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Geo-Environmental Investigation

Project: Plots 3 to 5, Lincolnshire Food Enterprise Zone (FEZ), Holbeach

EGE Project No: EGE-22-08-09-01

Client: Stirlin Developments Limited

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1.0 Authorisation, Context and Purpose

1.1 Authorisation

Evolve Geo-Environmental Limited (EGE) was instructed by Stirlin Developments Limited (the 'Client') to undertake a Geo-Environmental Investigation for Plot 3, Plot 4 and Plot 5, Lincolnshire Food Enterprise Zone (FEZ), Holbeach (the 'Site). This Report follows the Preliminary (Geo-Environmental) Risk Assessment (PRA) undertaken for the Site, dated 7th September 2022.

1.2 Context and Purpose

This Report is designed in general accordance with:

- Guidance on Land Contamination: Risk Management pages of the GOV.UK web pages;
- The relevant requirements of the National Planning Policy Framework 2019 (NPPF) (paragraphs 170 & 178-180) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf; and
- The Planning Practice Guidance (Land Affected by Contamination) https://www.gov.uk/guidance/land-affected-by-contamination.

The aim of the study was to complete a geo-environmental assessment of the Site to obtain information regarding ground conditions, from which risks to end-users, the environment and structures have been assessed specific to the proposed development scheme, with remediation, and/or mitigation measures suggested, where necessary.

The investigation has also gathered geotechnical information to support preliminary design of foundations and infrastructure. The Report provides recommendations for further work (where appropriate) based on the findings of the investigation.

1.3 Existing Information

EGE has been provided/ obtained the following information:

- GPS Survey for Proposed Units (Topo), South Lincs Food Enterprise Zone, Holbeach, by Castle Hill Surveys Limited, drawing No. CHS-22-143-01, dated 8th July 2022 (Drawing I);
- Proposed Site Layout, Landscaping and Boundary Details, South Lincs Food Enterprise Zone, Plots 3,4 & 5, by John Roberts Architects, Drawing No. 8174S-PP-02 Rev. C, dated June 2022 (Drawing II); and
- Preliminary (Geo-Environmental) Risk Assessment (PRA), Plots 3, 4 and 5, Food Enterprise Zone (FEZ), Holbeach by Evolve Geo-Environmental, dated September 2022.

1.4 Proposed Development

The proposed development comprises up to 12 no. light industrial units arranged in 3 no. blocks with associated hard and soft landscaping.

A Proposed Development Plan is included as Drawing II.

1.5 Limitations

Although specific sections of this Report may generally follow guidance set out in Eurocode 7 for a Ground Investigation Report (GIR), as defined in BS EN 1997-1:2004 and BS EN 1997-2:2007, this Report has not been designed to fully meet Eurocode 7 requirements, including number of sampling locations and sample quality protocols. Furthermore, this Report also includes information which may support a Geotechnical Design Report (GDR) as defined in BS EN 1997-1:2004; however, unless otherwise explicitly stated, the investigation has not been undertaken in accordance with Eurocode 7 and the preliminary geotechnical interpretation, assessments, and recommendations presented within this Report may not meet the full requirements of a GDR.

The EGE standard limitations are included as Appendix I. In addition, the following limitations also apply to this Assessment:

- This Assessment does not constitute a Flood Risk Assessment (FRA); and
- This investigation was not undertaken to advise on the classification or potential management routes for waste materials. Classification and management of these waste soils either on to Site, off Site or within the development are likely to require further investigation and assessment. Comments on potential disposal routes are for information purposes only.

Specific limitations encountered during the Ground Investigation (GI) include the following:

- Locations were positioned based on existing underground utilities, which includes an underground electricity service trending east to west within the southern boundary;
- Locations were limited in the southern and central part of the Site given the presence of large earth bunds (approximately 1.5 m to 2.0 m in height) in this part of the Site;
- Borehole BH101 was terminated at 15.00 m bgl given very dense sands and collapse; as such a further borehole (BH102) was drilled to provide additional coverage which was extended to a maximum depth of 12.80 m bgl; and
- Two BRE365 infiltration test locations (SA101 and SA102) were undertaken at depths of approximately 1.00 m bgl and 1.60 m bgl, respectively. Given the very slow to static infiltration rates, the testing was terminated and deemed a failed test.

These limitations are not considered to have affected the aims of the investigation and good overall coverage was obtained.

2.0 Site Details

A summary of the current Site status, environmental setting and key historical features is presented below. This has been summarised from the existing report(s) listed in Section 1.3 which should be consulted for further detail.

2.1 Site Setting

Co-ordinates, Area and Elevation	▽ National Grid Reference (NGR) 534660, 325560; ▽ Approximately 0.5 Hectares (ha); and ▽ Circa 3.0 to 3.4 (m) above ordnance datum (AOD) at the Site surface and 4.0 to 4.9 m AOD on top of the existing bunds. Information based on Client provided Topographical Survey included as Drawing I.
General Site Location	The Site is 0.51 hectares (ha) and is located approximately 1.5 km to the north west of Holbeach town centre, and approximately 450 m south west of the A17/A151 junction. The Site is accessed via a newly constructed spur from a roundabout on the A151. A Site Location Map of the area currently under Assessment is provided as Figure I.
Current Site Use	The Site is currently an undeveloped parcel of land associated with the wider FEZ development area. The Site is almost entirely covered with waist high self-set weeds and shrubs. A small earth bund is present across the north part of the Site, adjacent to the access road to prevent unlawful access. Large earth bunds circa 1.5 m to 2.0 m in height, covered with self-set weeds and shrubs, are present trending east to west in the southern part of the Site. It is highly feasible that these are waste arisings from the construction of the new adjacent development sites and/or the access road which links to the A151 roundabout. Other smaller stockpiles of material are also present including asphalt plannings, limestone hardcore and mixed soil/concrete stockpiles.
Adjacent Land use	The Site is bound by the following land uses: ▽ North – new access road, beyond which is a vacant development plot associated with the wider FEZ area; ▽ East – A foul water pumping station associated with the FEZ development area; ▽ South – Rose View Drive mobile home park; and ▽ West – Vacant development plot associated with the wider FEZ area.
Site Setting	Reference to the BGS online viewer indicates that the Site is underlain by superficial Tidal Flat Deposits (Clay and Silt) which are in turn underlain by the West Walton Formation (Mudstone and Siltstone bedrock). The superficial and bedrock aquifers are classified as Unproductive Strata. The Site is not within Source Protection Zone (SPZ).

	There are no groundwater abstractions within 500 m of the Site. The nearest surface water feature is an unnamed land drainage associated with the A151 located approximately 90 m south east. The New River (Drain) is located approximately 300 m to the east. There are no surface water abstractions within 500 m of the Site. A footpath and associated land drain are shown to trend across the Site from historical mapping in a general east to west direction from the first map edition dated 1887 until sometime between 1969 and 1977 when they are no longer shown, with the drain assumed to have been infilled. No other relevant features are noted on subsequent mapping. No pertinent on or off-Site records were identified from the Landmark Report.
EGE Initial CSM	**Potential sources** of contamination were identified as follows: ▽ Potential infilled drain trending approximately east to west across the Site; ▽ Limited fuel spillages from framing activities; ▽ Potential Made Ground/deposited waste from adjacent construction activities and within stockpiles; and ▽ Potential unrecorded/ un-mapped sources. **Potential receptors** were considered to include: ▽ Construction workers. ▽ Third parties during construction (adjacent Site users and adjacent residents). ▽ Future Site users and maintenance workers ▽ The unnamed surface water approximately 90 m south east; and ▽ The Built Environment (new buildings and infrastructure / utilities). **Potential pathways** were considered to be as follows: ▽ Direct contact, ingestion or inhalation of soil bound contaminants / dust during or following redevelopment. ▽ Inhalation of organic vapours associated with contamination. ▽ Migration of ground gas / vapours into on-site buildings causing asphyxiation or risk of explosion. ▽ Leaching of contamination into perched groundwater followed by migration of groundwater to the wider groundwater environment. ▽ Direct contact between aggressive ground conditions and new infrastructure. On the basis of the above, environmental investigation was recommended to be undertaken to confirm the soil conditions and risk to the identified receptors, which could be undertaken at the time of a geotechnical assessment.

3.0 Ground Investigation

EGE undertook intrusive investigation on the 6th September 2022 to assess the Possible Pollutant Linkages (PPL's) identified in the initial CSM and provide preliminary geotechnical information.

3.1 Ground Investigation Scope of Works

The scope of works included the following:

- Appointment of a specialist service avoidance contractor to clear intrusive locations for the presence of identifiable services/utilities and provide x, y and z co-ordinates of intrusive locations;
- Supervision by two EGE representatives over one day to supervise work on full time Site attendance basis;
- Drilling of 2 no. sonic boreholes (BH101 and BH102) to a maximum depth of 15.00 m bgl with Standard Penetration Tests (SPTs) at 1.0 m centres for the first 5.0 m and 1.5 m centres thereafter;
- Installation of 1 no. boreholes (BH101) as a 50 mm internal diameter monitoring well to facilitate groundwater level and ground gas monitoring;
- Undertake 5 no. machine dug trial pits (TP101 to TP105) to a maximum depth of 2.00 m bgl;
- Completion of 2 no. soil infiltration tests (SA101 and SA102) at depths of approximately 1.60 and 1.00 m bgl, respectively to BRE365 methodology;
- Excavation within existing stockpiles (Bund 1 and Bund 2) to visually assess the materials and collect samples for chemical analytical testing;
- Plate load CBR testing within TP101 to TP104 at depths between 0.20 and 0.35 m bgl (below topsoil/Made Ground);
- Collection of soil samples for chemical and geotechnical laboratory testing from across the Site; and
- Completion of three (3 no.) groundwater level and ground gas monitoring visits at approximately weekly intervals following completion of intrusive works.

An Approximate Intrusive Location Plan is included as Figure III. Exploratory hole logs are included as Appendix II.

3.2 Environmental Sample Rational and Sampling Methodology

The locations were positioned based on information collected and reviewed within the previous PRA and also based on EGE's Site reconnaissance at the time of the investigation.

Chemical testing was undertaken on selected samples based from on-Site observations during soil sampling and the PRA.

Soils collected for laboratory analysis were placed in a variety of containers appropriate to the anticipated testing suite. Records of the samples taken as part of the Site investigation works, including their depths and location, are included within the exploratory hole records. All samples were submitted to a UKAS accredited laboratory (EurofinsChemtest) with testing

methodologies for each specific compounds contained within the laboratory results included as Appendix III.

3.2.1 Environmental Sampling Rational

Sample Location	Depth (m bgl)	Justification	Strata	Determinands						
				Metals in soil	Asbestos identification	Speciated EPA-16 PAHs	pH in soil	TPHCWG A/A Split	Inert WAC (Single Stage)	Moisture Content
BH101	0.50	General Site Coverage	Made Ground (Topsoil)	✓	✓	✓	✓	✓		✓
BH102	1.00		Tidal Flat Deposits	✓	✓	✓	✓	✓		✓
TP102	0.10		Made Ground (Topsoil)	✓	✓	✓	✓	✓	✓	✓
TP105	0.20			✓	✓	✓	✓	✓		✓
SA102	0.20			✓	✓	✓	✓	✓		✓
Bund 1 (S1)	Composite	Soil Bund	Made Ground	✓	✓				✓	✓
Total				**6**	**6**	**5**	**5**	**5**	**2**	**6**

3.2.2 Monitoring Well Installations

One (1 no.) borehole (BH101) was installed as a 50 mm internal diameter groundwater level and ground gas monitoring well, installed within the natural soils. The well construction details are included within the exploratory hole logs within Appendix II.

3.3 Geotechnical Sample Rational and Sampling Methodology

The locations were positioned based on the Client provided development plan to inform preliminary foundation information and pavement design. The locations were agreed with the Client prior to the works being undertaken.

Sampling comprised disturbed jar/tub and bulk samples as detailed on the exploratory logs. All samples were submitted to a UKAS accredited laboratory (Lincs Lab) with the specific testing standards contained within the laboratory results included as Appendix IV.

3.2.3 Geotechnical Sampling Rational

Sample Location	Depth (m bgl)	Justification	Strata	Determinands			
				Moisture Content	PSD - Dry Sieve BS	Atterberg (4 point)	pH and Water Soluble
BH101	2.00	BRE Special Digest 1 Concrete in aggressive ground	Sandy clayey SILT				✓
BH101	2.50	Soil classification and water content.		✓	✓		
BH101	6.00	BRE Special Digest 1 Concrete in aggressive ground	Fine to medium SAND				✓
BH101	12.00		Medium SAND				✓
BH102	3.00 - 4.00	Soil classification and water content.	Silty fine to medium SAND	✓	✓		
TP102	1.50	Soil classification and water content.	Silty fine SAND	✓	✓		
TP105	1.00	To assess potential shrinkage and swelling of clays	Silty CLAY			✓	
Total				**3 (9*)**	**3**	**1**	**3**

*Additional 6 no. moisture contents in chemical testing

3.4 In-Situ Testing

SPT tests were undertaken in BH101 and BH102, at 1.00 m intervals until 5.00 m bgl and 1.50 m thereafter. The results of these tests are presented on the borehole logs included as Appendix II.

3.5 Monitoring Programme

Three (3 no.) rounds of groundwater level and ground gas monitoring were undertaken on BH101 between 12th and 27th September 2022.

Measurements of the depth to groundwater within the monitoring wells were taken using an electronic dip meter.

To characterise the ground gas regime at the Site, an infrared gas meter was used to measure gas flow, concentrations of carbon dioxide (CO2), methane (CH4) and oxygen (O2) in percentage by volume. Initial and steady state concentrations were recorded. The atmospheric pressure before and during monitoring, together with the weather conditions, was recorded.

The monitoring record sheets are included as Appendix V.

4.0 Ground Conditions

The following Sections summarise the soil and groundwater conditions identified during the Site Investigation.

4.1 Ground Conditions Summary

A summary of the observed ground conditions during the Site investigation are provided in the table below:

Strata		Description	Depth Range (m bgl)	Comments
Topsoil		Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies with frequent rootlets.	0.00 to 0.60	Identified in all locations at depths between 0.15 m (SA101 and TP101) and 0.60 m (BH101). Average depth of 0.28 m.
Tidal Flat Deposits	Beneath the topsoil, Tidal Flat Deposits comprising clays, silts and sands were identified from a minimum depth of 0.15 m bgl to the maximum drilled depth of 15.00 m bgl. Strength characteristics of the deposit were generally consistent comprising of firm silts and clays or medium dense to dense sands which increased to very dense with depth. Given the variable consistency of the deposit, it is difficult to differentiate between the sands/ silts and clays through on-Site observations and the descriptions within the borehole logs and those in the table below are aided by the laboratory results.			
	Silt	Firm yellowish orange occasionally grey slightly sandy SILT.	0.15 to 3.00	Identified in BH101 and BH102 and TP101 to TP105.
	Clay	Firm orangish brown silty CLAY.	0.20 to 1.70	Identified in BH101, SA102 and TP105.
	Sand	Medium dense to dense, becoming very dense with depth (approximately 10.00 m bgl) orangish grey occasionally silty fine to medium SAND.	0.15 to 15.00+	Identified in BH101, BH102, SA101, TP102 and TP105.
Soil Stockpiles		Soft dark grey/ dark brown very sandy silty CLAY, with occasional fine to coarse gravels. (TOPSOIL)	-	Likely topsoil strip from the wider FEZ development plots.

The ground conditions across the Site are typical of the mapped geology.

No evidence of peat or organic materials was noted within the Tidal Flat Deposits.

4.2 Visual and Olfactory Evidence of Contamination

Significant visual and olfactory evidence of contamination was not identified during the soil sampling exercise.

4.3 Groundwater Strikes during Site Investigation

No groundwater was identified during the intrusive investigation.

4.4 Groundwater Levels during Monitoring

Groundwater levels were monitored on a total of three (3 no.) occasions at approximately weekly intervals between 12th and 27th September 2022. The monitoring record sheets are included as Appendix V and summarised in the table below.

Exploratory Hole Location	Groundwater Level (m bgl)		Groundwater Level (m AOD)		Comments
	Maximum	Minimum	Maximum	Minimum	
BH101	2.47	2.33	0.66	0.80	-

5.0 Contaminated Land Assessment

5.1 Background Information

5.1.1 Human Health

The presence of hazardous substances identified as part of the risk assessment is only of concern if an actual or potential unacceptable risk is deemed to be present. Legislation and guidance on the assessment of contaminated sites, requires a tiered risk-based approach.

Section 2.0 and Section 3.0 of this Report represents the first stage of the tiered approach to contaminated land assessment through a desk-based risk assessment and investigation. This Section represents a Generic Quantitative Risk Assessment (GQRA) from information obtained through intrusive Site investigation and a comparison of Site contaminant levels against specific Generic Assessment Criteria (GAC). The general GAC utilised as part of this assessment include:

- Land Quality Management/CIEH S4ULs for Human Health Risk Assessment 2014 (LQM);
- Category 4 Screening Levels (C4SL) by DEFRA; and
- A 5,000 mg/kg maximum value for Total TPH based on EGE professional opinion given the absence of specific GAC.

5.1.2 Controlled Waters

Given the 'prevent and limit' approach of the Water Framework Directive (2000/60/EC) and the identified receptors, a range of Water Quality Standards (WQS) have been applied as Generic Assessment Criteria (GAC), these include:

- Water Framework Directive standards and thresholds (WFD);
- Freshwater Environmental Quality Standards (EQS);
- UK Drinking Water Quality Standards (DWQS);
- WHO Guidelines for Drinking Water Quality; and
- SEPA resource protection values.

The above guidance values have been used as initial conservative GAC to assess whether groundwater contamination requires further assessment or discussion in terms of the risks to controlled waters.

5.2 Human Health Generic Quantitative Risk Assessment

Given the proposed end-use of the Site (light industrial units), the risk to Human Health has been assessed against the commercial GAC, assuming 1% Soil Organic Matter (SOM).

5.2.1 Site Wide Soil Analytical Summary

A total of six (6 no.) soil samples were collected from the Made Ground/Topsoil (4 no.), natural Tidal Flat Deposits (1 no.) and an existing soil stockpile (1 no.). The samples were submitted to a UKAS accredited laboratory for a suite of potential contaminants of concern. A summary of concentrations above laboratory detection limits are provided in the following table.

Contaminant	Max Conc. (mg/kg)	GAC (mg/kg)	GAC Source	No. Exceed GAC / No. of samples	Location of Exceedances (depth) = Concentration (mg/kg)
Asbestos	-	Detected	N/A	0/6	-
Metals					
Arsenic	7.3	640	LQM	0/6	-
Cadmium	<0.10	190	LQM	0/6	
Chromium III	12	8,600	LQM	0/6	
Copper	8.8	68,000	LQM	0/6	
Lead	9.2	2,300	C4SL	0/6	
Mercury	<0.05	1,100	LQM	0/6	
Nickel	9.5	980	LQM	0/6	
Zinc	25	730,000	LQM	0/6	
Polycyclic Aromatic Hydrocarbons					
Naphthalene	<0.10	190	LQM	0/5	-
Acenaphthylene	<0.10	83,000	LQM	0/5	
Acenaphthene	<0.10	84,000	LQM	0/5	
Fluorene	<0.10	63,000	LQM	0/5	
Phenanthrene	<0.10	22,000	LQM	0/5	
Anthracene	<0.10	520,000	LQM	0/5	
Fluoranthene	<0.10	23,000	LQM	0/5	
Pyrene	<0.10	54,000	LQM	0/5	
Benzo[a]anthracene	<0.10	170	LQM	0/5	
Chrysene	<0.10	350	LQM	0/5	
Benzo[b]fluoranthene	<0.10	44	LQM	0/5	
Benzo[k]fluoranthene	<0.10	1,200	LQM	0/5	
Benzo[a]pyrene	<0.10	35	LQM	0/5	
Indeno(1,2,3-c,d)pyrene	<0.10	500	LQM	0/5	
Dibenz(a,h)anthracene	<0.10	3.5	LQM	0/5	
Benzo[g,h,i]perylene	<0.10	3,900	LQM	0/5	
Total PAH16	<2.0	N\A	-	-	-
Petroleum Hydrocarbons					
Aliphatic TPH >C5-C6	<1.0	3,200	LQM	0/5	
Aliphatic TPH >C6-C8	<1.0	7,800	LQM	0/5	
Aliphatic TPH >C8-C10	<1.0	2,000	LQM	0/5	
Aliphatic TPH >C10-C12	<1.0	9,700	LQM	0/5	

Contaminant	Max Conc. (mg/kg)	GAC (mg/kg)	GAC Source	No. Exceed GAC / No. of samples	Location of Exceedances (depth) = Concentration (mg/kg)
Aliphatic TPH >C12-C16	<1.0	59,000	LQM	0/5	
Aliphatic TPH >C16-C21	<1.0	160,0000	LQM	0/5	
Aliphatic TPH >C21-C35	<1.0	160,0000	LQM	0/5	
Aromatic TPH >C5-C7	<1.0	26,000	LQM	0/5	
Aromatic TPH >C7-C8	<1.0	56,000	LQM	0/5	
Aromatic TPH >C8-C10	<1.0	3,500	LQM	0/5	
Aromatic TPH >C10-C12	<1.0	16,000	LQM	0/5	
Aromatic TPH >C12-C16	<1.0	36,000	LQM	0/5	
Aromatic TPH >C16-C21	<1.0	28,000	LQM	0/5	
Aromatic TPH >C21-C35	<1.0	28,000	LQM	0/5	
Total TPH	<10	5,000	EGE	0/5	-

Notes:
C4SL = Category 4 Screening Levels (C4SLs) published by DEFRA.
LQM = Land Quality Management/CIEH S4ULs for Human Health Risk Assessment, 2014.
EGE = Evolve Geo-Environmental 'in-house' screening value based on professional judgement.

Although detectable concentrations of heavy metals were identified above laboratory detection limits, these compounds were not above commercial GAC values by several orders of magnitude.

Concentrations of sPAH and TPH were not identified above laboratory detection limits.

No asbestos was identified.

Evidence of volatile vapours has not been identified.

No evidence of Non-Aqueous Phase Liquid (NAPL) was identified during sampling.

Furthermore, concentrations of target contaminants within existing topsoil were not identified above the most stringent generic assessment criteria for a residential with plant uptake and as such, topsoil is considered suitable for re-use in landscaped areas.

Significant contamination was not identified in the soil stockpile.

The chemical soil analytical results are included as Appendix III.

5.3 Controlled Waters Generic Quantitative Risk Assessment

The approach adopted to assessing risks to Controlled Waters/Water Environment is based principally on considering the concentrations of contaminants identified within groundwater samples obtained in comparison to relevant GAC.

5.3.1 Groundwater Analytical Summary

Given the low groundwater sensitivity for the Site and of the immediate surrounding area, specific groundwater samples were not required to be obtained for analysis. Furthermore, given the absence of significant desk based potential contaminative sources, the underlying

Unproductive Strata, that significant soil contamination has not been identified from in-situ soil sampling and visual and olfactory evidence of contamination (including NAPL) was not identified, the risk to Controlled Waters is considered very low.

Furthermore, the Site is largely to be covered in hardstanding/ buildings, further mitigating infiltration and subsequent lateral migration of any contamination, if present.

On this basis the risk to Controlled Waters is considered negligible and no further works or risk assessment is considered to be required.

5.4 Waste Management

In recent years a number of mechanisms have aimed to change the way in which waste materials have traditionally been managed (i.e. a move away from less sustainable options such as landfill disposal).

In general, the predominant waste material encountered during the construction phase of development schemes will likely be construction waste, predominantly waste soils within the Upper Weathered Lincolnshire Limestone Member.

This assessment was not undertaken as a waste classification assessment and has not been undertaken in accordance with WM3, however two Waste Acceptance Criteria (WAC) tests were undertaken on the materials from the Tidal Flat Deposits and bund materials.

The results of the WAC testing are included within Appendix III and should be passed to an appropriate disposal facility/ haulier to confirm disposal routes and budgets.

In accordance with best practice, sustainability and cost efficiency, materials should be retained on-Site where possible.

6.0 Geotechnical Assessment

6.1 Background Information

The proposed development comprises up to 12 no. light industrial units arranged in 3 no. blocks with associated hard and soft landscaping.

A Proposed Development Plan is included as Drawing II.

No development loads have been provided at this stage and as such, the information provided below should be treated as preliminary.

6.2 Factual Geotechnical Laboratory Data

The table below summarises the results of in-situ and laboratory test data. The geotechnical laboratory data is included as Appendix IV.

Parameter	Unit	Value or Range	Justification
Tidal Flat Deposits			
w (Water Content)	%	7.5* - 25	Laboratory Testing
IP (Plasticity Index)	-	15	Laboratory Testing
PL (Plastic Limit)	%	20	Laboratory Testing
LL (Liquid Limit)	%	35	Laboratory Testing
Volume Change Potential	-	Low	NHBC
Uncorrected SPT 'N'	Blows	8 to 50	In Situ Testing

*Including chemical results

6.3 Ground Model Summary

Ground Conditions generally comprised of topsoil underlain by Tidal Flat Deposits to the maximum drilled depth of 15.00 m bgl. Topsoil was generally sandy gravelly silt to an average thickness of 0.28 m bgl.

Beneath the topsoil, Tidal Flat Deposits comprising clays, silts and sands were identified from a minimum depth of 0.15 m bgl to the maximum drilled depth of 15.00 m bgl. Strength characteristics of the deposit were generally consistent comprising firm silts and clays or medium dense to dense sands which increased to very dense with depth. Given the variable consistency of the deposit, it is difficult to differentiate between the sands/ silts and clays is difficult through on-Site observations and the descriptions within the borehole logs are aided by the laboratory results.

Groundwater was not identified during drilling/ excavation however was identified in BH101 during return monitoring at approximately 0.80 m AOD.

6.4 Foundations

6.4.1 Spread Foundations

Made Ground/ topsoil is considered to be too variable, weak and compressible in its existing condition for conventional shallow foundations at the Site.

Subject to additional limited investigation, particularly within areas directly beneath earth bunds, it is considered that traditional strip foundations are potentially suitable following the topsoil strip from a minimum depth of 1.00 m bgl with a maximum allowable bearing pressure of 75 KN/m^2 within the firm silty clays, firm sandy silts and medium to dense sands, with settlement limited to less than 25 mm.

Consideration should be given to founding in uniform strata in order limit the potential for differential settlement. Re-enforcement within the strip foundation may be required to limit the effects of differential settlement between silty clay, sandy silts and sandy soils, however, it is noted that the soils are likely to behave consistently.

Foundations should be cast in dry conditions and the formation inspected prior to casting.

6.4.2 Volume Change Potential

The underlying clayey soils of the Tidal Flat Deposits (possible founding strata) has identified a worst-case plasticity index of 15, which represents a likely low volume change potential in accordance with NHBC guidance.

The volume change potential should be considered in any foundation schedule for structures and services located within the influence zone of trees or bushes (proposed, existing or to be removed) and appropriate precautions and/or founding depths should be designed accordingly. In cohesive soils, it is recommended that foundations should be designed in accordance with NHBC Standard Chapter 4.2 "*Building Near Trees"* and within NHBC guidance for heave protection and possible void formers, if required.

6.4.3 Ground Improvement Techniques

Where the above allowable bearing capacity is not considered sufficient, consideration may be given to transferring loads to competent geology, through ground improvement of existing soils.

The precise ground improvement technique/proprietary methods, suitability of the ground, suitability of fill materials and allowable bearing capacity that can be achieved would need to be confirmed by discussions with a suitably experienced contractor; whose design should be warranted.

6.4.4 Piling

Where traditional foundations are unsuitable or ground improvement techniques not appropriate, a piled foundation solution using driven/ traditional bored or continuous flight auger (CFA) piles transferring loads to competent geology may be suitable for the proposed or anticipated design loads, utilising both skin friction and end bearing capacity.

The precise method of pile installation and applicability of proprietary systems, diameters and depths required would need to be informed based on the results of this investigation, by discussions with a piling contractor with suitable experience, whose design should be warranted.

There may be a requirement for the placement of a suitably engineered piling mat, which should be designed and validated by a suitably qualified and experienced engineer.

6.5 Floor Slabs

Given the low volume change potential of the clays, it is considered likely that a ground bearing floor slab would be suitable at the Site subject to removal of all unsuitable materials (topsoil)

and the existing upper Tidal Flat Deposits, heavily proof rolled or re-engineered to the required engineer specification to avoid differential settlement.

6.6 Roads and Pavements

A total of four (4 no.) plate load CBR tests were undertaken immediately below the topsoil from TP101 to TP104 at depths between 0.20 and 0.35 m bgl.

The CBR results ranged from between 11.1 % in TP102 to 12.7 % in TP105, confirming the consistency of the underlying geology.

It is recommended that a conservative CBR value of 5.0 % should be adopted for preliminary pavement design for external areas. Where soils are considered to be frost susceptible a geotextile membrane is recommended.

6.7 Drainage and Infiltration Testing

A total of two (2 no) infiltration tests (SA101 and SA102) were undertaken at depths of approximately 1.00 and 1.60 m, respectively to BRE365 methodology.

Given the poor infiltration rates of $x10^{-07}$ (SA101) and failed test (SA102) it is unlikely infiltration to land for surface water is suitable at this location and alternatives should be considered.

The BRE365 calculation spreadsheets are included as Appendix V.

6.8 Groundwater

Groundwater has been identified during subsequent monitoring from BH101 at depths between 2.33 m bgl and 2.47 m bgl (0.80 m AOD and 0.66 m AOD).

Significant groundwater would not be anticipated during the excavations required as part of the proposed development above approximately 2.0 m bgl. Should groundwater be encountered, then local dewatering via sump and pump should be suitable, however, treatment prior to disposal to sewer may be required.

Excavations below 2.00 m bgl are likely to be quickly inundated, as such local dewatering by sump and pump may not be appropriate, and as such other forms of groundwater control will need to be considered.

6.9 Excavations and Obstructions

It is expected that conventional mechanical excavators will readily remove the stockpiles, Made Ground/ topsoil and Tidal Flat Deposits.

All shallow foundation or services excavations at the Site should be considered unstable, therefore, temporary support of all excavations should be considered when excavating on-site.

6.10 Chemical Attack on Buried Concrete

In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils for the Tidal Flat Deposits at the Site would be classified as Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater, when considering the most appropriate type of concrete to be used at the Site in order to resist chemical attack from elevated sulphate present in the soils (assuming mobile groundwater in non-pyritic soils).

7.0 Ground Gas Risk Assessment

7.1 Background Information

Based on the proposed commercial end use, the following documents have been consulted when assessing the gas regime at the Site:

- NHBC/RSK Group PLC (2007), Guidance on Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present, Report Edition No. 4;
- CIRIA C665 (2007), Assessing risks posed by hazardous ground gases to buildings;
- British Standards Institute (BSI, 2019): Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, BS:8485:2015+A1:2019; and
- CL:AIRE Research Bulletin 17 (RB17), 2012, 'A Pragmatic Approach to Ground Gas risk Assessment'.

The presence of a source of hazardous gas within the ground does not necessarily indicate a risk will be present. Consideration of recorded gas flows together with source concentrations can allow an initial assessment to be made of the potential both for generation and subsequent migration of gas. A Characteristic Situation (CS) is derived from an assessment of the ground gas data and forms the basis of determining mitigation measures.

7.2 Hazardous Ground Gas Monitoring Programme

Although significant sources of ground gas were not identified during the desktop assessment, EGE undertook validatory ground gas monitoring at the time of the groundwater level monitoring. Three (3 no.) rounds of hazardous ground gas monitoring was undertaken on BH101, between 12th and 27th September 2022 using an infra-red gas analyser.

7.3 Hazardous Ground Gas Conceptual Site Model

7.3.1 Sources

Following the desktop assessment and Site investigation works, the following potential and actual sources of hazardous ground gas were identified:

- Potential infilled drain trending approximately east to west across the Site; and
- Potential unrecorded/ un-mapped sources.

No further significant on-Site or off-Site sources of ground gas were identified. No significant thickness of Made Ground was identified during the on-Site soil observations and sampling.

7.3.2 Pathways

The following plausible pathways are considered applicable to this Assessment:

- Vertical and lateral migration of ground gas through permeable strata;
- Potential for gases to enter current and future buildings through voids in the floor including service entry points and cracks and accumulate in confined spaces; and
- Future maintenance/construction workers may come into contact with hazardous ground gases via entry into below ground confined spaces such as excavations or service entries/inspection points.

7.3.3 Receptors

The principal receptors are considered to be:

- Future residents; and
- Buildings/ property.

7.4 Ground Gas Screening Value

The Gas Screening Value (GSV - maximum gas concentration as a fraction x maximum recorded flow) is used to provide an initial assessment of risks to future Site users. The GSVs calculated for the monitoring wells are presented in the following table.

Location	Maximum Steady Methane (%v/v)	Maximum Steady Carbon Dioxide (%v/v)	Maximum Steady Flow Rate (l/hr)	GSV/Classification		Flooded?
				GSV	Classification	
BH101	<0.1	1.9	<0.1	0.0019	CS1	N

As can be seen from the table above, the hazardous ground gas monitoring data indicates that the Site would be classified as a CS1 (Very Low Risk), which is consistent with the findings of the desktop assessment and soil analytical results.

On the basis of the above, ground gas protection measures **are not** required for the proposed development and no further risk assessment is required.

In addition, the Site is in a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level).

No radon protective measures are necessary in the construction of new dwellings or extensions.

8.0 Revised Conceptual Site Model

A revised CSM is presented in the table below and has been formulated taking into account all of the available data from the EGE assessment, suitable for a site with a proposed commercial end-use.

Source	Pathway(s)	Receptor(s)	Risk Ratings	Justification & Mitigation (if required)
Low level heavy metals above laboratory detection, however below GAC from soils across the Site and stockpiles. Unrecorded Sources.	Direct contact/ ingestion and inhalation of dust, vapours and asbestos fibres.	Future Site users. Groundworkers during the redevelopment or during any sub-surface maintenance works.	**Low Risk**	Significant contamination has not been identified following soil sampling and analysis at the Site, consistent with the findings of the desktop assessment. No volatile contamination or asbestos fibres have been identified. The Site will be largely encapsulated through proposed hardstanding and buildings, limiting the direct exposure risk to Future Site users from the low-level contamination. Clean certified topsoil will be required in landscaped areas, undertaken in accordance with the requirements of YALPAG for cover systems document. The thickness of the proposed cover layer should be agreed with the Local Authority within a Remediation Method Statement to support Planning Requirements. Existing topsoil is likely to be suitable for re-use. Groundworkers should use appropriate personal protective equipment (PPE) and maintain good standards of hygiene to be protected from any soil contamination which may be present. A 'hotspot' protocol should be in place during any below surface works for groundworkers to act upon should potential unexpected contamination be identified, however the risk is considered low. On this basis of the above it is considered that further investigation and risk assessment is not required.

	Leaching of contamination into groundwater. Vertical and lateral migration of contamination through permeable deposits below the Site.	Controlled Waters	**Very Low Risk**	Limited potential sources of contamination have been identified from the desktop assessment and Site investigation which would be of significant risk to Controlled Waters. The Site is located on Unproductive Strata and not within an SPZ. No ground or surface water abstractions are located in the vicinity of the Site. Given, the presence of proposed buildings/ hardstanding, this will further limit infiltration and subsequent mobilisation of contamination from soils in to controlled waters. On this basis the risk to Controlled Waters remains very low and no further works or risk assessment is required.
	Direct infiltration in water supply pipes.	Service conduits.	**Low Risk**	Limited potential sources of contamination have been identified and the previous EGE Preliminary Risk Assessment should be provided to the Local Water Provider who will confirm any requirements for upgraded water supply pipes, if new installations are required as part of the new development.
Hazardous ground gas (Made Ground and organic deposits).	Accumulation of gas in enclosed spaces and sub-floor voids.	Buildings and future Site users.	**Low Risk**	Significant on or off-Site sources of ground gas have not been identified. Following the EGE validatory ground gas monitoring, significant flows or volumes of hazardous ground gas have not been identified, and as per the risk assessment in Section 7.0 of this Report, Specific ground gas protection measures are not required. Vigilance is required during groundworks for any suspect ground conditions, such as deep Made Ground, organic or deleterious materials and organic contamination which may present a potential source of hazardous ground gas.

Risk Ratings included as Appendix VII.

9.0 Conclusions and Recommendations

Soils	Significant contamination has not been identified at the Site following intrusive investigation by EGE and the risk remains **low** given the Site is largely to be encapsulated by hardstanding/ buildings or a specific clean cover layer in landscaped areas. No volatile contamination has been identified and visual or olfactory evidence of contamination (including NAPL) was identified during the soil sampling. It is recommended that the following standard construction phase remediation measures are undertaken during the development to mitigate residual risk: ▽ A 'hotspot protocol' to be in place for groundworkers to report suspected previously unidentified contamination over and above that detailed in this Report; and ▽ A clean certified layer of subsoil/topsoil in landscaped areas in accordance with the Yorkshire and Lincolnshire Pollution Advisory Guidance (YALPAG) for clean cover systems, Version 4.1, the details of which should be provided within a Remediation Strategy to support the discharge of likely Planning Conditions. Existing topsoil may be suitable for re-use.
Groundwater	Significant sources of contamination have not been identified from the desktop assessment or in shallow soil samples collected as part of this investigation, as such the risk to Controlled Waters is considered **Very Low** and no further works or risk assessment is required.
Ground Gas	Following the validatory ground gas monitoring the Site is classified as a **CS1 (Very Low risk)**. As such, ground gas protection measures are not required for the proposed development. In addition, the Site is in a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). **No radon protective measures are necessary** in the construction of new dwellings or extensions.
Potable Water Pipes	Limited potential sources of contamination have been identified EGE's previous desktop assessment should be provided to the Local Water Provider who will confirm any requirements for upgraded water supply pipes, if new installations are required as part of the new development.
Geotechnical Recommendations	Topsoil is considered to be too variable, weak and compressible in its existing condition for conventional shallow foundations at the Site. Subject to additional limited investigation, particularly within areas directly beneath earth bunds, it is considered that traditional strip foundations are potentially suitable following the topsoil strip from a minimum depth of 1.00 m bgl with a maximum allowable bearing pressure of 75 KN/m2 within the firm silty clays, firm sandy silts and medium to dense sands, with settlement limited to less than 25 mm. Consideration should be given to founding in uniform strata in order limit the potential for differential settlement. Re-enforcement within the strip foundation may be required to limit the effects of differential settlement

	between silty clay, sandy silts and sandy soils, however it is noted that the soils are likely to behave consistently. Foundations should be cast in dry conditions and the formation inspected prior to casting. In addition, the following information is considered pertinent: ▽ The underlaying soils are generally granular however cohesive soils have identified a low volume change potential; ▽ Ground bearing floor slabs are considered suitable, subject to removal of all unsuitable materials (Topsoil) and the formation heavily proof rolled; ▽ Significant groundwater would not be anticipated during the excavations required as part of the proposed development above approximately 2.0 m bgl. Should groundwater be encountered, then local dewatering via sump and pump should be suitable; ▽ In accordance with the recommendations of BRE Special Digest 1, 'Concrete in Aggressive Ground' 2005, the conditions of the soils for the Tidal Flat Deposits at the Site would be classified as Design Sulphate Class DS-1 and ACEC Class AC-1 for soils and groundwater; ▽ Infiltration rates ranged between $x10^{-07}$ and failed test. Given the poor infiltration rates of $x10^{-07}$ (SA101) and failed test (SA102) it is likely infiltration to land for surface water is not suitable at his location and alternatives should be considered; and ▽ A design CBR value of 5% is considered suitable for the Tidal Flat Deposits.
Recommendations	On the basis of the above, the following recommendations are made: ▽ Clean cover layer in proposed landscaped areas in accordance with the YALPAG document. Existing topsoil is considered likely to be suitable for re-use; ▽ A 'Hotspot' Protocol to be in place during the groundworkers for workers to act upon should potential contamination, other than that identified as part of this investigation, is identified; ▽ All groundworkers to be provided with task specific PPE suitable for the contamination and asbestos identified as part of this assessment; ▽ Consultation with the Local Water Authority to confirm the requirements of any upgraded potable water pipes; and ▽ Additional testing maybe required to support the off-Site disposal of waste soils, including further WAC testing.

Drawings

evolve
GEO-ENVIRONMENTAL

Drawing I – Client Provided Topographical Drawing

evolve
GEO-ENVIRONMENTAL

E534600.00 E534620.00 E534640.00 E534660.00 E534680.00 E534700.00 E534720.00

N325620.00 N325600.00 N325580.00 N325560.00 N325540.00 N325520.00

LEVELS SHOWN INSIDE THE KERBS/CHANNELS HAVE BEEN TAKEN ON THE CHANNEL BLOCK
LEVELS SHOWN TO THE REAR OF THE KERB (IN THE JUNCTIONS) HAVE BEEN TAKEN ON THE KERB TOP AS THERE ARE NO CHANNELS
LEVELS TAKEN ALONG THE CROWN/CL OF THE ROAD HAVE BEEN TAKEN ON THE BASE COURSE

KERBS & CHANNELS
TARMAC PATH (TO BASE COURSE ONLY, NOT SURVEYED)
R O A D (TO BASE COURSE LEVEL ONLY)
TARMAC PATH (TO BASE COURSE ONLY)
EDGINGS
APPROX TARMAC EDGE
HEAPS OF STONE/GRAVEL IN THIS AREA (NOT SURVEYED)
HEAP OF TARMAC / CONCRETE
B U N D (VERY OVERGROWN)
B U N D (VERY OVERGROWN)
OVERGROWN IN THIS AREA
B U N D (VERY OVERGROWN)
DASHED HATCHING SHOWS TREES SPREAD FROM LAND TO THE SOUTH OF THE SITE
TARMAC ACCESS TO COMPOUND (BASE COURSE)
PUMPING STATION COMPOUND (NO ACCESS, NOT SURVEYED)
GATES
MESH SECURITY FENCE
WOODEN POST & RAIL FENCE
/ WOODEN CLOSE BOARDED FENCE
POST & RAIL FENCE

MH CL 3.67 · MH CL 3.65 · MH CL 3.60 · MH CL 3.63 · MH CL 3.50 · MH CL 3.54 · MH CL 3.51 · MH CL 3.52 · MH CL 3.47 · MH CL 3.46 · MH CL 3.68 FULL OF DEBRIS · MH CL 3.51 · MH CL 3.38 · MH CL 3.40 · MH CL 3.28 · MH CL 3.50 (BURIED)

SMH CL 3.47 IL 2.36 225DIA · FMH CL 3.46 IL 1.46 150DIA · BTMH · SV · WO · LC · T1 · T2 · T3 · S1 · S2 · S3

0 10 20

NOTES

ABBREVIATIONS & SYMBOLS

AV	AIR VALVE	OHC	OVERHEAD CABLE
BH	BORE HOLE	PB	POST BOX
BOL	BOLLARD	PINV	PIPE INVERT LEVEL
CATV	CABLE TV MH	PM	PARKING METER
CCTV	SECURITY CAM	PO	POST
CL	COVER LEVEL	PT	PIPE TOP LEVEL
CH	CHANNEL	P/R	POST & RAIL FENCE
COL	COLUMN	P/W	POST & WIRE FENCE
DC	CABLE TV LID	RD	EDGE OF ROAD/NO KERB
DP	DOWN PIPE	RE	RODDING EYE/POINT
DR	DRAIN	RL	RIDGE LEVEL
EL	EAVES LEVEL	RP	REFLECTIVE POST
EP	ELECTRIC POLE	RS	ROAD SIGN
ER	EARTH ROD	SLVL	STONE LEVEL
FB	FLOWER BED	SOFF	SOFFIT LEVEL
FH	FIRE HYDRANT	SV	VALVE
FFL	FINISHED FLOOR LEVEL	SW	SURFACE WATER
FP	FLAG POLE	Tac	TACTILE PAVING
FW	FOUL WATER	TH	TRIAL HOLE
GV	GAS VALVE	TL	TRAFFIC LIGHTS
HW	HEADWALL	TLVL	TARMAC LEVEL
IC	INSPECTION COVER	TOW	TOP OF WALL LEVEL
IL	I NVERT LEVEL	TP	TELEGRAPH POLE
KB	KERB BOTTOM	TRK	TRACK
KO	KERB OFFLET	UTL	UNABLE TO LIFT
KT	KERB TOP	VP	VENT PIPE
LP	LAMP POST	WL	WATER LEVEL
LC	LIGHT COLUMN	WLVL	WATER LEVEL
MH	MANHOLE	WM	WATER METER
MP	MARKER POST	WO	WASH OUT POINT

FENCE · HEDGE · ELECTRIC · BANK EDGE · STORM LINE · FOUL LINE · TELECOM LINE · GAS LINE · LARSON PILES · CHANNELS · WATER MAIN

TREE · BOREHOLE · STATION · TBM · MANHOLE · GULLY · BATTER · WATER LVL · GATE

1. THE POSITION OF THIS SURVEY IS BASED ON GPS OSTN15 GRID
2. ALL LEVELS RELATE TO HGTS TAKEN USING TRIMBLE VRS NOW
3. TREES SPREADS ARE DRAWN TO SCALE AND SHOW THE GENERAL/AVERAGE CANOPY SPREAD.
4. ALL BELOW GROUND LEVEL INFORMATION INCLUDING VOIDS, DRAINAGE & SERVICES HAVE BEEN IDENTIFIED FROM THE SURFACE LEVEL ONLY, THEREFORE PIPE SIZES ETC ARE ESTIMATIONS ONLY. ALL CRITICAL DIMENSIONS SHOULD BE CHECKED PRIOR TO THE COMMENCEMENT OF ANY SITE WORKS
5. EVERY EFFORT HAS BEEN MADE TO LOCATE AND SURVEY ALL VISIBLE FEATURES. IT SHOULD BE NOTED THAT SOME ITEMS MAY HAVE BEEN OBSCURED AT THE TIME OF THE SURVEY AND THEREFORE NOT SHOWN ON THIS DRAWING.
6. PHYSICAL BOUNDARY FEATURES SHOWN ON THIS DRAWING DO NOT NECESSARILY REPRESENT THE ACTUAL LEGAL BOUNDARIES. THIS INFORMATION SHOULD BE CONFIRMED WITH THE RELEVANT DOCUMENTATION.
7. THE CONTRACTOR MUST CHECK AND VERIFY ALL SITE LEVELS, DIMENSIONS, UTILITIES AND DRAINAGE DETAILS PRIOR TO THE COMMENCEMENT OF ANY SITE WORKS. ANY DISCREPANCIES MUST BE NOTIFIED TO CASTLE HILL SURVEYS LTD.
8. ALL SURVEY STATION CONTROL POINTS MUST BE CHECKED BY THE CONTRACTOR PRIOR TO STARTING ANY SITE WORKS.

Point	Easting	Northing	Elevation
s1	534605.232	325589.080	3.830
s2	534645.539	325579.777	3.728
s3	534677.551	325574.204	3.673

SURVEY DATE	08 / 07 / 2022	INITIALS	SRW

REV	AMENDMENTS	DRN	DATE

Client:
STIRLIN DEVELOPMENTS LTD

Project Title:
SOUTH LINCS FOOD ENTERPRISE ZONE
HOLBEACH, LINCS

Drawing Title:
GPS SURVEY FOR PROPOSED UNITS

Scale @ A1:	Date:
1 : 200	08 / 07 / 2022
Drawing No: CHS 22-143-01	Rev:
C.A.D.Title: stirlin holbeach\topo (chs 22-143-01).mjo	
Drawn By: SRW	Checked By: CT

CASTLE HILL SURVEYS LTD
Land Surveying & Site Setting Out Services
Commerce House, Carlton Boulevard,
Lincoln, LN2 4WJ Tel : 07710649549
E-mail : castlehillsurveys@outlook.com
Website : www.castlehillsurveys.co.uk

Drawing II – Proposed Development Plan

evolve
GEO-ENVIRONMENTAL



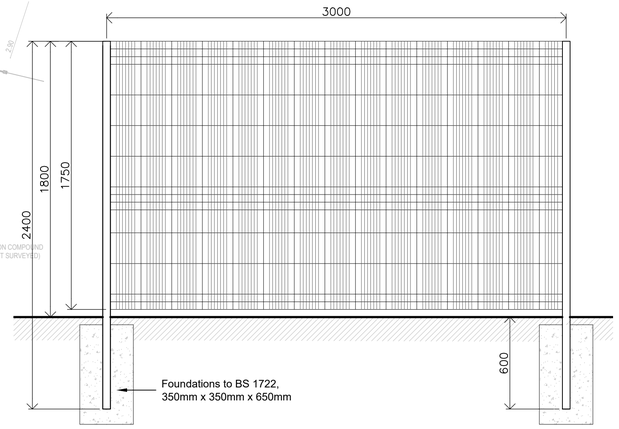
PROPOSED SITE LAYOUT
Graphic Scale 1:200
0m 2m 4m 6m 8m 10m

LEGEND

- Private Area of Tarmac
- Area of Gravel
- Area of Shrubs
- Future EV charging provision
- Proposed Trees
- 4.8m high Lighting Column - Q-Street Pro External Light - ref QSTREET-PRO-50NW/FX. Lighting Column to be installed 1.2m below ground level.
- CCTV Column Location
- Electric Vehicle Charging point

Unit No.	Size (GIA)
1	2152sq.ft.
2	2152sq.ft.
3	2152sq.ft.
4	2152sq.ft.
5	1947sq.ft.
6	1947sq.ft.
7	1313sq.ft.
8	1313sq.ft.
9	1313sq.ft.
10	1733sq.ft.
11	1733q.ft.
12	2152sq.ft.
TOTAL	**22,059sq.ft.**

50 No. Car Spaces



1.8m high Green Stripe Mesh Fencing Detail
1:20

ALL DIMENSIONS AND SETTING OUT ARE TO BE VERIFIED ON SITE AND ALL DISCREPANCIES REFERRED TO THE ARCHITECT BEFORE WORK COMMENCES. COPYRIGHT RESERVED

REV.	DATE	DESCRIPTION
B	7.7.22	Revisions in accordance with client comments dated 6.7.22
C	11.7.22	Layout revised to accord with Topo survey

PLANNING APPLICATION

Trees and Shrubs

Within the landscaping for the new development a total of 3 types new specimen trees will be established and the table below provides details of sizes, species and numbers.

Ref	Name	Genus	Size	No.
1	Rowan	Sorbus acuparia	1.5 /1.8m small standard	2
2	Alder	Alnus glutinosa	1.5 /1.8m small standard	4
3	Birch	Betula pendula	1.5 /1.8m small standard	3

The trees are to be pit planted into excavations not less than 500x 500 x500mm to provide sufficient space for the root-ball of the standard tree. The sides and base of the planting pit will be forked to improve drainage. The tree will be placed in the planting pit with good quality planting compost and held in place using a low stake for support with a single tie approximately 300mm above ground. After planting the soil will be gently firmed and levelled with additional compost and the tree will be watered in. Planting will not take place during severe weather conditions or when there is a frost or snow on the ground. The planting of the trees should take place in the first suitable planting season following completion of construction works, ideally during the dormant winter season.

Shrubs shall be planted in pits 300x300x400mm, and the backfill shall include 3 ltrs of peat free compost, where 2 or more shrub spaces are indicated within a single bed each species shall be randomly mixed throughout the bed in groups of 3/5.

Planting beds to receive 75mm depth pulverized bark mulch. ensure the top of mulch layer is 15mm below adjacent pavement or other surfaces to prevent spillage.

Areas A, & B = 115m2 Density 3/m2

Name	No.
Lonicera Baggesen's Gold	70
Prunus Otto Luyken	70
Viburnus Tinus	70
Corbus Alba	70
Philadelphus Belle Etoile	70

Final position of trees and shrubs subject to confirmation of service location and approval of statutory undertakers.

Planting Notes

Topsoil shall be a minimum of 400mm depth over planting beds and graded to fall. imported topsoil must be BS3882:2007 compliant and existing topsoil must be cultivated in accordance with BS3882:2007. No cultivation should take place in wet/waterlogged conditions.
Herbicide and cultivation: Topsoil to be treated with two applications of herbicide prior to planting, where necessary, strictly in accordance with the control of pesticide regulations 1986 (as amended 1997 or, otherwise updated/superseaded legislation) and following manufacturers instructions by qualified staff. The topsoil shall then be cultivated to 150mm depth.
Planting of all plants and turf shall conform to BS:3936:1992 and BS:4428:1998.
Trees are to be planted in pits 800x800x450mm Trees to be supported by 1Nr stake (1500mm long, per tree, 600mm above ground, 75mm dia.) and 1 Nr bio-degradable tie.Alginure soil improver and 150g Enmag (or equivalent) to be incorporated into the soil of all new tree pits. Trees to be planted centrally within new pit.
Shrubs shall be planted in pits 300x300x400mm, and the backfill shall include 3 ltrs of peat free compost, where 2 or more shrub spaces are indicated within a single bed each species shall be randomly mixed throughout the bed in groups of 3/5.
Planting beds to receive 75mm depth pulverized bark mulch. ensure the top of mulch layer is 15mm below adjacent pavement or other surfaces to prevent spillage.
Final position of trees and shrubs subject to confirmation of service location and approval of statutory undertakers.
All trufed/seeded areas to be cultivated and leveled as required removing any stones, rubble, subsoil, general construction waste.
Bare-root shrubs to be planted between mid-November and mid-March dependant upon the planting season.

Aftercare Management

The landscaped grassland areas within the development will be managed by seasonal mowing. These grassland areas will be cut two at least two times each year and the cuttings will either be left to lie or removed for composting as appropriate.
If any noxious weeds or invasive species establishes within the grassland areas or within the shrubs planted areas these specific locations will be spot treated with a translocated herbicide applied by spray to eliminate these.
Any tree or hedgerow plant established within the landscaped areas which fails to establish or becomes diseased or damaged within a period of seven years after planting will be replaced. All replacement stock will be plants of similar size and species to the original specification and will be planted in the next planting season.
At a suitable time during the first spring period after planting the new trees and shrubs, an application of herbicide will be carefully applied by a landscape contractor around the base during the first growing season to eliminate any surviving weed competition and assist the shrubs to establish and maintain healthy growth and vigour. Application of herbicide will be carried out on an annual basis in spring throughout the five year aftercare period to restrict weed growth and assist the establishment of the planted stock.
Tree ties and stakes used to support trees will be checked each year and adjusted as necessary. If, on the completion of the five year aftercare period, the stakes are considered to be unnecessary and the trees can support themselves, these stakes and ties will be removed and the stake holes filled with coarse granular material to assist with water and air infiltration to the root bole of the tree.
The hedgerow will have rabbit guards and canes fitted and these will be checked annually and replaced / straightened where necessary. It is anticipated that the hedgerow will not need any cutting for the first four years after planting whilst is starts to establish. However from year 5 until year 7 of the aftercare period the hedgerow will be trimmed to 1m height and spread to help this to thicken and create dense growth. Any gaps will be identified and filled with new planting during the aftercare period.

client
Stirlin

project
SOUTH LINCS FOOD ENT. ZONE
PLOT 3, 4, & 5

drawing
PROPOSED SITE LAYOUT
LANDSCAPING & BOUNDARY DETAILS

scale	date
1:100 @ A1	JUNE 22
drawn	checked
KSC	
drawing no.	revision
8174S-PP-02	C

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Figures

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Figure I – Site Location Plan

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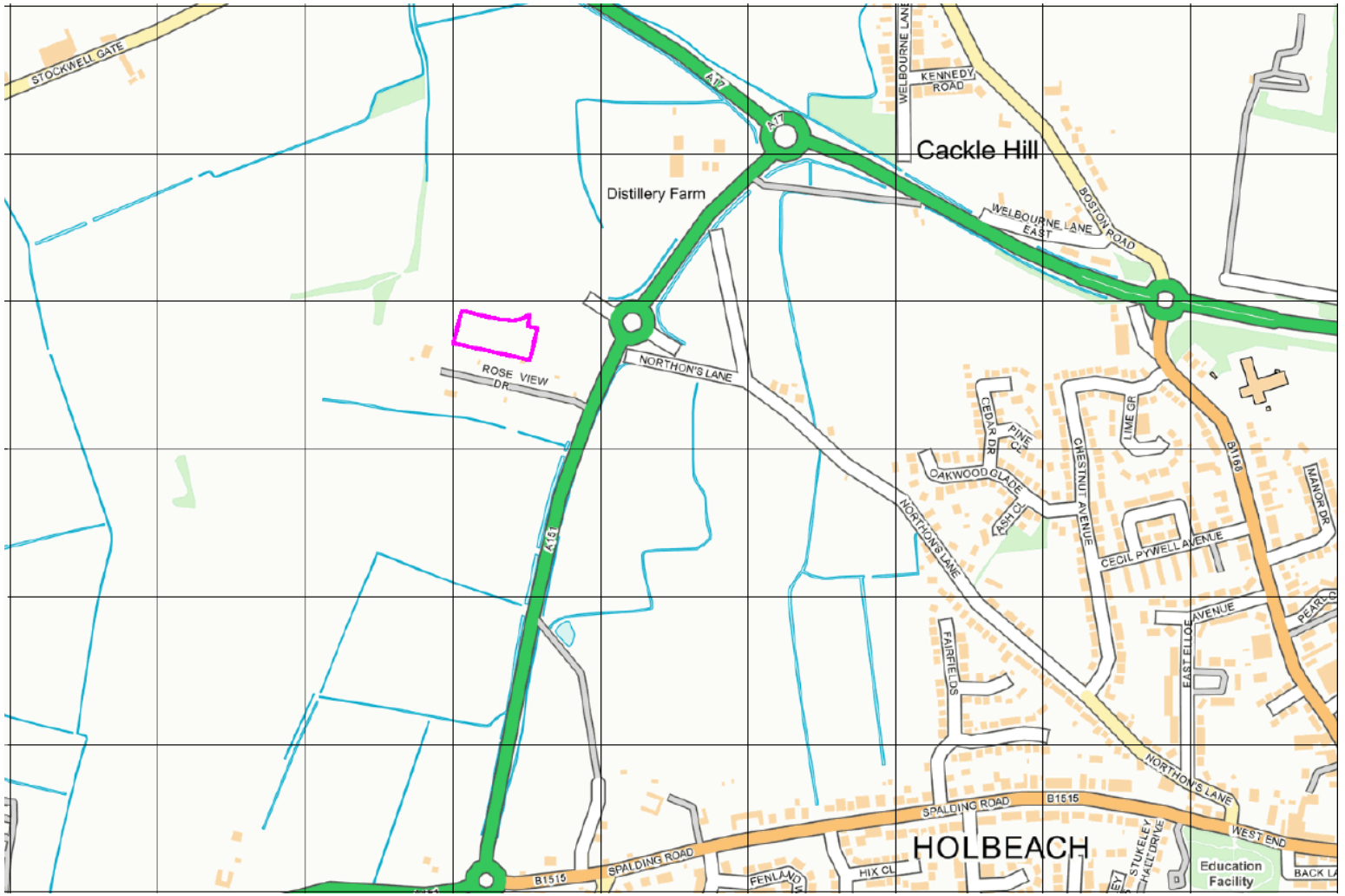


Figure No. and Title	Figure I – Site Location Map
Project Name	Plots 3, 4 and 5, Food Enterprise Zone (FEZ), Holbeach
Client	Stirlin Developments Limited
Service	Geo-Environmental Assessment
Date of Issue	October 2022
Project number	EGE-22-08-09-01

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Figure II – Approximate Intrusive Location Plan

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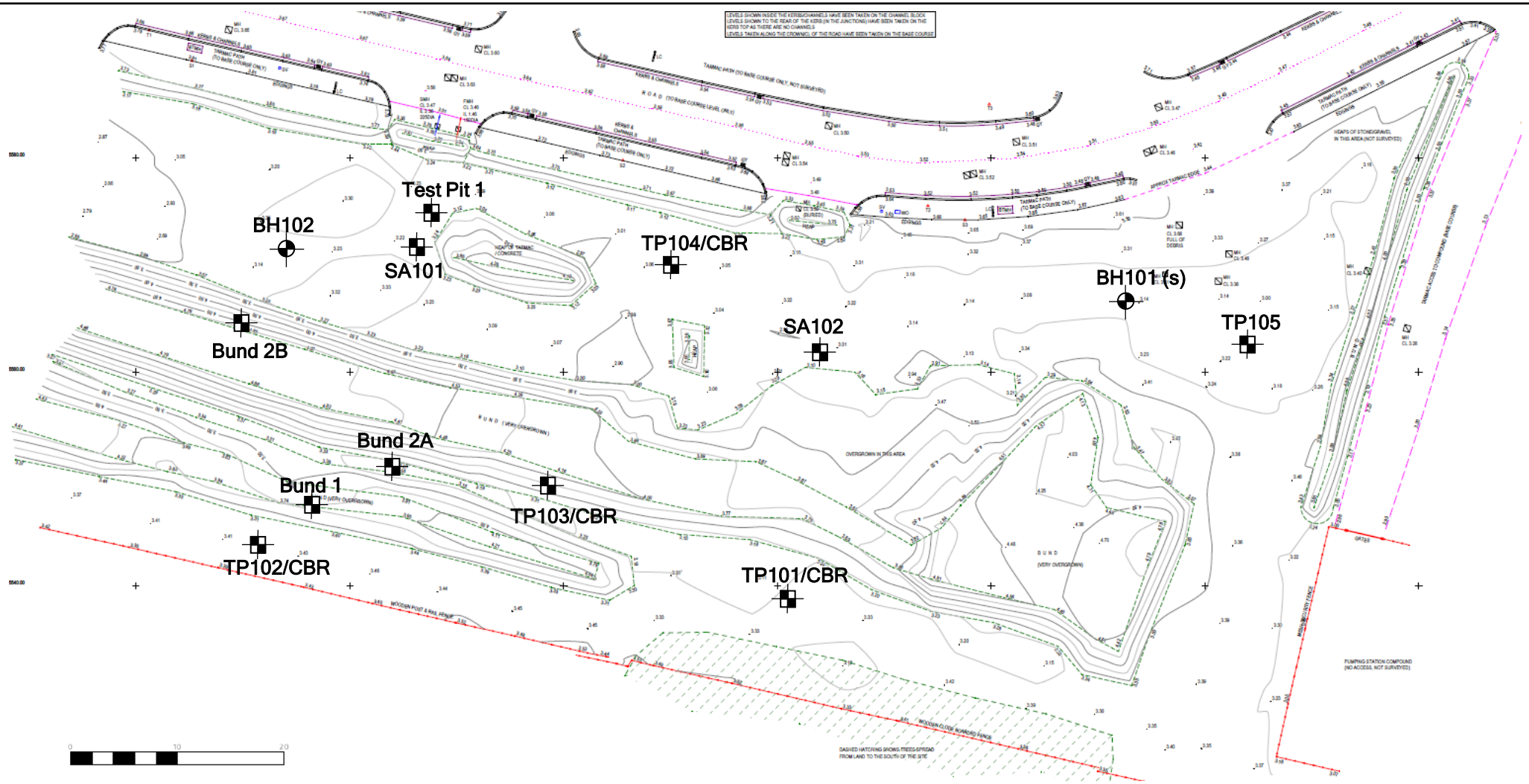


Figure No. and Title	Figure II - Approximate Intrusive Location Plan
Project Name	Plots 3, 4 and 5, Food Enterprise Zone (FEZ), Holbeach
Client	Stirlin Developments Limited
Service	Geo-Environmental Investigation
Date of Issue	September 2022
Project number	EGE-22-08-09-01

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Appendices

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Appendix I – Standard Limitations

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Limitations

The conclusions and recommendations made in this Report are limited to those that can be made based on the findings of the investigation and in the context of the proposed development.

Where comments are made based on information obtained from third parties, EGE assumes that all third party information is true and correct. No independent action has been undertaken to validate the findings of third parties, unless specifically stated.

This Report has been prepared in accordance with our understanding of current best practice. However changes to best practice, guidance or legislation may necessitate revision of this Report after the date of issue.

EGE has prepared this Report for the sole use and reliance of the Client, in accordance with our Standard Conditions and Limitations issued with the proposal. This Report may not be used or relied upon by any unauthorised third party without the explicit written agreement of EGE. Third parties use the information at their own risk.

Appendix II – Exploratory Hole Logs

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Project:	Project No:	Hole ID:
Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**BH101**
	Date: 06/09/2022	Client: **Stirlin Developments Limited**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	DEPTH (Thickness)	Sample Details: TYPE	Sample Details: REF	Sample Details: Depth	Test Results: SPT N Value/Drive mm	"Installation/" Backfill Details
MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. (TOPSOIL)				0.60	E	ES1	0.50		
Firm orangish brown silty CLAY. (TIDAL FLAT DEPOSITS)				(1.10) 1.70			1.20 - 1.65	SPT N=11 1,1/2,2,3,4	
Firm orange sandy clayey SILT. Sand is fine. (TIDAL FLAT DEPOSITS)				(1.30) 3.00	SDS BLK	D1 B1	2.00 2.50	SPT N=12 1,2/2,2,3,5	
Medium dense to dense orangish grey fine to medium SAND. (TIDAL FLAT DEPOSITS)			(150mm)	(8.50)			3.00 - 3.45 4.00 - 4.45 5.00 - 5.45 6.00 6.50 - 6.95 8.00 - 8.45 9.50 - 9.95	SPT N=16 2,3/3,4,4,5 SPT N=22 3,4/5,5,6,6 SPT N=19 3,3/4,4,5,6 SPT N=26 3,4/5,6,7,8 SPT N=32 4,5/6,7,8,11 SPT N=37 4,6/7,9,10,11	
			10.50		SDS	D2			
Very dense grey fine to medium SAND. (TIDAL FLAT DEPOSITS)				11.50 (3.50)	SDS	D3	11.00 - 11.45 12.00 12.50 - 12.95 14.00 - 14.45 14.80 - 15.25	SPT N=39 4,6/8,9,10,12 SPT N=50/105mm (8,11/18,21/30mm,11/mm) SPT N=50/50mm (25/50mm/50/50mm) SPT N=50/80mm (20,5/3mm/40,10/5mm)	
Borehole terminated at 15.00 m bgl due to collapsing and very dense sands.				15.00					

REMARKS :

1. Borehole arisings logged in general accordance to BS5930:2015+A1:2020;
2. Borehole location cleared for underground utilities by Safe Dig Surveys Limited;
3. Hand dug inspection pit to 1.2 m bgl prior to drilling;
4. Approx 6,000 L water added;
5. Borehole terminated at 15.00 m bgl due to very dense sands and collapse.

CHISELLING		
Depth From	Depth To	Time Taken
13.50	14.00	00:00

WATER LEVEL OBSERVATIONS				
Date	Time	Water Strike	Standing Level	Casing Depth

NO WATER ENCOUNTERED:

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
	150mm to 10.50m	

All measurements in metres unless otherwise stated	10m/page Scale: 1:103.13	Coordinates to Local Grid Ground Level to Local Datum		Page 1 of 1
Plant Used: Fraste Sonic	Coordinates / Level (mAOD): E: 534666.001 N: 325565.581 Level: 3.134	Logged By: PH	Checked By: PB	Approved By: PB

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Project:	Project No:	Hole ID:
Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**BH102**
	Date: 06/09/2022	Client: **Stirlin Developments Limited**

DESCRIPTION OF STRATA	LEGEND	WATER	CASING DEPTH / (Diam. mm)	DEPTH (Thickness)	Sample Details TYPE	Sample Details REF	Sample Details Depth	Test Results SPT N Value/Drive mm	Backfill Details
MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. (TOPSOIL)				0.40					
Firm yellowish orange slightly sandy SILT. Sand is fine. (TIDAL FLAT DEPOSITS)				(1.60)	E	ES1	1.00 1.20 - 1.65	SPT N=8 1,1/1,2,2,3	
				2.00			2.00 - 2.45	SPT N=11 1,2/2,3,3,3	
Medium dense becoming dense grey silty fine to medium SAND. (TIDAL FLAT DEPOSITS)					BLK	B1	3.00 - 4.00 3.00 - 3.45	SPT N=14 1,2/3,3,4,4	
							4.00 - 4.45	SPT N=16 3,3/3,4,4,5	
			(150mm)				5.00 - 5.45	SPT N=15 2,2/3,3,4,5	
				(9.00)			6.50 - 6.95	SPT N=19 3,3/3,4,5,7	
							8.00 - 8.45	SPT N=23 2,3/4,5,6,8	
							9.50 - 9.95	SPT N=39 5,6/8,9,10,12	
			10.50						
Very dense becoming grey fine to medium SAND. (TIDAL FLAT DEPOSITS)				11.00			11.00 - 11.45	SPT N=50 5,10/11,12,13,14	
				(1.80)					
							12.50 - 12.95	SPT N=50/140mm (10,12/15,35/65mm)	
Borehole terminated at 12.80 m bgl due to collapsing and very dense sands.				12.80					

REMARKS :

1. Borehole arisings logged in general accordance to BS5930:2015+A1:2020;
2. Borehole location cleared for underground utilities by Safe Dig Surveys Limited;
3. Hand dug inspection pit to 1.2 m bgl prior to drilling;
4. Approx 5,000 L water added;
5. borehole terminated at 14.00 m bgl due to very dense sands and collapse; and
6. Borehole backfileld with arisings.

CHISELLING			WATER LEVEL OBSERVATIONS				
Depth From	Depth To	Time Taken	Date	Time	Water Strike	Standing Level	Casing Depth
NO CHISELLING UNDERTAKEN:			NO WATER ENCOUNTERED:				

BOREHOLE DIAMETER	CASING DIAMETER	DEPTH SEALED
	150mm to 10.50m	

All measurements in metres unless otherwise stated	10m/page Scale: 1:88.00	Coordinates to Local Grid Ground Level to Local Datum		Page 1 of 1
Plant Used: Fraste Sonic	Coordinates / Level (mAOD): E: 534653.47 N: 325557.748 Level: 3.081	Logged By: PH	Checked By: PB	Approved By: PB

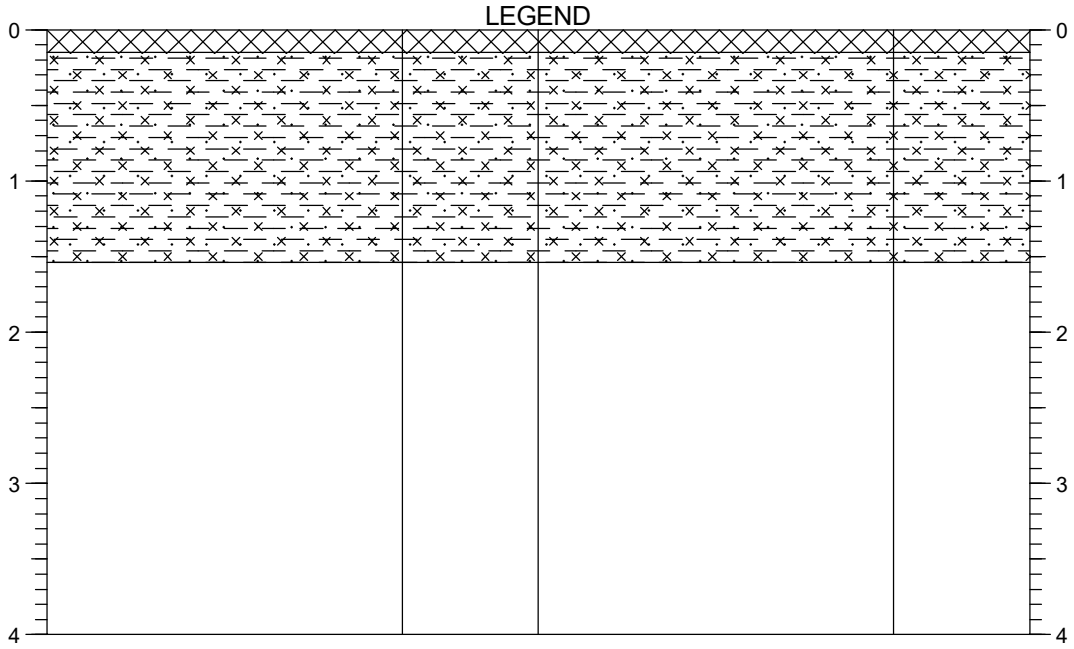
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Project:	Project No:	Hole ID:
Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**SA101**

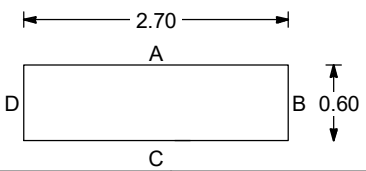
TRIAL PIT LOG

Date:	Client:
06/09/2022	**Stirlin Developments Limited**



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
0.15		MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. Frequent rootlets (TOPSOIL)				
		Orange occasional orangish grey silty slightly clayey fine SAND. (TIDAL FLAT DEPOSITS)				
(1.39)						
1.54		End of trial pit at 1.54 m bgl for BRE365 infiltration test.				

Shoring/Support:
Stability:



Bearing: °



REMARKS :

1. Arisings logged in general accordance to BS5930:2015+A1:2020;
2. Location cleared for underground utilities by Safe Dig Surveys Limited;
3. Trial pit remained stable throughout;
4. Trial pit converted to BRE365 infiltration test;
5. No groundwater identified; and
6. Trial pit backfilled with gravel and arisings and nominally compacted.

All measurements in metres unless otherwise stated	10m/page Scale: 1:50	Coordinates to Local Grid Ground Level to Local Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 534623.718 N: 325570.414 Level: 3.228	PH	PB	PB

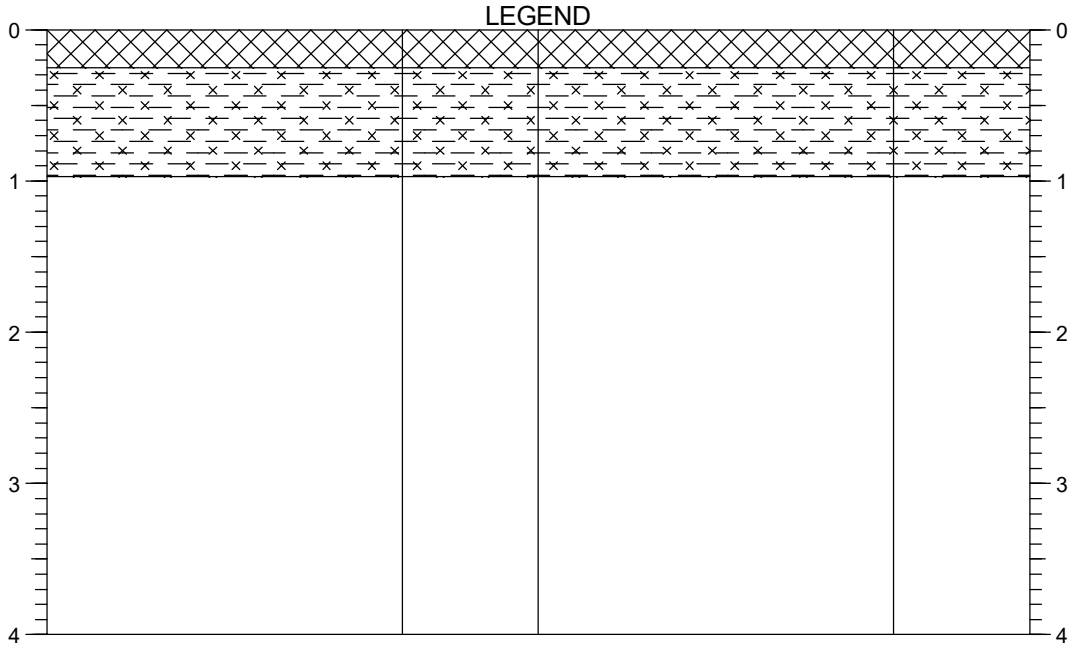
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Project:	Project No:	Hole ID:
Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**SA102**

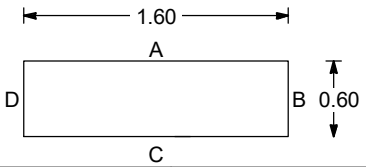
TRIAL PIT LOG

Date:	Client:
06/09/2022	**Stirlin Developments Limited**



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
0.25		MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. Frequent rootlets (TOPSOIL)	0.20	ES1		
(0.72)		Firm brown silty CLAY (TIDAL FLAT DEPOSITS)				
0.97		End of trial pit at 0.97 m bgl for BRE365 infiltration test.				

Shoring/Support:
Stability:



Bearing: °



REMARKS :

1. Arisings logged in general accordance to BS5930:2015+A1:2020;
2. Location cleared for underground utilities by Safe Dig Surveys Limited;
3. Trial pit remained stable throughout;
4. Trial pit converted to BRE365 infiltration test;
5. No groundwater identified; and
6. Trial pit backfilled with gravel and arisings and nominally compacted.

All measurements in metres unless otherwise stated	10m/page Scale: 1:50	Coordinates to Local Grid Ground Level to Local Datum

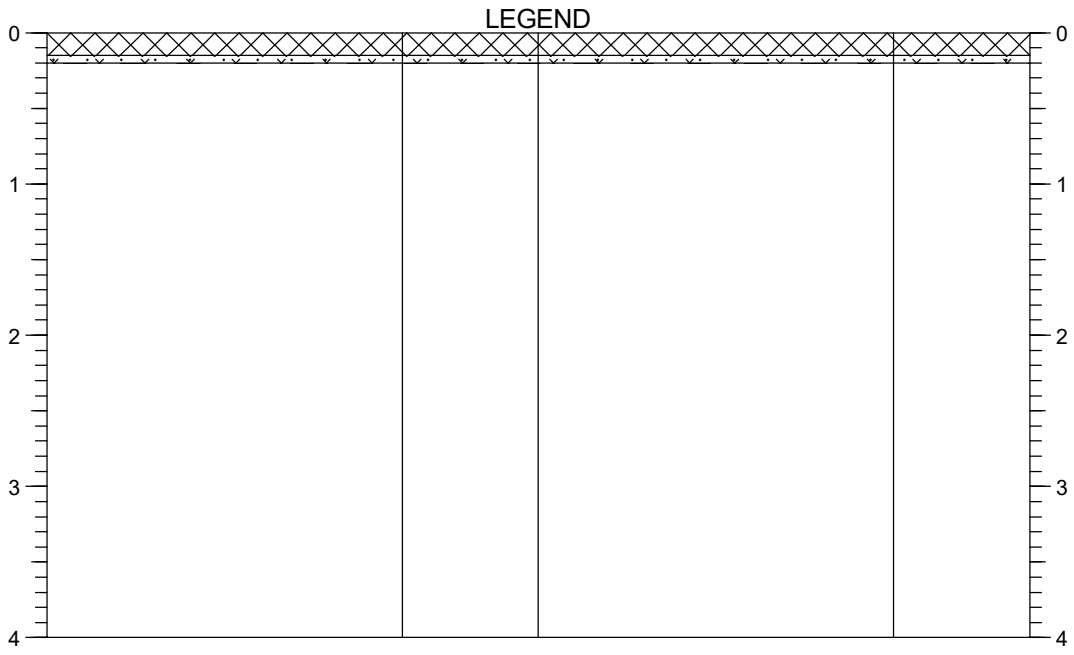
Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 534685.229 N: 325562.996 Level: 3.066	PH	PB	PB

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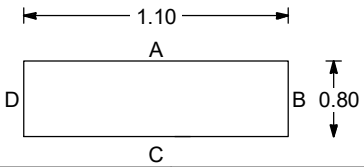
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Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**TP101**

TRIAL PIT LOG	Date:	Client:
	06/09/2022	**Stirlin Developments Limited**



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
0.15 / 0.20		MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. Frequent rootlets (TOPSOIL)				
		Orange clayey sandy SILT. Sand is fine. (TIDAL FLAT DEPOSITS)				
		End of Trial pit at 0.20 m bgl for CBR plate test.				

Shoring/Support:
Stability:



Bearing: °



REMARKS :

1. Arisings logged in general accordance to BS5930:2015+A1:2020;
2. Location cleared for underground utilities by Safe Dig Surveys Limited;
3. Trial pit remained stable throughout;
4. Plate load CBR Test undertaken below topsoil;
5. No groundwater identified; and
6. Trial pit backfilled with gravel and arisings and nominally compacted.

All measurements in metres unless otherwise stated	10m/page Scale: 1:50	Coordinates to Local Grid Ground Level to Local Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 534655.662 N: 325549.092 Level: 5.218	PH	PB	PB

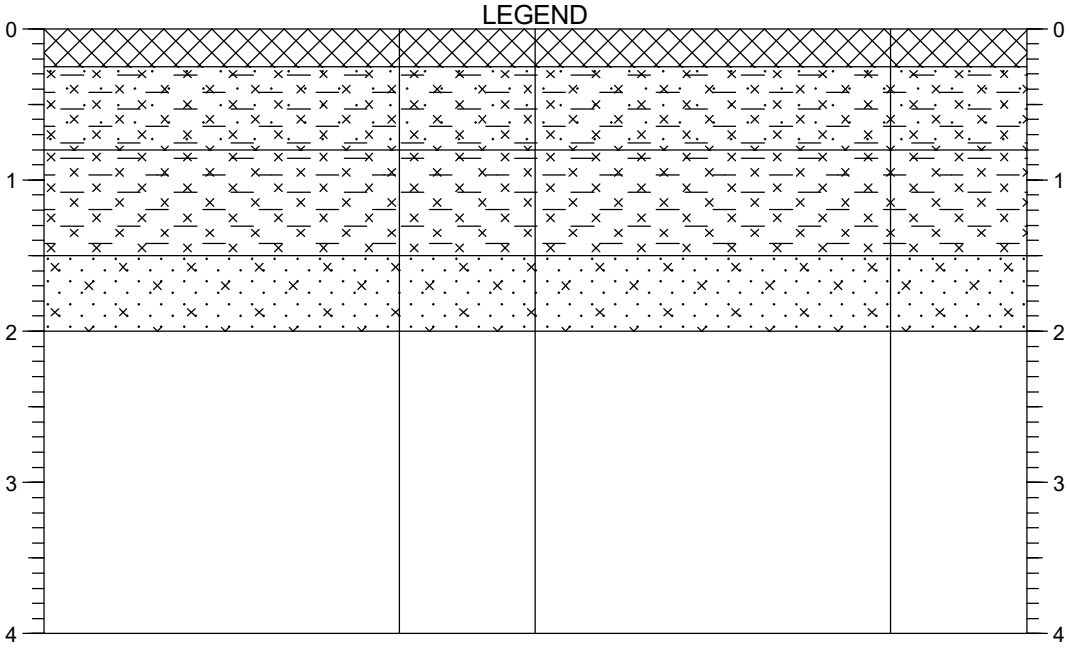
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Project:	Project No:	Hole ID:
Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**TP102**

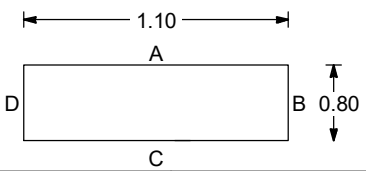
TRIAL PIT LOG	Date:	Client:
	06/09/2022	**Stirlin Developments Limited**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
0.25		MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. Frequent rootlets (TOPSOIL)	0.10	ES1		
(0.55) 0.80		Firm dark grey slightly sandy SILT. Sand is fine. (TIDAL FLAT DEPOSITS)				
(0.70) 1.50		Firm brown mottled orange clay SILT. (TIDAL FLAT DEPOSITS)				
(0.50) 2.00		Orange silty fine SAND. (TIDAL FLAT DEPOSITS)	1.50	B1		
		End of Trial pit at 2.00 m bgl.				

Shoring/Support:
Stability:



Bearing: °



REMARKS :

1. Arisings logged in general accordance to BS5930:2015+A1:2020;
2. Location cleared for underground utilities by Safe Dig Surveys Limited;
3. Trial pit remained stable throughout;
4. Plate load CBR Test undertaken below topsoil at 0.35 m;
5. No groundwater identified; and
6. Trial pit backfilled with gravel and arisings and nominally compacted.

All measurements in metres unless otherwise stated	10m/page Scale: 1:50	Coordinates to Local Grid Ground Level to Local Datum

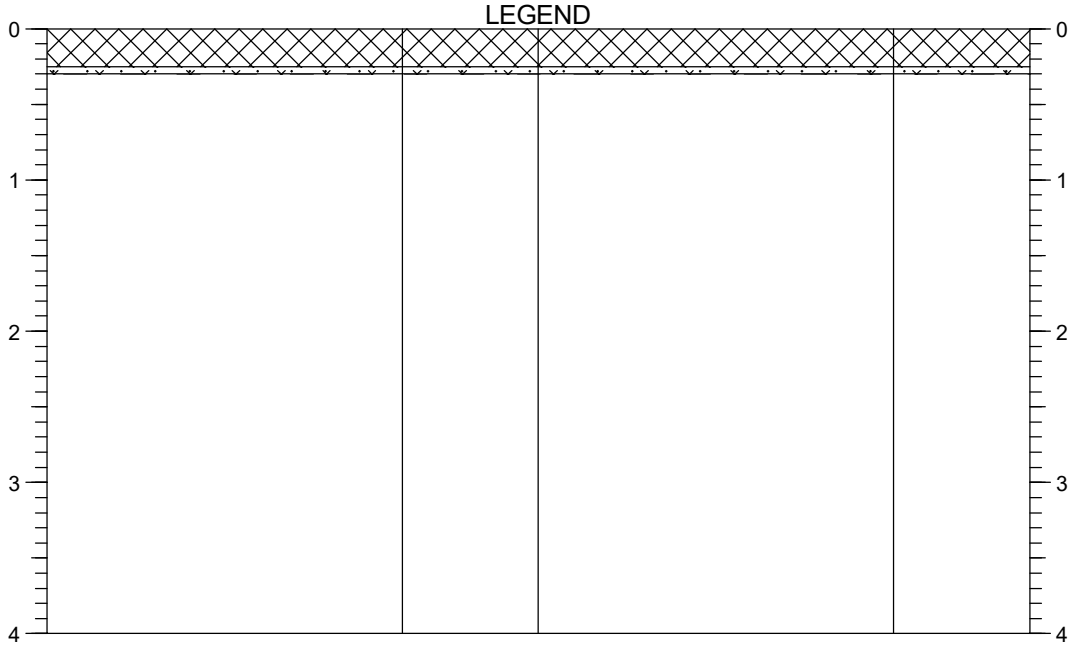
Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 534640.857 N: 325554.028 Level: 5.504	PH	PB	PB

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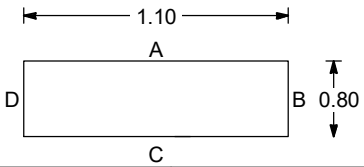
Project:	Project No:	Hole ID:
Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**TP103**
TRIAL PIT LOG	Date: 06/09/2022	Client: **Stirlin Developments Limited**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
0.25 / 0.30		MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. Frequent rootlets (TOPSOIL) Orange clayey sandy SILT. Sand is fine. (TIDAL FLAT DEPOSITS) End of Trial pit at 0.30 m bgl for CBR plate test.				

Shoring/Support:
Stability:



Bearing: °



REMARKS :

1. Arisings logged in general accordance to BS5930:2015+A1:2020;
2. Location cleared for underground utilities by Safe Dig Surveys Limited;
3. Trial pit remained stable throughout;
4. Plate load CBR Test undertaken below topsoil;
5. No groundwater identified; and
6. Trial pit backfilled with gravel and arisings and nominally compacted.

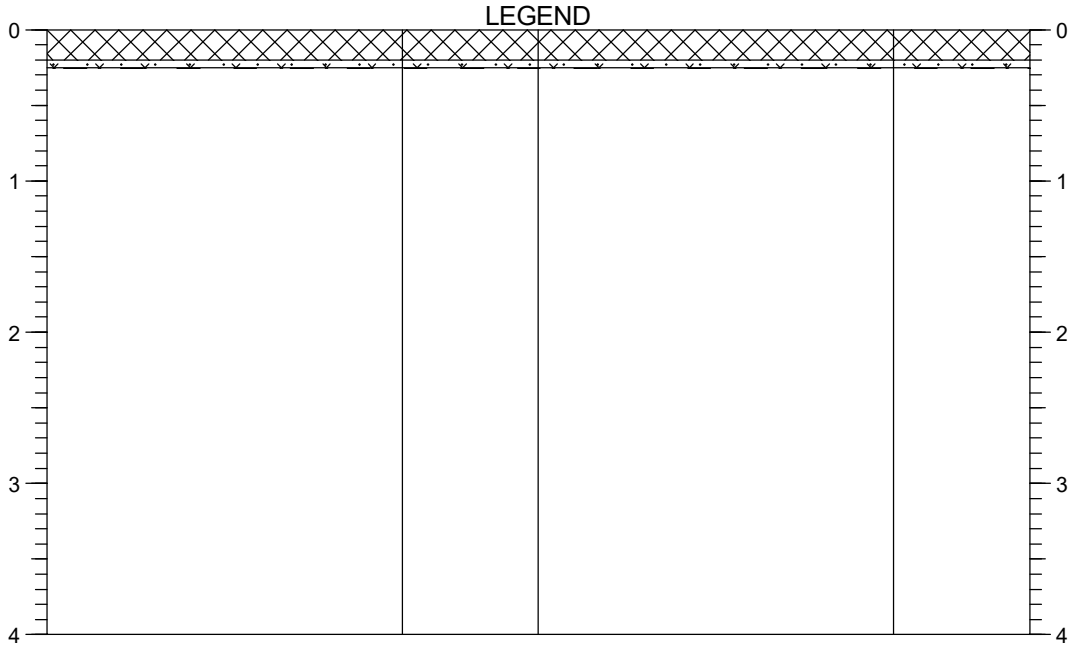
All measurements in metres unless otherwise stated	10m/page Scale: 1:50	Coordinates to Local Grid Ground Level to Local Datum		
Plant Used: JCB 3CX	Coordinates / Level (mAOD): E: 534626.977 N: 325556.466 Level: 5.192	Logged By: PH	Checked By: PB	Approved By: PB

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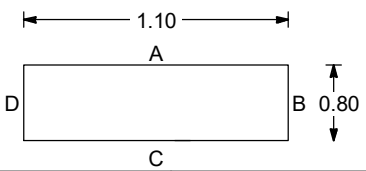
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Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**TP104**

TRIAL PIT LOG	Date:	Client:
	06/09/2022	**Stirlin Developments Limited**



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
0.20		MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. Frequent rootlets (TOPSOIL)				
0.25		Orange clayey sandy SILT. Sand is fine. (TIDAL FLAT DEPOSITS)				
		End of Trial pit at 0.25 m bgl for CBR plate test.				

Shoring/Support:
Stability:



Bearing: °



REMARKS :

1. Arisings logged in general accordance to BS5930:2015+A1:2020;
2. Location cleared for underground utilities by Safe Dig Surveys Limited;
3. Trial pit remained stable throughout;
4. Plate load CBR Test undertaken below topsoil;
5. No groundwater identified; and
6. Trial pit backfilled with gravel and arisings and nominally compacted.

All measurements in metres unless otherwise stated	10m/page Scale: 1:50	Coordinates to Local Grid Ground Level to Local Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 534614.148 N: 325560.115 Level: 3.045	PH	PB	PB

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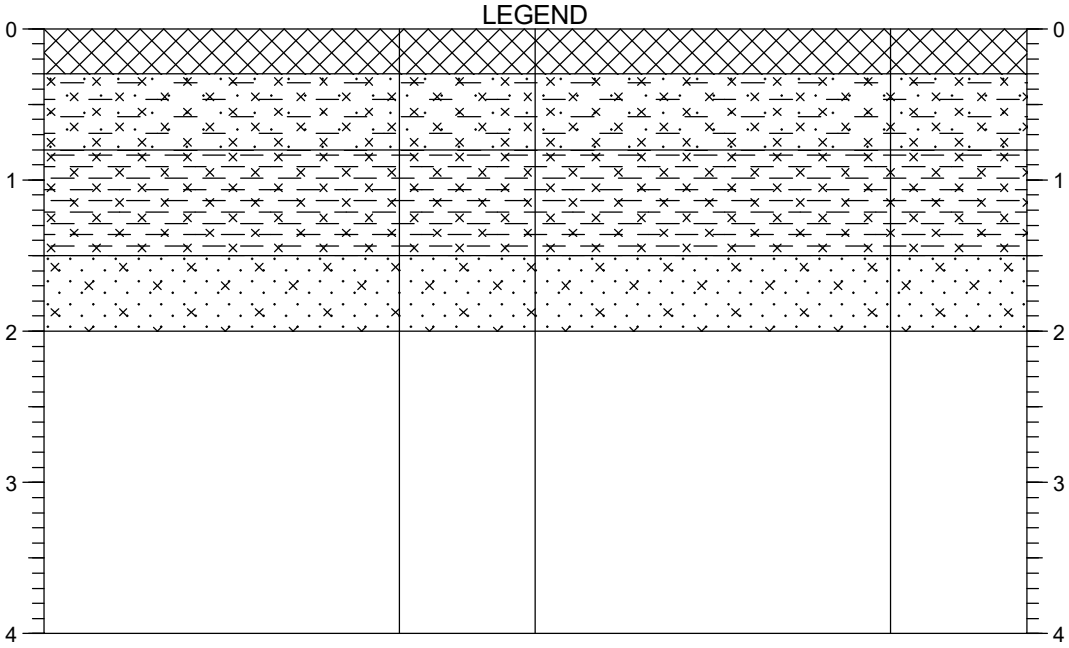
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Project:	Project No:	Hole ID:
Plots 3 to 5, FEZ, Holbeach	**EGE-22-08-09-01**	**TP105**

TRIAL PIT LOG

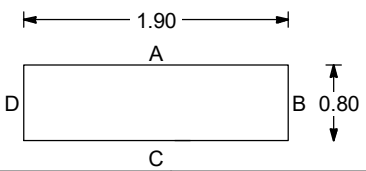
Date:	Client:
06/09/2022	**Stirlin Developments Limited**

LEGEND



STRATA			SAMPLES		TESTS	
Depth	No	DESCRIPTION	Depth	No	Depth	Results
0.30		MADE GROUND: Brown very sandy slightly gravelly silt. Gravel is fine to medium sub-rounded to sub-angular mixed lithologies. Frequent rootlets (TOPSOIL)	0.20	ES1		
(0.50) 0.80		Firm dark grey slightly sandy SILT. Sand is fine. (TIDAL FLAT DEPOSITS)				
(0.70) 1.50		Firm brown mottled orange silty CLAY. (TIDAL FLAT DEPOSITS)	1.00	D1		
(0.50) 2.00		Orange silty fine SAND. (TIDAL FLAT DEPOSITS)				
		End of Trial pit at 2.00 m bgl.				

Shoring/Support:
Stability:



Bearing: °



REMARKS :

1. Arisings logged in general accordance to BS5930:2015+A1:2020;
2. Location cleared for underground utilities by Safe Dig Surveys Limited;
3. Trial pit remained stable throughout;
4. No groundwater identified; and
5. Trial pit backfilled with gravel and arisings and nominally compacted.

All measurements in metres unless otherwise stated	10m/page Scale: 1:50	Coordinates to Local Grid Ground Level to Local Datum

Plant Used:	Coordinates / Level (mAOD):	Logged By:	Checked By:	Approved By:
JCB 3CX	E: 534607.176 N: 325562.968 Level: 3.066	PH	PB	PB

Appendix III – Chemical Analytical Results

evolve
GEO-ENVIRONMENTAL

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	22-34562-1
Initial Date of Issue:	20-Sep-2022
Client	Evolve Geo-Environmental Ltd
Client Address:	15 Newland Lincoln Lincolnshire LN1 1XG
Contact(s):	Paul Huteson
Project	FE2, Holbech

Quotation No.:		**Date Received:**	09-Sep-2022
Order No.:		**Date Instructed:**	09-Sep-2022
No. of Samples:	9		
Turnaround (Wkdays):	5	**Results Due:**	15-Sep-2022
Date Approved:	20-Sep-2022		

Approved By:



Details: Stuart Henderson, Technical Manager

Results - Soil

Project: FE2, Holbech

Client: Evolve Geo-Environmental Ltd			**Chemtest Job No.:**		22-34562	22-34562	22-34562	22-34562	22-34562	22-34562	22-34562	22-34562
Quotation No.:			**Chemtest Sample ID.:**		1503685	1503686	1503687	1503688	1503689	1503690	1503691	1503692
Order No.:			Client Sample Ref.:		ES1	D1	D2	D3	ES1	ES1	ES1	ES1
			Sample Location:		BH101	BH101	BH101	BH101	BH102	TP102	TP105	SA102
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	2.00	6.00	12.00	1.00	0.10	0.20	0.20
			Date Sampled:		06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022
			Asbestos Lab:		DURHAM				DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
ACM Type	U	2192		N/A	-				-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected				No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	12	14	17	17	12	9.7	11	14
pH	M	2010		4.0		8.8	8.9	8.9				
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.48				0.86	0.79	0.54	0.94
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010		0.033	0.075	0.097				
Arsenic	M	2455	mg/kg	0.5	7.3				5.8	4.9	3.6	4.9
Cadmium	M	2455	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Chromium	M	2455	mg/kg	0.5	12				9.7	9.1	6.5	8.3
Copper	M	2455	mg/kg	0.50	8.8				3.6	3.4	4.4	5.0
Mercury	M	2455	mg/kg	0.05	< 0.05				< 0.05	< 0.05	< 0.05	< 0.05
Nickel	M	2455	mg/kg	0.50	9.5				8.6	8.1	5.8	7.2
Lead	M	2455	mg/kg	0.50	9.2				5.6	5.0	3.7	5.9
Selenium	M	2455	mg/kg	0.25	0.28				0.26	0.25	< 0.25	< 0.25
Zinc	M	2455	mg/kg	0.50	25				21	24	15	20
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0				< 5.0	< 5.0	< 5.0	[C] < 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0				< 1.0	< 1.0	< 1.0	[C] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0				< 5.0	< 5.0	< 5.0	[C] < 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10				< 10	< 10	< 10	[C] < 10
Naphthalene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: FE2, Holbech

Client: Evolve Geo-Environmental Ltd			**Chemtest Job No.:**		22-34562	22-34562	22-34562	22-34562	22-34562	22-34562	22-34562	22-34562
Quotation No.:			**Chemtest Sample ID.:**		1503685	1503686	1503687	1503688	1503689	1503690	1503691	1503692
Order No.:			Client Sample Ref.:		ES1	D1	D2	D3	ES1	ES1	ES1	ES1
			Sample Location:		BH101	BH101	BH101	BH101	BH102	TP102	TP105	SA102
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	2.00	6.00	12.00	1.00	0.10	0.20	0.20
			Date Sampled:		06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022	06-Sep-2022
			Asbestos Lab:		DURHAM				DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Fluorene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10				< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0				< 2.0	< 2.0	< 2.0	< 2.0

Results - Soil

Project: FE2, Holbech

Client: Evolve Geo-Environmental Ltd			**Chemtest Job No.:**		22-34562
Quotation No.:			**Chemtest Sample ID.:**		1503693
Order No.:			Client Sample Ref.:		S1
			Sample Location:		Bund
			Sample Type:		SOIL
			Top Depth (m):		
			Date Sampled:		06-Sep-2022
			Asbestos Lab:		DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected
Moisture	N	2030	%	0.020	7.5
pH	M	2010		4.0	
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	
Arsenic	M	2455	mg/kg	0.5	7.1
Cadmium	M	2455	mg/kg	0.10	0.10
Chromium	M	2455	mg/kg	0.5	11
Copper	M	2455	mg/kg	0.50	7.3
Mercury	M	2455	mg/kg	0.05	< 0.05
Nickel	M	2455	mg/kg	0.50	8.7
Lead	M	2455	mg/kg	0.50	9.3
Selenium	M	2455	mg/kg	0.25	0.32
Zinc	M	2455	mg/kg	0.50	24
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	
Naphthalene	M	2700	mg/kg	0.10	
Acenaphthylene	M	2700	mg/kg	0.10	
Acenaphthene	M	2700	mg/kg	0.10	

Results - Soil

Project: FE2, Holbech

Client: Evolve Geo-Environmental Ltd			**Chemtest Job No.:**		22-34562
Quotation No.:			**Chemtest Sample ID.:**		1503693
Order No.:			Client Sample Ref.:		S1
			Sample Location:		Bund
			Sample Type:		SOIL
			Top Depth (m):		
			Date Sampled:		06-Sep-2022
			Asbestos Lab:		DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Fluorene	M	2700	mg/kg	0.10	
Phenanthrene	M	2700	mg/kg	0.10	
Anthracene	M	2700	mg/kg	0.10	
Fluoranthene	M	2700	mg/kg	0.10	
Pyrene	M	2700	mg/kg	0.10	
Benzo[a]anthracene	M	2700	mg/kg	0.10	
Chrysene	M	2700	mg/kg	0.10	
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	
Benzo[a]pyrene	M	2700	mg/kg	0.10	
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	
Total Of 16 PAH's	M	2700	mg/kg	2.0	

Results - Single Stage WAC

Project: FE2, Holbech

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	22-34562						
Chemtest Sample ID:	1503690						
Sample Ref:	ES1						
Sample ID:							
Sample Location:	TP102						
Top Depth(m):	0.10						
Bottom Depth(m):							
Sampling Date:	06-Sep-2022						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.23	3	5	6
Loss On Ignition	2610	M	%	1.9	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.7	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.035	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0020	0.020	0.5	2	25
Barium	1455	U	0.014	0.14	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	0.0018	0.019	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0022	0.022	0.5	10	30
Nickel	1455	U	0.0010	0.010	0.4	10	40
Lead	1455	U	0.0007	0.0067	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	0.0006	0.0057	0.1	0.5	7
Zinc	1455	U	0.003	0.028	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	1.2	12	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	59	590	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.4	54	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.7

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: FE2, Holbech

Chemtest Job No:	22-34562				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1503693						
Sample Ref:	S1						
Sample ID:							
Sample Location:	Bund						
Top Depth(m):							
Bottom Depth(m):							
Sampling Date:	06-Sep-2022				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	0.96	3	5	6
Loss On Ignition	2610	M	%	4.0	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	M	mg/kg	87	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.4	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	< 0.0020	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0066	0.066	0.5	2	25
Barium	1455	U	0.012	0.12	20	100	300
Cadmium	1455	U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455	U	0.0039	0.039	2	50	100
Mercury	1455	U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455	U	0.0015	0.015	0.5	10	30
Nickel	1455	U	0.0011	0.011	0.4	10	40
Lead	1455	U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455	U	0.003	0.032	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	1.1	11	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	67	670	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.6	66	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.5

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1503692	ES1		SA102	06-Sep-2022	C	Plastic Bag

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Appendix IV – Geotechnical Laboratory Results

evolve
GEO-ENVIRONMENTAL

Lincs Laboratory, St Georges Lane,
Riseholme, Lincoln, LN2 2LQ

Tel: (01522) 530355
Email: Lincslab@lincolnshire.gov.uk

TO:

Paul Huteson
Evolve Geo Environmental Ltd
c/o 15 Newland
Lincoln
LN2 2XG

Paulh@evolvegeo-env.co.uk

REPORT NO: 81709
JOB NO: 44732
DATE: 26 September 2022

PROJECT TITLE: FEZ HOLBEACH
WORK UNDERTAKEN: ANALYSIS OF SOILS

Authorising Signature:  (L Ghaleb; Supervisor - Laboratory Testing)

Notes:

1. This report is factual and only relates to the items tested.
2. Advice on the interpretation of these results is available from Lincs Laboratory Consultancy Staff. Opinions and interpretations are outside the scope of our UKAS/ISO 17025 accreditation.
3. Any samples or their residues will normally be kept for four weeks after the publication of this report.
4. Tests marked 'UKAS accredited' in this report are listed in our UKAS accreditation schedule bearing No.0699.
5. This report shall not be reproduced except in full, without written approval of Lincs Laboratory.
6. This report contains results for samples taken by a third party. The results apply to the sample as received.

Distribution:

√1 - Client
1 - Lab File

UKAS TESTING
0699

Lincs Laboratory

St Georges Lane, Riseholme, Lincoln, LN2 2LQ
Tel: (01522) 530355 Email: lincslab@lincolnshire.gov.uk

UKAS TESTING
0699

REPORT: 81709
JOB NO: 44732
DATE: 26 September 2022

PROJECT TITLE: FEZ HOLBEACH
WORK UNDERTAKEN: MOISTURE CONTENT TEST RESULTS

Lab Sample (No)	Ref (No)	Sample (type)	Depth (m)	MC (%)
S308-22	BH101	d	2.5	17
S309-22	BH102	d	3-4	25
S310-22	TP102	d	1.5	14

Notes:

i) Sampler : Client
ii) Sampling Procedure : Not Supplied
iii) Date Received : 09.09.22
iv) Date Tested : 14.09.22
v) Test Procedure : BS 1377:Part 2:1990 Cl 3.2 (UKAS Accredited)
vi) The test method stated has been superseded by BS EN ISO 17892-1:2014
vii) The samples were prepared in accordance with BS 1377:Part 1:1990 (UKAS Accredited)
viii) d = Disturbed

Lincs Laboratory St Georges Lane, Riseholme, Lincoln LN2 2LQ
Tel: (01522) 530355
Email: Lincslab@lincolnshire.gov.uk

UKAS TESTING
0699

REPORT: 81709
JOB NO: 44732
DATE: 26 September 2022

PROJECT TITLE: FEZ HOLBEACH
WORK UNDERTAKEN: PARTICLE SIZE DISTRIBUTION (WET GRADING ANALYSIS) TEST RESULTS

Lab Sample No:	BH (No)	Sample (type)	Depth (m)	Sieve Size (mm)	Passing (%)
S308-22	BH101	d	2.5	1.18	100
				0.600	100
				0.425	100
				0.300	100
				0.212	100
				0.150	99
				0.063	39

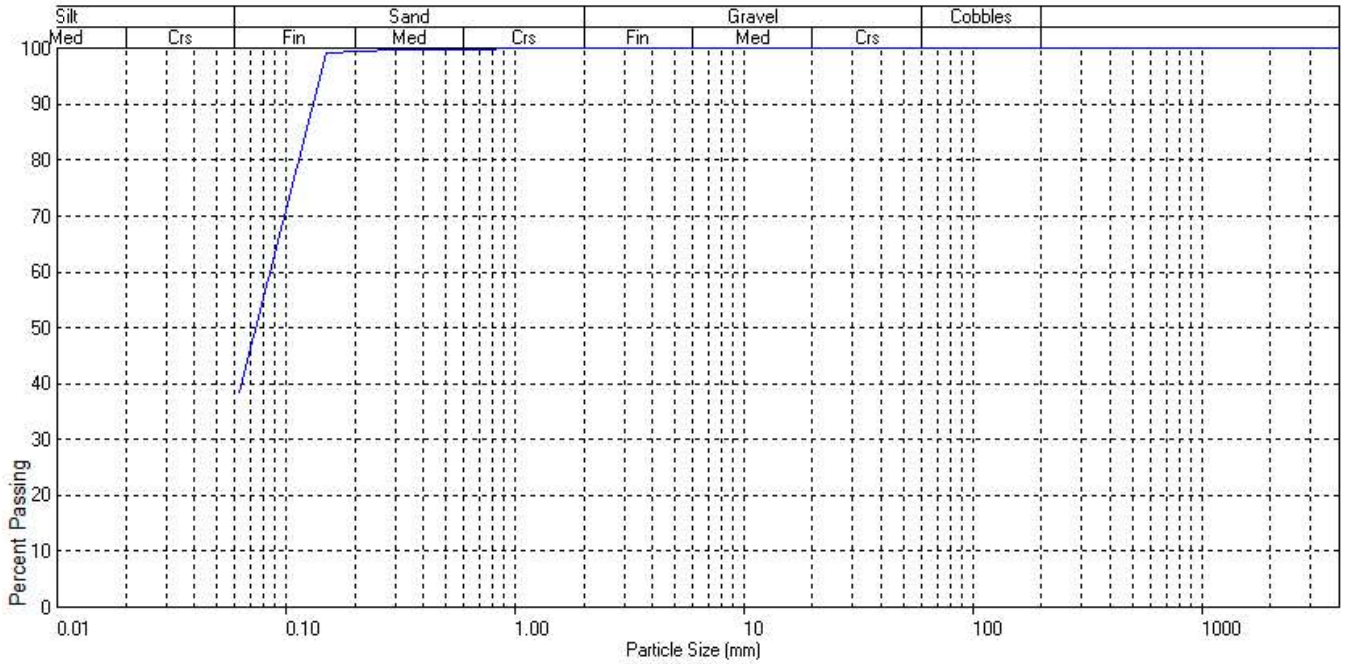
Material Description: Dark Yellowish Brown CLAYEY SILT

Notes:

i) Sampler : Client
ii) Sampling Procedure : Not Supplied
iii) Date Received : 09.09.22
iv) Date Tested : 13.09 – 14.09.22
v) Test Procedure : BS 1377:Part 2:1990 Cl 9.2 (UKAS Accredited)
vi) The sample was prepared in accordance with BS 1377:Part 1:1990 (UKAS Accredited)
vii) d = Disturbed

Lincs Laboratory
St Georges Lane
Riseholme
Lincoln, LN2 2LQ
Tel: 01522 530355

Particle Size Distribution



Job Name: FEZ Holbeach

Job Location: 44732

Sample Ref: S308-22

Sample Location: BH101 2.5m

Date Tested: 16/09/2022

Lincs Laboratory St Georges Lane, Riseholme, Lincoln LN2 2LQ
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Email: Lincslab@lincolnshire.gov.uk

UKAS TESTING
0699

REPORT: 81709
JOB NO: 44732
DATE: 26 September 2022

PROJECT TITLE: FEZ HOLBEACH
WORK UNDERTAKEN: PARTICLE SIZE DISTRIBUTION (WET GRADING ANALYSIS) TEST RESULTS

Lab Sample No:	BH (No)	Sample (type)	Depth (m)	Sieve Size (mm)	Passing (%)
S309-22	BH102	d	3 - 4	5	100
				3.35	100
				2.00	100
				1.18	100
				0.600	99
				0.425	99
				0.300	99
				0.212	99
				0.150	88
				0.063	17

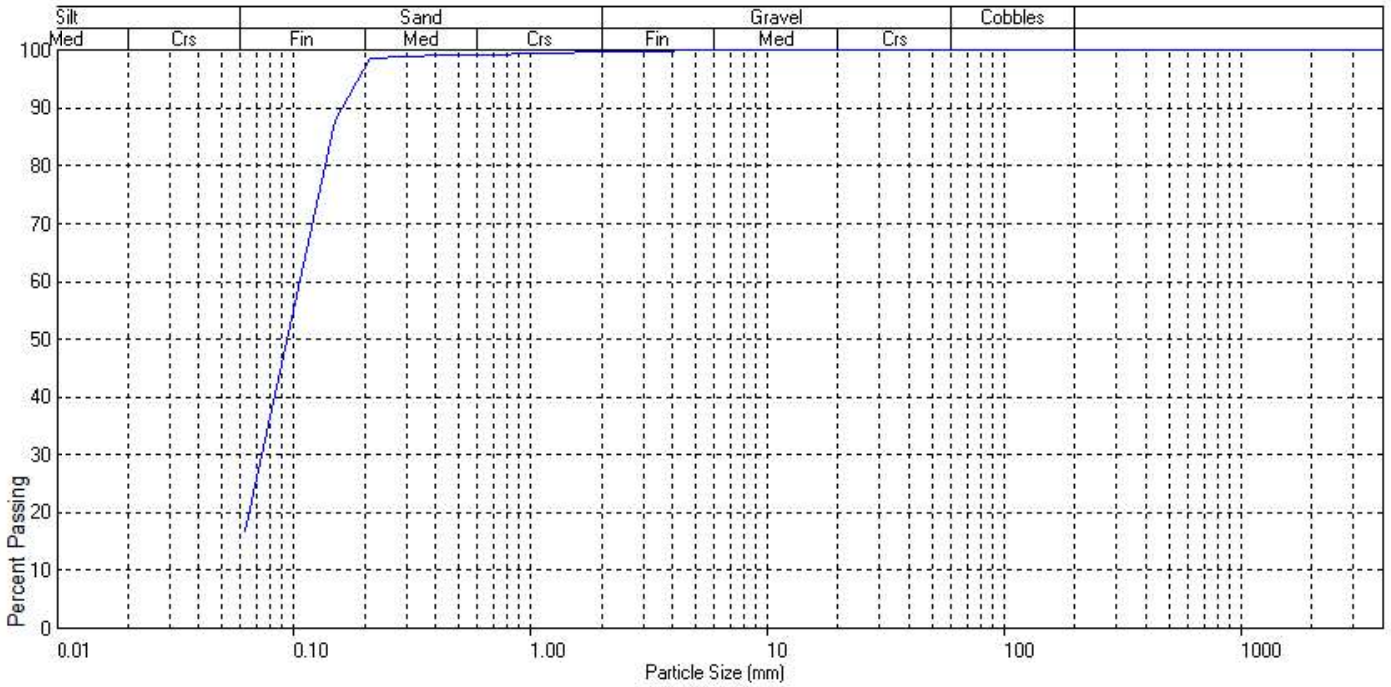
Material Description: Dark Yellowish Brown SILT

Notes:

i) Sampler : Client
ii) Sampling Procedure : Not Supplied
iii) Date Received : 09.09.22
iv) Date Tested : 13.09 – 14.09.22
v) Test Procedure : BS 1377:Part 2:1990 Cl 9.2 (UKAS Accredited)
vi) The sample was prepared in accordance with BS 1377:Part 1:1990 (UKAS Accredited)
vii) d = Disturbed

Lincs Laboratory
St Georges Lane
Riseholme
Lincoln, LN2 2LQ
Tel: 01522 530355

Particle Size Distribution



Job Name: FEZ Holbeach

Job Location: 44732

Sample Ref: S309-22

Sample Location: BH102 3-4m

Date Tested: 16/09/2022

Lincs Laboratory St Georges Lane, Riseholme, Lincoln LN2 2LQ
Tel: (01522) 530355
Email: Lincslab@lincolnshire.gov.uk

UKAS TESTING
0699

REPORT: 81709
JOB NO: 44732
DATE: 26 September 2022

PROJECT TITLE: FEZ HOLBEACH
WORK UNDERTAKEN: PARTICLE SIZE DISTRIBUTION (WET GRADING ANALYSIS) TEST RESULTS

Lab Sample No:	TP (No)	Sample (type)	Depth (m)	Sieve Size (mm)	Passing (%)
S310-22	TP102	d	1.5	1.18	100
				0.600	100
				0.425	100
				0.300	100
				0.212	99
				0.150	99
				0.063	72

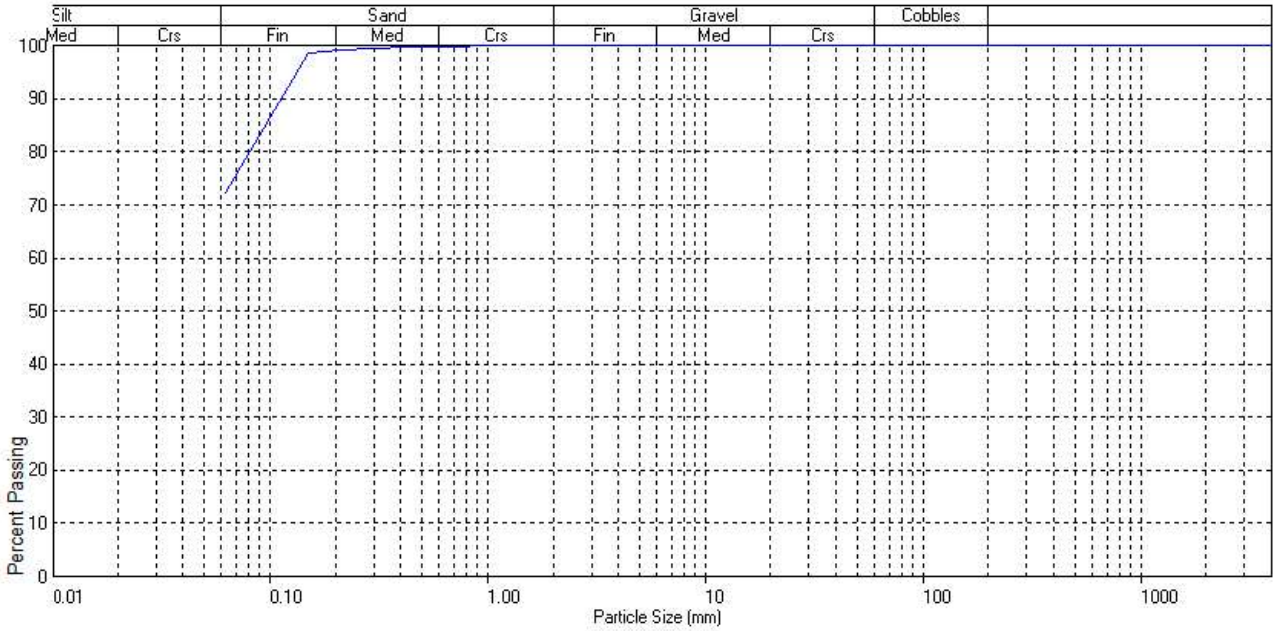
Material Description: Dark Yellowish Brown SILT

Notes:

i) Sampler : Client
ii) Sampling Procedure : Not Supplied
iii) Date Received : 09.09.22
iv) Date Tested : 13.09 – 14.09.22
v) Test Procedure : BS 1377:Part 2:1990 Cl 9.2 (UKAS Accredited)
vi) The sample was prepared in accordance with BS 1377:Part 1:1990 (UKAS Accredited)
vii) d = Disturbed

Lincs Laboratory
St Georges Lane
Riseholme
Lincoln, LN2 2LQ
Tel: 01522 530355

Particle Size Distribution



Job Name: FEZ Holbeach

Job Location: 44732

Sample Ref: S310-22

Sample Location: TP102 1.5m

Date Tested: 16/09/2022

Lincs Laboratory St Georges Lane, Riseholme, Lincoln LN2 2LQ
Tel: (01522) 530355
Email: Lincslab@lincolnshire.gov.uk

UKAS TESTING
0699

REPORT: 81709
JOB NO: 44732
DATE: 26 September 2022

PROJECT TITLE: FEZ HOLBEACH
WORK UNDERTAKEN: ATTERBERG LIMITS TEST RESULTS

Lab Sample No:	Ref (No)	Sample (type)	Depth (m)	LL (%)	PL (%)	PI (%)	Ret 425um (%)
S311-22	TP105	d	1.0	35	20	15	0.0

Material Description: Dark Yellowish Brown SILT

Notes:

i) Sampler : Client
ii) Sampling Procedure : Not Supplied
iii) Date Received : 09.09.22
iv) Date Tested : 13.09 – 20.09.22
v) Test Procedures : (PL) BS 1377:Pt 2:1990 Cl 5.3 (UKAS Accredited)
(LL) BS 1377:Pt 2:1990 Cl 4.3 (UKAS Accredited)
(PI) BS 1377:Pt 2:1990 Cl 5.4 (UKAS Accredited)
vi) The sample was prepared in accordance with BS 1377:Part 1:1990 (UKAS Accredited)
vii) d = Disturbed
viii) The test method state for Moisture Content has been superseded by BS EN ISO 17892-1:2014.

LABORATORY REPORT

4043

Contract Number: PSL22/5809

Report Date: 07 September 2022

Client's Reference:

Client Name: Evolve Geo-Environmental

For the attention of: Paul Huteson

Contract Title: Food Enterprise Zone, Holbeach, Lincolnshire

Date Received: 6/9/2022
Date Commenced: 6/9/2022
Date Completed: 7/9/2022

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)
R Berriman (Quality Manager)
S Royle (Laboratory Manager)
L Knight (Senior Technician)
S Eyre (Senior Technician)
T Watkins (Senior Technician)

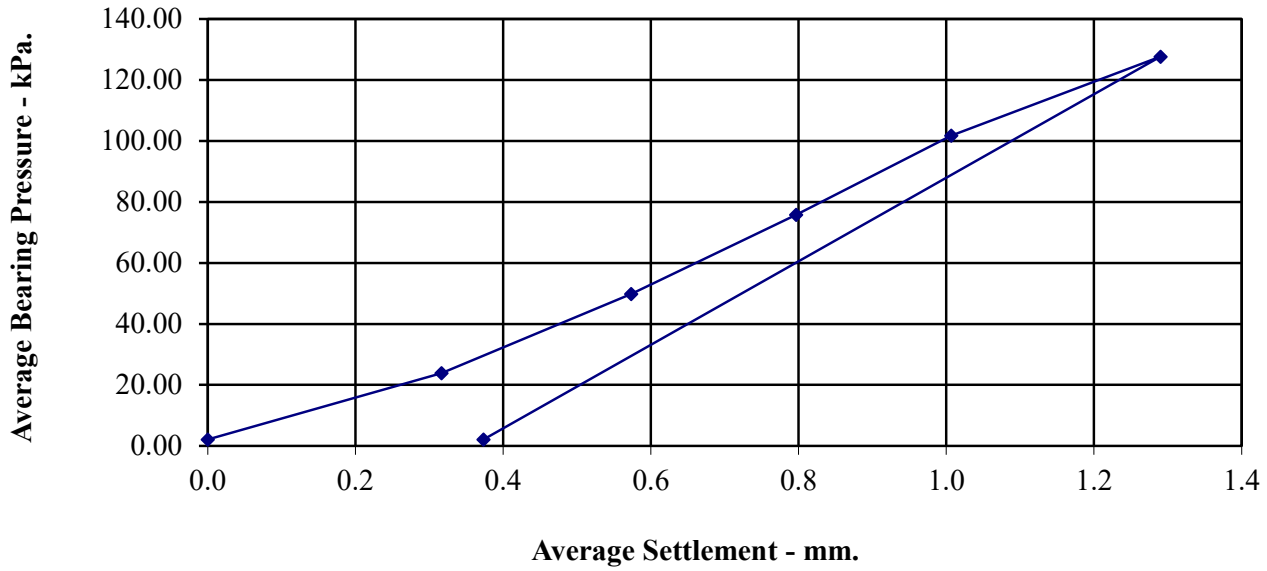
5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: awatkins@prosoils.co.uk
rberriman@prosoils.co.uk

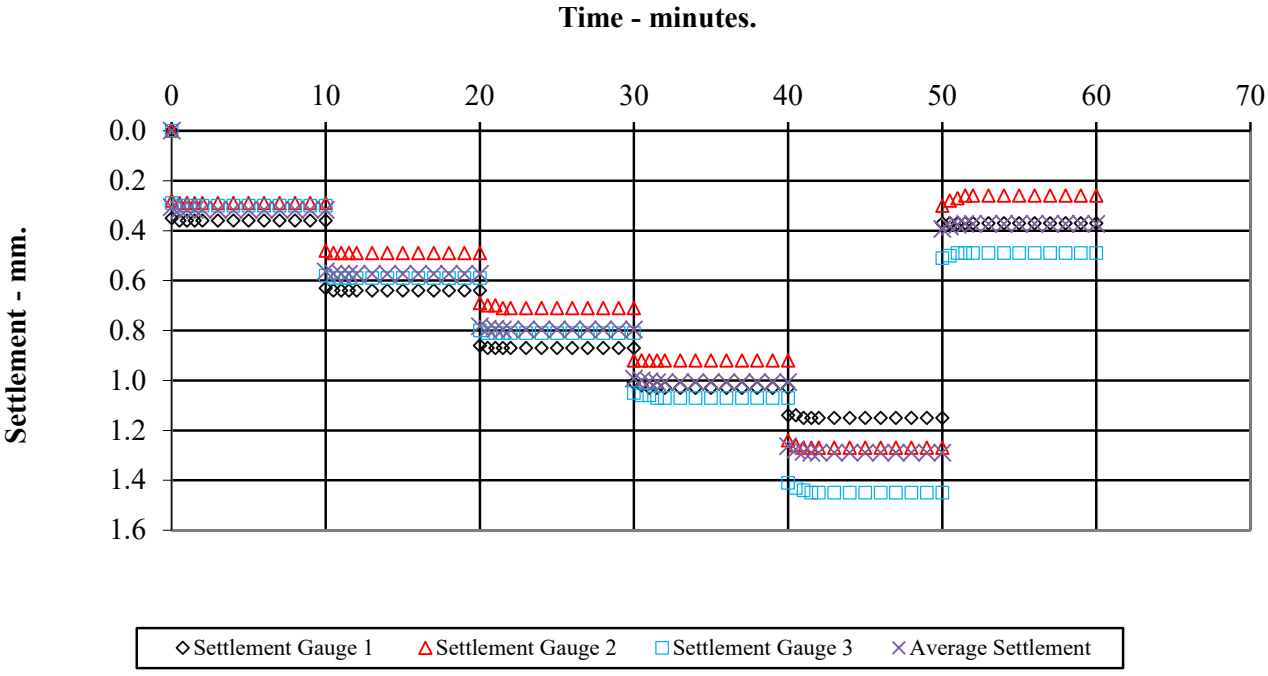
VERTICAL DEFORMATION TESTS.

BS 1377 : Part 9 : 1990.

Date of Test:	**06-Sep-22**	**Test Ref:**	**CBR 01**
Grid Ref:		**Depth (m):**	**-0.20**
Layer:		**Comments:**	

Maximum Applied Pressure (kPa): **127.66**
Maximum Deformation (mm): **1.29**
Plate Area (m2): **0.1626**
Description: **Brown sandy CLAY.**





Calculation of Equivalent CBR Value from Plate Bearing Test

Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4
Incorporating IAN 73/06

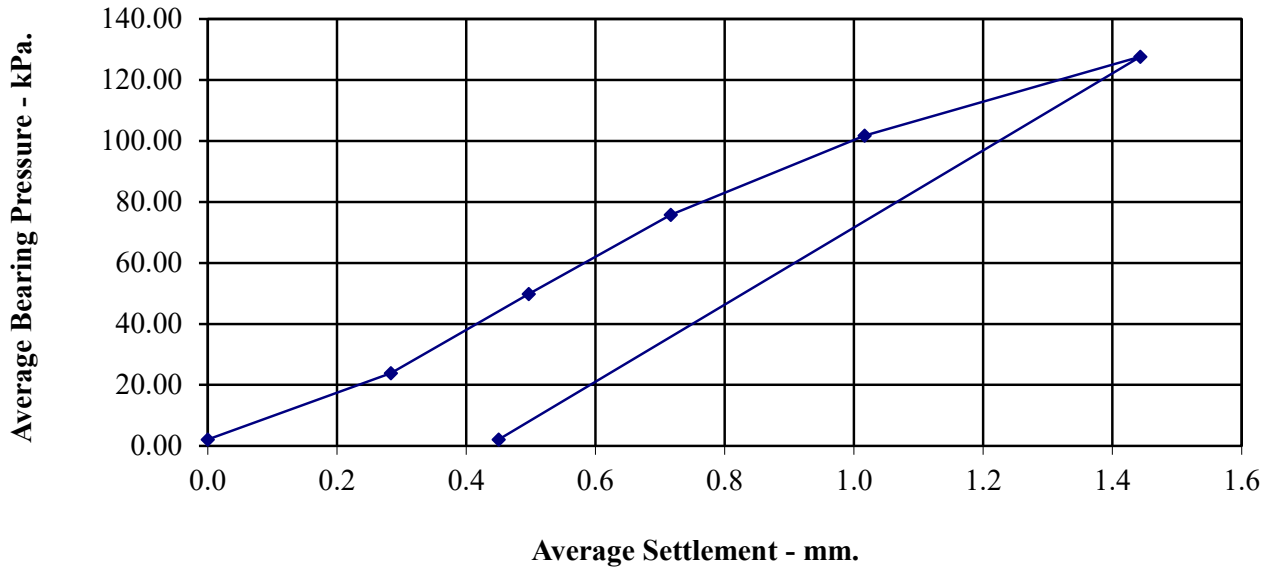
Date of Test	**6-Sep-22**	
Test Ref	**CBR 01**	
Depth (m)	**-0.20**	
Grid Ref		
Layer		
Comments		
Description	**Brown sandy CLAY.**	
Maximum Deflection	**1.29**	**mm**
Deflection required for CBR value	**1.25**	**mm**
Load at 1.25mm	**124**	**kN/m^2**
Plate diameter	**455**	**mm**
Conversion factor for plate diameter	**0.629**	
K_{762}(modulus of subgrade reaction) calculated using 1.25mm settlement	**62.4**	**$kN/m^2/mm$**
CBR Value	**12.5**	**%**

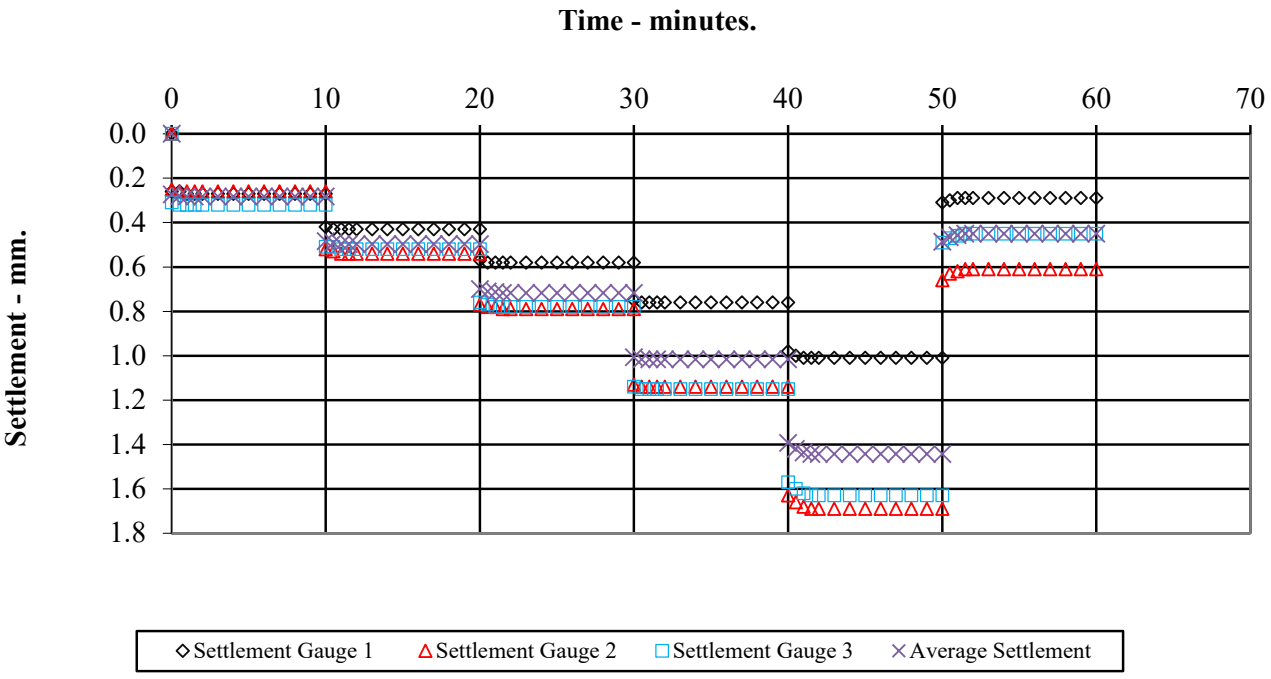
VERTICAL DEFORMATION TESTS.

BS 1377 : Part 9 : 1990.

Date of Test:	**06-Sep-22**	**Test Ref:**	**CBR 02**
Grid Ref:		**Depth (m):**	**-0.35**
Layer:		**Comments:**	

Maximum Applied Pressure (kPa): **127.66**
Maximum Deformation (mm): **1.44**
Plate Area (m2): **0.1626**
Description: **Brown sandy CLAY.**





Calculation of Equivalent CBR Value from Plate Bearing Test

Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4
Incorporating IAN 73/06

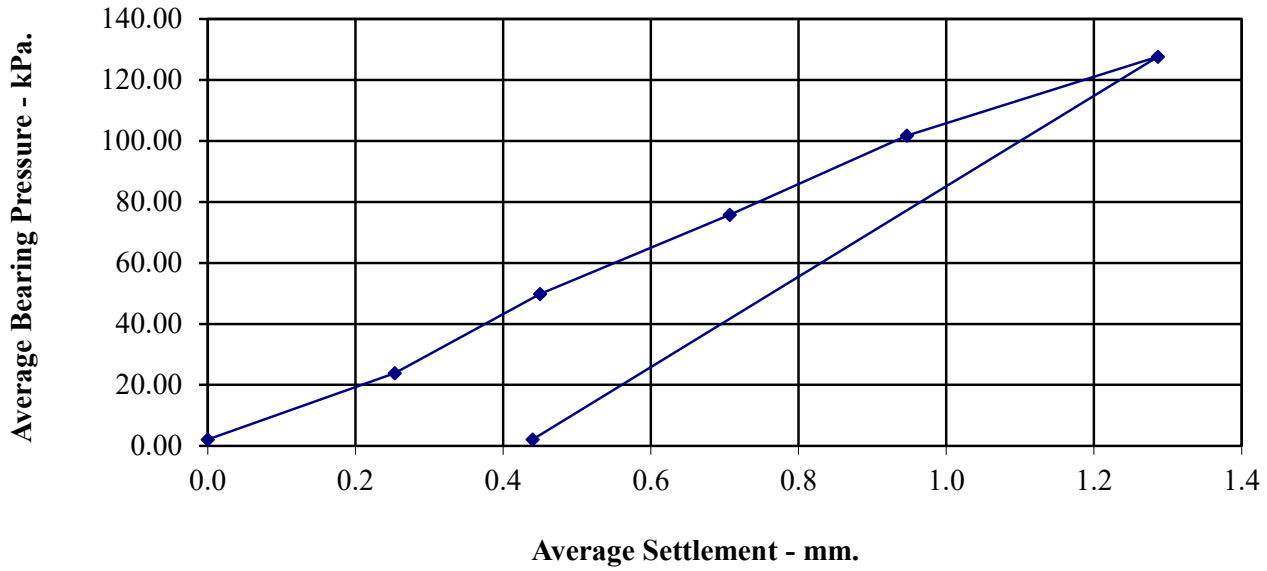
Date of Test	**6-Sep-22**	
Test Ref	**CBR 02**	
Depth (m)	**-0.35**	
Grid Ref		
Layer		
Comments		
Description	**Brown sandy CLAY.**	
Maximum Deflection	**1.44**	**mm**
Deflection required for CBR value	**1.25**	**mm**
Load at 1.25mm	**116**	**kN/m^2**
Plate diameter	**455**	**mm**
Conversion factor for plate diameter	**0.629**	
K_{762}(modulus of subgrade reaction) calculated using 1.25mm settlement	**58.3**	**kN/m^2/mm**
CBR Value	**11.1**	**%**

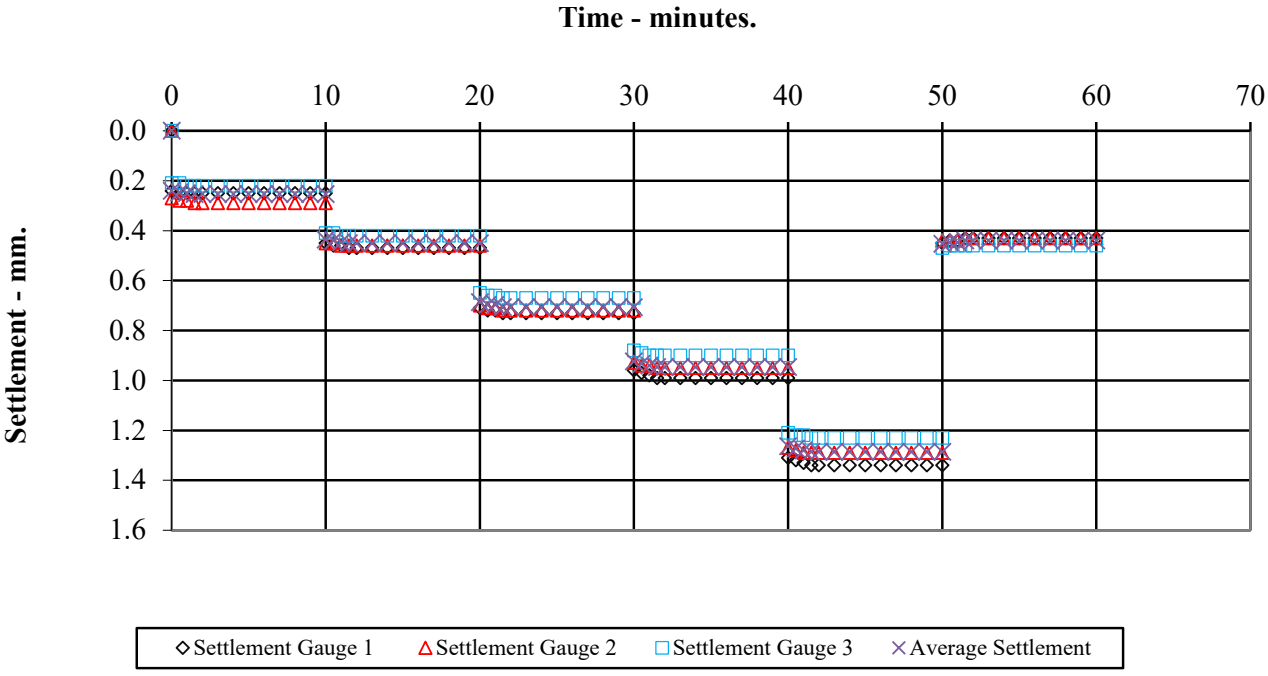
VERTICAL DEFORMATION TESTS.

BS 1377 : Part 9 : 1990.

Date of Test:	**06-Sep-22**	**Test Ref:**	**CBR 03**
Grid Ref:		**Depth (m):**	**-0.30**
Layer:		**Comments:**	

Maximum Applied Pressure (kPa): **127.66**
Maximum Deformation (mm): **1.29**
Plate Area (m2): **0.1626**
Description: **Brown sandy CLAY.**





Calculation of Equivalent CBR Value from Plate Bearing Test

Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4
Incorporating IAN 73/06

Date of Test	**6-Sep-22**
Test Ref	**CBR 03**
Depth (m)	**-0.30**
Grid Ref	
Layer	
Comments	
Description	**Brown sandy CLAY.**

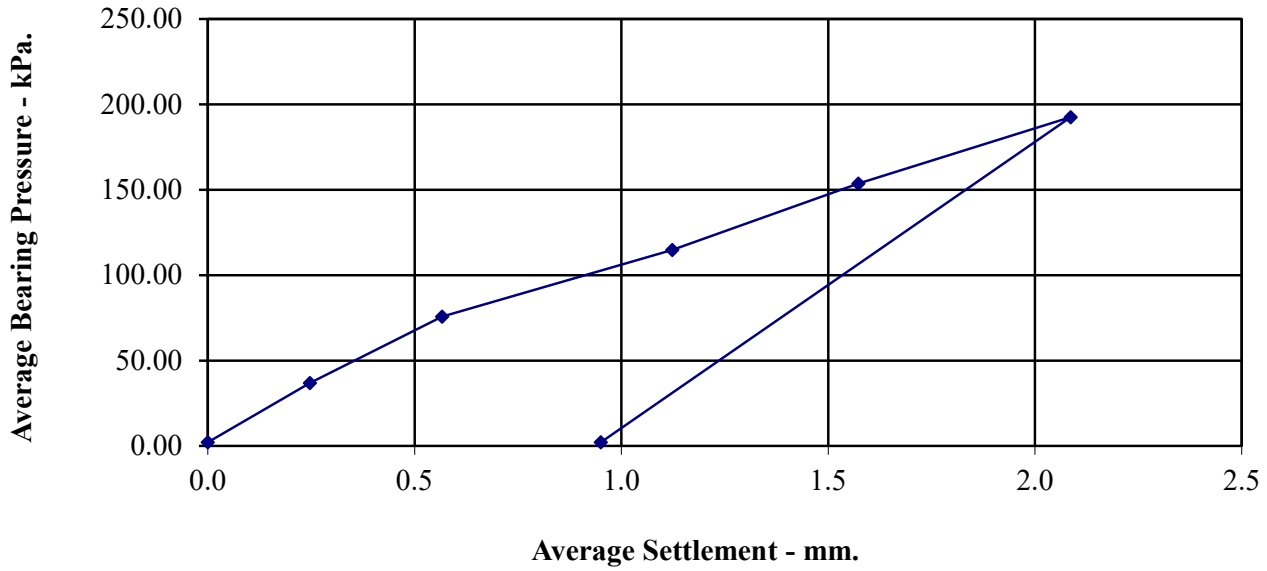
Maximum Deflection	**1.29**	**mm**
Deflection required for CBR value	**1.25**	**mm**
Load at 1.25mm	**125**	**kN/m^2**
Plate diameter	**455**	**mm**
Conversion factor for plate diameter	**0.629**	
K_{762}(modulus of subgrade reaction) calculated using 1.25mm settlement	**62.8**	**$kN/m^2/mm$**
CBR Value	**12.6**	**%**

VERTICAL DEFORMATION TESTS.

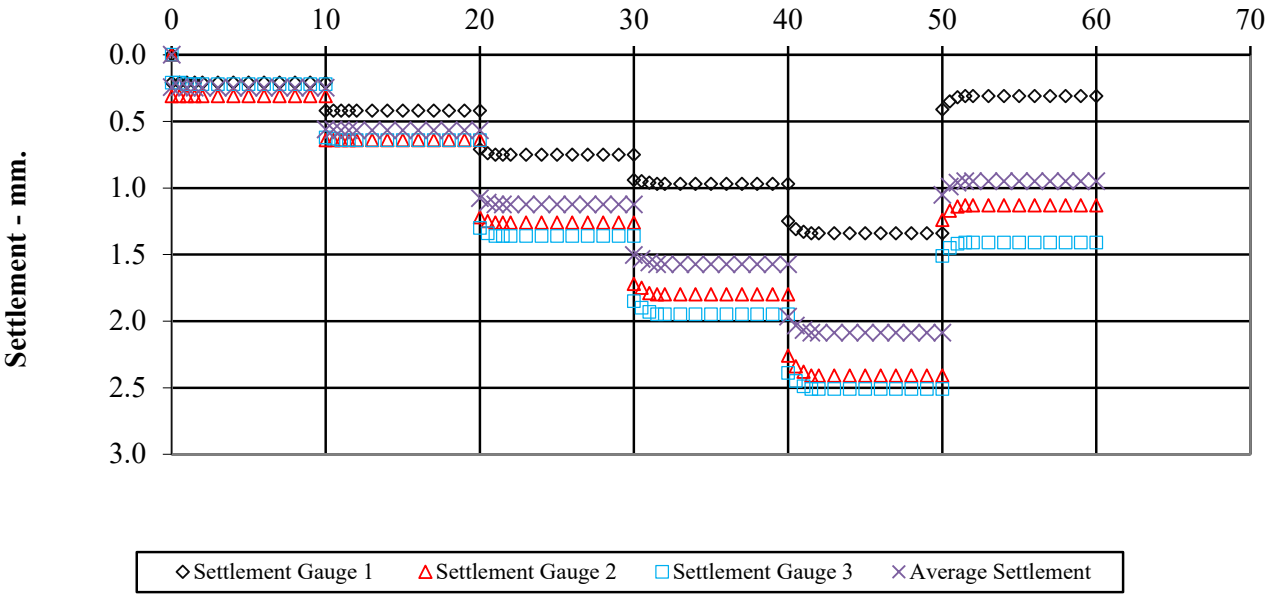
BS 1377 : Part 9 : 1990.

Date of Test:	**06-Sep-22**	**Test Ref:**	**CBR 04**
Grid Ref:		**Depth (m):**	**-0.25**
Layer:		**Comments:**	

Maximum Applied Pressure (kPa): **192.54**
Maximum Deformation (mm): **2.09**
Plate Area (m2): **0.1626**
Description: **Brown sandy CLAY.**



Time - minutes.



Calculation of Equivalent CBR Value from Plate Bearing Test

Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4
Incorporating IAN 73/06

Date of Test	**6-Sep-22**
Test Ref	**CBR 04**
Depth (m)	**-0.25**
Grid Ref	
Layer	
Comments	
Description	**Brown sandy CLAY.**

Maximum Deflection	**2.09**	**mm**
Deflection required for CBR value	**1.25**	**mm**
Load at 1.25mm	**126**	**kN/m^2**
Plate diameter	**455**	**mm**
Conversion factor for plate diameter	**0.629**	
K_{762}(modulus of subgrade reaction) calculated using 1.25mm settlement	**63.2**	**kN/m^2/mm**
CBR Value	**12.7**	**%**

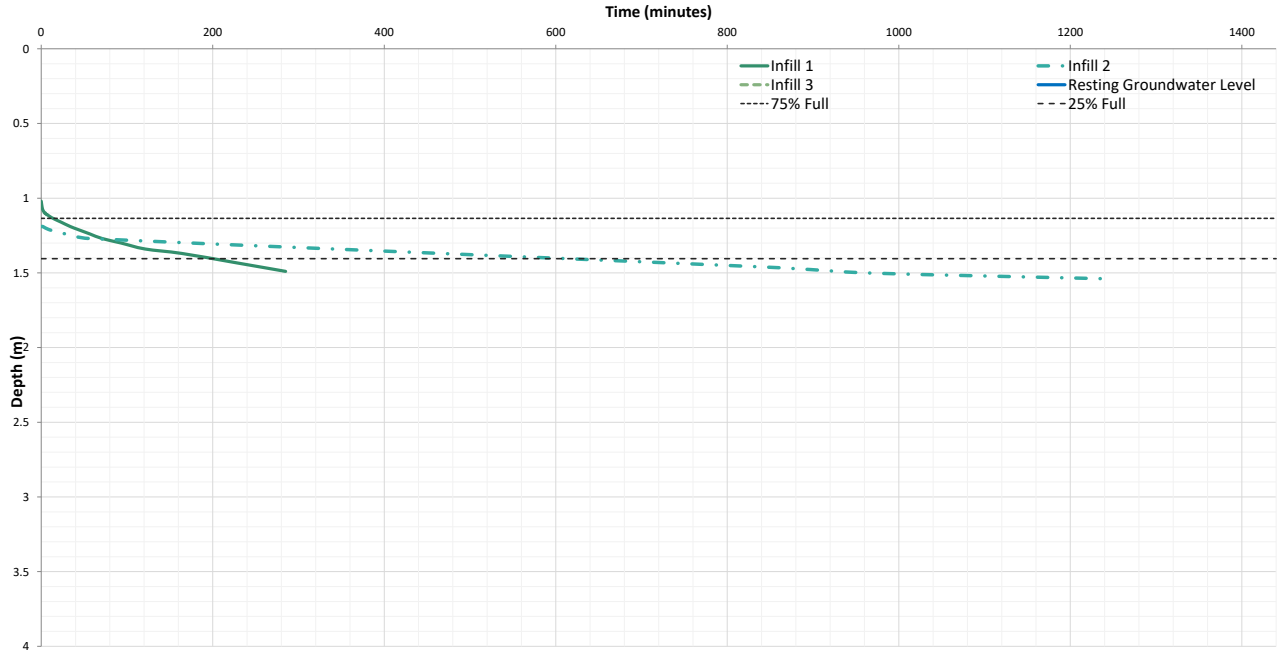
Appendix V – BRE365 Infiltration Sheets

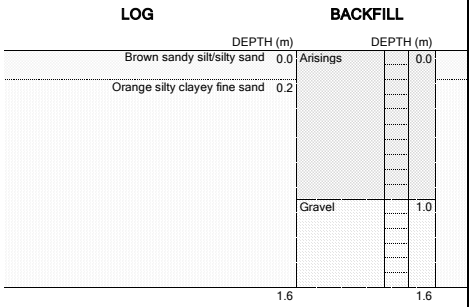
evolve
GEO-ENVIRONMENTAL

	units	Infill 1	Infill 2	Infill 3
Length	m		2.70	
Width	m		0.60	
Depth	m		1.54	
Gravel type			20mm single size	
Voids ratio			0.40	
Resting groundwater level at time of testing	m		5.00	
Depth of first reading	m	1.02	1.19	0.00
Depth of final reading	m	1.49	1.54	0.00
Did soakage test reach 25% of maximum fill depth?		Yes	Yes	No
Did soakage test reach near empty?		No	Yes	No
Depth at 75% full/effective depth	m	1.14	1.28	0.00
Depth at 25% full/effective depth	m	1.37	1.45	0.00
Time at 75% full/effective depth	mins	14.75	86.95	#N/A
Time at 25% full/effective depth	mins	166.54	809.05	#N/A
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m^3	0.15	0.11	0.00
Mean surface area for outflow (50% full/effective depth)	m^2	3.17	2.78	1.62
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	151.79	722.11	#N/A
Soil infiltration rate, f =	m/s	0.00000527	0.00000094	Failed Test
or	m/s	5.3E-06	9.4E-07	Failed Test

Recommended soil infiltration rate	
Failed Test	m/s

Note:
Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.





evolve GEO-ENVIRONMENTAL

TITLE: Soakaway Test Results
Plots 3 to 5, FEZ
Stirlin Developments Limited

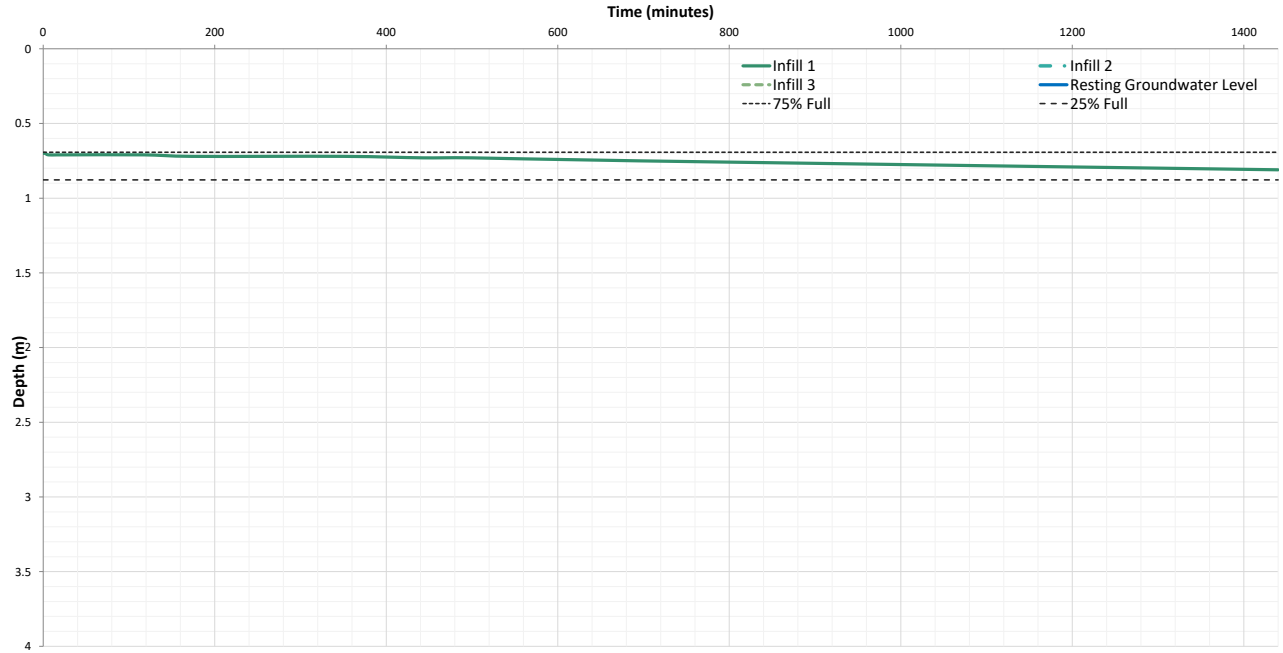
In general accordance with BRE Digest 365 (2016)

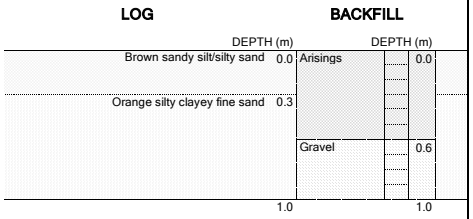
DRAWN BY: PH	SCALE: Not to Scale	PROJECT NUMBER: EGE-22-08-09-01
CHECKED BY: PB	REVISION: 1	SOAKAWAY NUMBER: SA101
DATE: 06/09/2022		

	units	Infill 1	Infill 2	Infill 3
Length	m		1.60	
Width	m		0.60	
Depth	m		0.97	
Gravel type			20mm single size	
Voids ratio			0.40	
Resting groundwater level at time of testing	m		5.00	
Depth of first reading	m	0.70	0.00	0.00
Depth of final reading	m	0.81	0.00	0.00
Did soakage test reach 25% of maximum fill depth?		No	No	No
Did soakage test reach near empty?		No	No	No
Depth at 75% full/effective depth	m	0.73	0.00	0.00
Depth at 25% full/effective depth	m	0.78	0.00	0.00
Time at 75% full/effective depth	mins	419.75	#N/A	#N/A
Time at 25% full/effective depth	mins	1098.08	#N/A	#N/A
Vp75 - 25 (volume outflowing between 75% and 25% full/effective depth)	m^3	0.02	0.00	0.00
Mean surface area for outflow (50% full/effective depth)	m^2	1.20	0.96	0.96
tp75 (time for the water level to fall from 75% to 25% full/effective depth)	mins	678.33	#N/A	#N/A
Soil infiltration rate, f =	m/s	Failed Test	Failed Test	Failed Test
or	m/s	Failed Test	Failed Test	Failed Test

Recommended soil infiltration rate	
Failed Test	m/s

Note:
Where water level reaches nearly empty (5% full), soil infiltration based on 'Full' depth. Where water level did not reach nearly empty (5% full), soil infiltration rate is based on 'Effective' drainage achieved only. Where water level did not fall below 25% of the maximum fill level, this is considered to be a 'Failed' test.





evolve GEO-ENVIRONMENTAL	TITLE: Soakaway Test Results Plots 3 to 5, FEZ Stirlin Developments Limited	*In general accordance with BRE Digest 365 (2016)*	DRAWN BY: PH SCALE: Not to Scale CHECKED BY: PB REVISION: 1 DATE: 06/09/2022 PROJECT NUMBER: EGE-22-08-09-01 SOAKAWAY NUMBER: SA102

Appendix VI – Ground Gas Monitoring Data Sheets

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GEO-ENVIRONMENTAL

BOREHOLE LOCATION/DATA		CH_4	CO_2	O_2	Mb	Peak Flow	Flow l/Hr	Pa	LEL	DTW	DTB
R1	BH101	<0.1	0.5	15.9	1008	0	0	0	0	2.33	2.94
R2	BH101	<0.1	0.9	14.7	1021	0	0	0	0	2.45	2.77
R3	BH101	<0.1	1.9	15.3	997	0	0	0	0	2.47	2.76

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Site: FEZ, Holbeach

Date: R1 12th Sept, R2 19th Sept, R3 27th Sept 2022

Client: Stirlin Developments Limited

Weather: R1 Overcast, Warm
R2 Overcast, slight breeze
R3 Overcast, windy

Appendix VII – Risk Ratings

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GEO-ENVIRONMENTAL

Risk Definitions	
Significance Level	Definition/Comments
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term. Likely contaminated land situation, risk assessment and action recommended.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term. Plausible contaminated land situation, risk assessment and possible action recommended.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild. Unlikely contaminated land situation, possible risk assessment and possible action.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe. Negligible risk, no action recommended except vigilance for changes in conditions.