



KINGMOOR
CONSULTING

Report Title

**PHASE 2 GROUND
INVESTIGATION REPORT**

Property Address

Plot 5
Land Adj Beech View
Gilgarren
Workington

Client

Mr Kevin Wirga

Our Reference

20-321r003_C

Date

OCTOBER 2020

Prepared by

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NOTES ON REPORT

Interpretation of ground conditions inherently depends on the conditions revealed by a limited data set. Kingmoor Consulting Ltd takes all reasonable professional care in preparation of this report, using current standards and industry best practice. However, we accept no liability whatsoever expressed or implied in respect of:

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- Any conditions not directly revealed by the investigation.
- Published standards or methodologies used or adopted in this report. • The opinion or position of any other party including any regulator, authority or stakeholder.
- Any dispute, claim or consequential loss arising from any finding or result in this report.
- Any matter other than ground conditions in the area under investigation.

Information contained in this report is intended for the use of the Client and his agents for the purposes set out, and we accept no liability for its use by other party or for any other purpose.

This report makes no representation on other matters such as ecology, agronomy, arboriculture, structural condition, building materials, boundaries and planning etc.

Introduction

The purpose of this report is to present findings of the geotechnical investigations undertaken on the proposed residential development site commissioned by the client, Mr Kevin Wirga. The proposed development shall consist of single residential dwelling and associated infrastructure in Gilgarran, Workington.

A Phase 1 GeoEnvironmental report has been prepared by GEO Environmental Engineering as part of the planning process and it was recommended that intrusive investigations are undertaken on the site. It also concluded that :

- *The development site is currently considered to represent a very low geotechnical risk.*
- *The site is currently considered to pose a negligible to very low risk to the proposed end users from ground contamination.*
- *The site is currently considered to pose a negligible risk to adjacent sites (the surrounding environment) and controlled waters with respect to potential ground/groundwater contamination.*
- *The site is currently considered to pose a very low risk to the proposed end users from ground gas.*

Should planning permission be granted it is recommended that any permission includes conditions relating to a Phase 2: Ground Investigation to allow the full characterisation of the site to ensure that if made ground and/or contamination is identified then it is dealt with in an appropriate manner to ensure the future suitability of the site for the proposed residential end use. Samples of topsoil should also be screened to ensure its appropriateness for re-use in a residential context.

This report considers the recommendations above and details the fieldworks and findings associated with the investigations.

Site Conditions

Geology

Superficial Deposits

The published superficial geology by The British Geological Survey shows the site is composed of loamy soils overlying the wethered shallow bedrock.

Trial pitting on the site indicated that the site has superficial deposits consisting of topsoil over a weathered bedrock formed of sandy clays with gravels and cobbles of sandstone and mudstone.

This was encountered to a total depth of 0.90m (TP5) Below Ground Level (BGL).

Solid Geology

The solid geology as published by the British Geological Survey shows the site to be underlain by the Whitehaven Sandstone Formation comprising of cross bedded sandstones and mudstones

The exploratory works confirmed these stratas present on site with rockhead being encountered at 0.2m BGL (TP5a) and 0.90m (TP5).

Groundwater

No ground water was encountered in the exploratory works undertaken on the site.

Testing

Insitu Testing

Percolation Tests

Percolation tests were conducted on the site consisting of a single test in TP5A on site and testing met with the requirements for BRE 365 and tests were undertaken.

Results for the percolation tests are presented in the appendices of this report and should be used in the detailed design of any drainage infrastructure present on the site.

Other Testing

From inspection of the natural material encountered on site and the nature of the ground, no further testing was undertaken on site. Recommendations made in the Phase 1 Report regarding ground gas monitoring were an incorrect statement as it was assumed that an opencast coal working was present within 1000m of the site, these were sand and gravel pits and have since ceased operations. We consider that these historic operations pose no issues associated with ground gas at the site.

The likelihood of ground gases being present given the nature of the site, and underlying ground conditions is unlikely and we would therefore conclude that monitoring for ground gases would not be required in the future.

Laboratory Testing

Samples were obtained for both chemical and geotechnical testing on the site and to verify the site conditions are suitable for reuse on site and pose no risk to Human Health.

Testing included a suite of tests to screen for a range of contaminants including :

Arsenic, Cadmium, Chromium (III and VI), Copper, Lead, Mercury, Nickel, Selenium, Zinc, Cyanide (free), pH, Water Soluble Sulphate, Total Organic Carbon, Asbestos and Speciated PAH.

In addition, it was considered that Waste Acceptance Criteria testing was undertaken on samples

obtained to ensure that materials to be removed from site met with the requirements of any potential disposal routes from site.

Plot 5

Eluate Analysis	Conc in Eluate		Amount Leached		BS EN 12457-3 Limit Values mg/kg at L:S 10:1		
	2:1	8:1	2:1 mg/kg	10:1 mg/kg	Inert Waste	Non-reactive Hazardous Waste	Hazardous Waste
Liquid : Waste Ratio	2:1	8:1					
pH (units)	7.1	7.5					
Temperature (°C)	20	20					
Conductivity (µS/cm)	87	31					
Antimony (µg/l Sb)	<0.1	0.2	<0.0002	<0.002	0.06	0.7	5
Arsenic (µg/l As)	0.99	1.04	0.002	0.010	0.5	2	25
Barium (µg/l Ba)	5.9	8.1	0.012	0.078	20	100	300
Cadmium (µg/l Cd)	<0.07	<0.07	<0.0002	<0.0007	0.04	1	5
Chromium (µg/l Cr)	3.4	2.0	0.007	0.022	0.5	10	70
Copper (µg/l Cu)	3.6	2.7	0.007	0.028	2	50	100
Lead (µg/l Pb)	0.3	4.4	0.0005	0.038	0.5	10	50
Mercury (µg/l Hg)	<0.008	<0.008	<0.00002	<0.00008	0.01	0.2	2
Molybdenum (µg/l Mo)	2.4	1.0	0.005	0.012	0.5	10	30
Nickel (µg/l Ni)	<0.5	<0.5	<0.001	<0.005	0.4	10	40
Selenium (µg/l Se)	0.38	0.33	0.0008	0.003	0.1	0.5	7
Zinc (µg/l Zn)	<1	<1	<0.002	<0.010	4	50	200
Chloride (mg/l Cl)	6.7	1.2	13	20	800	15000	25000
Fluoride (mg/l F)	0.2	0.2	0.4	2.0	10	150	500
Sulphate (mg/l SO ₄)	10	1.9	20	31	1000	20000	50000
Total Dissolved Solids (mg/l TDS)	65	25	130	307	4000	60000	100000
Phenol Index (µg/l PhOH)	<10	<10	<0.02	<0.1	1		
Dissolved Organic Carbon (mg/l C)	<5	<5	<10	<50	500	800	1000

Waste Analysis	Units	Result			
Total Organic Carbon	% w/w	1.6	3%	5%	6%
Loss on Ignition	% w/w	5.4			10%
BTEX	mg/kg	<0.06	6		
PCBs (7 congeners)	mg/kg	<0.045	1		
TPH (C10 - C40)	mg/kg	12	500		
PAH (total)	mg/kg	<0.36	100		
pH	pH units	7.2		>6	
Acid Neutralisation Capacity (pH4)	mol/kg	0.13		To be evaluated	
Acid Neutralisation Capacity (pH7)	mol/kg	0.01		To be evaluated	

From a review of the above results, all are considered inert waste and have no residual risk to human health.

Geotechnical Assessment

Foundations

All foundations should be taken through any Made Ground, soft or loose zones, disturbed soils, major root zones, or desiccated materials and taken wholly into or onto the weathered bedrock present as a firm clay. Such foundations, symmetrically loaded and up to a width of 1.00m, may be designed based on a maximum allowable net bearing pressure of 125 kN/m².

This assessment includes an appropriate factor of safety against shear failure, and settlements should remain within appropriate limits. This figure should be sufficient for the type of construction proposed. The clay will soften rapidly when exposed to free water. The final 50mm of any foundation trench should not be excavated until immediately before concreting, unless blinded or otherwise protected immediately after excavation.

Ground bearing floor slabs may be considered with the formation should be appropriately treated, and the design should allow potential future movements.

Excavations

The risks arising from excavation works should be properly assessed and appropriate safety precautions should be adopted. Reference may be made to various guidance including BS8000-1:1989, BS6031:2009 and CIRIA C97.

The likelihood of excavation instability through different strata is generally stable and given the limited depths of proposed excavation needed for construction, it is unlikely that stability will be considered an issue. It should be noted that all open unsupported excavations have the potential to collapse. Excavations which are to remain open for prolonged periods will require trench support. Water seepages may be encountered at shallow depth, particularly during wetter climatic conditions, and therefore some localised dewatering and trench support may be required.

It is considered that normal-rated plant and machinery will be sufficient for undertaking excavations. Care should be taken so as not to undermine existing structures, services, or adjacent property. Adjacent excavations should generally be tackled in order of depth with the deepest first. Vehicles and spoil heaps etc. should not surcharge excavations, and edge protection and fencing should be used as appropriate. Frozen materials should generally not be used as backfill.

Pavements

The proposed access road for this development is to be connected to the highway with a suitably designed access road.

The formation level should be carefully inspected, and any soft or loose zones should be removed and replaced with engineering fill, well-compacted in layers to a suitable specification. Consideration might be given to installing geotextiles. Cohesive formations will degrade rapidly if exposed to standing water for even short periods. All engineering fill should be granular and non-frost susceptible (i.e. <10% fine material passing 425µm sieve).

Building Materials

Recommendations with respect to Sulphate and buried concrete are made in section 7.8. It is noted that no onerous precautions in this respect are warranted.

The risk of chemical attack on water supply pipework has been assessed following the general Principles set out in the joint Water UK/HBF Contaminated Land Assessment Guidance dated January 2014. A summary of the main chemical criteria is reproduced below.

Test group (in mg/kg)	Polyethylene (PE)	Polyvinyl Chloride (PVC)	Metal or Aluminium Barrier
VOC's	0.5	0.125	Pass
VOC's + BTEX & MTBE	0.1	0.03	Pass
SVOC's (excl. PAH's etc.)	2.0	1.4	Pass
SVOC's + Phenols	2.0	0.4	Pass
SVOC's + Cresols & Chlorinated Phenols	2.0	0.04	Pass
Mineral oil EC11-20	10	Pass	Pass
Mineral oil EC21-40	500	Pass	Pass

The concentrations of each determinant were below the respective threshold standards, and therefore any type of potable water supply pipework appears to be appropriate. It is recommended that the local water utility company is consulted to confirm this assessment. Ethers, nitrobenzene, ketones, aldehydes and amines were not suspected. Redox potential and Conductivity should be checked where metal pipework is to be installed. Aluminium barrier pipework is acceptable under all conditions. No pipework should be laid where there is evidence of free product.

Soil Contamination Assessment

General

A Tier 1 Generic Quantitative Risk Assessment (GQRA) has been prepared for soil contamination. It should be noted that the presence of a possible contaminant does not necessarily imply that a site or area is contaminated or that there is any unacceptable risk to human health.

Outline Risk Assessment

The conceptual site model identifies the following lineages in respect to potential contaminants in the soil.

Source	Pathway	Receptor
Contaminants in soil	Ingestion, dermal contact, inhalation, soils, soil borne dusts, vapours, home grown vegetables	End User
	Ingestion, dermal contact, inhalation, soils, soil borne dusts, vapours, home grown vegetables	Adjacent Land Users
	Chemical attack by contaminates on plastics and concrete	Building Materials

End Users

No Made Ground was found during the intrusive investigation, selected samples of the topsoil were tested to confirm whether it was suitable to be reused. Several different partly overlapping schemes are currently in use in the UK, based on the Environment Agencies CLEAModel but with differing toxicological parameters. For the purpose of this report these schemes have and have been applied in the following hierarchy:

- Suitable For Use levels (S4UL) recently published by LQM in association with the CIEH.
- Category 4 Screening Levels (C4SL) recently published by the DEFRA and CL:AIRE.

The soil chemical analysis results have been compared against respective screening values for Residential land uses with plant uptake.

Whilst other standards exist, such as the LQM Generic Assessment Criterion and the Environment

Agency's Soil Guideline Values, these are considered to have been superseded by the above publications.

For contaminants where the respective screening value is dependent on Soil Organic Matter (SOM), the corresponding value for 2.5% was used (the arithmetic mean SOM value for the Topsoil was 4.1%).

The chemical analysis did not indicate any elevated concentrations of contaminants on the site in terms of the long-term health of end users, and therefore no remedial measures are considered necessary in this respect.

Building Materials

Recommendations with respect to Sulphate and buried concrete are made in section above. It is noted that no onerous precautions in this respect are warranted.

The risk of chemical attack on water supply pipework has been assessed following the general principles set out in the joint Water UK/HBF Contaminated Land Assessment Guidance dated January 2014. A summary of the main chemical criteria is reproduced below.

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SVOC's (excl. PAH's etc.)	2.0	1.4	Pass
SVOC's + Phenols	2.0	0.4	Pass
SVOC's + Cresols & Chlorinated Phenols	2.0	0.04	Pass
Mineral oil EC11-20	10	Pass	Pass
Mineral oil EC21-40	500	Pass	Pass

The concentrations of each determinant were below the respective threshold standards, and therefore any type of potable water supply pipework appears to be appropriate. It is recommended that the local water utility company is consulted to confirm this assessment.

Ethers, nitrobenzene, ketones, aldehydes and amines were not suspected. Redox potential and Conductivity should be checked where metal pipework is to be installed. Aluminium barrier pipework is acceptable under all conditions. No pipework should be laid where there is evidence of free product.

Adjacent Land Users

The conceptual site model identified a potential pollutant linkage in terms of contaminants within soils impacting adjacent land users through leaching out and lateral migration, in turn cross contaminating soils (and waters) on adjacent land.

Surrounding land uses were identified to comprise residential properties, analogous with the proposed development on site. No possible risk was posed to human health to on site end users. It is therefore concluded that the soils on this site pose no significant risk to surrounding land uses.

Conclusions

On the basis that no soil contamination risks were identified, it was concluded that no remediation was necessary.

Preliminary Waste Assessment

General

Waste may be defined as any substance or object in Annex 1 of the Waste Framework Directive² which the holder discards, intends to discard, or is required to discard. Subject to certain provisions, soils may either be handled as either:

- Non-Waste, and re-used (on or off-site), or
- Waste, and disposed of (to a waste management facility).

The waste producer has a legal duty of care to ensure that waste materials are handled properly and sent to the appropriate licenced facility. Further inspection, testing, segregation etc will be required on site, and the advice of a suitably qualified consultant sought wherever necessary. Substantial tax penalties and fines are being levied by the regulators. The advice contained in this section is preliminary only.

Non Waste

Soils may potentially be handled as Non-Waste and re-used on site (or on other sites) in accordance with various protocols such as those published by the EA or CL:AIRE . Typical requirements include:

- That the re-use of material will not endanger human health, cause nuisance, or harm the

wider environment (controlled waters, ecosystems, etc.)

- That there is a clear Environmental benefit from the activity, and that the waste is being used as a substitute for non-waste material.
 - The materials are suitable for use in terms of chemical and geotechnical parameters without further treatment.
- The holder is certain that the materials will be used in a safe manner, and only the necessary quantities of materials are being used.
 - Where the activities do not require a waste management licence (e.g. landfilling).
- A Waste Recovery Plan (EA) or Materials Management Plan (CL:AIRE) are produced and followed, and audited in a Verification Plan.

The chemical analysis suggests the Topsoil and natural soils these materials may be suitable for use in soft landscaped areas(subject to landscaping specifications), or under hardstandings such as roads or slabs (subject to geotechnical considerations).

Waste Disposal

Where materials are not reused they must be handled as Waste, and must be sent to a licenced waste management facility. The classification of waste is prescribed under the Waste Framework Directive and the Landfill Directive⁶ , as summarised below. Different waste management facilities may also have specific acceptance criteria, and their advice should be sought.

The results of the soil analysis have been classified as follows:

Sample	Location	Classification
TP5	Plot 5 @ 1.0m	Inert Waste

Exploratory Records



Kingmoor Consulting Ltd
 6B Clifford Court
 Parkhouse, Carlisle
 Cumbria, CA3 0JG

Project Plots 3 and 4, Gilgarren, Workington				Job no. 20-321	
Calcs for Trial Pit Records				Start page no./Revision 1	
Calcs by C Aimers	Calcs date 08/10/2020	Checked by	Checked date	Approved by	Approved date


TRIAL PIT LOG

Trial pit reference TP5					Sheet 1 of 1
Water	Reduced Level (m)	Legend	Depth (m)	Description	
	100.00				
		X X X X X X	(0.20) 0.20	TOPSOIL	
	99.80	X X X X	0.20		
		- - - - - - - - -	(0.25) 0.45	Firm red CLAY	
	99.55	- - - - - -	0.45		
		- x - x - x - x - x - x - x - x - x - x	(0.25) 0.70	Red sandy CLAY/SILT	
	99.30	- x - x - x - x - x	0.70		
		- : - : - : : - : - : - - : - : - : : - : - : - - : - : - : : - : - : - - : - : - : : - : - : - - : - : - : : - : - : -	(0.50) 1.20	Firm to stiff light grey mottled brown sandy CLAY	
	98.80	- : - : - : : - : - : -	1.20		
Trial pit ends					
Not shown to scale					
Additional notes:					

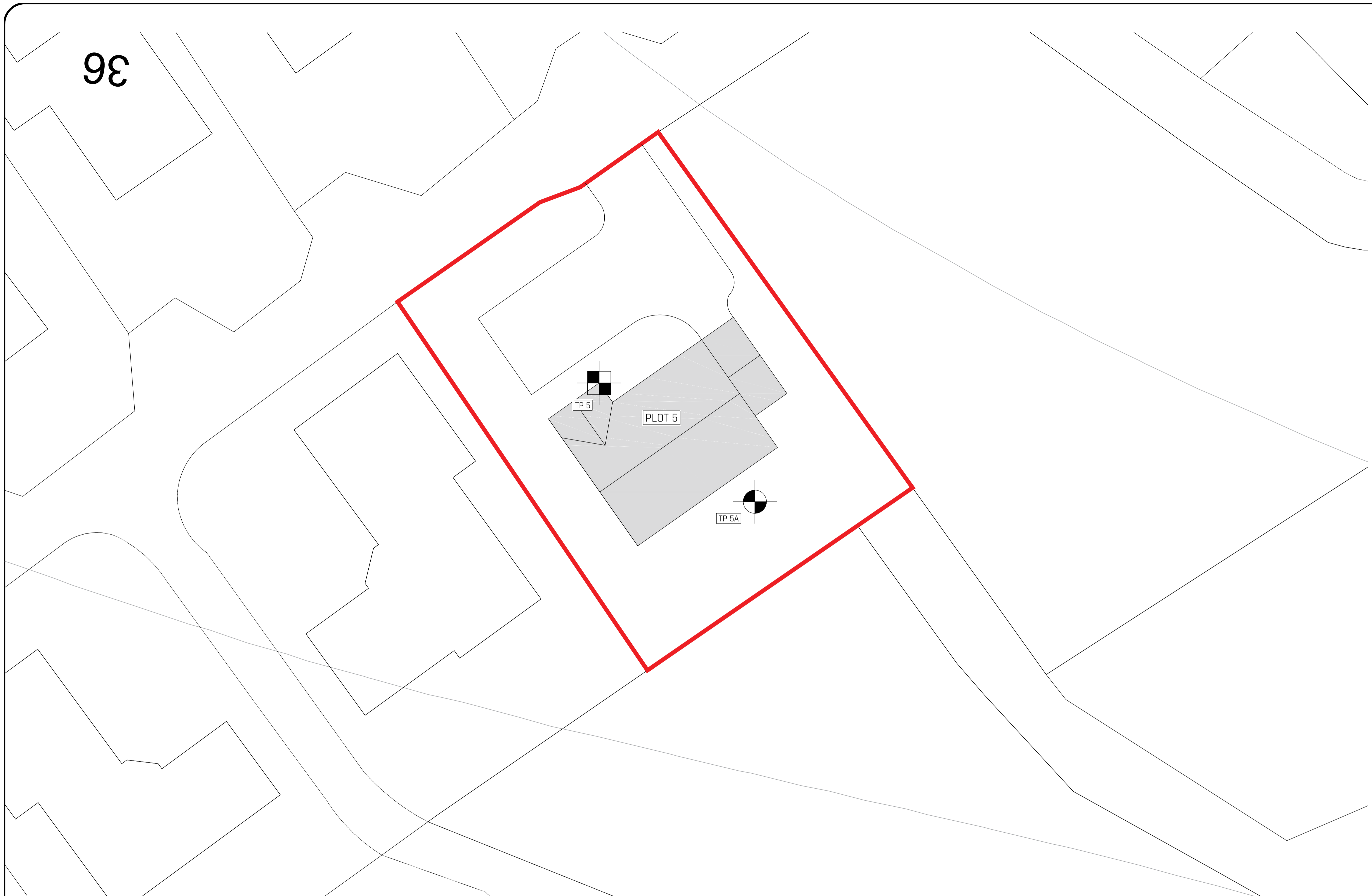
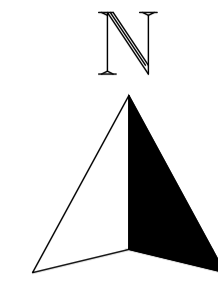
Drawings



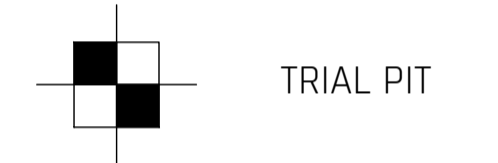
PLAN
SCALE 1:1000

 6B CLIFFORD COURT, PARKHOUSE, CARLISLE, CUMBRIA, CA3 0JG T: 01228 915900 E: hello@kingmoorconsulting.co.uk		CLIENT
PROJECT NEW DWELLINGS, GILGARREN WORKINGTON, CUMBRIA		
TITLE LOCATION PLAN		
SCALE AS NOTED	STATUS FOR PRECONSTRUCTION	
PAPER SIZE A1	DRAWN BY C AIMERS	CHECKED AND APPROVED C AIMERS
PROJECT PHASE BUILD	DATE OCT 2020	DATE OCT 2020
DRAWING NUMBER 20-321-DWG004		REVISION A

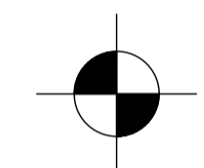
9E



KEY




TRIAL PIT



PERCOLATION TEST

PLAN
SCALE 1:150

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PROJECT NEW DWELLINGS, GILGARREN WORKINGTON, CUMBRIA		
TITLE PLOT 5 GEOTECHNICAL INVESTIGATIONS		
SCALE AS NOTED	STATUS FOR PRECONSTRUCTION	
PAPER SIZE A1	DRAWN BY C AIMERS	CHECKED AND APPROVED C AIMERS
PROJECT PHASE BUILD	DATE OCT 2020	DATE OCT 2020
DRAWING NUMBER 20-321-DWG007		REVISION A

Test Results

Waste Acceptance Criteria Testing BS EN 12457-Part 3, 2 Stage Process



Sample Details

Contract Name Gilgarren
 Lab Number 90003-6
 Sample ID TP5 1.00m
 Date Sampled 1 October 2020
 Date Received 7 October 2020
 Particle Size (<4mm) -
 Method of size reduction N/A
 Non-crushable matter N/A

Test Values

Mass of Raw Test Portion (MW) kg 0.214
 Mass of Dried Test Portion (MD) kg 0.175
 Moisture Content Ratio (MC) % 22.10
 Dry Matter Content Ratio (DR) % 81.90
 Leachant Volume (1) (L2) Litre 0.311
 Leachant Volume (2) (L8) Litre 1.400
 Eluate Volume (1) (VE1) Litre 0.250
 Eluate Volume (2) (VE2) Litre 1.280

Eluate Analysis	Conc in Eluate	
Liquid : Waste Ratio	2:1	8:1
pH (units)	7.1	7.5
Temperature (°C)	20	20
Conductivity (µS/cm)	87	31
Antimony (µg/l Sb)	<0.1	0.2
Arsenic (µg/l As)	0.99	1.04
Barium (µg/l Ba)	5.9	8.1
Cadmium (µg/l Cd)	<0.07	<0.07
Chromium (µg/l Cr)	3.4	2.0
Copper (µg/l Cu)	3.6	2.7
Lead (µg/l Pb)	0.3	4.4
Mercury (µg/l Hg)	<0.008	<0.008
Molybdenum (µg/l Mo)	2.4	1.0
Nickel (µg/l Ni)	<0.5	<0.5
Selenium (µg/l Se)	0.38	0.33
Zinc (µg/l Zn)	<1	<1
Chloride (mg/l Cl)	6.7	1.2
Fluoride (mg/l F)	0.2	0.2
Sulphate (mg/l SO ₄)	10	1.9
Total Dissolved Solids (mg/l TDS)	65	25
Phenol Index (µg/l PhOH)	<10	<10
Dissolved Organic Carbon (mg/l C)	<5	<5

Amount Leached		BS EN 12457-3 Limit Values mg/kg at L:S 10:1		
2:1 mg/kg	10:1 mg/kg	Inert Waste	Non-reactive Hazardous Waste	Hazardous Waste
<0.0002	<0.002	0.06	0.7	5
0.002	0.010	0.5	2	25
0.012	0.078	20	100	300
<0.0002	<0.0007	0.04	1	5
0.007	0.022	0.5	10	70
0.007	0.028	2	50	100
0.0005	0.038	0.5	10	50
<0.00002	<0.00008	0.01	0.2	2
0.005	0.012	0.5	10	30
<0.001	<0.005	0.4	10	40
0.0008	0.003	0.1	0.5	7
<0.002	<0.010	4	50	200
13	20	800	15000	25000
0.4	2.0	10	150	500
20	31	1000	20000	50000
130	307	4000	60000	100000
<0.02	<0.1	1		
<10	<50	500	800	1000

Waste Analysis	Units	Result			
Total Organic Carbon	% w/w	1.6	3%	5%	6%
Loss on Ignition	% w/w	5.4			10%
BTEX	mg/kg	<0.06	6		
PCBs (7 congeners)	mg/kg	<0.045	1		
TPH (C10 - C40)	mg/kg	12	500		
PAH (total)	mg/kg	<0.36	100		
pH	pH units	7.2		>6	
Acid Neutralisation Capacity (pH4)	mol/kg	0.13		To be evaluated	
Acid Neutralisation Capacity (pH7)	mol/kg	0.01		To be evaluated	

Disclaimer : The Landfill Waste Acceptance Criteria limits in this report are provided for guidance only.
 Chemtech Environmental Ltd does not take responsibility for any errors or omissions. Data is correct as of 01/09/2005.
 Samples will be disposed of 6 weeks from initial receipt unless written instructions are received and further storage is agreed.
 Waste Acceptance Criteria testing is outside the scope of the laboratory's UKAS accreditation.

Comments

Authorised by:

J. Campbell

Name:

John Campbell

Report date:

14 October 2020

Position:

Director

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