removed prior to soakaway construction, it is recommended that an alternative method of surface runoff water disposal be explored; this is reiterated in Section 5.

6.4 LANDFILL GAS & RADON GAS RISK

The Preliminary Conceptual Site Model presented in Section 2.2 identified potentially infilled features (nearby mineshafts) as well as the possibility of thick made ground (both on-site and across the wider surrounding area) associated with the historic mining legacy. Gas monitoring wells were therefore installed in two of the boreholes, with subsequent monitoring performed on a single occasion to date (carried-out during optimum period of low and/or rapidly-falling atmospheric pressure; results are presented in Appendix 6).

The landfill gas risk assessment has been undertaken in general accordance with BS8485:2015 "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings", and with reference

to Construction Industry Research and Information Association (CIRIA) 665: 'Assessing risks posed by hazardous ground gases to buildings' (2015).

As shown in Appendix 6, results record generally low levels of carbon dioxide (2.4 – 3.0%), nil methane and nil flow (0.0l/hr). These results are considered typical of 'general' made ground.

On this basis the implied maximum characteristic gas situation (CS) is derived by consideration of the maximum hazardous gas flow rate calculated from each single monitoring well, as shown in Table 6.4 below.

Table 6.4: Summary of Gas Monitoring Results & Maximum Characteristic Situation

BH No.	Maximum Steady State Flow (l/hr)	Maximum Peak Gas Concentrations (%)		Peak Hazardous Gas Flow Rate (l/hr)		Implied CS (l/hr)		Worst-Case CS (l/hr)	
		Carbon Dioxide	Methane	$Q_{hg}CO_2$	$Q_{hg}CH_4$	CO_2	CH_4	CO_2	CH_4
WS1	0.0	2.4	0	0.0	0.0	1	1	1	1
WS2	0.0	3.0	0	0.0	0.0	1	1	1	1
Notes:									
CS =	equivalent to GSV in C665								
	Worst-Case CS based on maximum observed flow rate and concentrations from any borehole during latest monitoring								

Based upon the calculations of peak hazardous gas flow rates for individual boreholes, the site is categorised as CS1 in line with BS8485 guidance, for which a gas protection score of 0 is attributed i.e. no gas protection measures required.

It is acknowledged that, in line with BS8485 & CIRIA 665 guidance, a minimum of 3 rounds of monitoring is usually undertaken to provide a robust dataset. In this case however, given the negligible gas concentrations recorded during optimum falling atmospheric conditions, and also that full radon protection measures are required in new construction (see below), it was considered unnecessary to carry out further monitoring since robust radon protection measures should effectively deal with any low-level landfill-type gas concentrations.

With regards to radon, British Geological Survey data indicates a probability of 10-30% that the Site is above the Action Level, therefore full radon protection measures will be required within new construction at this site. As a minimum it is expected that an upgraded (minimum 1200gauge) radon-proof membrane and ventilated sub-slab voids will be required, with the membrane lapped across wall cavities and overlapped sheet joints, plus any service entry points carefully tape-sealed; this should be clarified with the local building control officer who should advise concerning the specific scope of measures required.

6.5 WASTE CLASSSIFICATION FOR OFF-SITE DISPOSAL OF ARISINGS

In accordance with current legislation, all soil arisings generated for disposal as part of this development site are by definition a "commercial waste" and will be classified as both a directive and a controlled waste. In view of the proposed construction, and hence the likely derivation of excavated arisings for off-site disposal, then as per the European Waste Catalogue (EWC) such material will be coded 1705, that is "soil (including excavated soil from contaminated sites), stones and dredging spoil".

It is recommended that all soil contamination test results (refer to Appendix 3) be provided to the receiving landfill operator for their assessment/interpretation and classification prior to acceptance, although based upon the generally low total soils concentrations it is expected that they would achieve a non-hazardous classification (TBC).

Laboratory contamination test results should be supplemented by the attached Waste Acceptance Criteria (WAC) results – carried out upon a composite sample of material derived from 0.2 – 3.0m depth from across the site (refer to Appendix 5). These results demonstrate that site arisings classify as inert, and therefore arisings requiring off-site disposal can be disposed of at a suitably licensed inert landfill site. Note that these findings should be forwarded the receiving landfill operator, prior to transporting the waste, for their review since landfill permitted thresholds can vary.

6.4 WATER SUPPLY PIPEWORK

Comparison to generic guidance as set out in the UK Water Industry Research (UK WIR) report 'Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites' (2010) indicates that, at face value, recorded concentrations are unlikely to necessitate "toxic preventative measures" (i.e. upgrading of water supply pipework to a barrier pipe such as 'Protectaline' or similar), although it is recommended that advice be sought from the local regulatory authority / water provider prior to ordering pipework.

6.5 REFINED CONCEPTUAL SITE MODEL

In summary, laboratory contamination analysis and follow-up quantitative risk assessment has shown no significant human health in light of the proposed site redevelopment, although localised consideration may be required in terms of **controlled waters risk (specifically siting of proposed soakaways)** whilst **radon protection requirements** will require clarification from the local Building Control department.
In view of the above discussions the Preliminary Conceptual Site Model has been refined as shown in Figure 6.5 below.

Fig 6.5: Refined Conceptual Site Model

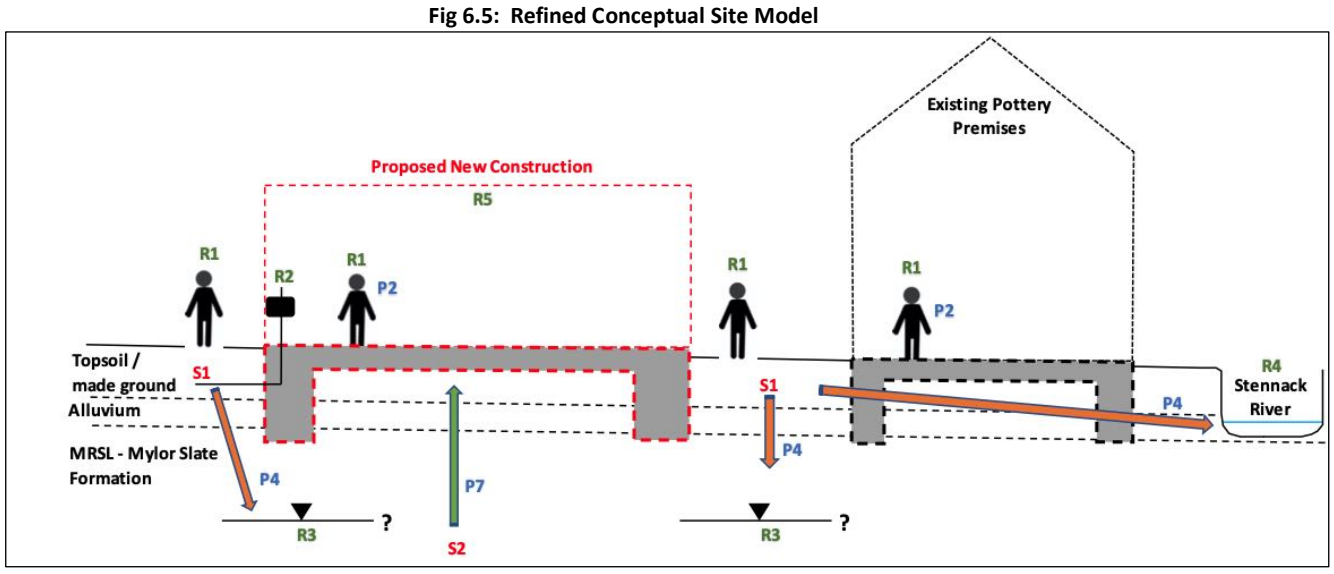


Table 6.5: Summary of Identified/Potential Pollutant Linkages

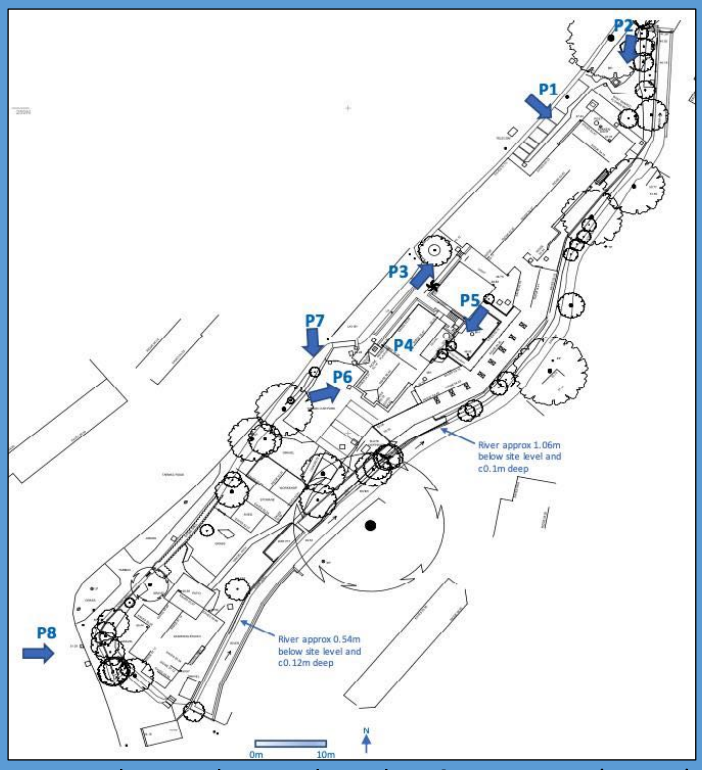
Potential Sources	Pathways	Receptors						Comments	Refined Risk Rating	Remedial / Mitigation Requirements
		R1	R2	R3	R4	R5	R6			
ON SITE										
S1	**P1**							Whilst laboratory testing has shown that there could theoretically be a perceived risk to controlled waters (secondary A aquifer and adjacent Stennack River), given the existing / proposed predominance of impermeable hardstand and that the offending made ground beneath the site will differ little to that beneath the wider region outside the site, pre-construction remedial measures in respect of controlled waters are considered unnecessary. However, the siting of soakaways in such material should be avoided in order to mitigate risk of unacceptable leachate generation and impaction of groundwater / nearby surface waters	Low - Moderate	The siting of soakaways in made ground material should be avoided in order to mitigate risk of unacceptable leachate generation and impaction of groundwater / nearby surface waters
	P2									
	P3									
	P4			X	X					
	P5									
	P6									
	P7									
S2	**P1**							British Geological Survey data indicates a probability of 10-30% that the Site is above the Radon Action Level	Moderate - High	Full radon protection measures will be required within new construction; specific scope to be discussed with local Building Control
	P2									
	P3									
	P4									
	P5									
	P6									
	P7	X				X				
OFF-SITE										
NONE										

SOURCES	**S1**	Made ground mantle beneath the site representing localised leachate risk to controlled waters
	S2	Bedrock geology representing potential source of radon gas
PATHWAYS	**P1**	Direct dermal contact or ingestion
	P2	Inhalation of dust and vapours
	P3	Permeation into new water supply pipework
	P4	Vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone
	P5	Direct contact with high sulphate-bearing clay
	P6	Landfill gas migration through unsaturated zone and accumulation within confined spaces
	P7	Radon gas migration through unsaturated zone and accumulation within confined spaces
RECEPTORS	**R1**	Future site users
	R2	Potable water supply
	R3	Groundwater (Mylor Slate Formation & superficial allivium classified as a 'Secondary A' aquifers)
	R4	Surface waters (closest is Stennack River to the immediate SE)
	R5	Proposed site buildings incl. concrete foundations
	R6	Adjacent site occupants / users

7.0 REFERENCES

Geotechnical
British Standards Institute, BS5930:2015 '*Code of Practice for Ground Investigations*'
National House Building Council (NHBC) Standards: Chapter 4.2 '*Building Near Trees*' (2016)
BS EN 14688: *'Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1 Identification and Description*' (2002)
BS EN 14688: *'Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2 Principles for a Classification'* (2004)
BS EN 14689: *'Geotechnical Investigation and Testing - Identification and Classification of Rock Part 1 Identification and Description*' (2003)
British Standards Institute, BS 1377: *'British Standard Methods of Test for Soils for Civil Engineering Purposes',* Parts 1 - 9, (1990)
Highways Agency Document HD 25/94 Volume 7, Section 2, Part 2 '*Pavement Design and Construction – Foundations*' (1994)
Building Research Establishment (BRE) Special Digest 1 '*Concrete in Aggressive Ground*' (2005)
British Geological Survey online & Landmark mapping 1:10,000 scale (Ref: 301237393_1_1 dated 14 Sept 2022)
Building Research Establishment (BRE) Digest DG365 "*Soakaway Design*" (2016)
Environmental
British Standards Institute, BS 10175: *'Code of Practice for the Investigation of Potentially Contaminated Sites'* (2011)
EA document Land Contamination Risk Management (LCRM), which replaces the outgoing Environment Agency CLR 11: 'Model Procedures for the Management of Land Contamination'
Environment Agency/National House Building Council (NHBC) R&D 66 'Guidance for the Safe Development of Housing on Land Affected by Contamination' (2000)
Chartered Institute of Environmental Health (CIEH)/Land Quality Management Limited (LQM). *CIEH/LQM. 'S4ULs for Human Health Risk Assessment' (2015); Land Quality Press*
Department of the Environment, Transport & the Regions: *'The Environmental Protection Act 1990: Part IIA'* (2000)
Construction Industry Research & Information Association (CIRIA) 665: '*Assessing Risks Posed by Hazardous Ground Gases to Buildings*' (2007)
British Standards Institute, BS8485: 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' (2015)
Building Research Establishment (BRE): Radon – '*Guidance on Protective Measures for New Buildings*' (2015)
Landmark Historical Ordnance Survey mapping & Envirocheck data sheets (Ref: 301237393_1_1 dated 14 Sept 2022)
The Water Framework Directive (Standards and Classification) Directions (England and Wales)' (2015)
The Water Supply (Water Quality) Regulations 2000 (Amendment) Regulations (2007)
Environment Agency (www.environment-agency.gov.uk)
Health Protection Agency (www.hpa.org.uk)
Zetica (www.zetica.com)
UK WIR report *'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'* (2010)

APPENDIX 1 – SITE PHOTOGRAPHS



Drawing showing Photograph numbers & orientations (P1 – P8)
(based upon Dow Jones Architects Drg No. 488-01-050, dated Feb 22; Scale: as shown)

P1

P2

P3

P4

P5 	**P6** 
P7 	**P8** 

APPENDIX 2 – EXPLORATORY HOLE LOGS

WS1/DP1

WS2

WS3/DP3

WS4

TP1/TP1b

TP2

TP3

TP4/TP4b

BOREHOLE LOG

S10 Geo-Consulting

Geotechnical & Geo-environmental Ground Investigation

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	15/09/22
Client	The Leach Pottery
Ground Level	51.4 AOD
Co-ordinates	150809, 39874
Drilling Method	Window Sampling
SPT Energy Ratio	Er = 75.73%

Borehole No. **WS1**

Sheet 1 of 4

Depth	Sample	SPT	HSV (kNm^2)	Legend	Depth	Stratum Description	Geology	Monitoring Well
					0.09	MADE GROUND: Tarmac hardstand (2 layers)		Plain & bentonite
					0.22	MADE GROUND: Stiff, pale orange, khaki brown and grey, slightly silty clay		
0.5m	Bag							
1.0m		N = 26			1.74	MADE GROUND: Probable loose to medium dense, mid brown, slightly silty, gravelly to very gravelly, 'soily' sand. Gravel is subangular, medium to coarse igneous rock including cobbles with occasional to rare pottery and sheet metal fragments, brick and slate with rare fine charcoal		Slotted & gravel
1.8m	Bag				1.81	... sandy 'soily' element predominantly mid brown/orangish brown below 0.86m	PMG/AL	
					1.96	SAND: Probable loose to medium dense, greyish brown mottled reddish brown, slightly silty sand	PMG/AL	
2.0m		N = 4			3.45	GRAVEL: Probable medium dense, brownish grey, sandy gravel. Gravel is subangular to subrounded, fine quartzite/igneous rock		
2.5-3.0m	Bag					SILT/SAND: Probable loose, greyish brown silt / sand; becoming gravelly below c2.5m ... material is damp/wet at/below c2.6m	AL	
3.0m		N = 31						
						Borehole terminated at 3.45m depth due to bending drill rods and collapse of loose cobbles near surface; dynamic probe carried out adjacent to borehole		
4.0m								
5.0m								

Casing used	No
Trees	Refer to site drawing
Roots	None identified
Desiccation	None identified
Dry/Groundwater	Wet at 2.62m
	Gas valve and cover installed

Notes

CAT-scanned - no services identified / encountered
AL - Alluvium

Core Recovery
0.0 - 1.0m Hand-dug starter pit
1.0 - 2.0m 75%
2.0 - 3.0m 50%

All dimensions in metres (NTS)

DYNAMIC PROBE LOG

Cook Ground Investigation

Client: SIO

CGI Contract No:

Site Name: Pottery St. Ives

Date: 15.9.22

WS/DP 1

Page No: 1

Depth (m)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Number of blows	4	2	1	1	1	1	2	2	2	2
Depth (m)	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
Number of blows	4	6	3	2	1	2	1	3	3	2
Depth (m)	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3
Number of blows	0	0	1	0	2	1	1	2	2	2
Depth (m)	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4
Number of blows	0	4	4	2	1	1	7	6	2	2
Depth (m)	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5
Number of blows	3	2	2	3	3	3	2	3	3	4
Depth (m)	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6
Number of blows	4	5	4	6	9	7	7	7	7	7
Depth (m)	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7
Number of blows	7	7	7	7	6	5	5	6	6	7
Depth (m)	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8
Number of blows	6	6	6	7	7	7	7	6	7	7
Depth (m)	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9
Number of blows	6	6	7	6	6	6	7	5	5	4
Depth (m)	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10
Number of blows	5	5	5	5	5	4	5	6	5	5
Depth (m)	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11
Number of blows										
Depth (m)	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	12
Number of blows										
Depth (m)	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13
Number of blows										
Depth (m)	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	14
Number of blows										
Depth (m)	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15
Number of blows										

Drive weight: 63.5kg +/- 0.5kg
Drop height: 750mm +/- 20mm

Nom. Cone area: 20cm^2
Cone mantle length: 50.5mm +/- 2mm
Cone tip length: 55.3 +/- 0.4mm

Rig Type:	Lead Driller:
Archway Competitor Dart	Ben Cook
Additional Plant:	

This is a site log only and the data are subject to ammendment after checking by engineer or geologist

Cook Ground Investigation Limited
T: 01963 350151 / 07973 573414
Email: Ben@cookgi.co.uk
Website: www.cookgi.co.uk

BOREHOLE LOG

S10 Geo-Consulting

Geotechnical & Geo-environmental Ground Investigation

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	15/09/22
Client	The Leach Pottery
Ground Level	50.2 AOD
Co-ordinates	150813, 39895
Drilling Method	Window Sampling
SPT Energy Ratio	Er = 75.73%

Borehole No. **WS2**

Sheet 2 of 4

Depth	Sample	SPT	HSV (kNm^2)	Legend	Depth	Stratum Description	Geology	Monitoring Well
					0.25	Grass over dark brown, silty loam topsoil with roots/rootlets		
0.5m	Bag					MADE GROUND: Probable loose to medium dense, mid brown, gravelly to very gravelly, slightly silty sand with occasional fine rootlets up to c0.4m; locally recovered as sandy/clayey gravel. Gravel is angular to subangular,fine to coarse igneous rock with cobbles		Plain & bentonite
1.0m	Bag	N = 10			2.26			
2.0m	Bag	N = 19						Slotted & gravel
			2.65m Cu=55		2.56	probable MADE GROUND: Probable medium dense, orange and pale grey, slightly silty/sandy, fine to medium gravel of quartzite/igneous rock		
					2.75	... localised charcoal/ashy parting (10mm thick) at 2.33m	AL	
3.0m	Bag	N = 17			3.3	CLAY: Firm, brownish grey mottled brownish yellow and orange, thinly laminated, slightly silty clay	AL	
4.0m		N = 20				SILT/CLAY: Probable firm, orange slightly mottled grey, slightly gravelly, friable, silty clay/clayey silt. Gravel is subangular, fine to medium igneous rock with occasional siltstone/mudstone		
					5.45	CLAY: Probable firm to stiff, brownish grey mottled orange, silty clay with occasional siltstone/mudstone lithorelicts	MRSL	
5.0m	Bag	N = 27						
6.0m		N = 57				**Borehole terminated at 5.45m depth; CPT testing continued to 6.42m depth**		

Casing used	No
Trees	Refer to site drawing
Roots	c0.4
Desiccation	None identified
Dry/Groundwater	Dry
	Gas valve and cover installed

Notes

CAT-scanned - no services identified / encountered
AL - Alluvium
MRSL - Mylor Slate Formation

Core Recovery
0.0 - 1.0m Hand-dug starter pit
1.0 - 2.0m 40%
2.0 - 3.0m 100%
3.0 - 4.0m 70%
4.0 - 5.0m 50%

All dimensions in metres (NTS)

BOREHOLE LOG

S10 Geo-Consulting

Geotechnical & Geo-environmental Ground Investigation

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	15/09/22
Client	The Leach Pottery
Ground Level	50.1 AOD
Co-ordinates	150829, 39909
Drilling Method	Window Sampling
SPT Energy Ratio	Er = 75.73%

Borehole No. **WS3**

Sheet 3 of 4

Depth	Sample	SPT	HSV (kNm^2)	Legend	Depth	Stratum Description	Geology	Monitoring Well
					0.05	MADE GROUND: Surface gravel scalpings (car park)		
					0.28	MADE GROUND: Probable medium dense, pale yellowish brown gravel scalpings		
					0.7	MADE GROUND: Probable loose to medium dense, mid brown, variably gravelly, slightly silty, 'soily' sand with fine rootlets up to c0.7m. Gravel is subangular, fine to coarse igneous rock with many cobbles at/below 0.5m depth ... impenetrable by hand digging and drilling below 0.7m depth; dynamic probe carried out instead		
1.0m						**Borehole terminated at 0.7m depth; dynamic probe carried out**		
2.0m								
3.0m								
4.0m								
5.0m								

Casing used	No
Trees	Refer to site drawing
Roots	0.6
Desiccation	None identified
Dry/Groundwater	Dry
	Gas valve and cover installed

Notes

CAT-scanned - no services identified / encountered

Core Recovery

0.0 - 0.7m Hand-dug starter pit

All dimensions in metres (NTS)

DYNAMIC PROBE LOG

Cook Ground Investigation

Client: SIO

CGI Contract No: WS/DP 3

Site Name: Pottery St Ives

Date: 15.9.22

Page No: 1

Depth (m)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Number of blows							5	11	5	6
Depth (m)	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
Number of blows	9	32	8	10	9	8	5	8	10	10
Depth (m)	2.1	2.2	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3
Number of blows	7	8	13	21	17	17	24	11	8	5
Depth (m)	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4
Number of blows	3	3	2	3	2	3	3	3	4	5
Depth (m)	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	5
Number of blows	10	12	11	11	11	12	10	7	7	5
Depth (m)	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6
Number of blows	5	5	6	5	6	7	6	7	7	8
Depth (m)	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7
Number of blows	8	7	7	10	12	10	9	7	7	7
Depth (m)	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8
Number of blows	7	8	7	8	7	6	7	7	7	8
Depth (m)	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9	9
Number of blows										
Depth (m)	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9	10
Number of blows										
Depth (m)	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9	11
Number of blows										
Depth (m)	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9	12
Number of blows										
Depth (m)	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	13
Number of blows										
Depth (m)	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9	14
Number of blows										
Depth (m)	14.1	14.2	14.3	14.4	14.5	14.6	14.7	14.8	14.9	15
Number of blows										

Drive weight: 63.5kg +/- 0.5kg
Drop height: 750mm +/- 20mm

Nom. Cone area: 20cm^2
Cone mantle length: 50.5mm +/- 2mm
Cone tip length: 55.3 +/- 0.4mm

Rig Type:	Lead Driller:
Archway Competitor Dart	Ben Cook
Additional Plant:	

This is a site log only and the data are subject to ammendment after checking by engineer or geologist

Cook Ground Investigation Limited
T: 01963 350151 / 07973 573414
Email: Ben@cookgi.co.uk
Website: www.cookgi.co.uk

BOREHOLE LOG

S10 Geo-Consulting

Geotechnical & Geo-environmental Ground Investigation

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	15/09/22
Client	The Leach Pottery
Ground Level	50.0 AOD
Co-ordinates	150830, 39914
Drilling Method	Window Sampling
SPT Energy Ratio	Er = 75.73%

Borehole No. **WS4**

Sheet 4 of 4

Depth	Sample	SPT	HSV (kNm^2)	Legend	Depth	Stratum Description	Geology	Monitoring Well
					0.12	MADE GROUND: Tarmac hardstand		
					0.35	MADE GROUND: Concrete over plastic membrane		
1.0m	Bag				1.8	MADE GROUND: Loose, mid brown/greyish brown, slightly silty, gravelly 'soily' fine sand with fine roots/rootlets. Gravel is subangular, fine to coarse igneous rock with occasional to rare charcoal ... becoming very gravelly and locally orangish brown at 1.5m depth		
2.0m								
3.0m						**Borehole terminated at 1.8 depth upon impenetrable cobble; made ground collapsed back to 1.5m upon completion; infiltration testing carried out**		
4.0m								
5.0m								

Casing used	No
Trees	Refer to site drawing
Roots	c1.1m
Desiccation	None identified
Dry/Groundwater	Dry
	Gas valve and cover installed

Notes

CAT-scanned - no services identified / encountered

Core Recovery

0.0 - 1.16m Hand-dug starter pit

1.16 - 1.8m 80%

All dimensions in metres (NTS)

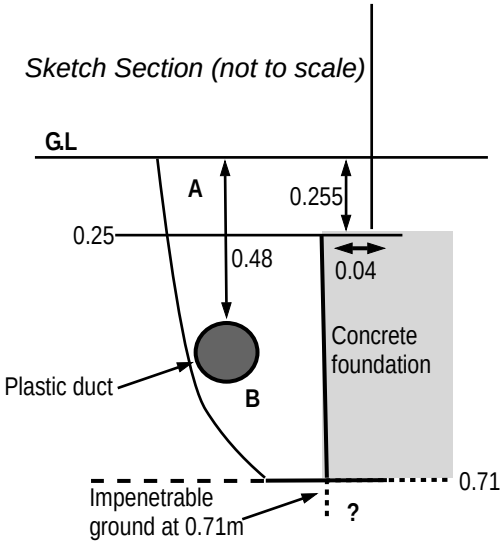
S10 Geo-Consulting
Geotechnical & Geo-environmental Ground Investigation

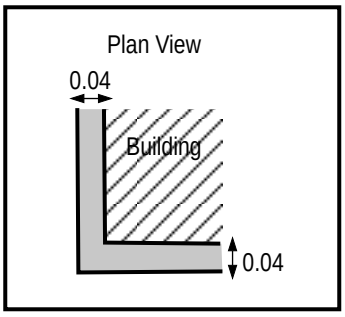
TRIAL PIT LOG

TP1

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	15/09/2022
Client	The Leach Pottery
Ground Level	49.9 AoD
Co-ordinates	150844, 39915

Sketch Section (not to scale)





Site Photographs

Details of Subsoil

A	**MADE GROUND**	Surface slate 'scalpings' over geotextile membrane
B	**MADE GROUND**	Probable loose, mid grey and brown, subangular, fine gravel over igneous rock and occasional slate

Undrained Shear Strength (kN/m2)

Trial Pit Terminated at 0.71m depth upon impenetrable ground - unable to tell if foundation extends beyond that depth
Additional pit TP1b excavated to glean further information

Roots:	None identified
Desiccation:	None identified
Dry/Groundwater:	Dry
Trees:	Refer to site drawing

Samples

Geotech:

Contam:

Notes

CAT-scanned - no services

Logged by Simon Wilkinson, S10 Geo-Consulting Limited

Stable/Unstable: Stable

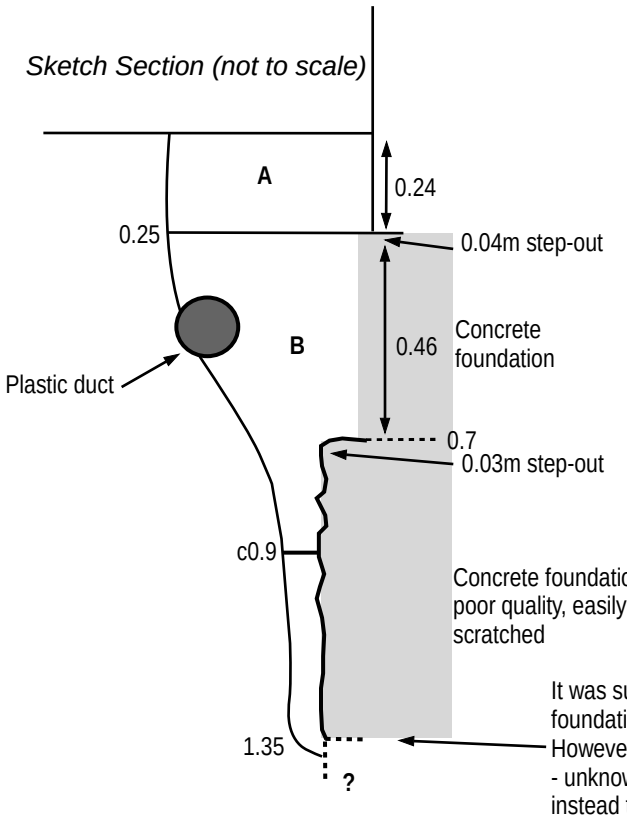
S10 Geo-Consulting
Geotechnical & Geo-environmental Ground Investigation

TRIAL PIT LOG

TP1b

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	16/09/2022
Client	The Leach Pottery
Ground Level	49.9 AoD
Co-ordinates	150845, 39915

Sketch Section (not to scale)



It was suspected that the underside of the foundation was at around 1.3m depth. However this was not definitively proven
- unknown if the suspected underside was instead the foundation being scratched away by the bar
- unable to extend the pit deeper due to loose spalling material and lateral restriction by the ducting & pedestrian access

Site Photographs

Details of Subsoil

A	**MADE GROUND**	Surface slate 'scalpings' over geotextile membrane
B	**MADE GROUND**	Loose, pea gravel of subangular to angular, fine granite
C	**MADE GROUND**	Loose, dark brown, silty 'soily' sand

Trial Pit Terminated at 1.35m depth

Undrained Shear Strength (kN/m2)

Roots:	None identified
Desiccation:	None identified
Dry/Groundwater:	Dry
Trees:	Refer to site drawing

Samples

Geotech:

Contam:

Notes

CAT-scanned - no services

Logged by Simon Wilkinson, S10 Geo-Consulting Limited

Stable/Unstable: Stable

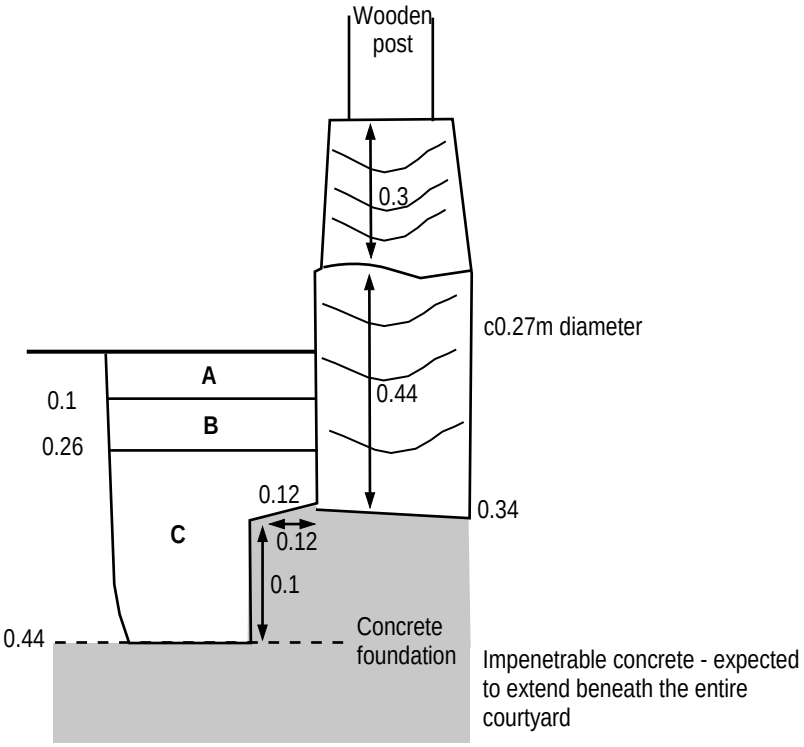
S10 Geo-Consulting
Geotechnical & Geo-environmental Ground Investigation

TRIAL PIT LOG

TP2

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	16/09/2022
Client	The Leach Pottery
Ground Level	48.9 AoD
Co-ordinates	150855, 39920

Sketch Section (not to scale)



Site Photographs

Details of Subsoil

A	**MADE GROUND**	Loose surface gravel scalpings over geotextile membrane
B	**MADE GROUND**	Probable medium dense, pale grey, medium to coarse gravel of degraded/broken concrete fragments with occasional fine roots from adjacent bamboo
C	**MADE GROUND**	Probable medium dense, mid brown, slightly silty, sandy gravel of angular to subangular, fine to coarse igneous rock including cobbles, with rare fine brick/tile fragments

Undrained Shear Strength (kN/m2)

Trial Pit Terminated at 0.44m depth upon impenetrable concrete slab

Roots:	0.26m
Desiccation:	None identified
Dry/Groundwater:	Dry
Trees:	Refer to site drawing

Samples

Geotech: 0.4

Contam:

Notes

CAT-scanned - no services

Logged by Simon Wilkinson, S10 Geo-Consulting Limited

Stable/Unstable: Stable

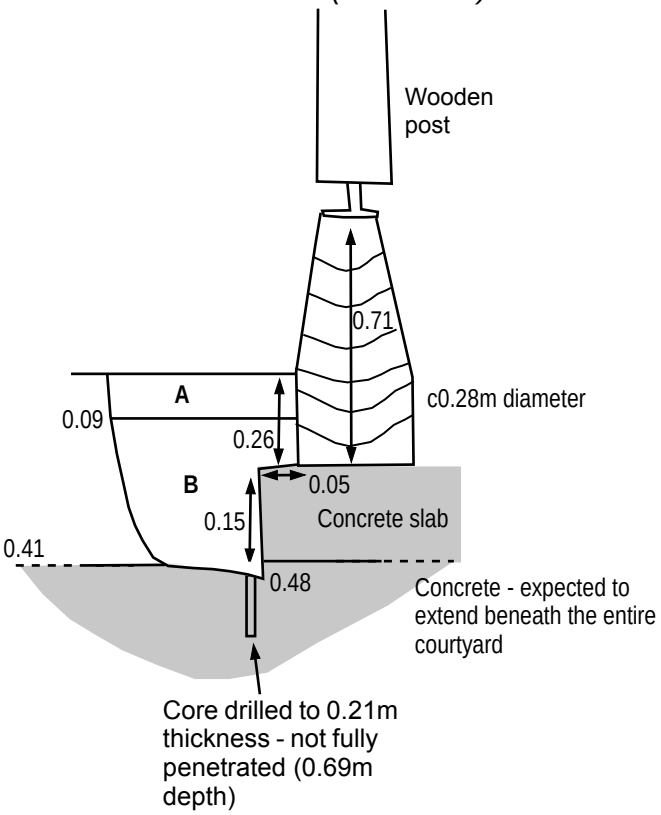
S10 Geo-Consulting
Geotechnical & Geo-environmental Ground Investigation

TRIAL PIT LOG

TP3

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	16/09/2022
Client	The Leach Pottery
Ground Level	48.9 AoD
Co-ordinates	150860, 39923

Sketch Section (not to scale)



Site Photographs

Details of Subsoil

A	**MADE GROUND**	Loose surface gravel scalpings over geotextile membrane
B	**MADE GROUND**	Probable medium dense to dense, greyish brown and grey, slightly sandy gravel of angular to subangular, fine to coarse granite

Undrained Shear Strength (kN/m2)

Trial Pit Terminated at 0.69m depth within impenetrable concrete

Roots:	None identified
Desiccation:	None identified
Dry/Groundwater:	Dry
Trees:	Refer to site drawing

Samples

Geotech: 0.2

Contam:

Notes

CAT-scanned - no services

Logged by Simon Wilkinson, S10 Geo-Consulting Limited

Stable/Unstable: Stable

S10 Geo-Consulting

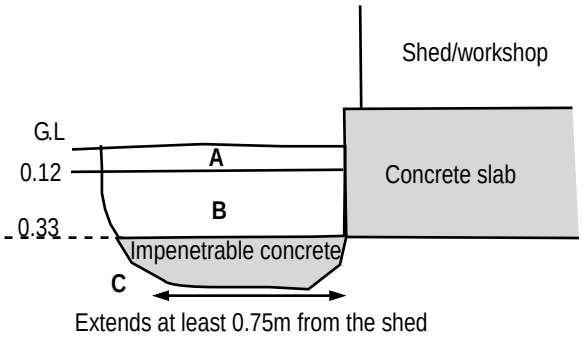
Geotechnical & Geo-environmental Ground Investigation

TRIAL PIT LOG

TP4

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	15/09/2022
Client	The Leach Pottery
Ground Level	49.9 AoD
Co-ordinates	150848, 39915

Sketch Section (not to scale)



Site Photographs

Details of Subsoil

A	**MADE GROUND**	Tarmac hardstand
B	**MADE GROUND**	Probable medium dense to dense, grey, compact, sandy gravel sub-base
C	**MADE GROUND**	Impenetrable concrete hardstand at 0.33m depth - extends >0.75m from the shed wall; unable to extend any further due to pedestrian access requirements

Undrained Shear Strength (kN/m2)

Trial Pit Terminated at 0.33m depth upon impenetrable concrete

Additional trail pit TP4b excavated at the rear of the building

Roots:	None identified
Desiccation:	None identified
Dry/Groundwater:	Dry
Trees:	Refer to site drawing

Samples

Geotech:

Contam:

Notes

CAT-scanned - no services

Logged by Simon Wilkinson, S10 Geo-Consulting Limited

Stable/Unstable: Stable

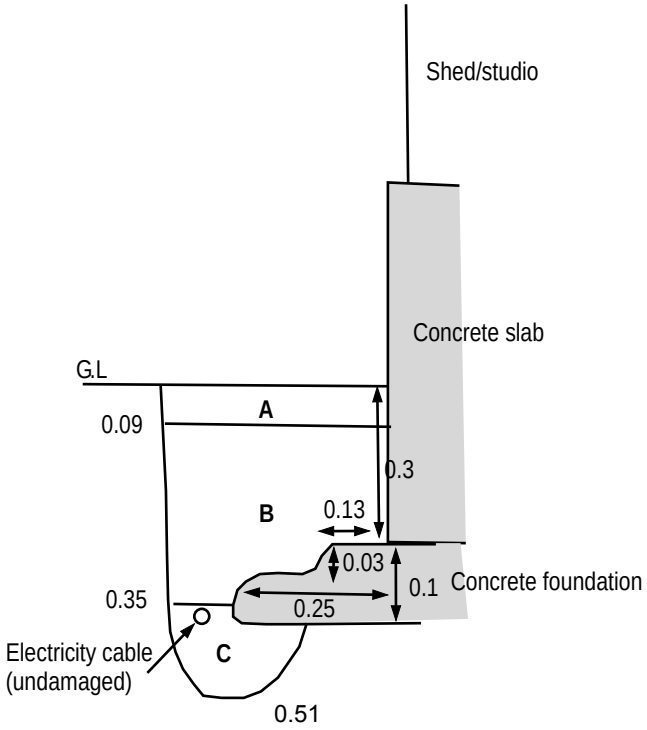
S10 Geo-Consulting
Geotechnical & Geo-environmental Ground Investigation

TRIAL PIT LOG

TP4b

Site	The Leach Pottery, St Ives
Job No.	22-137
Date	15/09/2022
Client	The Leach Pottery
Ground Level	49.9 AoD
Co-ordinates	150849, 39912

Sketch Section (not to scale)



Site Photographs




Details of Subsoil

A	**MADE GROUND**	Grass over mid brown, silty, rooted topsoil with fine rootlets
B	**MADE GROUND**	Probable loose, mid brown, slightly silty, gravelly, 'soily' sand with occasional fine rootlets up to 0.22m. Gravel is subangular, fine too coarse igneous rock including cobbles, wit rare brick cobble and rare pottery/porcelain and charcoal
C	**MADE GROUND**	Loose, pale grey pea gravel of subangular, fine granite

Undrained Shear Strength (kN/m2)

Trial Pit Terminated at 0.51 depth

Roots:	0.22m
Desiccation:	None identified
Dry/Groundwater:	Dry
Trees:	Refer to site drawing

Samples

Geotech: 0.05, 0.25m

Contam:

Notes

CAT-scanned - no services

Logged by Simon Wilkinson, S10 Geo-Consulting Limited

Stable/Unstable: Stable

APPENDIX 3 – INFILTRATION TEST RESULTS SHEETS

WS4 – Test 1

WS4 – Test 2

WS4 – Test 3

S10 Geo-Consulting
Geotechnical & Geo-environmental Ground Investigation

Project Number:	22-137	Exploratory Hole Number
Site Details:	Leach Pottery, St Ives	WS4

Soakaway Testing	Weather	Test No.
Carried out as falling head test in borehole; test approach broadly in line with BRE 365 Guidance	Cloudy, mild	1

Site Data

Elapsed Time (mins)	Depth (m)
0	0.84
1	1.01
2	1.15
3	1.21
4	1.24
5	1.25
30	1.5

N.B extrapolated value shown in red

Pit Measurements (m)

Length	0.1	m
Width	0.1	m
Depth	1.5	m
Depth to Water	0.840	m

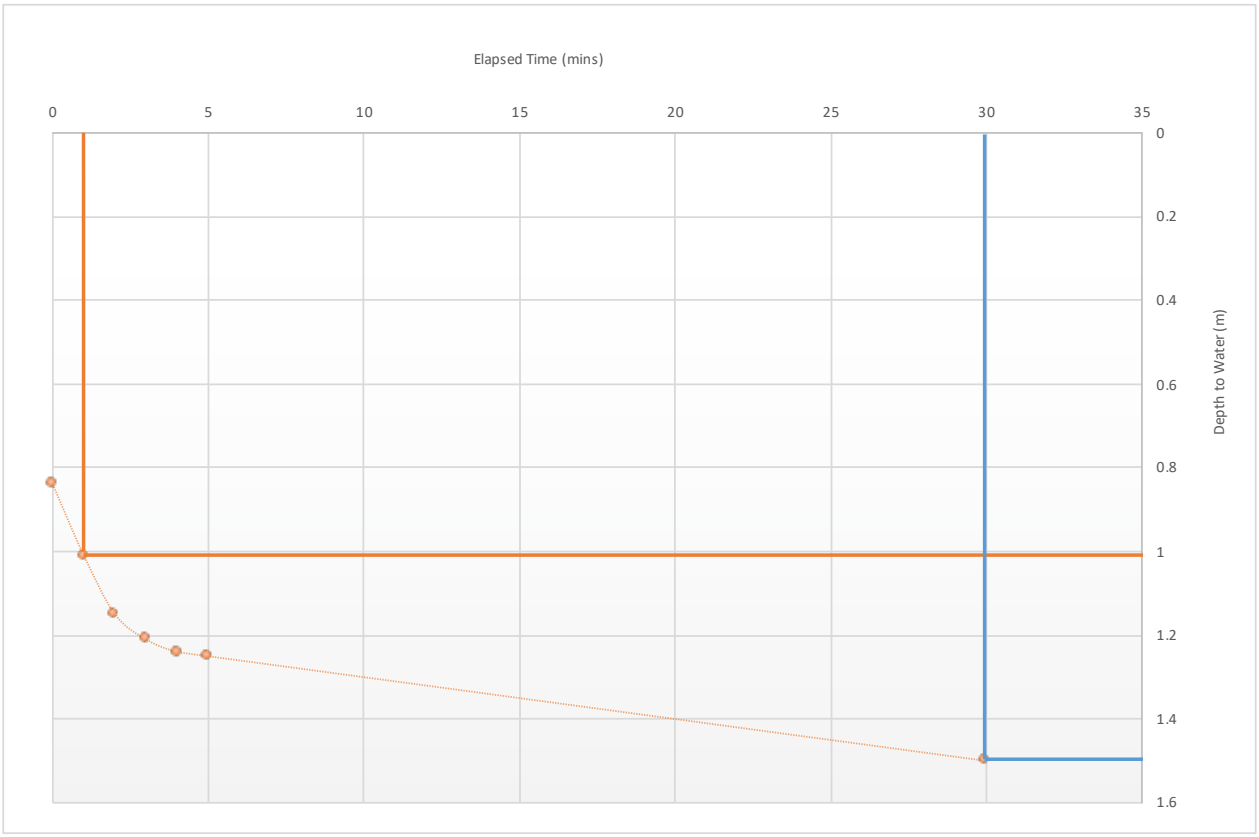
Storage / Outflow Calculations

Effective Storage Depth	0.660	m
Effective Storage Volume	0.007	m3
75% Full	1.005	m
25% Full	1.335	m
Vp75-Vp25 (Outflow Vol)	0.003	m3
Ap50 Outflow Area	0.142	m2

Outflow Time at:

75%	1	mins
25%	30	mins

Outflow tp75-tp25: 29



Soil Infiltration Rate	1.3E-05	m/second

S10 Geo-Consulting
Geotechnical & Geo-environmental Ground Investigation

Project Number:	22-137	Exploratory Hole Number
Site Details:	Leach Pottery, St Ives	WS4

Soakaway Testing	Weather	Test No.
Carried out as falling head test in borehole; test approach broadly in line with BRE 365 Guidance	Cloudy, mild	2

Site Data

Elapsed Time (mins)	Depth (m)
0	0.79
1	0.86
2	0.9
3	0.94
4	0.98
5	1.02
7	1.15

Pit Measurements (m)

Length	0.1	m
Width	0.1	m
Depth	1.15	m
Depth to Water	0.790	m

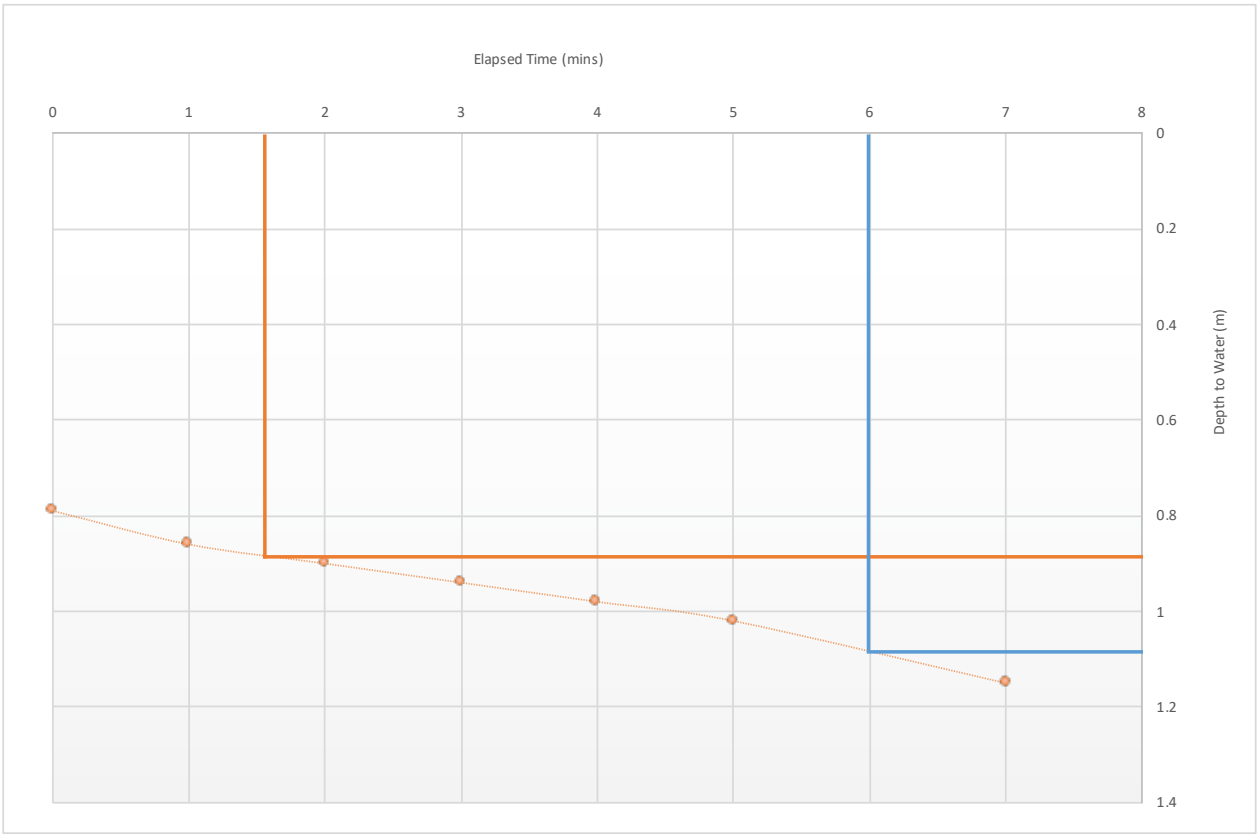
Storage / Outflow Calculations

Effective Storage Depth	0.360	m
Effective Storage Volume	0.004	m3
75% Full	0.880	m
25% Full	1.060	m
Vp75-Vp25 (Outflow Vol)	0.002	m3
Ap50 Outflow Area	0.082	m2

Outflow Time at:

75%	1.5	mins
25%	6	mins

Outflow tp75-tp25: 4.5



Soil Infiltration Rate	8.1E-05	m/second

S10 Geo-Consulting
Geotechnical & Geo-environmental Ground Investigation

Project Number:	22-137	Exploratory Hole Number
Site Details:	Leach Pottery, St Ives	WS4

Soakaway Testing	Weather	Test No.
Carried out as falling head test in borehole; test approach broadly in line with BRE 365 Guidance	Cloudy, mild	3

Site Data

Elapsed Time (mins)	Depth (m)
0	0.78
1	0.84
2	0.86
3	0.88
4	0.9
5	0.92
6	0.94
7	0.96
8	1.04

Pit Measurements (m)

Length	0.1	m
Width	0.1	m
Depth	1.07	m
Depth to Water	0.780	m

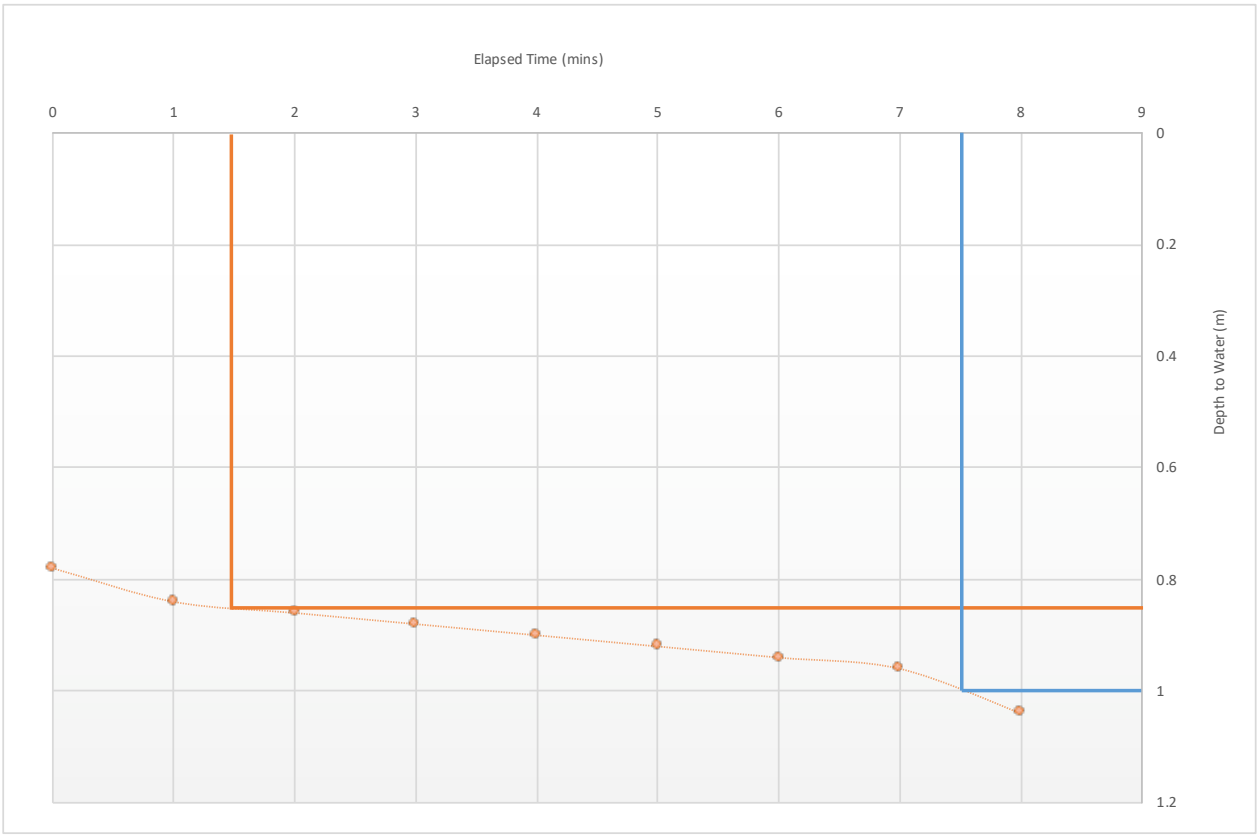
Storage / Outflow Calculations

Effective Storage Depth	0.290	m
Effective Storage Volume	0.003	m3
75% Full	0.853	m
25% Full	0.998	m
Vp75-Vp25 (Outflow Vol)	0.001	m3
Ap50 Outflow Area	0.068	m2

Outflow Time at:

75%	1.5	mins
25%	7.5	mins

Outflow tp75-tp25: 6



Soil Infiltration Rate	5.9E-05	m/second

APPENDIX 4

Contamination Statutory Framework Methodology

In line with the definition set out within Part 2A of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995), land is classified as 'contaminated land' when substances within or under the land result in significant harm being caused, or pose a significant possibility of significant harm, and/or where pollution of controlled waters is being caused, or is likely to be caused. A revision to the guidance in 2012 introduced a new four category approach in classifying land affected by contamination:
Category 1: there is an unacceptably high probability, supported by robust science-based evidence, that significant harm would occur if no action is taken to stop it.
Category 2: there is a strong case for considering that the risks from the land are of sufficient concern that the land poses a significant possibility of significant harm.
Category 3: land where the risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted.
Category 4: land that is clearly not contaminated land, where there is no risk or the level of risk posed is low.

New Category 4 Screening Levels (C4SLs) were subsequently developed by DEFRA and published by CL:AIRE, resulting in a framework and methodology including screening values for six common contaminants, in order to provide a simplified test for regulators to aid decision making on when land was suitable for use. Further research by LQM in conjunction with CIEH resulted in the publication of Suitable for Use Levels (S4Uls), which are now utilised as a robust source of guidance.

In the event that land is determined as contaminated land, the enforcing authority must consider how it should be remediated and, where appropriate, it must issue a remediation notice to require such remediation. The enforcing authority may be the local authority or the Environment Agency.

New legislation concerning the UK guidance on the assessment of land contamination is set out in the Contaminated Land Reports (CLRs); there were originally twelve documents introduced, although CLR reports 7-10 were withdrawn by DEFRA & EA, with updated versions of CLR 9 and CLR 10 produced in the form of Science Report SR2 and SR1. These documents discuss the risk being a combination of probability/frequency/occurrence of a defined hazard, as well as magnitude. For a risk of pollution or environmental harm to occur as a result of ground contamination, the source – pathway – receptor concept must be applied; if any one of these elements is missing, there can be no significant risk.

The presence or potential presence of contamination is a material issue in local authority's determination of planning applications, and where a change of use is proposed, especially on brownfield land; investigation, assessment and remediation of contamination is often a requirement of the Planning Authority.

Contamination Risk Assessment Methodology

Initially, a preliminary Conceptual Site Model is developed as part of a Phase 1 desk study assessment to establish potential contaminant sources, pathways and receptors. This qualitative risk assessment considers the consequence of the potential risk (minor to severe), and the likelihood (unlikely to highly likely) within a risk matrix to establish the probability of potential hazards (very low to very high).

Follow-up Phase 2 assessment, where required, comprises quantitative assessment of human health risk by comparison of soil concentrations (laboratory test results) against Tier 1 C4SLs and/or S4Uls, taking into account the variations in the guideline values brought about by varying soil organic content (data sets for 1%, 2.5% or 6% SOC can be applied as appropriate).

Contaminant concentrations below Tier 1 screening values are considered not to warrant further risk assessment.

If/where contaminant concentrations exceed Tier 1 thresholds, then there exists a potentially unacceptable risk to human health (although not necessarily a requirement for remediation), for which progression to a Tier 2 assessment is required, where site-specific parameters are used to derive site specific assessment criteria (SSAC) within the CLEA Model (v1.07).

In terms of controlled waters, leachable-soil or groundwater laboratory test results are compared against Level 1 Environmental Quality Standard (EQS) values derived from the Water Framework Directive (Standards and Classification) Directions (England & Wales) 2015, and the current UK Drinking Water Supply (Water Quality) Regs (DWS), dependent upon the most vulnerable receptor.

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i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
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Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 22-85391

Project / Site name:	St Ives	**Samples received on:**	22/09/2022
Your job number:	22 137	**Samples instructed on/ Analysis started on:**	22/09/2022
Your order number:	22 137	**Analysis completed by:**	30/09/2022
Report Issue Number:	1	**Report issued on:**	30/09/2022
Samples Analysed:	1 leachate sample - 9 soil samples		

Izabela Wójcik

Signed:

Izabela Wójcik
Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-85391
Project / Site name: St Ives
Your Order No: 22 137

Lab Sample Number				2431858	2431859	2431860	2431861	2431862
Sample Reference				WS1	WS1	WS2	WS2	WS4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.180	0.50	1.00	1.00
Date Sampled				15/09/2022	15/09/2022	15/09/2022	15/09/2022	15/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	17	5.4	17	17	7.9
Total mass of sample received	kg	0.001	NONE	0.4	0.4	0.4	0.4	0.3
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	SFS	N/A	N/A	SFS	SFS

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2	7.5	7.8	7.8	7.9
Organic Matter (automated)	%	0.1	MCERTS	-	0.3	3	-	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	0.3	-	-	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	-	-	-
Fluorene	mg/kg	0.05	MCERTS	0.21	-	-	-	-
Phenanthrene	mg/kg	0.05	MCERTS	3	-	-	-	-
Anthracene	mg/kg	0.05	MCERTS	0.45	-	-	-	-
Fluoranthene	mg/kg	0.05	MCERTS	6.4	-	-	-	-
Pyrene	mg/kg	0.05	MCERTS	5.2	-	-	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	4.7	-	-	-	-
Chrysene	mg/kg	0.05	MCERTS	4.2	-	-	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	5.5	-	-	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	2.7	-	-	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	5	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.9	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.88	-	-	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.7	-	-	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	44.2	-	-	-	-

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	140	21	120	130	98
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	36	15	27	25	31
Copper (aqua regia extractable)	mg/kg	1	MCERTS	400	45	270	300	170
Lead (aqua regia extractable)	mg/kg	1	MCERTS	280	15	150	140	140
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	28	12	22	24	27
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	460	29	140	150	100

Petroleum Hydrocarbons

TPH Texas (C6 - C8) $_{HS\_1D\_TOTAL}$	mg/kg	0.1	ISO 17025	-	-	-	-	< 0.1
TPH Texas (C8 - C10) $_{HS\_1D\_TOTAL}$	mg/kg	0.1	MCERTS	-	-	-	-	< 0.1
TPH Texas (C10 - C12) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	1	MCERTS	-	-	-	-	< 1.0
TPH Texas (C12 - C16) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	4	MCERTS	-	-	-	-	< 4.0
TPH Texas (C16 - C21) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH Texas (C21 - C40) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH Texas (C6 - C40) $_{EH\_CU+HS\_1D\_TOTAL}$	mg/kg	10	NONE	-	-	-	-	< 10

Analytical Report Number: 22-85391
Project / Site name: St Ives
Your Order No: 22 137

Lab Sample Number				2431858	2431859	2431860	2431861	2431862
Sample Reference				WS1	WS1	WS2	WS2	WS4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.180	0.50	1.00	1.00
Date Sampled				15/09/2022	15/09/2022	15/09/2022	15/09/2022	15/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-85391
Project / Site name: St Ives
Your Order No: 22 137

Lab Sample Number				2431863	2431864	2431865	2431866
Sample Reference				TP2	TP3	TP4B	TP4B
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.20	0.25	0.25
Date Sampled				16/09/2022	16/09/2022	16/09/2022	16/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	8	8.4	24	15
Total mass of sample received	kg	0.001	NONE	0.4	0.4	0.4	0.4
Asbestos in Soil	Type	N/A	ISO 17025	-	-	-	-
Asbestos Analyst ID	N/A	N/A	N/A	N/A	N/A	N/A	N/A
General Inorganics							
pH - Automated	pH Units	N/A	MCERTS	9.6	9.1	7.7	8.1
Organic Matter (automated)	%	0.1	MCERTS	-	-	-	3.5
Speciated PAHs							
Naphthalene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	-	-	0.29
Anthracene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	-	-	0.63
Pyrene	mg/kg	0.05	MCERTS	-	-	-	0.6
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	-	0.4
Chrysene	mg/kg	0.05	MCERTS	-	-	-	0.45
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	0.51
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	-	0.22
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	-	0.45
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	-	0.27
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	-	0.28
Total PAH							
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	-	4.1
Heavy Metals / Metalloids							
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	81	44	120	130
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	16	12	180	140
Copper (aqua regia extractable)	mg/kg	1	MCERTS	240	82	170	350
Lead (aqua regia extractable)	mg/kg	1	MCERTS	20	23	72	110
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11	7.7	98	70
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	58	100	120	120
Petroleum Hydrocarbons							
TPH Texas (C6 - C8) $_{HS\_1D\_TOTAL}$	mg/kg	0.1	ISO 17025	-	-	-	-
TPH Texas (C8 - C10) $_{HS\_1D\_TOTAL}$	mg/kg	0.1	MCERTS	-	-	-	-
TPH Texas (C10 - C12) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	1	MCERTS	-	-	-	-
TPH Texas (C12 - C16) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	4	MCERTS	-	-	-	-
TPH Texas (C16 - C21) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	-	-	-	-
TPH Texas (C21 - C40) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	-	-	-	-
TPH Texas (C6 - C40) $_{EH\_CU+HS\_1D\_TOTAL}$	mg/kg	10	NONE	-	-	-	-

Analytical Report Number: 22-85391
Project / Site name: St Ives
Your Order No: 22 137

Lab Sample Number				2431863	2431864	2431865	2431866
Sample Reference				TP2	TP3	TP4B	TP4B
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.40	0.20	0.25	0.25
Date Sampled				16/09/2022	16/09/2022	16/09/2022	16/09/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
U/S = Unsuitable Sample I/S = Insufficient Sample							

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Analytical Report Number: 22-85391
Project / Site name: St Ives

Your Order No: 22 137

Lab Sample Number				2431867
Sample Reference				WS4
Sample Number				None Supplied
Depth (m)				1.00
Date Sampled				15/09/2022
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	**Units**	**Limit of detection**	**Accreditation Status**	
Heavy Metals / Metalloids				
Arsenic (dissolved)	µg/l	1	ISO 17025	33
Boron (dissolved)	µg/l	10	ISO 17025	27
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	1
Copper (dissolved)	µg/l	0.7	ISO 17025	11
Lead (dissolved)	µg/l	1	ISO 17025	5.1
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	1.8
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	21

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-85391
Project / Site name: St Ives

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2431858	WS1	None Supplied	0.5	Brown loam and sand with gravel and vegetation.
2431859	WS1	None Supplied	0.18	Brown loam and sand with gravel and vegetation.
2431860	WS2	None Supplied	0.5	Brown loam and sand with gravel and vegetation.
2431861	WS2	None Supplied	1	Brown loam and sand with gravel and vegetation.
2431862	WS4	None Supplied	1	Brown loam and sand with gravel and vegetation.
2431863	TP2	None Supplied	0.4	Brown loam and sand with gravel and vegetation.
2431864	TP3	None Supplied	0.2	Brown loam and sand with gravel and vegetation.
2431865	TP4B	None Supplied	0.25	Brown loam and sand with gravel and vegetation.
2431866	TP4B	None Supplied	0.25	Brown loam and sand with gravel and vegetation.

Analytical Report Number : 22-85391
Project / Site name: St Ives

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
TPH Texas (Soil)	TPH Texas bands C6-C10 by HS/GC-MS & C10-C40 by GC-FID	In-house method	L088/L076	D	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions

Analytical Report Number : 22-85391
Project / Site name: St Ives

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
HS	Headspace Analysis				
MS	Mass spectrometry				
FID	Flame Ionisation Detector				
GC	Gas Chromatography				
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))				
CU	Clean-up - e.g. by Florisil®, silica gel				
1D	GC - Single coil/column gas chromatography				
2D	GC-GC - Double coil/column gas chromatography				
Total	Aliphatics & Aromatics				
AL	Aliphatics				
AR	Aromatics				
#1	EH_2D_Total but with humics mathematically subtracted				
#2	EH_2D_Total but with fatty acids mathematically subtracted				
_	Operator - understore to separate acronyms (exception for +)				
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total				

APPENDIX 5 – WASTE ACCEPTANCE CRITERIA (WAC) RESULTS

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Analytical Report Number : 22-85396

Project / Site name:	St Ives	**Samples received on:**	22/09/2022
Your job number:	22 137	**Samples instructed on/ Analysis started on:**	22/09/2022
Your order number:	22 137	**Analysis completed by:**	30/09/2022
Report Issue Number:	1	**Report issued on:**	30/09/2022
Samples Analysed:	1 10:1 WAC Sample		

Signed:

Dominika Warjan
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

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Waste Acceptance Criteria Analytical Results

Report No:	**22-85396**						
					Client:	**S10GEOCON**	
Location	**St Ives**						
Lab Reference (Sample Number)	2431909 / 2431910				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	16/09/2022				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	Composite						
Depth (m)	0.20-3.00						
Solid Waste Analysis							
TOC (%)**	0.3				3%	5%	6%
Loss on Ignition (%) **	2.2				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	8.07				100	--	--
pH (units)**	7.5				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	1.0				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0013			0.0109	0.5	2	25
Barium *	0.0082			0.0693	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0009			0.0072	0.5	10	70
Copper *	0.012			0.10	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0056			0.0476	0.5	10	30
Nickel *	0.0063			0.053	0.4	10	40
Lead *	0.0041			0.035	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0092			0.078	4	50	200
Chloride *	1.1			9.2	800	15000	25000
Fluoride	0.96			8.1	10	150	500
Sulphate *	2.7			22	1000	20000	50000
TDS*	48			410	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	6.32			53.3	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.40						
Dry Matter (%)	86						
Moisture (%)	14						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
*= UKAS accredited (liquid eluate analysis only)
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation
** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Analytical Report Number : 22-85396
Project / Site name: St Ives

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2431909	Composite	None Supplied	0.20-3.00	Brown loam and sand with gravel and vegetation.

Analytical Report Number : 22-85396
Project / Site name: St Ives

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D	MCERTS
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH at 20oC in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031	W	ISO 17025

Analytical Report Number : 22-85396
Project / Site name: St Ives

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

APPENDIX 6 – GAS MONITORING RESULTS

(TRIAL 2 HE.)

FIELD RECORD

GAS MONITORING

Site: Leach Pottery, Higher Stennack, St Ives

JOB No.: 22-137

BH/TP No.: WS1

Date/Monitored by: 12/10/22 — SLD.

Start Time: 11.40 am.

Barometric Pressure and Trend(previous 3 days)			Pressure Today
	1027	1024	1010

falling trend!

Ambient Temperature: 13 °C

Weather Conditions: overcast, light drizzle

Gas Concentration

		CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
585	15secs	0.0	2.4	19.7	0	0
570	30secs	0.0	2.4	19	0	0
555	45secs	0.0	2.4	18.9	0	0
540	1m	0.0	2.4	18.9	0	0
480	2m	0.0	2.4	18.9	0	0
420	3m	0.0	2.4	18.9	0	0
360	4m	0.0	2.4	18.9	0	0
300	5m	0.0	2.4	18.9	0	0
240	6m	0.0	2.4	18.9	0	0
180	7m	0.0	2.4	19.0	0	0
120	8m	0.0	2.4	19.0	0	0
60	9m	0.0	2.4	19.0	0	0
0	10m	0.0	2.4	19.0	0	0
Max Peak/Steady Values		0.0 / 0.0	2.4 / 2.4			

Flow Readings

585	15secs	0.0	l/hr
570	30secs	0.0	l/hr
555	45secs	0.0	l/hr
540	1m	0.0	l/hr
480	2m	0.0	l/hr
420	3m	0.0	l/hr
360	4m	0.0	l/hr
300	5m	0.0	l/hr
240	6m		l/hr
180	7m		l/hr
120	8m		l/hr
60	9m		l/hr
0	10m		l/hr
Max Peak/Steady Values		0.0 / 0.0	

Groundwater Level: DRY @ 2.1m

Depth and Horizon of Response Zone: 2m depth; response zone 1-2m.

FIELD RECORD

GAS MONITORING

Site: Leach Pottery, Higher Stennack, St Ives

JOB No.: 22-137

BH/TP No.: WS2

Date/Monitored by: 12/10/22 — SW

Start Time: 12.00 pm.

Barometric Pressure and Trend(previous 3 days)		Pressure Today
1027	1024	1010

falling trend !

Ambient Temperature: 13 °C

Weather Conditions: overcast, light drizzle

Gas Concentration

		CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
585	15secs	0.0	2.7	14.5	0	0
570	30secs	0.0	2.9	12.6	0	0
555	45secs	0.0	2.9	12.5	0	0
540	1m	0.0	3.0	12.5	0	0
480	2m	0.0	3.0	12.4	0	0
420	3m	0.0	3.0	12.2	0	0
360	4m	0.0	3.0	11.9	0	0
300	5m	0.0	3.0	11.8	0	0
240	6m	0.0	3.0	11.8	0	0
180	7m	0.0	3.0	11.7	0	0
120	8m	0.0	3.0	11.7	0	0
60	9m	0.0	3.0	11.7	0	0
0	10m	0.0	3.0	11.7	0	0
Max Peak/Steady Values		0.0 / 0.0	3.0 / 3.0			

Flow Readings

585	15secs	0.0	l/hr
570	30secs	0.0	l/hr
555	45secs	0.0	l/hr
540	1m	0.0	l/hr
480	2m	0.0	l/hr
420	3m	0.0	l/hr
360	4m	0.0	l/hr
300	5m	0.0	l/hr
240	6m		l/hr
180	7m		l/hr
120	8m		l/hr
60	9m		l/hr
0	10m		l/hr
Max Peak/Steady Values		0.0 / 0.0	

Groundwater Level: DRY @ 3.2m

Depth and Horizon of Response Zone: Depth 3m ; response zone 1-3 m

APPENDIX 7 – WHEAL JANE CONSULTANCY DESKTOP MINING SEARCH

(ref: MS41470, dated 3rd February 2022)

Wheal Jane Consultancy
Old Mine Offices
Wheal Jane
Baldhu, Truro
Cornwall, TR3 6EE

Archival (Desktop) Mining Search

Mining Risk: Moderate

Action: Structural Inspection

Address: Leach Pottery
Higher Stennack
St Ives
Cornwall
TR26 2HE

Client: Bernard Leach (St Ives) Trust Ltd
Leach Pottery
Higher Stennack
St Ives
Cornwall
TR26 2HE

Your Ref.:

Our Ref.: MS41470

Date: 3 February 2022

01872 560 200
consultancy@wheal-jane.co.uk

Dear Sirs,

Re: Leach Pottery, Higher Stennack, St Ives, Cornwall, TR26 2HE

We thank you for your recent request.

As instructed, we have carried out a mining search in respect of the above property, as delineated on the plan supplied for the purpose of requesting this search (a copy of which is included with this report).

The purpose of this mine search is to examine and interpret the plans and records in our possession relating to metalliferous mining activity and based upon this information, give a professional opinion in respect of potential risk to the property from such historical mining activity and, if required, make recommendations as may be deemed appropriate.

Where other workings relating to clay, stone or other minerals are noted to be in close proximity to the property mention will be made of them.

This report is of a format suitable for conveyancing purposes.

Mining Activity

The property, which is shown edged in green on the attached plan, is located in the St Ives mining district. It lies within the lease or sett boundaries of the old St Ives Consols Mine.

A lode (mineralised structure) known as Caunter Lode underlies the property, old geological mapping indicates it lying as shown by the zone coloured orange.

This is suggested to be a position at considerable depth from surface and is noted to be dipping in a southerly direction.

The plans of St Ives Consols Mine show considerable deep level workings on the course of this lode underlying the property.

The shallowest of these workings is identified as the 67 fathom level, which would lie at a depth in excess of 100 metres from surface.

These deep workings have been omitted from the plan for clarity.

An old mine shaft known as Millets Shaft lies some 25 metres to the east-south-east of the eastern end of the property.

Other shafts lie over 35 metres to the west-north-west of the property.

An old mine shaft known as Cornish Shaft of St Ives Consols Mine lies over 50 metres to the north-west of the property.

This shaft suffered a collapse on the 28th March 2018.

We have found no evidence of clay workings or other mineral workings in the immediate vicinity of the property.

Based upon the historic mapping sources we have reviewed we have found no evidence of any water supply wells within the boundaries of the property.

Conclusions

We know of no plans to exploit metallic minerals in the locality, nor do we consider this a likely event.

Although, based upon the information that is held in our possession, at the time of writing this report, we have found no documentary evidence to indicate the presence of shallow old mine workings directly underlying the property, given the location of the property within an area of extensive and ancient mining activity, we would consider it prudent that the property should be inspected.

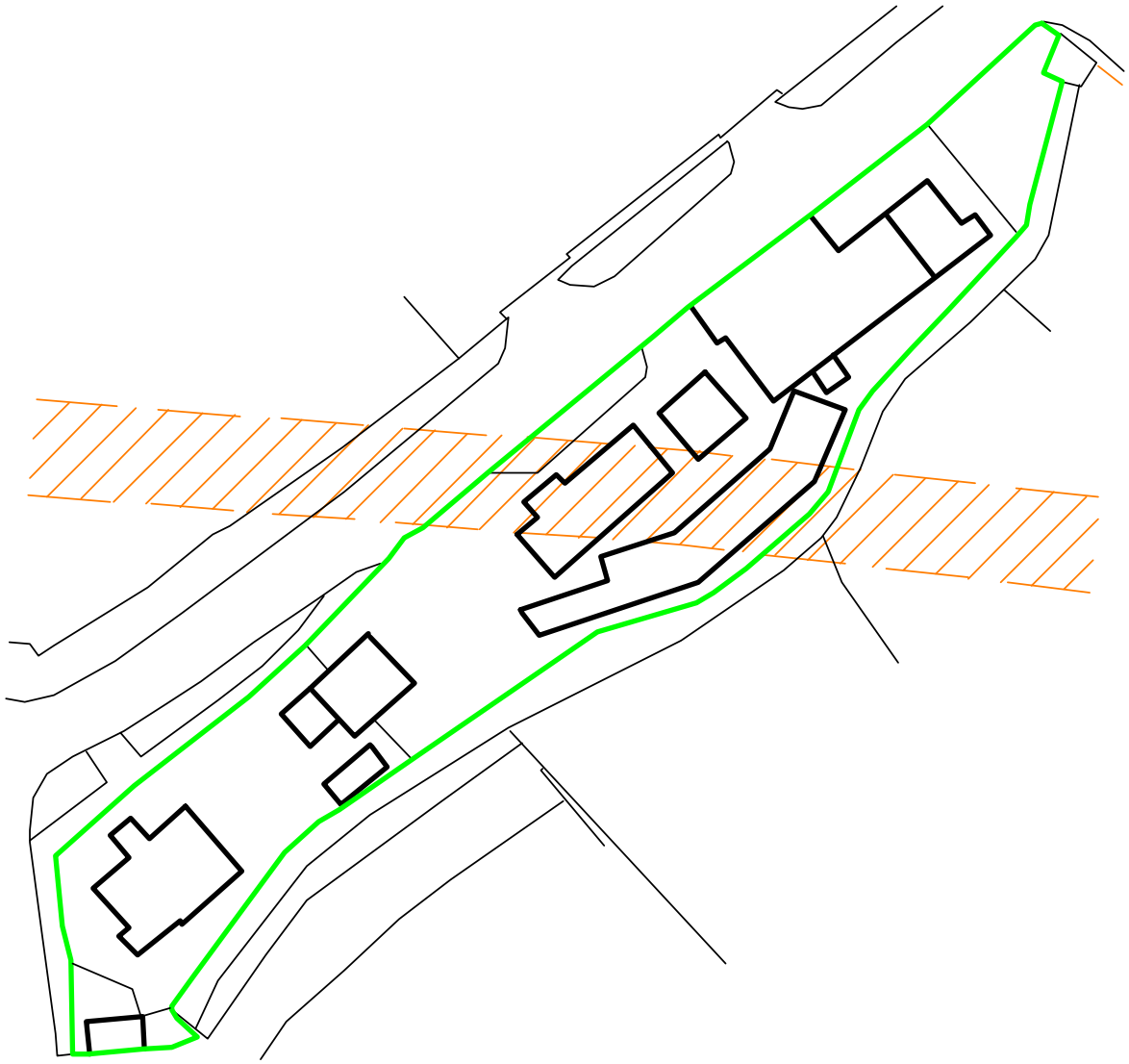
Recommendations

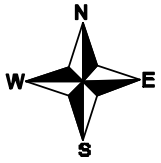
We would recommend that a qualified, chartered structural / civil engineer or surveyor, with experience of looking for mining and quarrying related issues, undertakes a thorough visual inspection of the property to check for any signs of abnormal settlement or distress.

If no evidence of any abnormal structural movement is observed in the course of such an inspection, we would consider that the property is at low risk from being affected by past mining activity.

Action: Structural Inspection

TITLE:	SCALE:	CLIENT REF.:
Archival Mining Plan	No Scale	
OUR REF:	DATE:	SITE ADDRESS: Leach Pottery Higher Stennack St Ives, TR26 2HE
MS41524	3 February 2022	





Legend

- Approximate location of Mine Shaft
- Mine Burrows (waste tips)
- Lode Zone (surface or undefined elevation)
- Adit (drainage tunnel)
- Possible Mine Shaft
- Deep Mine Tunnels
- Property Boundary

OS Licence No. AL 100040807

Wheal Jane Consultancy

Wheal Jane Mine
Baldhu
Truro
Cornwall
TR3 6EE

Tel: 01872 560200
Fax: 01872 562000
e-mail: consultancy@wheal-jane.co.uk
www.wheal-jane-consultancy.co.uk

Scope of Search & Limitations

This search has been carried out with reference to the extensive collection of plans, records and archives that are held in our possession at the time of writing this report and from this material we have endeavoured to give as accurate a report as possible in respect of the property as delineated in the initial request.

However, taking into account that such records may not be wholly complete or accurate, that records may exist of which we do not hold copies, or records exist that are held in private sources which are not available to us and that in Cornwall, Devon and Somerset many ancient shallow workings and shafts exist of which there are no records, we cannot accept liability for any inaccuracies there may be.

This report is concerned solely with the property searched and should not be used in connection with adjacent properties as only relevant mining features have been mentioned and any known features that would not have a direct influence upon the target property may have been omitted for clarity.

The report is based upon the property boundaries as shown on the supplied request plan.

We cannot accept liability for any inaccuracies if the property boundaries, as supplied to us by the client or the client's agent, are subsequently shown to be incorrect, incomplete or if no such request plan has been supplied when the search has been requested.

This report is confidential to the client and the client's legal advisor and the client's mortgage lender and as such may be used by them for conveyancing or related purposes.

We have no liability toward any person or organisation not party to commissioning this report.

This report or any part of it, is not permitted to be reproduced, copied, altered or in any other way distributed by any other person or organisation.

Unless otherwise expressly stated, nothing in this report shall create or confer any rights or other benefits pursuant to the Contracts (Rights of Third Parties) Act 1999 in favour of any person or organisation other than the person/organisation commissioning this report.

This report is not a contaminated land, environmental, geotechnical or archaeological survey and should not be interpreted as such.

No site visit has been made.

We trust that this report is to your satisfaction and will be happy to answer any queries with respect to it.

Yours faithfully,

Wheal Jane Consultancy
dalef@wheal-jane.co.uk
01872 560200

Mining Glossary

Adit	Horizontal mine drainage tunnel driven from low ground into mine workings. The adit tunnel is the shallowest level shown on mine plans and usually represents the earliest period of workings recorded. Adits have ventilation shafts at regular intervals, which are mostly unrecorded.
Alluvium	Clay, sand and debris deposited by a river. Often streamed for tin.
Burrow	A mine waste tip.
Caunter lode	A lode which runs in a different direction to the general trend of lodes in the district.
Coffin/Koffen	Trench-like openwork at surface.
Costean Pit	A small surface pit excavated to locate and/or sample a lode.
Crosscourse	Geological features which run at right-angles to the principal lodes of a district, and are vertical or sub-vertical faults. Mostly barren of payable minerals, but can carry values of iron ore, cobalt and other metallic minerals. Also known as 'guides' or 'trawns' in the St Just and St Ives mining districts respectively.
Crosscut	Tunnel driven underground, usually at right-angles to the lodes.
Dip of Lode	Angle of inclination of a lode from the horizontal.
Drive	Tunnel driven along the course of a lode.
Elvan	Igneous rock (quartz-porphyry) occurring as a vein or dyke. Can be extremely hard. Exploited by quarrying.
Granite	Igneous rock. Crystalline mixture of quartz, feldspar and mica.
Greenstone	Igneous rock also called 'blue elvan'. Generally extremely hard.
Gunnis	Open stope at surface or underground.
Kaolinisation	Alterations or weathering of granite to clay and sand from solid rock.
Killas	Generic term given to sedimentary rock in Cornwall.
Leat	A man-made watercourse.
Level	Horizon underground where ore movement and communications are maintained. Levels consist of lode drives and crosscut tunnels: i.e. 12 fathom level; the system of tunnels driven at 12 fathoms below adit horizon.
Lode	A mineralised structure or vein. Most lodes run from surface vertically or sub-vertically, and can vary from a few inches to several metres in width.
Mundic	Iron pyrite, arsenic and sulphur - arsenopyrite.
Openwork	A surface working, which has usually left a pit or backfilled excavation.
Outcrop	The part of the lode which breaks surface. Worked-out voids and backfilled areas are outcrop features.
Rab	Weathered zone of mixed rock and soil (natural profile)
Sett	An area of land leased for mining.
Shaft	Holes in the ground, which can vary from 0.5m x 1m up to shafts 7m across. Engine shafts tends to be large (typically 3m x 2m) and adit shafts are smaller (typically 1.2m x 1.8m). Depths vary down to 700m.
Stockwork	Mass of narrow veins or lodes running parallel and sub-parallel.
Stope	Ground where lode has been removed leaving void. Sometimes open to surface.
Tailings	Residual sands and slimes from ore dressing. Usually heavily contaminated.

Mining References (generic listing)

H G Dines - The Metalliferous Mining Region of South West England (2 Vols)
A K Hamilton Jenkin - Mines & Miners of Cornwall (16 Vols)
A K Hamilton Jenkin - Mines of Devon (2 Vols)
A K Hamilton Jenkin - Wendron
Thomas Spargo - Tin Mines of Cornwall (6 Vols)
J H Collins - Observations of West of England Mining Region
Sellwood, Durrance & Bristow - Geology of Cornwall
Durrance & Laming - Geology of Devon
Burt, Waite & Burnley - Cornish Mines
MRO Plans (CRO)
MRO Copies (SC Archive)
MRO Microfiche (SC)
South Crofty Archive
Tehidy Minerals Archive
JMS/JAB/JHB Archive
Wheal Jane Collection
Wheal Pendarves Collection
Geevor Collection
Thyssen Review & Plans
A K H Jenkin, Annotated 6" Plans
Geological 6" Plans
Richard Thomas Plans
Robert & Brenton Symons Plans
Nicholas Whitley Plans
K Bennet Annotated Plans
R Lyon Annotated Plans
Ordnance Survey 1880, 1906, etc Maps
H G Dines Composites

Search Request Plan

Copy of the request plan provided to Wheal Jane Consultancy to identify the property for search purposes:

Accuracy, quick turnaround times, competitive prices, fully qualified and experienced staff, full professional indemnity insurance cover.

Cornwall's first ISO certified mine search and site investigation specialists

Wheal Jane Consultancy

Geotechnical, environmental & mining services

Mine Search – What Next?