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CREASE DROVE, CROWLAND
PHASE II SITE APPRISAL
FOR
PARTNER CONSTRUCTION LTD &
WATERLOO HOUSING GROUP LTD

Project Ref:
P8723

Date:
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Prepared for:
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This report has been prepared in accordance with GRM's Accredited Quality Procedures

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Site Appraisal for Crease Drove, Crowland

SUMMARY OF RECOMMENDATIONS

Where further assessment is required it is indicated with a "Y" in the right hand column.		
Proposed Development	Residential properties with associated gardens, soft landscaping, infrastructure and a balancing pond.	
CONTAMINATION ASSESSMENT - REMEDIATION / WASTE DISPOSAL		
End Users	Delineation of local contamination and source removal or treatment.	Y
Site Workers	Asbestos removal within existing buildings by a suitably licenced contractor prior to demolition works. Ground workers to be made aware of hazards associated with asbestos containing materials and TPH impacted material and adopt safe working practices during development.	
Construction Materials	Appropriate concrete specification. PE water supply pipes should be suitable for majority of properties. Upgraded water supply pipes within clean backfill potentially required in southwest of site (to be confirmed by water authority) or delineation of contamination and source removal.	Y
Groundwater	Delineation of contamination and source removal or treatment.	Y
Surface Water	No remediation required.	
Waste Disposal	Preliminary Waste Classification: Non-Hazardous for topsoil and majority of made ground. Hazardous for hydrocarbon impacted soils and made ground with locally elevated pH. Inert for natural strata. Will need to be confirmed by receiving landfill.	Y
GEOTECHNICAL ASSESSMENT – FOUNDATIONS		
Ground Treatment Required	Temporary drainage for standing water and site surface drainage to prevent runoff, temporary haul roads and working platforms for piling. Potential ground improvement and/or earthworks for Peat depending on proposed levels.	
Main Bearing Strata	Abbey Sand and Gravel.	
Nett Allowable Bearing Pressure	110kN/m ² (Abbey Sand and Gravel) for traditional spread foundation. To be confirmed by a specialist for piles.	
Rockhead	Not encountered.	
Tree Influence	Some around site boundaries. Extent to be confirmed by a tree survey.	Y
Volume Change Potential	Medium for Peat and cohesive Abbey Sand and Gravel.	
Likely Foundation Types	65% Strip/Trench Fill plots, 35% Pile for remaining plots. Some dewatering and dig and pour techniques needed for traditional foundations.	Y
Likely Foundation Depth Range	1.0m begl minimum, 1.5m begl maximum depths; average depth 1.2m begl for traditional spread foundations. To be confirmed by piling contractor for piles, estimate 10m long.	Y
Excavation Hazards	Shallow groundwater and low strength, potentially collapsible materials at shallow depth.	
Floor Slab Types	100% beam and block.	
Gas Protection Requirements Radon and/or Landfill	Allow for gas protection measures until gas monitoring is complete. Radon protection not required.	Y
GEOTECHNICAL ASSESSMENT - GENERAL		
Slope Stability Risk/Settlement	Low at present profile. Potential for settlement of Peat where ground levels increased.	Y
Soakaways Potential	Not suitable.	
New Access Roads	Observational CBRs 2-5% in granular soils and 2% in cohesive soils (Abbey Sand and Gravel). 1% for Peat.	Y
Buried Concrete Class	DS-2, AC-2 for Made Ground if left in-situ. DS-1, AC-1 for superficial deposits. GEN-1, RC35. DS-4, AC-3s for Oxford Clay.	
Retaining Walls and Boundary Features	None existing or proposed.	

Further Assessment Targets	Additional investigation to delineate hydrocarbon contamination at WS06. Hydrocarbon source removal or treatment and validation. Post-demolition ground investigation and testing beneath warehouses. In-situ CBR's. Cable percussion boreholes for pile design. Completion of gas monitoring program. Gas design and verification plan if gas protection measures required. Further groundwater testing and possible liaison with Environment Agency if hydrocarbon impacted soils stay in-situ. Flood risk assessment.	Y
Other Comments	Possible earthworks for flood mitigation measures and settlement analysis in Peat. Potential for shallow groundwater controls and unstable strata.	Y

This summary is based on the full report that provides the detailed assessment of the ground risks affecting the development and how to manage them. It should not be used in isolation.

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1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Limited (GRM) has been appointed by Partner Construction Ltd and Waterloo Housing Group Ltd to undertake a Phase II Site Appraisal. A previous desk study by GRM (Phase I Site Appraisal (Desk Study), Report Ref: GRM/P8723/DS.1, Dated December, 2018) formed Phase I of the assessment and allowed the geotechnical and geo-environmental setting of the site to be determined and the identification of areas of particular concern that required targeted investigation. The Phase II works reported within this document comprise the intrusive ground investigation, geotechnical testing and chemical analysis. The information gained from the Phase II works will be used to refine the conceptual model for the site and determine cost-effective development solutions.

This document is intended to provide information that will assist decision making by identifying and recommending solutions to ground engineering and contamination issues.

GRM Standard Limitations of Reporting are provided in Appendix A of this report.

The Client proposes to develop the site with residential properties with associated gardens, soft landscaping, infrastructure and a balancing pond. The outline development proposals provided by the Client are presented in Appendix B.

1.2 OBJECTIVES OF THE SITE APPRAISAL

The principal aims of the Phase II Site Appraisal are as follows:

- a) Obtain information, from easily accessible sources, about the soil and groundwater conditions within the area of the site.
- b) Determine the possible ground-related geotechnical and contamination hazards within the site boundaries that may affect the proposed development.
- c) Provide preliminary development recommendations.
- d) Provide advice on further works required for the cost-effective reduction of risks to the development and procedures likely to satisfy regulators.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 PHASE I DESK STUDY SUMMARY

Project Name.	Crease Drove, Crowland.
Project Reference.	P8723.
Client.	Partner Construction Ltd.
Site Location (address).	Crease Drove, Crowland, PE6 0BN. A Site Location and Boundary Plan is presented in Appendix C.
National Grid Reference.	TF 237 096.
Site Area.	Approximately 1.5 hectares.
Summary of Proposed Development.	Residential properties with associated gardens, soft landscaping, infrastructure and a balancing pond.
Client Supplied Information.	The location of the site. Proposed development plan. Service plans.
Site Setting.	The site is bound by residential developments to the north and east and tilled farmland to the south. The western boundary is formed by Crease Drove with tilled farmland beyond. The west of the site is currently occupied by adjoined warehouses with associated concrete and asphalt/tarmac hard standing areas to the west and south. The remaining site area is generally vacant. Evidence of a previous building was observed roughly in the centre of the site. Potential asbestos containing material was identified on the existing warehouses. Dense plantations of trees and shrubs enclose all but the western site boundary, with various low to high demand water species noted. Bramble shrubs were also prevalent at the site and precluded access to localised areas of the site. Evidence of services identified on site included an underground power cable extending east from Crease Drove, and several manholes in the southwest corner of the site. Site personnel advised of an underground holding tank to the north of the existing warehouses (access precluded by bramble shrubs). The site is generally level with elevations of between 2mAOD and 3mAOD. Localised standing water and burnt material were also noted predominantly in the centre of the site during the walkover.

Site History.	The first available map indicates the site and surrounding area comprised open agricultural land with the exception of a corn mill approximately 150m east of the development area. The map for 1950 shows several buildings constructed approximately 70m west from the site. Development of the site commenced 1973-1975 and included the construction of the existing warehouse in the west of the site and an approximately 100m long drainage ditch running parallel to the southern site boundary. An additional warehouse was constructed in 1995 and remained until 2012 where it was demolished and the drainage channel was backfilled. Following this, the site remained unchanged until the present day.
Geology.	The BGS Geological sheet for this area shows the site to be underlain by superficial deposits of the Abbey Sand and Gravel (sands and gravels) in the north and west, and Peat (organic-rich clay) in the south and east. Solid geology of the Oxford Clay (comprising mudstone) is recorded to underlie the superficial deposits for the entire site. The Oxford Clay is known to contain high concentrations of sulphate and pyrite.
Groundwater and Surface Water.	The Abbey Sand and Gravel is classed as a Secondary A Aquifer. The Peat is classified as being unproductive strata. Solid strata (Oxford Clay) are also recorded as being unproductive. There are no groundwater abstraction licences within 500m of the site. The site is not recorded to be within a groundwater source protection zone.
Flood Risk.	The BGS suggests the site lies within a Zone 2 and a Zone 3 Floodplain and there is a low to medium risk from river flooding. The site is within an area susceptible to groundwater flooding at the surface, relating to Clearwater Flooding, the confidence level is moderate, though standing water was noted in the central areas of the site during the site walkover.
Mining.	The site is not indicated to be at risk from any coal or non-coal extraction activities.

Potential Soil Contamination Sources.	Potential localised made ground and filled ground, asbestos contamination based on previous site usage, and pesticides from adjacent land use.
Potential Ground Gas Sources (including Radon).	Potential ground gas sources are associated with the in-filled drainage ditches on site and with the presence of Peat in the south and east of the site. The site is not within an area recorded to require radon protection measures.



2.1 PHASE I CONCEPTUAL SITE MODEL

HUMAN HEALTH			
Source	Pathway	Receptor	Level of Risk
Potentially contaminated made ground / localised areas of burning / fill associated with previous development and drainage channels.	Indoor and outdoor inhalation of soil dust, the ingestion of, and dermal contact with, contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users.	Low.
Pesticides.		Construction and Maintenance Workers.	
Potentially contaminated made ground / infilled ground / organic rich natural strata.	Inhalation of ground gas.	End users.	Low to moderate.
Asbestos containing materials associated with existing and former buildings.	Inhalation of asbestos fibres.	Construction and Maintenance Workers.	Low to moderate.
Potentially contaminated made ground.	Water pipes.	End users.	Low.
CONTROLLED WATERS			
Potentially contaminated made ground / localised areas of burning / fill associated with previous development and drainage channels.	Leaching of contaminants and vertical migration to the groundwater.	Secondary A Aquifer – Undifferentiated Layers.	Low.
	Surface run off.	Local land drainage system.	Low.

3 PHASE II GROUND INVESTIGATION

3.1 FIELDWORK

The ground investigation has been designed in accordance with the general comments outlined in Appendix A (iv).

The ground investigation fieldwork was conducted on 5th December 2018, with groundwater/gas monitoring visits continuing after that period. A total of seven exploratory holes (six windowless sample boreholes and one hand-dug trial pit) were progressed, to depths ranging between 0.25m and 4.0m below existing ground level (begl). The exploratory hole location plan and exploratory hole logs are presented in Appendix D and Appendix E respectively.

LIST OF TARGETED EXPLORATORY HOLES	
Exploratory Hole	Reason for Location and Type
WS01 to WS03	Targeted at Peat strata or anticipated boundary between Peat and Abbey Sand and Gravel.
WS01 and WS06	Targeted at southern site boundary adjacent to agricultural land use.
WS04 and HD05	Targeted at the demolished warehouse footprint.
WS06	Targeted at the junction of site access path and Crease Drove.
WS07	Targeted at existing car park.
WS = Window Sample Hole, HD = Hand-Dug Pit.	

The exploratory holes were positioned in accessible locations across the site with reference to existing and proposed site features and the anticipated ground conditions. Areas not accessible at the time of the investigation included the area of the site to the north of the existing warehouses (northwest corner of the site) and warehouse footprint. The areas where further investigation is recommended are illustrated on the Ground Hazards Plan in Appendix L.

It is recommended that following the removal of the existing warehouse floor slab and hard standing additional investigation work is carried out to determine the potential presence of contamination and depth of made ground.

The ground levels reported on the logs were interpolated from the client supplied drawing No. AK0001_P05 'Crease Drove, Crowland – Site Feasibility/Sketch Layout Plan' dated April 2016 from David Turnock Architects.

Five gas and groundwater monitoring standpipes were installed during the site works, the rationale for these works are discussed fully in Section 6. A Gas Monitoring Plan, illustrating the locations of the standpipes, is presented in Appendix F. The standpipes will need to remain in place until approximately March 2019.

Following the investigation the site tenant advised GRM of an underground drainage tank in the southwest corner of the site adjacent to WS06. Although not currently in use, it is understood that the tank is connected to the warehouses and was used for sink water and toilet drainage purposes.

3.2 PROVEN GROUND

The following ground conditions were encountered during the investigation fieldwork:

- Topsoil
- Made Ground
- Peat (Superficial geology)
- Abbey Sand and Gravel (Superficial geology)
- Glacial Till (Superficial geology)
- Oxford Clay (Solid geology)

3.2.1 Topsoil

Topsoil was encountered as a dark brown clay in exploratory holes WS01 to WS03, to depths ranging between 0.3m to 0.6m begl. Localised brick and slate fragments were encountered in the topsoil in WS01, with rootlets and occasional roots generally noted to the full depth of the topsoil profiles.

3.2.2 Made Ground

Made ground was encountered in exploratory holes WS04, WS06, WS07, and hand-dug pit HD05 and its full thickness was penetrated in each location. The thickness varied between 0.15m and 1m. Various types of made ground were observed and included:

- Poorly compacted cobbly gravel (brick fill) to a depth of 0.4m begl in WS04. This made ground was locally encountered in the centre of the site and is likely to be from the demolished warehouse.
- Gravelly sandy clay to a depth of 0.15m begl in HD05, likely to be from the demolished warehouse or hardstanding.
- Approximately loose to medium dense gravelly sand to 0.3m begl in WS06 overlying slightly sandy cobbly gravel to 0.5m begl. This was encountered in the southwest corner of the site and is likely from the underground drainage tank backfill or as a granular base material from the access road pavement. Approximately medium dense, gravelly sand was also encountered to 0.6m begl in WS07 underlying a 40mm thick layer of asphalt/tarmac. This made ground is likely to be a granular base material for the car park pavement.

3.2.3 Peat

Peat deposits were encountered beneath the topsoil or made ground in WS01, WS06 and WS07 to proven depths of between 1.0m and 2.8m begl.

The Peat typically comprised soft to firm and occasionally very soft and stiff, grey-brown, dark brown, and grey, slightly sandy clay, slightly gravelly clay, and locally silty clay. A bed of saturated, loose clayey sand was encountered in WS01 between 2.1m and 2.5m begl. The Peat was also stained black in WS01 from 1.7m to 2.8m, in WS06 from 1.65m to 2.0m, and in WS07 from 0.6m to 1.0m begl.

Firm to stiff, grey and dark grey, slightly sandy clay was encountered beneath the made ground in WS06 between 0.5m and 0.85m begl. Although this material was not clearly defined, it was comparable to the Peat encountered in previous exploratory boreholes.

A thin (0.15m to 0.25m) layer possibly representative of Peat was also encountered beneath the topsoil in WS02 and WS03 to maximum depths of 0.75m and 0.55m begl, respectively.

Strong hydrocarbon odours and discolouration were observed in the Peat in WS06 from 0.85m to 1.5m begl, with slight hydrocarbon odours noted below 1.5m begl.

Standard Penetration Test N-values undertaken throughout the depth of the stratum, at depths of between 1m and 2m begl, ranged from 1 (WS01 at 1m begl) to 6 (WS01 at 2m and WS06 at 1m begl).

Utilising the empirical relationship formulated by Stroud (1974) where undrained shear strength is related to SPT N-values and a factor based on plasticity, these are indicative of very low to low strength, and locally extremely low strength soils.

3.2.4 Abbey Sand and Gravel

Abbey Sand and Gravel deposits were encountered in each exploratory hole to proven depths of between 2m and 3.45m, and in the hand-dug pit to 0.25m begl. The base of these deposits was not observed in WS01, WS02, WS07 and HD05. These deposits generally comprised:

- Firm to stiff, slightly gravelly, sandy clay (cohesive deposits).
- Medium dense, slightly clayey sandy gravel, generally increasing in gravel and decreasing in clay content with depth, with some localised gravelly sand bands (granular deposits).

The cohesive deposits were encountered underlying the topsoil, Peat or made ground in WS02 to WS04, WS06, and in HD05, to depths of up to 2.3m and were generally 0.1m to 0.55m thick. This material was encountered in HD05 from 0.15m to the termination depth of 0.25m begl.

The granular deposits were encountered beneath the made ground or Peat in WS01, and WS07, and beneath the cohesive deposits in the remaining locations (except HD05). WS07 terminated in very dense slightly clayey sandy gravel at 2.43m begl. The granular deposits were typically saturated.

Standard Penetration Test N-values undertaken throughout the depth of the stratum, at depths of between 1m and 3m begl, ranged from 11 to 51, indicating medium dense and locally very dense conditions. The lowest N-value was determined at 2m depth for WS03 and WS04.

3.2.5 Glacial Till

Superficial material consistent with Glacial Till was locally encountered in WS06 underlying the Abbey Sand and Gravel from 2.6m to 2.9m begl. The stratum typically comprised stiff, approximately medium strength, slightly gravelly clay. The gravel was observed to comprise chalk and rare flint.

3.2.6 Oxford Clay

This stratum was encountered below the Abbey Sand and Gravel in WS03 and WS04 and below the possible Glacial Till in WS06 from depths ranging between 2.6m and 2.95m begl. The full thickness of the formation was unproven in these exploratory holes.

The stratum typically comprised stiff clay, generally increasing in strength with depth. An approximately 0.2m thick weathering zone was encountered from 2.6m to 2.8m begl in WS04 where rare disseminated selenite crystals were noted. Although pyrite was not observed, the unweathered material, Oxford Clay can contain such minerals.

Standard Penetration Test N-values in the strata, undertaken between 3m and 4m begl, ranged between 17 and 29, suggesting high strength.

3.3 CONTAMINATION OBSERVATIONS

The following visual and olfactory evidence of potential contamination was encountered during the fieldwork and monitoring.

Location	Depth (m)	Description of contamination and strata affected
WS06	0.85-2.0	Peat with a strong hydrocarbon odour, decreasing with depth below 1.5m begl.

The fieldwork has revealed localised hydrocarbon contamination in the southwest of the site adjacent to the access road.

The brick fragments noted in the topsoil of WS01 and in the made ground at WS04 were not considered to be significant evidence of contamination, though samples were sent for a general suite of analysis to confirm this.

Peat containing occasional organics and wood fragments was recorded in the Peat strata in the southeast corner of the site in WS01 from 1.7m to 2.8m, and to a lesser extent in WS07 from 0.6m to 1.0m begl.

3.4 GROUNDWATER OBSERVATIONS

During the site work, groundwater was encountered in all of the exploratory holes within the superficial deposits from depths of between 0.35m and 2.0m begl, with the exception of HD05 which encountered slight groundwater seepage at 0.2m depth.

An oily sheen was observed on the groundwater during examination of the samples retrieved from WS06 from 0.85m to 1.5m begl and groundwater sampled from this location on the 8th January 2019 was noted as being discoloured.

During the first groundwater monitoring visit, a down hole oil / water interface probe was used. Free phase hydrocarbons were not detected.

Three groundwater monitoring visits have been conducted and the results of the monitoring are reported in Appendix G. In summary standing water was recorded in all installations, at typical depths of between ground level (WS04) and 1.10m (WS01).

Long term monitoring of groundwater levels has not been conducted as part of this investigation and interpreted levels are approximate and may be dependent on seasonal variations.

Based on groundwater data collected on the site, the groundwater flow is considered to flow to the south / southwest following the local topography.

3.5 GROUND GAS AND VAPOURS

Ground gases are discussed in full in Section 6. In summary, the concentrations of ground gases recorded to date are presented in Appendix G and summarised below:

- Methane has not been detected.
- Carbon dioxide between 0.0%v/v and 6.9%v/v.
- Oxygen between 15.0%v/v and 20.0%v/v.
- PID readings taken during the fieldwork have not indicated the presence of volatile organic hydrocarbons.

No flow was noted during the monitoring completed to date.

3.6 SUMMARY OF FIELDWORK OBSERVATIONS

The fieldwork has revealed/confirmed the following:

Significant Features identified during fieldwork
Made Ground – potential source of contamination. Organic Rich Strata (Peat) – potential source of ground gas. Cohesive Strata and Presence of Trees – deepened foundations. Sulphates and Sulphides in Made Ground / Pyritic Strata – upgrade concrete class. Low Strength Material – deepened or piled foundations, settlement if loaded. Shallow Groundwater – potential need for dewatering techniques and excavation side wall support. Total Petroleum Hydrocarbons – potential source of contamination. Underground Tank – potential source of contamination.

A ground hazards plan is provided in Appendix L.

4 LABORATORY ANALYSES RATIONALE

4.1 CHEMICAL LABORATORY ANALYSIS

Chemical laboratory analyses were selected to provide the parameters necessary to make an initial assessment of potentially contaminated soils and/or waters, for the budgetary design of the development. The choice of contamination testing was based on the Phase I assessment, identified past uses of the site, site observations and comprised:

- Three samples of topsoil were analysed for a general suite of contaminants (metals, inorganics and speciated PAH) (Greenfield suite).
- Three samples of made ground were analysed for a general suite of contaminants including asbestos (Brownfield suite).
- One sample of topsoil and one sample of made ground were analysed for pesticides.
- Two samples of Peat were analysed for organic matter.
- One sample of made ground in the old warehouse footprint has been screened for the presence of asbestos.
- One sample of Peat was analysed for banded aliphatic and aromatic hydrocarbons (TPHCWG).
- One sample of groundwater (WS06) has been tested for TPHCWG and benzene, toluene, ethylbenzene and xylene (BTEX) speciated, plus methyl tert-butyl ether (MTBE).

The chemical analysis results are presented in Appendix H.

Samples not used for testing will be stored for a month after issue of this report and then disposed of, unless the client requests in writing that they be kept.

4.2 GEOTECHNICAL LABORATORY TESTING

Geotechnical soils testing has been undertaken as part of the ground investigation including the following:

- Five samples (three samples of the Peat, one sample of the Abbey Sand and Gravel, and one sample of the Oxford Clay) underwent Atterberg Limits (PI) classification.
- Five samples (two samples of Peat and three samples of Abbey Sand and Gravel) underwent pH and water soluble sulphate testing.
- One sample of the Oxford Clay from WS03 underwent SD1 testing for concrete in pyritic ground.

Geotechnical tests were selected to provide the parameters necessary for the budgetary design of the development including foundations and infrastructure. The geotechnical test results are presented in Appendix H (pH and sulphate results) and Appendix I, and summarised in Section 10.2.

5 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH (SOIL)

5.1 INTRODUCTION

The Client proposes to develop the site with residential properties with associated gardens, soft landscaping, infrastructure and a balancing pond.

Potential contamination at the site has been put forward in earlier text and summarised in the Phase I conceptual model and includes:

- The potential of presence of asbestos.
- Potential pesticide contamination from adjacent farming and historic site use.
- Potentially contaminated made ground.
- Ground gas from organic-rich natural strata, made ground and in-filled drainage ditches.
- Hydrocarbons in soil and water (WS06 from 0.85m to 2.0m begl).

Representative samples of all strata and those considered to be potentially contaminated by virtue of the desk study and based on site observations were collected for further examination and potential testing.

The rationale for the end use specific *Tier 1 Acceptance Criteria (TAC)* used by GRM is outlined in Appendix A (vi) and for this site the chemical analysis results are being compared against the TAC for residential end use with plant uptake. In order to adopt a conservative approach a Soil Organic Matter (SOM) content 1% has been used to assess the topsoil, made ground and Peat, as this reflects the lowest SOM recorded in each material.

To provide an initial assessment, benzo(a)pyrene has been used as a surrogate marker compound for genotoxic PAHs with exception of naphthalene. A copy of the thresholds used in this assessment is presented in Appendix J.

5.2 RISK TO END USERS

The chemical analysis results are presented in Appendix H.

Whilst the number of samples tested is considered sufficient to characterise the made grounds and topsoil it is not considered appropriate to carry out statistical analysis on this data set. Therefore the results have been compared directly against the TAC. The result of the hydrocarbon analysis in a sample of Peat in WS06 has also been assessed separately.

5.2.1 Analysis of Soil Contamination Data

GRM General Suite – Topsoil

The values for all the contaminants tested in the topsoil were below the relevant 'Critical Concentrations' (i.e. TAC) for residential with plant uptake end use.

GRM General Suite – Made Ground

All test result values for all of the contaminants are below the relevant 'Critical Concentrations' (i.e. TAC) for residential end use with plant uptake end use.

It should be noted that an elevated pH of 12.2 was locally recorded in WS07 at 0.3m begl which is not considered to be a risk to human health particularly as this material is likely to be removed for the development.

Petroleum Hydrocarbons – Superficial Deposits (Peat)

Visual and olfactory evidence of potential petroleum hydrocarbon contamination was observed in exploratory hole WS06 between 0.85m and 2m begl. As such, a sample of Peat in WS06 was submitted for TPH analysis so that the risk to end users could be assessed. Petroleum hydrocarbons were also detected in the standing water sampled from WS06, though free phase product was not detected using an interface meter and PID reading were below the limit of detection during gas monitoring visits.

The sample analysed from WS06 revealed concentrations of petroleum hydrocarbons in excess of the TAC for the following two hydrocarbon bands:

- Aromatic C₁₂-C₁₆ (350mg/kg) exceeds the TAC of 140mg/kg.
- Aromatic C₁₆-C₂₁ (490mg/kg) exceeds the TAC of 260mg/kg.

Asbestos – Made Ground

The screening for asbestos on samples from the made ground, including two within the footprint of the former structure did not reveal the presence of such contamination in the samples analysed.

Pesticides

The screening for pesticides did not reveal the presence of such contamination in the samples analysed.

5.2.2 Water Supply Pipes

It is considered that, based on the UKWIR guidance, the concentrations of contaminants recorded to date are such that for the majority of the site PE water supply pipes should be suitable with the exception of the area encountering hydrocarbon impacted soils.

Given the localised hydrocarbon contamination identified remedial measures to protect underground pipes may be required. This may take the form of an alternative pipe material and/or backfilling of service trenches with clean inert material. However, following the remediation for end users and controlled water receptors, comprising delineation, source removal and validation or treatment, PE pipe may be suitable for the entire site. It is recommended that consultation with the relevant water supply company is undertaken to assess whether uprated water supply pipes are required.

5.2.3 Summary of Risk to End Users

The risk to end users from soil contamination is considered to be very low, moderate for the area in proximity to WS06.

Remedial works with respect to the elevated TPH in the Peat underlying the southwest of the site is considered to be necessary to be protective of human health in areas of soft landscaping and gardens and water supply pipes for this part of the site.

A warehouse remains across the western part of the site. Further assessment is considered necessary following removal of the floor slab to determine the extent of any made ground.

The existing topsoil in the east of the site has been shown to be uncontaminated and therefore is chemically suitable for re-use as a part of the proposed development.

5.3 RISK TO SITE WORKERS

Potential asbestos containing material has been noted to be present within the structures present at the site. It is assumed that the demolition will be undertaken by a suitably licensed asbestos removal contractor, which will mitigate the risk to construction and maintenance workers.

Appropriate personal protective equipment should be used during the TPH source removal in the southwest of the site.

The general comments outlined in Appendix A (vii) should be considered when site specific risk assessments are completed.

6 QUANTITATIVE RISK ASSESSMENT – HUMAN HEALTH (GROUND GAS)

The gas risk assessment methodology used by GRM is outlined in Appendix A (v).

As the proposed land use is classed as high (residential with gardens); five 35mm gas/water monitoring standpipes have been installed across the site (WS01 to WS04 and WS06). The response zones have been targeted at the natural strata.

Based on BS8576:2013 *Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds*, the gas hazard is considered low (natural soil with low organic content (up to 5%) and hydrocarbon impacted soils, and so the monitoring programme will comprise six visits over three months. To date three visits have been conducted; therefore, only an initial assessment of the local gas regime has been undertaken at this stage and further visits will be required to complete the monitoring program. A separate gas addendum letter report will be issued following the completion of the full monitoring program.

The gas monitoring results to date, are presented in Appendix G, and summarised in Section 3.5.

The gas monitoring has been undertaken using a LMSxi Multifunction Gas Analyser and Photo-Ionisation Detector (PID).

The primary guidance document to determine if protection measures are required is BS8485:2015 *Code of practice for the design of protective measures from methane and carbon dioxide ground gases for new buildings*. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Screening Value (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors such as gas concentrations.

As both flow rate and methane concentrations have been consistently below the monitor's lower limit of detection a default flow rate of 0.1l/hr and a default methane concentration of 0.1%v/v have been used in the following assessment.

Using the default flow rate of 0.1l/hr and the default methane concentration of 0.1%v/v a Q_{hg} of 0.0001l/hr has been calculated for methane. Using the default flow rate of 0.1l/hr and the maximum carbon dioxide concentration of 6.9%v/v, a Q_{hg} of 0.0069l/hr has been calculated for carbon dioxide. On this basis the GSV for the site is determined as 0.0069l/hr.

Although the GSV is <0.07l/hr, and the maximum recorded concentration of methane is <1%v/v; as the maximum recorded concentration of carbon dioxide is >5%v/v (6.9%), consideration has to be given to increasing the 'Characteristic Situation' from 1 to 2 as outlined in table 2 of BS8485:2015, for which gas protection measures are required.

Further monitoring will be required to confirm the above assessment; however, at this stage it is recommended that allowance is made for the incorporation of gas precautions.

It should be noted that the maximum carbon dioxide concentration was recorded in WS02 which is located in the proposed balancing pond. The next highest carbon dioxide reading was noted as 2.3% in WS01.

Gas precautions are required; refer to Section 9.1.1 for details.

The desk study risk assessment determined that no radon protection measures are required.

6.1 SUMMARY OF RISK FROM GAS

The investigation has revealed a specific risk to end users from ground gas and gas protection measures will be required.

VOC vapours have not been detected to date and at this stage VOC vapour protection is unlikely. To be confirmed on completion of the gas monitoring program.

7 QUANTITATIVE RISK ASSESSMENT - CONTROLLED WATERS

The methodology, rationale and guidance GRM have used to assess the risk to controlled waters are set out in Appendix A (viii).

The primary receptors for this site have been identified as the underlying Secondary A Aquifer (Abbey Sand and Gravel) and local land drainage system. The primary pathways are infiltration (aquifer) and surface run-off (drains).

The made ground encountered in WS06 to 0.85m begl is not regarded as a source of contamination due to its limited thickness and as it does not exhibit any obvious signs of contamination. Due to this, leachate analysis has not been undertaken on the made ground, or the groundwater tested for a general suite of contaminants.

The hydrocarbon impacted soils (noted between 0.85m and 2m begl in WS06) has been identified as a potential source of contamination for controlled waters and, accordingly, groundwater testing has been conducted to determine whether it poses a risk. The results of the initial groundwater analysis are provided in Appendix H.

7.1 INTERPRETATION OF GROUNDWATER OBSERVATIONS AND MONITORING

During the site works groundwater strikes were encountered in the Peat, WS01, WS06 and WS07, at depths of 2.0m, 1.5m and 0.35m begl. Return monitoring recorded standing groundwater at depths of between 0.93m and 1.09m begl in the WS01 and WS06 installations.

Groundwater strikes in areas of the site predominantly underlain by Abbey Sand and Gravel, WS02, WS03 and WS04, were encountered at depths of 0.8m, 1.0m and 1.5m begl respectively. Return monitoring at these locations recorded standing water at depths of between 0.0m and 0.85m depth. Slight water seepage was noted in HD05 from 0.2m begl. An overview of groundwater observations during the investigation is presented below:

Exploratory Hole	Approximate Exploratory Hole Level (mAOD)	Initial groundwater level (mAOD)	Groundwater level range during monitoring (mAOD)	Stratum
WS01	3.3	1.3	2.27 – 2.21	Peat
WS02	3.3	2.5	2.55 – 2.45	Abbey Sand and Gravel
WS03	3.0	2.0	2.50 – 2.42	Abbey Sand and Gravel
WS04	3.0	1.5	3.00 – 2.61	Abbey Sand and Gravel
WS06	2.5	1.0	1.57 – 1.55	Peat
WS07	2.5	2.15	-	Peat

Site observations have typically indicated lower standing water in areas underlain by Peat in comparison to the Abbey Sand and Gravel, though given the groundwater flow is likely to be south / southwest this may be the same groundwater body.

As the hydrocarbon contamination was recorded at depth within the Peat and not observed in the overlying made ground, surface run-off to the drainage ditches is not considered a viable pathway and therefore the Abbey Sand and Gravel deposit (Secondary A Aquifer) is considered to be the more sensitive receptor for the hydrocarbon contamination.

Although the contamination appears at this stage to be restricted to the Peat as the groundwater levels in the superficial strata are in close proximity with one another, hydraulic continuity between them is considered to be a possibility.

7.2 ASSESSMENT OF THE CHEMICAL ANALYSIS RESULTS

Following confirmation of the presence of elevated hydrocarbons in the soil horizon associated with the groundwater in WS06 a sample of groundwater was collected on the 8th January 2019 and dispatched directly to the laboratory for TPHCWG, benzene, toluene, ethylbenzene and xylene (BTEX) and methyl tert-butyl ether (MTBE) analysis.

It should be noted that the UK Drinking Water Standard (UK DWS) for TPH has now been revoked, however in the absence of an alternative standard a TPH of 10µg/l is often adopted as a conservative threshold value. The World Health Organisation (WHO) has also provides guidance values for TPHCWG fractions in drinking water, which also give context to the test results from WS06.

The results of the analysis which exceed available guidance are summarised below:

UKDWS				
TPH (µg/l)	Concentration WS06 (µg/l)			
10	7700			
WHO Drinking Water Thresholds (CL:AIRE – Petroleum Hydrocarbons in Groundwater 2017)				
TPH Fraction	Aliphatic fraction(µg/l)	WS06 (µg/l)	Aromatic fraction (µg/l)	WS06 (µg/l)
EC5-EC6	15000	<0.1	10 (benzene)	<6
EC6>EC8	15000	<0.1	700 (toluene)	<6
EC>8-EC10	300	<0.1	300 (ethylbenzene) 500 (xylenes)	<6 <12
EC>10-EC12	300	105	90	44.1
EC>12-EC16	300	1380	90	652
EC16>-EC21		2800	90	1720
EC>21-EC35		596	90	428

The results for BTEX Speciated and MTBE were below the limit of detection for the analysis, which is consistent with the findings of the soil analysis and in-situ PID readings. No further investigation is considered necessary.

The result for total TPH, 7700µg/l, is notably above the former threshold for UK drinking water of 10µg/l, with the aliphatic and aromatic fractions for EC>12-EC16, EC>16-EC21 and EC>21-EC35 also exceeding the WHO guidance.

WHO rank the overall mobility for these fractions from moderate (Aromatic >EC12-EC16) to very low (Aromatic >EC21-EC35), with most of these fractions being of low to very low mobility.

7.3 SUMMARY OF RISK TO CONTROLLED WATERS

The Abbey Sand and Gravel is designated as a Secondary A Aquifer, however there are no groundwater abstraction licences within 500m of the site and the site is not recorded to be within a groundwater source protection zone.

Therefore based upon the above findings it is considered that the risk to controlled waters, Secondary A Aquifer, from potential very low to moderate mobility hydrocarbon contamination in the adjacent superficial stratum, Peat, is moderate.

The source of the potential hydrocarbons needs to be found and then removed and/or treated to protect controlled waters.



8 PHASE II CONCEPTUAL SITE MODEL

HUMAN HEALTH			
Source	Pathway	Receptor	Remedial Solution
Locally elevated levels of hydrocarbons (WS06).	Indoor and outdoor inhalation of soil dust, the ingestion of, and dermal contact with, contaminated soil and soil dust, ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users.	Delineation of source. Removal of drainage tank. Removal and/or treatment of contaminated soil.
	Groundwater.	Construction and maintenance workers.	
Made ground, Peat.	Inhalation of carbon dioxide.	End users.	Gas protective measures required. To be confirmed following completion of the gas monitoring.
Potential asbestos containing materials associated with buildings.	Inhalation of asbestos fibres.	Construction workers.	Survey and controlled removal by a specialist contractor.
Locally elevated levels of hydrocarbons in Peat (WS06).	Migration of contamination through leaks and joints, degradation of water pipe materials.	End users.	PE water supply pipes and clean backfill required (to be confirmed by water supply company following delineation and validation of source removal or treatment).
CONTROLLED WATERS			
Locally elevated levels of hydrocarbons in Peat and groundwater (WS06).	Leaching of contaminants and vertical migration to the groundwater.	Secondary Aquifer – Undifferentiated Layers.	Delineation of source. Removal of drainage tank. Removal and/or treatment of contaminated soil.

9 REMEDIATION

The recommended remedial measures detailed below should be considered as preliminary and used to determine budget estimate costs for the remediation of the site.

9.1 RECOMMENDED REMEDIAL MEASURES AND VALIDATION REQUIREMENTS

9.1.1 Protection of End Users

Remediation with regard to hydrocarbons in shallow soils

Based on the recorded levels of contamination across the site remediation will be required in proximity to the hydrocarbon impacted soils observed in the southwest to protect end users of the proposed residential development.

It is considered that the most appropriate remedial solution for the area of localised hydrocarbon contamination is source removal. To this end it is recommended that, prior to any further significant earth movement on site an initial excavation, centred on the position of the hotspot, be progressed to remove the hydrocarbon contaminated soil. At this stage the excavation will need to be extended to the nearest clean exploratory hole, therefore it is recommended that further delineation works are undertaken to prove the extent of the contamination to minimise soil removal. The excavation will need to be extended until all visually impacted soils are removed. All arisings should be exported to a suitable landfill facility.

Once the initial hotspot excavations are complete, the sides and base of them will need to be sampled to determine whether the source of contamination has been removed. The samples taken will need to be subject to analysis for the contaminants of concern (i.e. hydrocarbons). If the validation samples are confirmed clean, then the excavations can be backfilled with clean arisings. If they fail, the excavations will require extension and re-validating.

Although there is no direct link between the hydrocarbon impacted soil and the below ground warehouse waste storage tank it is likely that the tank will be removed and therefore source removal and validation would be appropriate at this time.

In addition to the above general requirements, following demolition of the warehouse building and removal of any associated below ground structures, an inspection should be undertaken under floor slabs to assess any potential risk of contamination of the underlying soils.

Should any material suspected of being significantly contaminated be encountered during the redevelopment of the site, GRM can be contacted to undertake additional investigation if necessary. The local Environmental Health Officer should be contacted and informed of any additional remedial work required.

The existing topsoil across the eastern third of the site (WS01 to WS03) has been shown be uncontaminated and can be used as a growing medium in private gardens and soft landscaping. If there is insufficient topsoil to complete the proposed development, then some will need to be imported.

Any topsoil imported for use to construct the growing medium will require chemical validation to confirm that it is suitable for use. Samples of this material will need to be analysed for a suite of contaminants including metals, inorganics, speciated PAHs and other contaminants such as, speciated hydrocarbons and asbestos depending on the source. The number of samples that require analysis will depend in the volume imported and the source of the materials. Typically an analysis rate of one sample per 50m³ and one sample per 250m³ (minimum of three samples per source and material type) applies for generated and virgin soils respectively.

Ground Gas

Gas protection measures are required for the proposed development.

The gas protection measures are to comprise the provision of a gas resistant membrane (such as Monarflex Reflex Super, Juta GP1 or similar), fully sealed at joints and service penetrations, and beam and block floor slabs. These would provide a score of 4.5 points under BS8545 and so will be suitable for the type of building proposed (Type A).

It should be noted that the water table was above the response zones in a number of the boreholes during a number of the monitoring visits which may have impacted the results. However this is considered representative of site conditions and when the water table was below the response zone (WS02) carbon dioxide levels were found to be greater than 5%.

9.1.2 Protection of Site Workers

The risk to site workers from the identified soil contamination is negligible. Although locally elevated carbon dioxide has been identified, no remedial measures are required.

However the use of suitable PPE and adoption of appropriate working protocols should be enforced during the ground works stage of construction and suitable precautions should be taken during the removal of any asbestos containing materials and hydrocarbon contaminated soils.

9.1.3 Protection of Controlled Waters

The risk to controlled waters, Secondary A Aquifer, is moderate, however following the recommended delineation, source removal and validation of the hydrocarbon contamination as recommended above no further remedial measures are considered necessary in terms of the risk to groundwater.

9.1.4 Protection of Water Pipes

It is considered that, based on the UKWIR guidance, the concentrations of contaminants recorded to date are such that PE water supply pipes would be suitable for the majority of the site, upgraded locally, southwest corner, to Barrier Type. However, following source removal of the hydrocarbon contamination it is recommended that the local water supply company for the site be contacted to confirm the use of PE water supply pipe across the entire site.

9.2 REMEDIATION METHOD STATEMENT

A Remediation Method Statement and a Gas Protection Measures Design and Verification Plan is required at this stage.

Following your review of this document, we would recommend that a copy of it be forwarded to the Local Authority for comment and approval, prior to commencing development of the site. The Local Authority may choose to include other consultees as part of the planning process (such as the Environment Agency).

Consultation should be undertaken at the earliest possible opportunity to avoid abortive or delayed works.

9.3 DISPOSAL AND CLASSIFICATION

Based on the Waste Classification Report (Appendix K) it is considered that the natural strata impacted with hydrocarbons (WS06 at 0.9m begl) and the shallow made ground due to elevated pH (WS07 at 0.3m begl) will be classed as Hazardous Waste.

Therefore, at this stage, we would recommend segregating the contaminated soils in the area of WS06 and WS07 and disposing of it as Hazardous Waste. Further testing of these materials may allow off-site disposal under separate waste streams.

The remaining made ground will not be classed as Hazardous Waste and at this stage we would recommend allowing for this to generally be disposed of as Non-Hazardous Waste.

The unaffected natural strata underlying the site is likely to be classified as Inert for disposal purposes, however, further testing will be required to confirm this.

Early consultation with the relevant landfill sites over their particular acceptance criteria may produce cost savings. Reference should be made to the relevant notes in Appendix A (x).

Care should be taken to keep clean natural arisings separate from the made ground and free from construction materials, as natural soils mixed with made ground and construction materials may attract additional disposal costs.

Although not identified during the site works, visible asbestos containing materials (ACMs) within soils will result in the soils being classified as Hazardous Waste. Visible ACMs should be removed, employing appropriate health and safety protocols and where possible should be undertaken prior to disposal.

It is recommended that any materials to be exported are stockpiled and tested to confirm disposal rates, as this may be more cost effective than using the results contained within this report.

10 GEOTECHNICAL ASSESSMENT

10.1 INTRODUCTION

The Client proposes to develop the site with residential properties with associated gardens, soft landscaping, infrastructure and a balancing pond. Finished floor levels and the levels of any underground engineering works have not been provided.

Detailed development plans were not available at the time of report preparation so it has been assumed in the following assessment that the development will be in line with current planning guidance and comprise two to three storey residential housing and two storey one bedroom apartment buildings.

In addition to the site specific comments below reference should be made to the general comments relating to the Geotechnical Assessment listed in Appendix A (xi to xvi).

10.2 GEOTECHNICAL TESTING

Geotechnical testing has been carried out both on site and in the laboratory; the results of this testing are provided on the logs in Appendix E, and in Appendix I. These results are summarised in the tables below:

In situ Testing:

Test Parameter	Range of Results (m begl)		
	Peat	Abbey Sand and Gravel	Oxford Clay
SPT 'N' values	1 to 6 at 1m 6 at 2m	15 to 33 at 1m 11 to 51 at 2m 13 to 15 at 3m	17 to 29 at 3m 20 at 4m

Laboratory Testing:

Test Parameter	Range of Results		
	Peat	Abbey Sand and Gravel	Oxford Clay
Natural Moisture Content	29 to 47%	21%	23%
Plasticity Index	24 to 37% (medium volume change potential).	25% (medium volume change potential).	27% (medium volume change potential).

10.3 ENGINEERING GROUND TREATMENT

Though the near surface soils were generally firm under foot during the intrusive investigation, localised standing water and wet ground conditions were recorded in the centre of the site during the walkover in November 2018. Due to this localised standing water and prevalence of peat in the southeast of the site, it is recommended that temporary haul roads are allowed for until the main roads are constructed.

A working platform will be required for any piling plant in areas underlain by peat. It is recommended that the design of the working platform is carried out as soon as possible. The working platform certificate requires signing by the Principal Contractor for the site. An allowance for this, and responsibility for the design of the platform (estimated at 800mm thick if constructed without reinforcement), should be made in tender packages and site programmes.

Earthworks may be required depending on the need for flood risk mitigation measures. It should be noted that raising site levels on the Peat will create settlement that will need to be allowed for in infrastructure design.

Allowance should also be made for temporary site surface water drainage to prevent run off from the site to local drains.

Dependent on proposed levels, some earthworks or ground improvement may be necessary to mitigate settlement of the soft Peat deposits.

10.4 EXCAVATION CONDITIONS

Excavation of the materials encountered during the ground investigation should be easily achieved using conventional hydraulic excavation techniques. A breaker or similar plant is likely to be required where hard standing or existing foundations are encountered, including those observed in the former warehouse footprint.

From the ground investigation undertaken, it is likely that excavations in the Peat and Abbey Sand and Gravel would be liable to collapse without warning and this situation is likely to be exacerbated by water ingress. The observed groundwater conditions suggest that the use of full dewatering systems (e.g. well pointing) may be necessary to dewater excavations. An overview of groundwater levels is presented in Appendix N.

Care should be taken to ensure that dewatering does not lead to settlement of soils below existing structures or services on or off-site.

10.5 EXISTING STRUCTURES / SUBSTRUCTURES

There are existing structures on the site including warehouses, underground tanks, old foundations or other buried structures (associated with the demolished warehouse), and localised underground services in the west of the site.

10.6 FOUNDATIONS

The topsoil, extremely low to low strength Peat deposits, and untreated made ground, are considered unsuitable as bearing strata and all new foundations encountering these materials should be carried down through them to found on the more competent and consistent granular medium dense (or denser), Abbey Sand and Gravel.

Based on the general ground conditions, a minimum depth of 1m below is recommended to bear onto the granular Abbey Sand and Gravel.

Peat was encountered in the south of the site to depths of 1m to 2.8m begl. In the shallower areas of Peat (across the centre of the site) traditional foundations would be suitable and should found below the Peat into the granular deposits of the Abbey Sand and Gravel. The practical depth of excavation through the Peat is likely to be restricted to say 1.5m depth by high groundwater and excavation instability.

There are trees along and within the site boundaries and any new foundations within the zone of influence of these trees will need to be deepened in line with guidance in NHBC Chapter 4.2. However, it is recommended to take all traditional foundations through the cohesive layer to the top of the granular Abbey Sand and Gravel deposits (encountered from depths of between 1m to 1.5m begl).

Based on approximate depths of peat across the site, and the most recent proposed development layout it is estimated that approximately 65% of the proposed plots will be suitable for trench foundations. At this stage it is estimated that foundation depths of between 1m and 1.5m begl, with an average foundation depth of 1.2m begl might be expected. An illustrative proposed foundation plan highlighting anticipated foundation requirements is presented in Appendix M.

TRENCHFILL

The Abbey Sand and Gravel encountered in the anticipated foundation depths, was generally medium dense for the granular material. It is anticipated that a nett allowable bearing pressure of at least 110kN/m² should be available for conventional strip or trench fill footings. This will allow line loads up to 50kN/m to be taken on footings 450mm wide and 65kN/m on footings 600mm wide. This should result in total settlements of not more than 20mm, keeping differential settlements within acceptable limits.

Heave precautions will be required where the foundations lie within the heave zone of trees as defined in NHBC Standards Chapter 4.2 and cohesive strata are present. Foundations should be remote from the direct action of tree roots, and should not be constructed so close to trees as to significantly damage their root systems.

Wider footings may be required for higher point/line loads such as at party walls etc. Should wider footings be required for higher point/line loads, GRM should be contacted for further advice.

An allowance for some dewatering and the use of dig and pour techniques is recommended to mitigate against excavation instability and groundwater ingress. Excavations should not be left open as they will suffer from water ingress, overbreak and additional concrete usage.

PILES

The Peat is not considered suitable for the proposed structures to found on. It is anticipated that approximately 35% of the site is either underlain by Peat to over 2.5m in depth or potentially located over the existing tanks.

A piling specialist will need to be approached to provide pile dimensions and safe pile capacities. They are likely to require provision of cable percussion boreholes to provide information for detailed design. Consideration should be given to nearby structures and infrastructure and achieving sufficient penetration to resist heave when choosing the appropriate pile type. Due to the presence of poor near surface bearing strata the piles should be progressed into the Oxford Clay. Due to the high groundwater and saturated granular soils, allowance for temporary casing would be prudent.

Until confirmed otherwise allow for the use of 10m long piles.

Whilst piled foundations would end bear beneath the influence of trees, the piles and ring beams should be designed to resist potential heave from tree influence and down-drag from settlement in the Peat.

A testing regime and objectives of the works will need agreeing with regulatory and warranting bodies prior to works. The pile design will need to be justified to the warranting bodies and the justification should be included within the piling contract.

10.7 FLOOR SLABS

Due to the localised influence of trees, presence of extremely low to low strength Peat and requirement for gas protection measures, it is recommended that an allowance be made for the proposed structures to have voided beam and block floors.

10.8 BURIED CONCRETE

Based on the recorded water soluble sulphate and pH levels in the superficial deposits and made ground at the site, in accordance with the requirements of BRE Special Digest 1 (2005), 'Concrete in Aggressive Ground', the buried concrete at the site should be assumed as DS-2, AC-2 for made ground and DS-1, AC-1 for superficial deposits.

For traditional foundations bearing into in the Oxford Clay (i.e. not piling), a worse case Design Sulphate Class for buried concrete should be assumed as DS-4 and the ACEC Class as AC-3s.

The results of the water soluble sulphate and pH testing are presented in Appendix H.

10.9 SLOPE STABILITY AND RETAINING STRUCTURES

The site and surrounding area is flat, therefore, there is no significant risk of slope instability occurring on the site at present gradients.

Earthworks and re-grading of the site may be a requirement as part of any flood risk mitigation measures. Future ground profiles may require earth retaining structures, for which further advice may be required when more information is available.

It should be noted that raising levels over peat will cause settlement, the extent of which will need to be assessed. Infrastructure protection and possible earthworks and/or ground improvement is likely required to mitigate against this.

10.10 SOAKAWAY DRAINAGE

The clay Peat strata are not considered to have a suitable infiltration rate for use in soakaways. Whilst the Abbey Sand and Gravel potentially has a suitable infiltration rate, the presence of shallow groundwater precludes its use in soakaways. An alternate drainage solution is recommended.

A balancing pond is proposed. The level of the pond in relation to the groundwater should be considered to determine if the pond requires lining and designing to resist floatation.

10.11 NEW ACCESS ROADS AND EARTHWORKS

Site observations suggest that cohesive and granular soils on the site will have CBR values of 2%, and 2% to 5%, respectively, and 1% for the Peat, when suitably drained. Proof rolling and the improvement of soft spots may result in increased CBR values and the incorporation of a geotextile grid into sub-base layers may allow for reduced capping thickness.

Site observations should be confirmed by in situ or laboratory testing in accordance with the adopting Local Authority's preference.

It should be noted that raising levels over peat will cause settlement, the extent of which will need to be assessed. Infrastructure protection and possible earthworks and/or ground improvement is likely required to mitigate against this.

11 FURTHER INVESTIGATION

Further investigation, to determine more accurately the effect of some of the identified hazards on the development, is recommended. This includes the following:

- Additional investigation to delineate extent of hydrocarbon contamination in southwest of the site.
- Further WAC testing for TPH and pH impacted material.
- Additional investigation in northwest corner and below warehouse following site clearance.
- Completion of current gas monitoring programme and re-assessment of the ground gas regime.
- Gas design and verification plan if gas protection measures are necessary.
- In-situ CBR testing.
- Cable percussion boreholes for pile design.
- Further groundwater sampling, and possible liaison with the Environment Agency.
- Earthworks for flood mitigation measures.
- Settlement and slope stability assessment based on proposed levels.
- Trial pits to determine water ingress and excavation stability for traditional foundations.
- Trial pits to delineate the extent of the Peat strata.

A copy of this report should be submitted to the Planning Department of the Local Authority/Local Authority EHO for review, if planning conditions exist for this site. A copy should also be sent to the NHBC for their records.

12 CONCLUSIONS

Based on the evidence currently available the site is assessed as being of moderate risk for geotechnical hazards and moderate risk for contamination hazards.



A P P E N D I X A

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GENERAL APPRAISAL COMMENTS

i INFORMATION SOURCES

Where available the following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:10,000 for local area
- British Geological Survey (BGS) Geology Map Scale 1:50,000/1:63,320
- BGS Memoir
- BGS Borehole Records
- BGS online viewer: <http://www.bgs.ac.uk/data/mapViewers/home.html>
- Environment Agency Groundwater Vulnerability Maps
- Historical Ordnance Survey (OS) Maps
- Environmental Data Report
- Environment Agency Website: <http://www.environment-agency.gov.uk/>
- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010.
- Coal Authority Records / Coal Mining Report
- DEFRA/Environment Agency Contaminated Land publications and DoE Industry Profiles
- BRE Guide BR211 (2015), 'Radon: Guidance on protective measures for new buildings'
- HPA-RPD-033 (2007), 'Indicative Atlas of Radon in England and Wales'
- PHE-CRCE-032 (PHE, 2017), Radon in Homes in England: 2016 Data Report
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- BS8485:2015, 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'
- Other technical references used throughout this document are detailed in the text.

ii CONTAMINANTS OF CONCERN

The DoE Industry Profiles are normally used to assess likely contaminants from past land use and potential nearby industrial sources. For land uses where no profile is available, likely contaminants of concern are selected by GRM based on past experience of similar sites, a general screening suite of contaminants covered by CLEA and common contaminants from the Industry Profiles.

- | | | |
|------------|-------------------|--|
| • Arsenic | • Copper | • Water soluble sulphate |
| • Cadmium | • Nickel | • PAH (polycyclic aromatic hydrocarbons) |
| • Chromium | • Zinc | |
| • Lead | • Phenols | |
| • Mercury | • cyanide (total) | |
| • Selenium | • pH | |

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. There is the potential for asbestos containing material to be mixed up with made ground, following any demolition works.

CONCEPTUAL MODEL METHODOLOGY

The consideration of contamination is based upon the principles of risk assessment, using the 'source-pathway-receptor' model in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied to form a pollutant linkage:

- The presence of substances that may cause harm (SOURCE).
- The presence of a target which may be harmed (RECEPTOR).
- The existence of a plausible migration route between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage there is no risk. Where a potential linkage is identified in order for it not to pose a risk to the identified receptor it must be broken.

iv INTRUSIVE INVESTIGATION SAMPLING METHODOLOGY

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. A general grid pattern has been adopted, where possible, to provide sufficient information based on the current proposed layout scheme. Some holes have been targeted at particular hazards identified in the Phase I assessment. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

v GROUND GAS RISK ASSESSMENT METHODOLOGY

Gas monitoring programmes undertaken by GRM are designed to broadly comply with the recommendations outlined in CIRIA Report C665 'Assessing risks posed by hazardous ground gas to buildings' (2007) and BS8576 'Guidance on Investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs) (2013).

To assess the risks posed by ground gases such as radon, carbon dioxide and methane, the relevant current guidance has been used. For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (BR211: 2015)'. For methane and carbon dioxide the primary guidance document used to determine if protection measures are required is *BS8485:2015 Code of practice for the design of protective measures from methane and carbon dioxide ground gases for new buildings*. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Flow Rate (GSF) for the site. The gas regime is then determined based on the GSF and other limiting factors such as gas concentrations.

Where flow is not recorded during the monitoring a default flow rate of 0.1l/hr will be used in the assessment to produce a positive result.

vi HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

Guidance contained in the Environment Agency's CLEA Reports has been used to assess the risks posed to human health.

For residential developments that include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land with plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered including the consumption of home-grown vegetables.

For residential developments that do not include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land without plant uptake' are used, i.e. a female with a start age class of

one and an end age class of six. All pathways are considered except the consumption of home-grown vegetables.

For commercial/industrial developments the default Tier 1 Assessment Criteria (TAC) for 'commercial/industrial' are used, i.e. a female with a start age class of sixteen and an end age class of eighteen. All pathways are considered except the consumption of home-grown vegetables.

The TAC used by GRM include Category 4 Screening Levels (C4SLs) published by DEFRA, values calculated by GRM using the CLEA v1.071 risk assessment, and values and Suitable for Use Levels (S4UL) developed by LQM/CIEH. The TAC used in the assessment are selected based on the lowest site specific SOM values returned as part of the chemical analysis.

Where soil chemical analysis results are found to exceed the TAC, Site-Specific Risk Assessments may be undertaken using the CLEA v1.071 risk assessment software using the age classes and pathways described above.

vii RISK TO SITE WORKERS – GENERAL COMMENTS

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Demolition and dismantling of existing structures on the site must be carried out to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

viii CONTROLLED WATERS RISK ASSESSMENT METHODOLOGY

Where the desk study and fieldwork do not reveal a potential source of contamination no leachate or groundwater testing will be performed. Where a potential source is identified the testing will comprise leachate testing on the material considered most likely to pose a risk, groundwater testing will be undertaken if water is present at shallow depth.

The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate/groundwater test results. When the most sensitive receptor is considered to be the aquifer (groundwater) UKDWS will be adopted as the Initial Tier 1 screening values. Where the most sensitive receptor is a surface water feature the EQS values will be used as Initial Tier I Screening values.

ix CONSTRUCTION MATERIALS RISK ASSESSMENT METHODOLOGY

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- UK Water Industry Research (UKWIR) Contamination thresholds for sub-surface water pipes, for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

x WASTE DISPOSAL, SITE WASTE MANAGEMENT PLANS AND MATERIAL MANAGEMENT PLANS

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The chemical analysis results included in this report should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous, then the site will need to be registered with the Environment Agency prior to the movement of the waste. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. GRM can assist in the production of Material Management Plans under the CL:AIRE Definition of Waste: Code of Practice. The DoWCoP enables:

- The direct transfer and re-use of clean naturally occurring soil materials between sites, and
- The re-use of both contaminated and uncontaminated materials on their site of origin and between sites within defined Cluster projects.

GRM can also undertake the role of Qualified Person and submit the DoW CoP project Declaration.

Likewise making the site as volume neutral as possible will reduce the costs of development. Whilst not a statutory requirement, Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

xi GEOTECHNICAL ASSESSMENT GENERAL COMMENTS

Where finished floor levels of proposed structures have not been provided by the Client, then for the purposes of initial assessment, GRM will assume that finished levels will not vary appreciably from the existing ground levels. If the depths of any underground engineering works (i.e. sewers, pumping stations etc.) are unknown they will not be taken in to account in the assessment and it will be assumed that any such works will not compromise foundation or ground stability.

Should the development proposals or finished levels be different from these assumptions then the comments/recommendations in the Geotechnical Assessment may require revising.

It should be noted that the results of window sampling and/or cable percussive boreholes may not give a true indication of a soils actual engineering properties (i.e. stability, mass structure etc). GRM consider that that prior to development trial pitting should be undertaken to confirm the recommendations in the Geotechnical Assessment.

xii GEOTECHNICAL ASSESSMENT – ENGINEERING GROUND TREATMENT

Near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should always be taken to avoid this, as excessive disturbance may leads to more onerous floor slab designs, road cap thickness and increased amounts of off-site disposal etc.

Near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known.

xiii GEOTECHNICAL ASSESSMENT – EXCAVATIONS

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground, soft and very soft clays and granular soils. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

If contaminated water enters excavations it should be removed and transported to an appropriate treatment facility by a suitably licensed carrier before construction begins.

xiv GEOTECHNICAL ASSESSMENT – SUBSTRUCTURES

Where practicable, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There may be existing structures and/or infrastructure in close proximity to the proposed development. New build foundations may be constructed next to pavements with existing underground services beneath them, or excavations may be required near existing footings associated with adjacent properties. These potential hazards need to be taken into consideration when designing foundations and the groundworker needs to be made aware of their potential impact during the redevelopment works. Foundations close to existing underground services or buildings may require alternative foundation techniques (such as piling) to protect the integrity of these structures.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing buildings/roads/ services that are to be retained.

xv GEOTECHNICAL ASSESSMENT – SOAKAWAYS

Soakaway testing in trial pits by GRM is broadly carried out in accordance with BRE DG 365 (2016). The testing comprises the excavation of a test pit to a suitable depth, and the placement of water into the pit. The level of water present is then monitored over time. For borehole installations, the permeability testing (falling head/rising head) is undertaken in accordance with BS5930.

If it is decided to proceed with the use of soakaway drainage, then the following general points should be noted:

- Soakaways should not be placed so that water can be discharged through potentially contaminated made ground.
- The Environment Agency may require soakaways to be sealed systems such that only roof run off falls to soakaway.

- Interceptors are likely to be required for soakaways for highway drainage. The adopting authority for the highways should be consulted at the earliest opportunity regarding the use of soakaways for highways drainage.
- Consideration of site levels and slopes should be taken into account during the design.
- The construction of all soakaways should be in accordance with the current building regulations.
- Soakaways should not be placed within 5m of a proposed building.
- Placement of soakaways needs to be considered so as to avoid ponding of water down slope.
- The base of a soakaway should not be below the highest recorded water level.
- The Environment Agency prefer 1m of dry soil to be present between the base of a soakaway and the water table to provide attenuation for contamination.

xvi

GEOTECHNICAL ASSESSMENT – FOUNDATIONS

If soft or hard spots are encountered during foundation excavation then they should be replaced with suitably compacted material or the footings deepened to suitable strata, to avoid differential settlement.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a single plot then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (e.g. piles or vibro-replacement).

NOTES ON LIMITATIONS**General**

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

- a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and
- b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and as considered necessary and appropriate to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as provisional only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. Whilst exploratory testing is intended to gain an accurate representation of the site, the very nature of sampling and testing is such that it cannot ensure that all localised conditions are detected.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects. The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.



A P P E N D I X B

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ACCOMMODATION SCHEDULE

DWELLING TYPE	GIFA	HEIGHT (STOREYS)	AMOUNT	%
1B 1B2P HOUSE	54.20m ²	2	06	12
F133 2B4P HOUSE	72.54m ²	2	24	48
F113 3B5P HOUSE	84.30m ²	2	02	40
F131 3B5P HOUSE	83.66m ²	2	18	
TOTAL			50	100

AREA = 1.54 Ha

- 1800mm brick wall
- 1800mm close boarded fence
- Proposed Knee Rail
- Paving Hatch
- Proposed trees
- Trees retained
- Trees removed
- Root Protection Area
- Bin storage
- Rent to Buy
- Shared Ownership
- Rented

Notes:

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- This drawing is for information only and does not constitute an offer of any development.

Revision:

Revision	Date	By	Check
1.0	01/10/18	GRM	GRM
2.0	01/10/18	GRM	GRM
3.0	01/10/18	GRM	GRM
4.0	01/10/18	GRM	GRM
5.0	01/10/18	GRM	GRM
6.0	01/10/18	GRM	GRM
7.0	01/10/18	GRM	GRM
8.0	01/10/18	GRM	GRM
9.0	01/10/18	GRM	GRM
10.0	01/10/18	GRM	GRM

Client: Partner Construction Ltd

Project: CREASE DRIVE, CROWLAND, PETERBOROUGH

Drawing: SITE LAYOUT

Drawn by: JJ

Checked: JJ

Date: OCT 2018

Scale: 1:500

BM3

DO NOT SCALE

NOTES:

Approximate Site Boundary

GRM
Development Solutions
geoenvironmental - civil - structural

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mail@grm-uk.com www.grm-uk.com

CLIENT:

Partner Construction Ltd

PROJECT:

Crease Drove, Crowland

TITLE:

Proposed Development Plan

SCALE@SIZE:	ISSUE:
NTS	FINAL
DESIGN/DRAWN by:	DATE:
DAA	March, 2019
PROJECT No:	DRAWING No:
P8723	1

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DO NOT SCALE
NOTES:

— Approximate Site Boundary



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CLIENT:

Partner Construction Ltd

PROJECT:

Crease Drove, Crowland

TITLE:

Site Location and Boundary Plan

SCALE@SIZE :

NTS

ISSUE:

FINAL

DESIGN/DRAWN by :
LB

DATE:
January, 2019

PROJECT No:

P8723

DRAWING No:

2

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DO NOT SCALE

NOTES:

- Approximate Site Boundary
- Window Sample Location
- Window Sample Location with monitoring well
- Hand-Dug Pit Location

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CLIENT:

Partner Construction Ltd

PROJECT:

Crease Drove, Crowland

TITLE:

Exploratory Hole Location Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN by :	DATE:
LB	January, 2019
PROJECT No:	DRAWING No:
P8723	3



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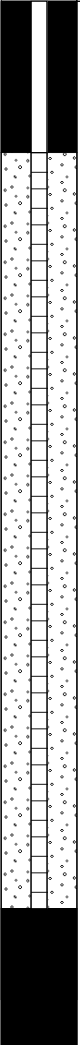
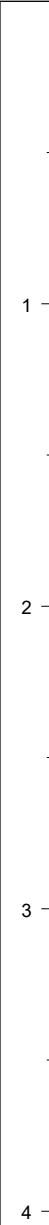
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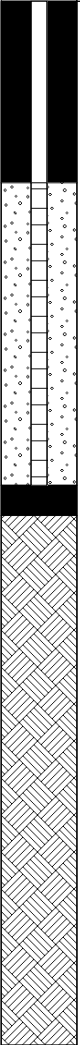
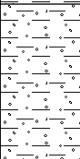
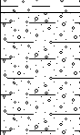
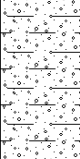
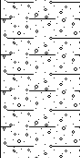
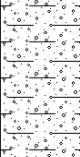
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		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS01 Sheet 1 of 1	
Site Name: Crease Drive, Crowland							Ground Level (mAOD) 3.30	
Client: Partner Construction Ltd					GRM Project Ref: P8723		Coordinates 523827 E 309611 N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	Result						
		0.05 - 0.20	D	N=1 (0,0/0,1,0,0)				Dark brown, slightly sandy CLAY. sand is fine to medium. With a trace of rootlets. TOPSOIL <i>- with some brick and slate fragments</i>		
		0.05 - 0.20	ES					Firm to stiff, grey-brown, CLAY. PEAT.		
		0.50 - 0.60	D			0.40	2.90			
		0.50 - 0.60	ES							
		0.60 - 0.80	D			0.70	2.60			
		0.80 - 1.00	ES					Soft to firm, grey-brown stained yellow-brown, slightly sandy CLAY. Sand is fine to medium. With trace of rootlets. PEAT.		
		1.00 - 1.45	SPTLS			1.05	2.25			
		1.00 - 1.20	S					Very soft to soft, grey slightly stained red-brown, silty CLAY. With a trace of roots. PEAT.		
		1.20 - 1.40	D					<i>- grading dark brown, slightly sandy silty clay</i>		
						1.50	1.80			Firm, grey, slightly gravelly CLAY. Gravel is fine to medium, subrounded, mudstone. PEAT.
		1.80	D			1.70	1.60			Soft, grey frequently stained dark grey and black, sandy CLAY. Sand is fine to medium. With some rootlets and visible wood fragments. Faint organic odour. PEAT.
		2.00 - 2.45	SPTLS		N=6 (1,1/1,2,2,1)					<i>- slightly gravelly clayey sand band, wet</i>
		2.00	S							
		2.50	D							<i>- grading stiff slightly gravelly sandy CLAY</i>
		2.90	D			2.80	0.50			Medium dense, brown to orange-brown, slightly clayey, slightly sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, subangular, quartzite. ABBEY SAND AND GRAVEL.
		3.00 - 3.45	SPTLS		N=15 (2,3/3,3,4,5)					
		3.00	S			3.45	-0.15			End of Borehole at 3.45m

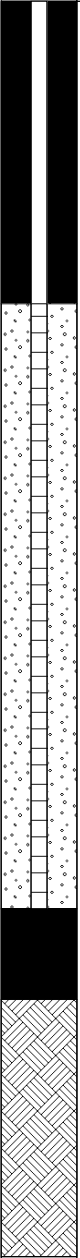
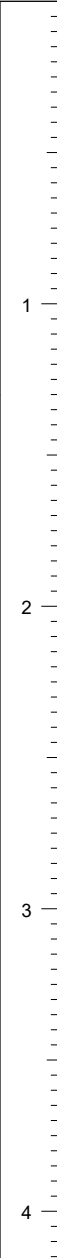
Crew: RGI		Logger: LB		Weather: Rain	
Equipment: Tracked Window Sampling Rig					
Reason for termination of borehole: Target depth reached					
Groundwater Remarks: 2m					
General Remarks:					
Hole Started:	05/12/2018	Hole Complete:	05/12/2018	Version:	FINAL
				Scale:	1:25

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS02 Sheet 1 of 1		
Site Name: Crease Drive, Crowland							Ground Level (mAOD) 3.30		
Client: Partner Construction Ltd					GRM Project Ref: P8723			Coordinates 523843 E 309660 N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description		
		Depth	Type	Result							
		0.20	D						Brown-grey CLAY. With some rootlets. TOPSOIL.		
		0.20	ES								
						0.60	2.70		Firm, dark brown, silty CLAY. With trace of rootlets. PEAT.		
		0.80	D			0.75	2.55				
		0.80	ES						Firm to stiff, brown and orange-brown, slightly sandy, slightly gravelly CLAY. Sand is fine to medium. Gravel is fine to medium, subangular and quartzite. Wet. ABBEY SAND AND GRAVEL. <i>- stiff to very stiff, slightly sandy gravelly CLAY, wet</i>		
		1.00 - 1.45	SPTLS	N=33 (1,7/8,8,8,9)							
		1.00	S								
		1.30	D			1.30	2.00		Medium dense, brown, slightly clayey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, subangular and subrounded, quartzite. ABBEY SAND AND GRAVEL. <i>- grading orange-brown sandy GRAVEL</i> <i>- grading slightly clayey sandy GRAVEL</i>		
		1.80	D								
										Medium dense, brown, slightly clayey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, subangular and subrounded, quartzite. ABBEY SAND AND GRAVEL. <i>- grading orange-brown sandy GRAVEL</i> <i>- grading slightly clayey sandy GRAVEL</i>	
2.00 - 2.45	SPTLS	N=20 (3,4/5,4,6,5)									
2.00	S										
										Medium dense, brown, slightly clayey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, subangular and subrounded, quartzite. ABBEY SAND AND GRAVEL. <i>- grading orange-brown sandy GRAVEL</i> <i>- grading slightly clayey sandy GRAVEL</i>	
2.70	D										
3.00 - 3.45	SPTLS	N=13 (3,3/3,2,4,4)									
											Medium dense, brown, slightly clayey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, subangular and subrounded, quartzite. ABBEY SAND AND GRAVEL. <i>- grading orange-brown sandy GRAVEL</i> <i>- grading slightly clayey sandy GRAVEL</i>
3.00	S										
						3.45	-0.15		End of Borehole at 3.45m		

Crew: RGI		Logger: LB		Weather: Rain	
Equipment: Tracked Window Sampling Rig					
Reason for termination of borehole: Target depth reached					
Groundwater Remarks: 0.8m					
General Remarks:					
Hole Started:	05/12/2018	Hole Complete:	05/12/2018	Version:	FINAL
				Scale:	1:25

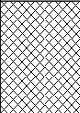
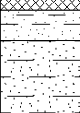
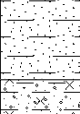
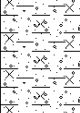
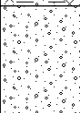
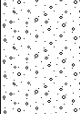
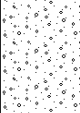
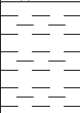
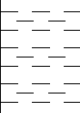
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS03 Sheet 1 of 2		
Site Name: Crease Drive, Crowland							Ground Level (mAOD) 3.00		
Client: Partner Construction Ltd					GRM Project Ref: P8723			Coordinates 523785 E 309636 N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	Result						
		0.20	D						Dark brown CLAY. With some rootlets. TOPSOIL.	
		0.20	ES			0.30	2.70			
						0.55	2.45		Firm to stiff, grey, slightly gravelly, sandy CLAY. Sand is fine. Gravel is fine, subangular, mudstone and quartzite. PEAT.	
		0.70	D							
		0.70	ES							
		1.00 - 1.45	SPTLS	N=28 (1,5/5,7,8,8)		1.00	2.00		Stiff, brown and orange-brown, slightly gravelly sandy CLAY. Sand is fine to medium. Gravels is fine, subangular, mudstone and quartzite. ABBEY SAND AND GRAVEL. - grading firm to stiff slightly sandy CLAY	
		1.00	S							
		1.20	D			1.30	1.70			
									Medium dense, grey-brown, slightly clayey, slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, subangular, quartzite. With some shells. Wet. ABBEY SAND AND GRAVEL.	
		1.70	D							
		2.00 - 2.45	SPTLS	N=11 (3,3/4,3,2,2)						
									Medium dense, brown to orange-brown, slightly clayey, sandy GRAVEL. Sand is fine to medium. Gravel is fine to medium, subangular, quartzite. ABBEY SAND AND GRAVEL. - grading sandy GRAVEL	
		2.00	S							
		2.60	D							
									Stiff, grey, CLAY. OXFORD CLAY.	
2.95	D			2.95	0.05					
3.00 - 3.45	SPTLS	N=29 (4,4/5,7,9,8)								
										
3.45	S									
3.00										
										
3.90	D									
4.00 - 4.45	SPTLS	N=20 (2,2/4,5,5,6)								
										
4.45	S									
4.00										
Continued on Next Sheet										

Crew: RGI		Logger: LB		Weather: Rain	
Equipment: Tracked Window Sampling Rig					
Reason for termination of borehole: Target depth reached					
Groundwater Remarks: 1.0m					
General Remarks:					
Hole Started:	05/12/2018	Hole Complete:	05/12/2018	Version:	FINAL
				Scale:	1:25

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole				Borehole No WS03 Sheet 2 of 2		
Site Name: Crease Drove, Crowland								Ground Level (mAOD) 3.00		
Client: Partner Construction Ltd					GRM Project Ref: P8723			Coordinates 523785 E 309636 N		
Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	Result						
						4.45	-1.45		Stiff, grey, CLAY. OXFORD CLAY.	
									End of Borehole at 4.45m	
										5
										6
										7
										8
Crew: RGI					Logger: LB			Weather: Rain		
Equipment: Tracked Window Sampling Rig										
Reason for termination of borehole: Target depth reached										
Groundwater Remarks: 1.0m										
General Remarks:										
Hole Started: 05/12/2018		Hole Complete: 05/12/2018		Version: FINAL		Scale: 1:25				

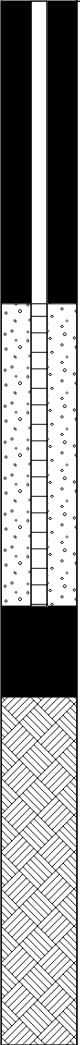
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS04 Sheet 1 of 1		
Site Name: Crease Drive, Crowland							Ground Level (mAOD) 3.00		
Client: Partner Construction Ltd					GRM Project Ref: P8723			Coordinates 523775 E 309677 N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description		
		Depth	Type	Result							
		0.20 0.20	D ES						Brick fill, fine to coarse gravel and cobbles of brick, slightly clayey. MADE GROUND.		
						0.40 0.50	2.60 2.50			Stiff, grey mottled orange-brown, slightly gravelly, sandy CLAY. Sand is fine to medium. Gravel is fine to medium, subangular, quartzite. ABBEY SAND AND GRAVEL.	
		0.70	D							Medium dense, brown and orange-brown, slightly gravelly, clayey SAND. Sand is fine to medium. Gravel is fine to medium, subangular, quartzite. wet. ABBEY SAND AND GRAVEL.	1
		1.00 - 1.45 1.00	SPTLS S	N=24 (2,4/5,6,7,6)		1.00	2.00			- sandy CLAY from 0.6m to 0.75m	
		1.40	D							Stiff, grey-brown, slightly sandy, slightly gravelly CLAY. Sand is fine to medium. Gravel is fine, subangular, quartzite. ABBEY SAND AND GRAVEL.	
		1.60	D			1.50	1.50			Medium dense, orange-brown, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, subangular, quartzite. Wet. ABBEY SAND AND GRAVEL.	2
		2.00 - 2.45 2.00	SPTLS S	N=11 (2,1/2,2,4,3)						- Gravelly CLAY band from 1.7m to 1.9m	
		2.80	D			2.60	0.40			Stiff, grey mottled orange-brown, CLAY. OXFORD CLAY.	3
		3.00 - 3.45 3.00	SPTLS S	N=17 (2,2/4,5,4,4)						- selenite observed from 2.6m to 2.8m - grey	
						3.45	-0.45			End of Borehole at 3.45m	4

Crew: RGI		Logger: LB		Weather: Rain	
Equipment: Tracked Window Sampling Rig					
Reason for termination of borehole: Target depth reached					
Groundwater Remarks: 0.5m					
General Remarks:					
Hole Started:	05/12/2018	Hole Complete:	05/12/2018	Version:	FINAL
				Scale:	1:25

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No HD05 Sheet 1 of 1		
Site Name: Crease Drive, Crowland							Ground Level (mAOD) 3.00		
Client: Partner Construction Ltd					GRM Project Ref: P8723			Coordinates 523744 E 309667 N	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
	0.05 - 0.10	D		0.15 0.25	2.85 2.75	 	Brown and grey, gravelly sandy CLAY. Sand is fine to medium. Gravel is fine to coarse. With some brick fragments. MADE GROUND Stiff, grey mottled orange-brown, slightly gravelly, slightly sandy CLAY. Sand is fine to medium. Gravel is fine to medium, subrounded, quartzite. ABBEY SAND AND GRAVEL. End of Pit at 0.25m		
							1		
							2		
							3		
							4		
Date Excavated: 05/12/2018				Groundwater Observations:					
Date Backfilled: 05/12/2018				Seepage at 0.2m					
Shoring:									
Stability:									
Plant Used: Hand Dug Pit				Trial Pit Dimensions (m): 		Reason for termination of Trial Pit:			
Logged by: LB						Refusal			
General Remarks:									
Relative density is approximate and determined by observation only.									
Version: FINAL			Scale: 1:25						

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS06 Sheet 1 of 1	
Site Name: Crease Drive, Crowland							Ground Level (mAOD) 2.50	
Client: Partner Construction Ltd					GRM Project Ref: P8723		Coordinates 523682 E 309646 N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description				
		Depth	Type	Result									
		0.40	D	N=6 (1,1/1,2,2,1)		0.30	2.20		Dark grey and brown, gravelly SAND. Sand is fine to medium. Gravel is fine to medium, subangular, slate and quartzite. MADE GROUND.	1			
		0.40	ES			0.50	2.00				Approximately medium dense, light brown, slightly sandy, cobbly GRAVEL. sand is fine to medium. Gravel is fine to coarse, subrounded and subangular, sandstone. MADE GROUND.		
		0.90	ES			0.75	1.75				Firm to stiff, grey, slightly sandy CLAY. Sand is fine to medium. POSSIBLE MADE GROUND.		
		1.00	D			0.85	1.65				Firm, dark grey, slightly sandy, silty CLAY. Sand is fine. POSSIBLE MADE GROUND.		
		1.00 - 1.45	SPTLS	N=19 (3,5/5,4,5,5)					Soft to firm, grey frequently stained black, slightly gravelly clay. Gravel is fine to medium, subangular. Strong hydrocarbon odour. PEAT.	2			
		1.00	S						- faint hydrocarbon odour, grading stiff, grey mottled orange-brown, wet				
		1.90	D						2.00		0.50		Stiff, orange-brown, slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular, quartzite. ABBEY SAND AND GRAVEL. Wet.
		2.00 - 2.45	SPTLS						2.40		D		- grading medium dense, orange-brown, slightly clayey, gravelly SAND.
		2.40	S	N=21 (2,3/4,4,5,8)					Stiff, grey, slightly gravelly CLAY. Gravel is fine to medium, subangular, chalk and rare flint. GLACIAL TILL.	3			
		2.90	D						2.60		-0.10		Stiff, grey, CLAY. OXFORD CLAY
3.00 - 3.45	SPTLS	3.00	-0.50								Stiff, grey, CLAY. OXFORD CLAY		
3.00	S	3.45	-0.95								End of Borehole at 3.45m		
									4				

Crew: RGI		Logger: LB		Weather: Rain	
Equipment: Tracked Window Sampling Rig					
Reason for termination of borehole: Target depth reached					
Groundwater Remarks: 1.5m					
General Remarks:					
Hole Started: 05/12/2018		Hole Complete: 05/12/2018		Version: FINAL	
				Scale: 1:25	

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS07 Sheet 1 of 1		
Site Name: Crease Drive, Crowland							Ground Level (mAOD) 2.50		
Client: Partner Construction Ltd					GRM Project Ref: P8723			Coordinates 523690 E 309682 N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	Result						
		0.30	ES			0.04	2.46		ASPHALT/TARMAC Approximately medium dense, light brown, gravelly SAND. Sand is fine to medium. Gravel is fine to medium, subangular, quartzite. MADE GROUND. - sandstone cobble band (50mm)	1
		0.70	D			0.60	1.90		Firm, dark grey, slightly sandy, slightly gravelly CLAY. Sand is fine to medium. Gravel is fine, subangular and quartzite. with rare wood fragments. PEAT.	
		0.70	ES							
		0.90	D							
		0.90	ES							
		1.00 - 1.45	SPTLS	N=15 (2,2/3,3,4,5)		1.00	1.50	Medium dense, brown, slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, subangular, quartzite. Wet. ABBEY SAND AND GRAVEL.		
		1.45	S							
		1.00	S							
		1.40	D							
		1.80	D			1.70	0.80	Medium dense, brown to orange-brown, slightly clayey sandy gravel. Sand is fine to coarse. Gravel is fine to medium, subangular, quartzite. Wet. ABBEY SAND AND GRAVEL. - grading dense to very dense	2	
2.00 - 2.45	SPTLS	N=51 (1,5/51 for 275mm)								
2.00	S									
					2.43	0.07		End of Borehole at 2.43m	3	
									4	

Crew: RGI		Logger: LB		Weather: Rain	
Equipment: Tracked Window Sampling Rig					
Reason for termination of borehole: Refusal					
Groundwater Remarks: 0.35m					
General Remarks:					
Hole Started: 05/12/2018		Hole Complete: 05/12/2018		Version: FINAL	
				Scale: 1:25	



A P P E N D I X F

**GRM Development Solutions provides
multi-disciplinary consultancy services, UK-wide:**

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- Structural Engineering Services
- Construction Management
- Site Services

Tel: 01283 551249

info@grm-uk.com

Fax: 01283 211968

www.grm-uk.com



DO NOT SCALE

NOTES:

— Approximate Site Boundary

⊕ Window Sample Location with monitoring well

GRM
Development Solutions
geoenvironmental - civil - structural

GRM Development Solutions Ltd
Laurus House, First Ave, Centrum 100,
Burton-on-Trent, Staffordshire
Tel: 01283 551 249 Fax: 01283 211 968
mail@grm-uk.com www.grm-uk.com

CLIENT:

Partner Construction Ltd

PROJECT:

Crease Drove, Crowland

TITLE:

Gas and Groundwater Monitoring Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN by :	DATE:
LB	January, 2019
PROJECT No:	DRAWING No:
P8723	4



A P P E N D I X G

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In-Situ Gas Monitoring Results

Project Name: Crease Drove Crowland Peterborough
 Project Number: P8723
 Client: Partner Construction
 Date: 20/12/2018
 Weather: Raining
 Atmospheric Pressure (mb): 1001
 Pressure Trend: TBA
 Equipment: Gas Data GFM430
 Operator: Tom Robson

Ground Gases													
				Methane %v/v		CO2 %v/v		Oxygen %v/v		Gas Flow l/h		PID Reading ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	0.50	3.00	NS	0.00	0.00	2.10	2.10	18.20	18.20	0.00	0.00	Not Recorded	
WS02	0.60	1.60	NS	0.00	0.00	3.90	3.90	15.60	15.60	0.00	0.00	Not Recorded	
WS03	1.00	3.00	NS	0.00	0.00	0.90	0.90	19.40	19.40	0.00	0.00	Not Recorded	
WS04	0.50	1.50	NS	0.00	0.00	0.30	0.30	19.80	19.80	0.00	0.00	Not Recorded	
WS06	1.00	2.00	NS	0.00	0.00	0.30	0.30	19.70	19.70	0.00	0.00	Not Recorded	

Ground Waters	
Depth to Groundwater mbegl	Total Well Depth mbegl
1.09	2.94
0.75	1.65
0.50	3.20
0.39	1.43
0.93	2.09

Comments

All holes bailed

Notes

L.E.L. Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
 N.D. Not Detected
 N.R. Not Recorded
 PID Photo-Ionising Detector
 % By volume

Highlighted cell for following conditions:
 a Methane =>1% v/v
 b Carbon Dioxide =>5% v/v
 MG Made Ground
 NS Natural Strata

Ground Material Key

NS Natural Strata



In-Situ Gas Monitoring Results

Project Name:	Crease Drove Crowland Peterborough
Project Number:	P8723
Client:	Partner Construction
Date:	02/01/2019
Weather:	Cloudy
Atmospheric Pressure (mb):	1044
Pressure Trend:	TBA
Equipment:	Gas Data GFM430
Operator:	Tom Robson

Ground Gases													
				Methane %v/v		CO2 %v/v		Oxygen %v/v		Gas Flow l/h		PID Reading ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	0.50	3.00	NS	0.00	0.00	2.30	2.30	17.50	17.50	0.00	0.00	Not Recorded	
WS02	0.60	1.60	NS	0.00	0.00	5.80	5.80	15.00	15.00	0.00	0.00	Not Recorded	
WS03	1.00	3.00	NS	0.00	0.00	1.40	1.40	18.90	18.90	0.00	0.00	Not Recorded	
WS04	0.50	1.50	NS	0.00	0.00	0.30	0.30	19.40	19.40	0.00	0.00	Not Recorded	
WS06	1.00	2.00	NS	0.00	0.00	0.60	0.60	19.60	19.60	0.00	0.00	Not Recorded	

Ground Waters	
Depth to Groundwater mbegl	Total Well Depth mbegl
1.03	2.91
0.85	1.63
0.58	3.15
0.00	1.41
0.95	1.92

Comments

All holes bailed

Notes

L.E.L. Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
 N.D. Not Detected
 N.R. Not Recorded
 PID Photo-Ionising Detector
 % By volume

Highlighted cell for following conditions:
 a Methane =>1% v/v
 b Carbon Dioxide =>5% v/v
 MG Made Ground
 NS Natural Strata

Ground Material Key

NS Natural Strata



In-Situ Gas Monitoring Results

Project Name:	Crease Drove Crowland Peterborough
Project Number:	P8723
Client:	Partner Construction
Date:	17/01/2019
Weather:	Ice
Atmospheric Pressure (mb):	1003
Pressure Trend:	TBA
Equipment:	Gas Data LMSXi, Ion Science Tiger Pro Photo-ionising detector (PID)
Operator:	Tom Robson

Ground Gases													
				Methane %v/v		CO2 %v/v		Oxygen %v/v		Gas Flow l/h		PID Reading ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	0.50	3.00	NS	0.00	0.00	0.70	0.70	19.40	19.40	0.00	0.00	0.60	0.60
WS02	0.60	1.60	NS	0.00	0.00	6.90	6.90	15.50	15.50	0.00	0.00	0.20	0.20
WS03	1.00	3.00	NS	0.00	0.00	1.30	1.30	19.20	19.20	0.00	0.00	0.00	0.00
WS04	0.50	1.50	NS	0.00	0.00	0.00	0.00	20.00	20.00	0.00	0.00	0.00	0.00
WS06	1.00	2.00	NS	0.00	0.00	0.00	0.00	19.80	19.80	0.00	0.00	0.30	0.30

Ground Waters	
Depth to Groundwater mbegl	Total Well Depth mbegl
1.10	2.90
0.89	1.63
0.68	3.20
0.30	1.43
1.10	1.90

Comments: None

Notes

L.E.L. Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)
 N.D. Not Detected
 N.R. Not Recorded
 PID Photo-Ionising Detector
 % By volume

Highlighted cell for following conditions:
 a Methane =>1% v/v
 b Carbon Dioxide =>5% v/v
 MG Made Ground
 NS Natural Strata

Ground Material Key

NS Natural Strata



In-Situ Gas Monitoring Results

Project Name: Crease Drove Crowland Peterborough
Project Number: P8723
Client: Partner Construction

Pressure Range:	900mb-1044mb
Reading Below 1000mb:	1

Summary of Results for period: 20/12/2018 to 17/01/2019

Ground Gases													
ID	Top	Base	Strata	Methane (%v/v)		CO2 (%v/v)		Oxygen (%v/v)		Gas Flow (l/h)		PID Reading (ppm)	
				Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
WS01 (4)	0.50	3.00	NS	0.00	0.00	0.70	2.30	17.50	19.40	0.00	0.00	0.60	0.60
WS02 (4)	0.60	1.60	NS	0.00	0.00	3.90	6.90	15.00	15.60	0.00	0.00	0.20	0.20
WS03 (4)	1.00	3.00	NS	0.00	0.00	0.90	1.40	18.90	19.40	0.00	0.00	0.00	0.00
WS04 (4)	0.50	1.50	NS	0.00	0.00	0.00	0.30	19.40	20.00	0.00	0.00	0.00	0.00
WS06 (4)	1.00	2.00	NS	0.00	0.00	0.00	0.60	19.60	19.80	0.00	0.00	0.30	0.30

Groundwater	
Depth to Groundwater (mbegl)	
Min	Max
1.03	1.10
0.75	0.89
0.50	0.68
0.00	0.39
0.93	1.10

BS8485:2015 Suggested Worse Case Site Classification:

Site Summary:

	GSV (l/h)	Max Values
Methane	0.0001	0.1
CO2	0.0069	6.9
Default Flow (l/h)	0.1	

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.= 5% Flammable Gas)	Highlighted cell for following conditions:
N.D.	Not Detected	a Methane =>1% v/v
N.R.	Not Recorded	b Carbon Dioxide =>5% v/v
PID	Photo-Ionising Detector	GSV Gas Screening Value:
%	By volume	Peak state values used for Methane
NS	Natural Strata	Steady state values used for Carbon Dioxide and Gas Flow



A P P E N D I X H

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GRM Development Solutions

Laurus House
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Centrum 100
Burton Upon Trent
DE14 2WH

Analytical Test Report: L18/2871/GRM/001 - Amendment A

Your Project Reference:	Crease Drove, Crowland	Samples Received on:	10/12/2018
Your Order Number:	P8723	Testing Instruction Received:	10/12/2018
Report Issue Number:	2	Sample Tested:	10/12/2018 to 07/01/2019
Samples Analysed:	15 Samples	Report issued:	07/01/2019

Signed

James Gane
Commercial Manager
Nicholls Colton Group

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report with the exception of the asbestos test portion which is held for 6 months unless otherwise requested.

Moisture Content was determined in accordance with NC method statement MS - CL - Sample Prep, oven dried at <30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with NC method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

With the exception of Sulphate and Sulphur which are crushed over the 2mm test sieve, concentrations are reported as a percentage mass of the dry soil passing the 10mm BS test sieve. As received samples have been corrected for moisture content but not stone content.

Samples were supplied by customer, results are representative of the material provided

Asbestos

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Deviating Samples

Samples were received in suitable containers	Yes
A date and time of sampling was provided	Yes
Sample holding times were exceeded prior to analysis of determinants	No

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue 24.01.2017

Owned by Emily Blissett - Customer Services Supervisor

Authorised by James Gane - Commercial Manager

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L18/2871/GRM/001 - Amendment A

Project Reference - Crease Drove, Crowland

Analytical Test Results - GRM Soil Suite

NC Reference			23177	23178	23179	23180	23181	23182	23183
Client Sample Reference			WS01	WS01	WS01	WS02	WS02	WS03	WS03
Client Sample Location			WS01	WS01	WS01	WS02	WS02	WS03	WS03
Depth - Top (m)			0.05	0.80	1.80	0.20	0.80	0.20	0.70
Depth - Bottom (m)			0.20	1.00	1.80	0.20	0.80	0.20	0.70
Date of Sampling			05/12/2018	05/12/2018	05/12/2018	05/12/2018	05/12/2018	05/12/2018	05/12/2018
Time of Sampling			Not Provided	Not Provided	Not Provided	Not Provided	Not Provided	Not Provided	Not Provided
Sample Matrix			Clay	Clay	Clay	Clay	Clay	Clay	Clay
Determinant	Units	Accreditation							
Arsenic	(mg/kg)	MCERTS	15	-	-	21	-	25	-
Cadmium	(mg/kg)	MCERTS	0.8	-	-	0.9	-	1.0	-
Chromium (Total)	(mg/kg)	UKAS	34	-	-	43	-	52	-
Copper	(mg/kg)	MCERTS	33	-	-	26	-	31	-
Lead	(mg/kg)	MCERTS	40	-	-	58	-	72	-
Mercury	(mg/kg)	UKAS	< 2.5	-	-	< 2.5	-	< 2.5	-
Nickel	(mg/kg)	MCERTS	41	-	-	30	-	31	-
Selenium	(mg/kg)	u	< 8.0	-	-	< 8.0	-	< 8.0	-
Zinc	(mg/kg)	MCERTS	120	-	-	100	-	90	-
Total Phenols	(mg/kg)	MCERTS	< 1.0	-	-	< 1.0	-	< 1.0	-
Cyanide (Total)	(mg/kg)	MCERTS	< 1.0	-	-	< 1.0	-	< 1.0	-
Chromium (Hexavalent)	(mg/kg)	u	< 1.0	-	-	< 1.0	-	< 1.0	-
pH	pH Units	MCERTS	6.7	5.9	-	6.7	6.8	6.0	5.3
SOM	(%)	UKAS	7.0	-	0.5	9.2	-	14	-
Sulphate	(mg/l)	u	290	450	-	< 10	77	240	390
Acenaphthene	(mg/kg)	MCERTS	< 0.02	-	-	< 0.02	-	< 0.02	-
Acenaphthylene	(mg/kg)	UKAS	< 0.02	-	-	< 0.02	-	< 0.02	-
Anthracene	(mg/kg)	UKAS	< 0.02	-	-	< 0.02	-	< 0.02	-
Benzo (a) anthracene	(mg/kg)	MCERTS	0.04	-	-	0.04	-	0.09	-
Benzo (a) pyrene	(mg/kg)	MCERTS	0.04	-	-	0.04	-	0.08	-
Benzo (b) fluoranthene	(mg/kg)	MCERTS	0.07	-	-	0.07	-	0.14	-
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	0.04	-	-	0.04	-	0.06	-
Benzo (k) fluoranthene	(mg/kg)	MCERTS	< 0.02	-	-	< 0.02	-	0.05	-
Chrysene	(mg/kg)	MCERTS	0.05	-	-	0.06	-	0.11	-
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	< 0.02	-	-	< 0.02	-	< 0.02	-
Fluoranthene	(mg/kg)	MCERTS	0.07	-	-	0.09	-	0.21	-
Fluorene	(mg/kg)	MCERTS	< 0.02	-	-	< 0.02	-	< 0.02	-
Indeno (1, 2, 3-cd) pyrene	(mg/kg)	MCERTS	0.03	-	-	0.03	-	0.06	-
Naphthalene	(mg/kg)	MCERTS	< 0.02	-	-	< 0.02	-	< 0.02	-
Phenanthrene	(mg/kg)	MCERTS	0.04	-	-	0.03	-	0.09	-
Pyrene	(mg/kg)	MCERTS	0.07	-	-	0.07	-	0.18	-
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	0.64	-	-	0.67	-	1.2	-
Asbestos	-	UKAS	-	-	-	-	-	-	-
Pesticide Screen	(mg/kg)	u	Undetected <1mg/kg	-	-	-	-	-	-
1377 Organic matter	(%)	UKAS	-	-	-	-	-	-	-

L18/2871/GRM/001 - Amendment A

Project Reference - Crease Drove, Crowland

Analytical Test Results - GRM Soil Suite

NC Reference			23185	23186	23187	23188	23189	23190	23191
Client Sample Reference			WS04	WS04	HD05	WS06	WS06	WS06	WS07
Client Sample Location			WS04	WS04	HD05	WS06	WS06	WS06	WS07
Depth - Top (m)			0.20	1.40	0.05	0.40	0.90	1.00	0.30
Depth - Bottom (m)			0.20	1.40	0.10	0.40	0.90	1.00	0.30
Date of Sampling			05/12/2018	05/12/2018	05/12/2018	05/12/2018	05/12/2018	05/12/2018	05/12/2018
Time of Sampling			Not Provided	Not Provided	Not Provided	Not Provided	Not Provided	Not Provided	Not Provided
Sample Matrix			Sand	Clay	Sand	Sand	Clay	Clay	Sand
Determinant	Units	Accreditation							
Arsenic	(mg/kg)	MCERTS	-	-	16	< 10	-	-	29
Cadmium	(mg/kg)	MCERTS	-	-	0.8	< 0.2	-	-	1.0
Chromium (Total)	(mg/kg)	UKAS	-	-	31	2.7	-	-	28
Copper	(mg/kg)	MCERTS	-	-	18	8.0	-	-	12
Lead	(mg/kg)	MCERTS	-	-	28	6.5	-	-	11
Mercury	(mg/kg)	UKAS	-	-	< 2.5	< 2.5	-	-	< 2.5
Nickel	(mg/kg)	MCERTS	-	-	21	5.1	-	-	22
Selenium	(mg/kg)	u	-	-	< 8.0	< 8.0	-	-	< 8.0
Zinc	(mg/kg)	MCERTS	-	-	380	28	-	-	70
Total Phenols	(mg/kg)	MCERTS	-	-	< 1.0	< 1.0	-	-	< 1.0
Cyanide (Total)	(mg/kg)	MCERTS	-	-	< 1.0	< 1.0	-	-	< 1.0
Chromium (Hexavalent)	(mg/kg)	u	-	-	< 1.0	< 1.0	-	-	< 1.0
pH	pH Units	MCERTS	-	8.1	7.7	8.4	-	7.3	12.2
SOM	(%)	UKAS	-	-	3.1	< 1.7	-	-	< 1.7
Sulphate	(mg/l)	u	-	200	1500	120	-	95	230
Acenaphthene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Acenaphthylene	(mg/kg)	UKAS	-	-	< 0.02	< 0.02	-	-	< 0.20
Anthracene	(mg/kg)	UKAS	-	-	< 0.02	< 0.02	-	-	< 0.20
Benzo (a) anthracene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Benzo (a) pyrene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Benzo (b) fluoranthene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Benzo (k) fluoranthene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Chrysene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Fluoranthene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Fluorene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Naphthalene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Phenanthrene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Pyrene	(mg/kg)	MCERTS	-	-	< 0.02	< 0.02	-	-	< 0.20
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	-	-	< 0.32	< 0.32	-	-	< 3.20
Asbestos	-	UKAS	No asbestos detected	-	No asbestos detected	No asbestos detected	-	-	No asbestos detected
Pesticide Screen	(mg/kg)	u	-	-	-	Undetected <1mg/kg	-	-	-
1377 Organic matter	(%)	UKAS	-	-	-	-	1.8	-	-

L18/2871/GRM/001 - Amendment A

Project Reference - Crease Drove, Crowland

Analytical Test Results - BRE Suite

NC Reference		23184	
Client Sample Reference		WS03	
Client Sample Location		WS03	
Depth - Top (m)		3.90	
Depth - Bottom (m)		3.90	
Date of Sampling		05/12/2018	
Time of Sampling		Not Provided	
Sample Matrix		Clay	
Determinant	Units	Accreditation	
Water soluble sulphate	(mg/l)	u	450
Acid Soluble Sulphate	(%)	u	0.18
Total Sulphur	(%)	u	0.54
pH Value	pH Units	MCERTS	8.7

L18/2871/GRM/001 - Amendment A

Project Reference - Crease Drove, Crowland

Analytical Test Results - TPH CWG

NC Reference		23189	
Client Sample Reference		WS06	
Client Sample Location		WS06	
Depth - Top (m)		0.90	
Depth - Bottom (m)		0.90	
Date of Sampling		05/12/2018	
Time of Sampling		Not Provided	
Sample Matrix		Clay	
Determinant	Units	Accreditation	
Aliphatics			
>C ₅ to C ₆	(mg/kg)	u	< 0.03
>C ₆ to C ₈	(mg/kg)	u	< 0.03
>C ₈ to C ₁₀	(mg/kg)	u	1.2
>C ₁₀ to C ₁₂	(mg/kg)	u	81
>C ₁₂ to C ₁₆	(mg/kg)	u	700
>C ₁₆ to C ₂₁	(mg/kg)	u	790
>C ₂₁ to C ₃₅	(mg/kg)	u	180
Aromatics			
>C ₅ to C ₇	(mg/kg)	u	< 0.03
>C ₇ to C ₈	(mg/kg)	u	< 0.03
>C ₈ to C ₁₀	(mg/kg)	u	< 0.03
>C ₁₀ to C ₁₂	(mg/kg)	u	22
>C ₁₂ to C ₁₆	(mg/kg)	u	350
>C ₁₆ to C ₂₁	(mg/kg)	u	490
>C ₂₁ to C ₃₅	(mg/kg)	u	140
Total			
>C ₅ to C ₃₅	(mg/kg)	u	2800

L18/2871/GRM/001 - Amendment A

Project Reference - Crease Drove, Crowland

Sample Descriptions

NC Reference	Client Sample Reference	Sample Location	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
23177	WS01	WS01	Dark brown slightly sandy slightly gravelly silty clay	39	2.1	-
23178	WS01	WS01	Orangish brown slightly sandy slightly gravelly silty clay	-	-	81
23179	WS01	WS01	Grey slightly sandy silty clay	26	1.1	-
23180	WS02	WS02	Dark brown slightly sandy silty clay	37	2.1	-
23181	WS02	WS02	Brown sandy silty clay	-	-	75
23182	WS03	WS03	Dark brown slightly sandy silty clay with rare rootlets	44	2.8	-
23183	WS03	WS03	Orangish brown slightly sandy silty clay	-	-	92
23184	WS03	WS03	Grey slightly sandy silty clay	-	-	100
23186	WS04	WS04	Orangish brown slightly sandy slightly gravelly silty clay	-	-	65
23187	HD05	HD05	Orangish brown gravelly sand	21	16	-
23188	WS06	WS06	Orangish brown gravelly sand	13	35	-
23189	WS06	WS06	Grey slightly sandy silty clay	22	1.2	-
23190	WS06	WS06	Orangish brown slightly sandy slightly gravelly silty clay	-	-	100
23191	WS07	WS07	Orangish brown gravelly sand	14	34	-

L18/2871/GRM/001 - Amendment A

Project Reference - Crease Drove, Crowland

Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Soil	Metals	Air Dried	In house method statement - MS - CL - ICP metals
Soil	PAH	As Received	In house method statement - MS - CL - PAH (As received)
Soil	Phenols	As Received	In house method statement - MS - CL - Phenols by Skalar
Soil	Chromium (hexavalent)	As Received	In house method statement - MS - CL - Hexavalent Chromium by Skalar
Soil	Cyanide	As Received	In house method statement - MS - CL - Cyanide by Skalar
Soil	pH	As Received	In house method statement - MS - CL - pH in soils (using a 1:3 soil to water extraction)
Soil	SOM	Air Dried	In house method statement - MS - CL - TOC Eltra
Soil	Sulphate (w/s)	Oven Dried	In house method statement - MS - CL - Anions by Aquakem
Soil	Acid Sulphate	Oven Dried	In house method statement - MS - CL - BRE Analysis
Soil	Total Sulphur	Oven Dried	In house method statement - MS - CL - BRE Analysis
Soil	CWG	As Received	In house method statements - MS - CL - EPH in soil and MS - CL - VPH
Soil	Asbestos	-	Fibre identification is in accordance with in house documented methods which are based on the procedure documented in the HSE Document HSG 248 "Asbestos: The analysts guide for sampling, analysis and clearance procedures"
Soil	Pesticide Screen	As Received	In house method statement - MS - CL - Pesticides 1. Sample preparation was in accordance with BS 1377 : Part 1 : 2016 2. Testing was in accordance with BS 1377: Part 3: 1990 Clause 3. 3. The reported % organic content is the average organic matter content present in the soil fraction passing the 2mm test sieve to the nearest 0.1% of the original oven dry mass of soil. 4. Some information required by BS 1377 has not been reported. This information is available on request. 5. Sulphides and chlorides were not identified in the above sample.
Soil	1377 Organic Matter	Air Dried	

GRM Development Solutions

Laurus House
First Avenue
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Burton Upon Trent
DE14 2WH

Analytical Test Report: L19/0053/GRM/001

Your Project Reference:	Crease Drove, Crowland	Samples Received on:	08/01/2019
Your Order Number:	P8723	Testing Instruction Received:	08/01/2019
Report Issue Number:	1	Sample Tested:	08/01 to 16/01/2019
Samples Analysed:	1 water sample	Report issued:	17/01/2019

Signed



Peter Swanston

Environmental Laboratories Manager
Nicholls Colton Group

Notes:

General

Please refer to Methodologies tab for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Samples were supplied by customer, results are representative of the material provided

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue 24.01.2017

Owned by Emily Blissett - Customer Services Supervisor

Authorised by James Gane - Commercial Manager

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L19/0053/GRM/001

Project Reference - Crease Drove, Crowland

Analytical Test Results - Water

NC Reference		24268	
Client Sample Reference		WS06	
Client Sample Location		WS06	
Depth - Top (m)		1.00	
Depth - Bottom (m)		2.00	
Date of Sampling		05/12/2018	
Time of Sampling		Not Provided	
Sample Matrix		Water	
Determinant	Units	Accreditation	
pH	pH Units	u	6.3
Sulphate	(mg/l)	u	98
Benzene	(µg/l)	u	< 6.00
Toluene	(µg/l)	u	< 6.00
Ethylbenzene	(µg/l)	u	< 6.00
m&p Xylene	(µg/l)	u	< 12.00
o-Xylene	(µg/l)	u	< 6.00
MTBE	(µg/l)	u	< 6.00

L19/0053/GRM/001

Project Reference - Crease Drove, Crowland

Analytical Test Results - TPH CWG Water Samples

NC Reference				24268
Client Sample Reference				WS06
Client Sample Location				WS06
Depth - Top (m)				1.00
Depth - Bottom (m)				2.00
Date of Sampling				05/12/2018
Time of Sampling				Not Provided
Sample Matrix				Water
Determinant	Units	Accreditation		
Aliphatics				
>C ₅ to C ₆	(µg/l)	u	<	0.10
>C ₆ to C ₈	(µg/l)	u	<	0.10
>C ₈ to C ₁₀	(µg/l)	u	<	0.10
>C ₁₀ to C ₁₂	(µg/l)	u		105
>C ₁₂ to C ₁₆	(µg/l)	u		1380
>C ₁₆ to C ₂₁	(µg/l)	u		2800
>C ₂₁ to C ₃₅	(µg/l)	u		596
Aromatics				
>C ₅ to C ₇	(µg/l)	u	<	0.10
>C ₇ to C ₈	(µg/l)	u	<	0.10
>C ₈ to C ₁₀	(µg/l)	u	<	0.10
>C ₁₀ to C ₁₂	(µg/l)	u		44.1
>C ₁₂ to C ₁₆	(µg/l)	u		652
>C ₁₆ to C ₂₁	(µg/l)	u		1720
>C ₂₁ to C ₃₅	(µg/l)	u		428
Total				
>C ₅ to C ₃₅	(µg/l)	u		7700

L19/0053/GRM/001

Project Reference - Crease Drove, Crowland

Analysis Methodologies

Matrix	Determinant	Sample condition for analysis	Test Method used
Water	pH	As Received	BS 1377, Part 3, 1990
Water	Sulphate	As Received	In house method statement - MS - CL - Anions (Aquakem)
Water	CWG	As Received	In house method statement - MS - CL - VOC and MBTEX and TPH EPH Waters
Water	BTEX	As Received	In house method statement - MS - CL - VOC and MBTEX



A P P E N D I X I

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GRM Development Solutions

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DE14 2WH

Analytical Test Report: L18/2871/GRM/002

Your Project Reference:	Crease Drove, Crowland	Samples Received on:	10/12/2018
Your Order Number:	P8723	Testing Instruction Received:	10/12/2018
Report Issue Number:	1	Sample Tested:	11 to 14/12/2018
Samples Analysed:	5 Samples	Report issued:	20/12/2018

Signed

James Gane
Commercial Manager
Nicholls Colton Group

Notes:

Samples will be retained for 14 days after issue of this report unless otherwise requested.

The results included within the report are representative of the samples submitted for analysis.

A certificate of sampling was not supplied.

Samples were provided by client

1377 Plasticity Index

Testing was in accordance with BS1377:Part 2:1990

1377 Moisture Content

Moisture content testing was in accordance with BS1377 : Part 2 :1990

Accreditation Key

UKAS = UKAS Accreditation, u = Unaccredited

Date of Issue 24.01.2017

Owned by Emily Blissett - Customer Services Supervisor

Authorised by James Gane - Commercial Manager

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L18/2871/GRM/002

Project Reference - Crease Drove, Crowland

Analytical Test Results - Soil

NC Reference		18-26883	18-26884	18-26885	18-26886	18-26887
Client Sample Reference		WS01	WS01	WS03	WS04	WS06
Client Sample Location		WS01	WS01	WS03	WS04	WS06
Depth - Top (m)		0.8	1.80	2.95	1.40	1.00
Depth - Bottom (m)		0.1	1.80	2.95	1.40	1.00
Date of Sampling		05/12/2018	05/12/2018	05/12/2018	05/12/2018	05/12/2018
Sample type		Disturbed	Disturbed	Disturbed	Disturbed	Disturbed
Sample Description		Brown silty clay	Grey brown slightly gravelly silty clay	Grey silty clay	Brown gravelly silty clay	Green brown gravelly silty clay
Determinant	Units					
Moisture Content	(%)	47	29	23	21	30
Moisture Content Prep	-	3.2.3.1 (Fine)	3.2.3.1 (Fine)	3.2.3.1 (Fine)	3.2.3.2 (Medium)	3.2.3.2 (Medium)
Fines passing 425µm test sieve	(%)	100	99	100	83	92
Liquid Limit	(%)	76	44	45	44	45
Plastic Limit	(%)	39	20	18	19	20
Plasticity Index	(%)	37	24	27	25	25
PI preparation	-	From Natural	From Natural	From Natural	From Natural	From Natural



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	GRM TIER 1 ASSESSMENT CRITERIA		
LAND USE	Residential with Plant Uptake		
CONTAMINANT	1%	2.50%	6%
^e Arsenic	37	37	37
^e Cadmium	26	26	26
^b Chromium III	2590	2590	2590
^e Chromium VI	21	21	21
^e Lead	200	200	200
^c Mercury	170	170	170
^a Selenium	350	350	350
^a Nickel	130	130	130
^b Phenols	240	471	951
^b Copper	2300	2300	2300
^b Zinc	4590	4590	4590
^d Cyanide	34	34	34
^e Benzene	0.20	0.36	0.87
^b Toluene	118	267	609
^b Ethylbenzene	64	151	349
^b <i>o</i> - xylene	43	101	235
^b <i>m</i> - xylene	41	98	228
^b <i>p</i> - xylene	40	93	217
Non Genotoxic PAHs			
^b Acenaphthene	333	746	1450
^b Acenaphthylene	170	407	906
^b Anthracene	3770	7890	13700
^b Fluoranthene	391	690	981
^b Fluorene	166	939	849
^b Naphthalene	1.5	3.5	8.2
^b Phenanthrene	149	316	558
^b Pyrene	867	1560	2270
Genotoxic PAHs			
^{e/f} Benzo(a)pyrene	5	5	5
ALIPHATIC HYDROCARBONS			
^b C5-C6	28	51	105
^b C6-C8	68	152	347
^b C8-C10	18	43	102
^b C10-C12	87	215	509
^b C12-C16	709	1680	3400
^b C16-35	128000	128000	128000
AROMATIC HYDROCARBONS			
^b C5-7 (benzene)	64	128	271
^b C7-8 (toluene)	118	267	609
^b C8-C10	26	63	146
^b C10-C12	69	165	364
^b C12-C16	141	325	662
^b C16-C21	264	547	938
^b C21-C35	1120	1490	1720

Notes

- a SGV (2009)
- b LQM/CIEH values or derived using CLEAv1.06 with LQM/CIEH Data.
- c SGV for inorganic Hg used (ref.2009 SGV, Pg5, Para.4)
- d Atkins ATRISKsoil Value
- e C4SL - SP1010 (2014)
- f Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)

NB Where C4SLs/SGVs have not been produced, all TACs have been revised in line with report SP1010 (2014), however, the default consumption rates in the CLEAv1.06 model have been retained.

GRM.TAC.08.14

GRM Controlled Waters Tier 1 Assessment Criteria

Table 1a

UKDWS			EQS freshwater (µg/l)*	EQS other surface water (µg/l)* (Including saline waters)
Parameter	Concentration	Units		
Acrylamide	0.1	µg/l	-	
Aluminium	200	µgAl/l	-	
Ammonium	0.5	mgNH4/l	0.2 as N	0.021 unionised as N
Antimony	5	µgSb/l	-	
Arsenic	10	µgAs/l	50 (dissolved)	25 (dissolved)
Benzene	1	µg/l	10	8
Boron	1	mgB/l	750 [#]	-
Bromate	10	µgBrO3/l	-	-
Cadmium	5	µgCd/l	See Table 2b	0.2
Chromium	50	µgCr/l	-	-
Chromium (III)	-	µg/l	4.7	-
Chromium (VI)	-	µg/l	3.4	0.6
Chloride (i)	250	mgCl/l	188mg/l [#]	
Conductivity (i)	2500	µS/cm at 20°C	-	
Copper(ii)	2	mg/l	1	3.76 (where DOC <1mg/l)
Cyanide	50	µgCN/l	1	1
1, 2 dichloroethane	3	µg/l	10	
Dichloromethane	-	µg/l	20	20
Epichlorohydrin	0.1	µg/l	-	
Fluoride	1.5	mgF/l	1mg/l [#]	
Hydrogen ion	10	pH value	-	
Iron	200	µgFe/l	1000 (dissolved)	1000 (dissolved)
Lead (ii)	10	µgPb/l	1.2 (dissolved & bioavailable)	1.3
Manganese	50	µgMn/l	130 (bioavailable)	-
Mercury	1	µgHg/l	0.07 (dissolved)	0.07 (dissolved)
Mineral Oil (TPH)	10	µg/l	5000 (total) ****	5000 (total) ****
Nickel (ii)	20	µgNi/l	4 (dissolved & bioavailable)	8.6
Nitrate (iii)	50	mgNO3/l	-	-
Nitrite (iii)	0.5	mgNO2/l	-	-
Phenol	0.5	µg/l	7.7	7.7
Polycyclic Aromatic Hydrocarbons (vii) *	0.1	µg/l	-	-
Fluoranthene	-	µg/l	0.0063	0.0063
Naphthalene	-	µg/l	2	2
Benzo(a)pyrene	0.01	µg/l	0.00017	0.00017
Benzo(b)fluoranthene	-	µg/l	-	-
Benzo(k)fluoranthene	-	µg/l	-	-
Benzo(g,h,i)perylene	-	µg/l	-	-
Indeno(1,2,3-cd)pyrene	-	µg/l	-	-
Anthracene	-	µg/l	0.1	0.1
Selenium	10	µgSe/l	7.5	-
Sodium	200	mgNa/l	150mg/l [#]	-
Sulphate (i)	250	mgSO4/l	188mg/l [#]	-
Tetrachloroethene and Trichloroethene (viii)	10	µg/l	10	10
Tetrachloroethane	-	µg/l	140	-
Tetrachloromethane	3	µg/l	12	12
Toluene	700***	µg/l	74	74
Xylene	500***	µg/l	30 [†]	30 [†]
Ethylbenzene	300***	µg/l	20**	20**
1,1,1-Trichloroethane	-	µg/l	100 [†]	100 [†]
Trichlorobenzenes	-	µg/l	0.4	0.4
Trichloromethane	-	µg/l	2.5	2.5
Tributyltin	-	µg/l	0.0002	0.0002
Vinyl chloride	0.5	µg/l	-	-
Carbon Tetrachloride	-	µg/l	12	12
Zinc	5000	µg/l	10.9 (dissolved & bioavailable) + background concentration	6.8 (dissolved & bioavailable) + 1.1

Table 1b

Pesticides			EQS freshwater (µg/l)*	EQS other surface water (µg/l)* (Including saline waters)
Aldrin	0.03	µg/l	-	
Dieldrin	0.03	µg/l	-	-
Heptachlor	0.03	µg/l	-	-
Heptachlor epoxide	0.03	µg/l	-	-
other pesticides	0.1	µg/l	-	-
Cyclodiene pesticides: Sum of Aldrin, Dieldrin, Endrin & Isodrin	-	µg/l	0.01 (sum)	0.005
DDT total	-		0.025	0.025
Pesticides: Total (vi)	0.5	µg/l	-	-

Table 2

EQS for Hardness Related Substances*						
Substance	EQS Type	EQS (µg/l) for hardness classes (mg/l CaCO ₃)				
		Class 1: <40	Class 2: 40-50	Class 3: 50-100	Class 4: 100-200	Class 5: >200
Cadmium (dissolved)	Annual average	<0.08	0.08	0.09	0.15	0.25

Reference

* The Water Framework Directive (Standards and Classification) Directions (England and Wales) Directions 2015

** Provisional EQS Value

*** WHO Drinking Water Standard

**** EA PPG3

[†] The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2010 - Now Withdrawn

[#] Groundwater Drinking Water Protected Zones Only

Ambient Background Concentrations for dissolved zinc in freshwaters in England and Wales (to be used in conjunction with Table 1a)	
Catchment/Group of catchments ⁽ⁱⁱ⁾	ABC (µg/l)
Tyne	4.8
Tees	4.1
Ouse, Humber	2.9
Nene	4.0
Great Ouse	3.1
River Stour	3.0
Blackwater/Chelmer	3.6
Lee	3.3
Thames	2.0
Test	2.0
Avon/Hants	3.1
Exe	1.4
Dart	1.7
Clywd/Conwy	2.0
Dee	2.9
Eden	1.2
Anglesey	3.0
Tamar	2.9
Fal	5.8
Camel	7.1
Tone/Parrett	3.3
Frome, Bristol Avon	2.3
Wye	2.0
Usk	2.2
Taff	2.8
Neath	2.8
Loughar	3.9
Tywi	2.0
Teifi	2.5
Rheidol/Ystwyth	4.1
Dovey	3.2
Glaslyn	2.6
All other freshwaters not listed above	1.4



A P P E N D I X K

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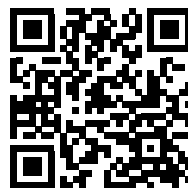
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Waste Classification Report



S2JSN-XNBVM-C6ZQJ

Job name

P8723 Crease Drove

Description/Comments

Assessment based on chemical analysis for human health risk assessment from ground investigation.

Project

P8723

Site

Crease Drove, Crowlands

Related Documents

#	Name	Description
None		

Waste Stream Template

GRM Standard Suite - incl TPH

Classified by

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Siobhan Jackson
Date:
21 Dec 2018 11:13 GMT
Telephone:
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Laurus House
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Report

Created by: Siobhan Jackson
Created date: 21 Dec 2018 11:13 GMT

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	WS01	0.05	Non Hazardous		3
2	WS01[1]	0.80	Non Hazardous		5
3	WS02	0.20	Non Hazardous		6
4	WS02[1]	0.80	Non Hazardous		8
5	WS03	0.20	Non Hazardous		9
6	WS03[1]	0.70	Non Hazardous		11
7	WS04	1.40	Non Hazardous		12
8	HD05	0.05	Non Hazardous		13
9	WS06	0.9	Hazardous	HP 3(i), HP 7, HP 11	15
10	WS06[1]	0.40	Non Hazardous		17
11	WS06[2]	1.00	Non Hazardous		19
12	WS07	0.30	Hazardous	HP 8	20

Appendices	Page
Appendix A: Classifier defined and non CLP determinands	22
Appendix B: Rationale for selection of metal species	23
Appendix C: Version	24

Classification of sample: WS01

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS01	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.05 m		
Moisture content:		
39%		
(dry weight correction)		

Hazard properties

None identified

Determinands

Moisture content: 39% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				15 mg/kg	1.32	14.248 mg/kg	0.00142 %	✓		
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium sulfide }			1	0.8 mg/kg	1.285	0.74 mg/kg	0.0000576 %	✓		
	048-010-00-4	215-147-8	1306-23-6								
3	chromium { chromium(III) oxide }				34 mg/kg	1.462	35.75 mg/kg	0.00358 %	✓		
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				33 mg/kg	1.126	26.73 mg/kg	0.00267 %	✓		
	029-002-00-X	215-270-7	1317-39-1								
5	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	40 mg/kg		28.777 mg/kg	0.00288 %	✓		
	082-001-00-6										
6	mercury { mercury dichloride }				<2.5 mg/kg	1.353	<3.384 mg/kg	<0.000338 %			<LOD
	080-010-00-X	231-299-8	7487-94-7								
7	nickel { nickel dihydroxide }				41 mg/kg	1.579	46.59 mg/kg	0.00466 %	✓		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8 mg/kg	2.554	<20.429 mg/kg	<0.00204 %			<LOD
	034-002-00-8										
9	zinc { zinc sulphate }				120 mg/kg	2.469	213.177 mg/kg	0.0213 %	✓		
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]								
10	phenol				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	604-001-00-2	203-632-7	108-95-2								
11	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %			<LOD
	006-007-00-5										
12	pH				6.7 pH		6.7 pH	6.7 pH			
			PH								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
13	acenaphthene	201-469-6	83-32-9		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
14	acenaphthylene	205-917-1	208-96-8		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
15	anthracene	204-371-1	120-12-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	0.04 mg/kg		0.0288 mg/kg	0.00000288 %	✓		
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	0.04 mg/kg		0.0288 mg/kg	0.00000288 %	✓		
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	0.07 mg/kg		0.0504 mg/kg	0.00000504 %	✓		
19	benzo[ghi]perylene	205-883-8	191-24-2		0.04 mg/kg		0.0288 mg/kg	0.00000288 %	✓		
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
21	chrysene	601-048-00-0	205-923-4	218-01-9	0.05 mg/kg		0.036 mg/kg	0.0000036 %	✓		
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
23	fluoranthene	205-912-4	206-44-0		0.07 mg/kg		0.0504 mg/kg	0.00000504 %	✓		
24	fluorene	201-695-5	86-73-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.03 mg/kg		0.0216 mg/kg	0.00000216 %	✓		
26	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
27	phenanthrene	201-581-5	85-01-8		0.04 mg/kg		0.0288 mg/kg	0.00000288 %	✓		
28	pyrene	204-927-3	129-00-0		0.07 mg/kg		0.0504 mg/kg	0.00000504 %	✓		
Total:									0.0393 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS01[1]

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS01[1]	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.80 m		

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				5.9 pH		5.9	pH	5.9 pH		
Total:										0%	

Key

- User supplied data
- Determinand defined or amended by HazWasteOnline (see Appendix A)

Classification of sample: WS02

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	WS02	LoW Code:	
Sample Depth:	0.20 m	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	37%	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
(dry weight correction)			

Hazard properties

None identified

Determinands

Moisture content: 37% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				21	mg/kg	1.32	20.239	mg/kg	0.00202 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium sulfide }			1	0.9	mg/kg	1.285	0.844	mg/kg	0.0000657 %	✓	
	048-010-00-4	215-147-8	1306-23-6									
3	chromium { chromium(III) oxide }				43	mg/kg	1.462	45.874	mg/kg	0.00459 %	✓	
		215-160-9	1308-38-9									
4	copper { dicopper oxide; copper (I) oxide }				26	mg/kg	1.126	21.367	mg/kg	0.00214 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
5	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	58	mg/kg		42.336	mg/kg	0.00423 %	✓	
	082-001-00-6											
6	mercury { mercury dichloride }				<2.5	mg/kg	1.353	<3.384	mg/kg	<0.000338 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
7	nickel { nickel dihydroxide }				30	mg/kg	1.579	34.588	mg/kg	0.00346 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8	mg/kg	2.554	<20.429	mg/kg	<0.00204 %		<LOD
	034-002-00-8											
9	zinc { zinc sulphate }				100	mg/kg	2.469	180.241	mg/kg	0.018 %	✓	
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
10	phenol				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	604-001-00-2	203-632-7	108-95-2									
11	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
	006-007-00-5											
12	pH				6.7	pH		6.7	pH	6.7 pH		
			PH									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
13	■ acenaphthene	201-469-6	83-32-9		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
14	■ acenaphthylene	205-917-1	208-96-8		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
15	■ anthracene	204-371-1	120-12-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	0.04 mg/kg		0.0292 mg/kg	0.00000292 %	✓		
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	0.04 mg/kg		0.0292 mg/kg	0.00000292 %	✓		
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	0.07 mg/kg		0.0511 mg/kg	0.00000511 %	✓		
19	benzo[ghi]perylene	205-883-8	191-24-2		0.04 mg/kg		0.0292 mg/kg	0.00000292 %	✓		
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
21	chrysene	601-048-00-0	205-923-4	218-01-9	0.06 mg/kg		0.0438 mg/kg	0.00000438 %	✓		
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
23	fluoranthene	205-912-4	206-44-0		0.09 mg/kg		0.0657 mg/kg	0.00000657 %	✓		
24	fluorene	201-695-5	86-73-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.03 mg/kg		0.0219 mg/kg	0.00000219 %	✓		
26	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
27	phenanthrene	201-581-5	85-01-8		0.03 mg/kg		0.0219 mg/kg	0.00000219 %	✓		
28	pyrene	204-927-3	129-00-0		0.07 mg/kg		0.0511 mg/kg	0.00000511 %	✓		
Total:									0.0372 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
■	Determinand defined or amended by HazWasteOnline (see Appendix A)
🧪	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS02[1]



Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS02[1]	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.80 m		

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	pH		PH		6.8 pH		6.8 pH	6.8 pH		
Total:								0%		

Key

	User supplied data
•	Determinand defined or amended by HazWasteOnline (see Appendix A)

Classification of sample: WS03

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS03	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.20 m		
Moisture content:		
44%		
(dry weight correction)		

Hazard properties

None identified

Determinands

Moisture content: 44% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				25	mg/kg	1.32	22.922	mg/kg	0.00229 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium sulfide }			1	1	mg/kg	1.285	0.893	mg/kg	0.0000694 %	✓	
	048-010-00-4	215-147-8	1306-23-6									
3	chromium { chromium(III) oxide }				52	mg/kg	1.462	52.778	mg/kg	0.00528 %	✓	
		215-160-9	1308-38-9									
4	copper { dicopper oxide; copper (I) oxide }				31	mg/kg	1.126	24.238	mg/kg	0.00242 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
5	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	72	mg/kg		50	mg/kg	0.005 %	✓	
	082-001-00-6											
6	mercury { mercury dichloride }				<2.5	mg/kg	1.353	<3.384	mg/kg	<0.000338 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
7	nickel { nickel dihydroxide }				31	mg/kg	1.579	34.003	mg/kg	0.0034 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8	mg/kg	2.554	<20.429	mg/kg	<0.00204 %		<LOD
	034-002-00-8											
9	zinc { zinc sulphate }				90	mg/kg	2.469	154.331	mg/kg	0.0154 %	✓	
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
10	phenol				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	604-001-00-2	203-632-7	108-95-2									
11	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD
	006-007-00-5											
12	pH				6	pH		6	pH	6pH		
			PH									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
13	acenaphthene	201-469-6	83-32-9		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
14	acenaphthylene	205-917-1	208-96-8		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
15	anthracene	204-371-1	120-12-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	0.09 mg/kg		0.0625 mg/kg	0.00000625 %	✓		
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	0.08 mg/kg		0.0556 mg/kg	0.00000556 %	✓		
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	0.14 mg/kg		0.0972 mg/kg	0.00000972 %	✓		
19	benzo[ghi]perylene	205-883-8	191-24-2		0.06 mg/kg		0.0417 mg/kg	0.00000417 %	✓		
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	0.05 mg/kg		0.0347 mg/kg	0.00000347 %	✓		
21	chrysene	601-048-00-0	205-923-4	218-01-9	0.11 mg/kg		0.0764 mg/kg	0.00000764 %	✓		
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
23	fluoranthene	205-912-4	206-44-0		0.21 mg/kg		0.146 mg/kg	0.0000146 %	✓		
24	fluorene	201-695-5	86-73-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		0.06 mg/kg		0.0417 mg/kg	0.00000417 %	✓		
26	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
27	phenanthrene	201-581-5	85-01-8		0.09 mg/kg		0.0625 mg/kg	0.00000625 %	✓		
28	pyrene	204-927-3	129-00-0		0.18 mg/kg		0.125 mg/kg	0.0000125 %	✓		
Total:									0.0367 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS03[1]

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS03[1]	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.70 m		

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				5.3 pH		5.3	pH	5.3 pH		
Total:									0%		

Key

- User supplied data
- Determinand defined or amended by HazWasteOnline (see Appendix A)

Classification of sample: WS04



Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS04	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
1.40 m		

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	• pH				8.1 pH		8.1 pH	8.1 pH		
			PH							
Total:								0%		

Key

	User supplied data
•	Determinand defined or amended by HazWasteOnline (see Appendix A)

Classification of sample: HD05

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
HD05	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.05 m		
Moisture content:		
21%		
(dry weight correction)		

Hazard properties

None identified

Determinands

Moisture content: 21% Dry Weight Moisture Correction applied (MC)

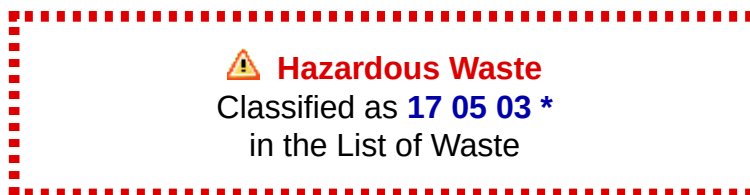
#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				16 mg/kg	1.32	17.459 mg/kg	0.00175 %	✓		
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium sulfide }			1	0.8 mg/kg	1.285	0.85 mg/kg	0.0000661 %	✓		
	048-010-00-4	215-147-8	1306-23-6								
3	chromium { chromium(III) oxide }				31 mg/kg	1.462	37.445 mg/kg	0.00374 %	✓		
		215-160-9	1308-38-9								
4	copper { dicopper oxide; copper (I) oxide }				18 mg/kg	1.126	16.749 mg/kg	0.00167 %	✓		
	029-002-00-X	215-270-7	1317-39-1								
5	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	28 mg/kg		23.14 mg/kg	0.00231 %	✓		
	082-001-00-6										
6	mercury { mercury dichloride }				<2.5 mg/kg	1.353	<3.384 mg/kg	<0.000338 %			<LOD
	080-010-00-X	231-299-8	7487-94-7								
7	nickel { nickel dihydroxide }				21 mg/kg	1.579	27.413 mg/kg	0.00274 %	✓		
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]								
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8 mg/kg	2.554	<20.429 mg/kg	<0.00204 %			<LOD
	034-002-00-8										
9	zinc { zinc sulphate }				380 mg/kg	2.469	775.482 mg/kg	0.0775 %	✓		
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]								
10	phenol				<1 mg/kg		<1 mg/kg	<0.0001 %			<LOD
	604-001-00-2	203-632-7	108-95-2								
11	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %			<LOD
	006-007-00-5										
12	pH				7.7 pH		7.7 pH	7.7 pH			
			PH								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
13	acenaphthene	201-469-6	83-32-9		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
14	acenaphthylene	205-917-1	208-96-8		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
15	anthracene	204-371-1	120-12-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
19	benzo[ghi]perylene	205-883-8	191-24-2		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
21	chrysene	601-048-00-0	205-923-4	218-01-9	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
23	fluoranthene	205-912-4	206-44-0		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
24	fluorene	201-695-5	86-73-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
26	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
27	phenanthrene	201-581-5	85-01-8		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
28	pyrene	204-927-3	129-00-0		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
Total:									0.0925 %		

Key

- User supplied data
- Determinand values ignored for classification, see column 'Conc. Not Used' for reason
- Determinand defined or amended by HazWasteOnline (see Appendix A)
- Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
- <LOD** Below limit of detection
- CLP: Note 1 Only the metal concentration has been used for classification

Classification of sample: WS06



Sample details

Sample Name:	LoW Code:
WS06	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.9 m	Entry:
Moisture content:	17 05 03 * (Soil and stones containing hazardous substances)
22%	
(dry weight correction)	

Hazard properties

HP 7: Carcinogenic "waste which induces cancer or increases its incidence"

Hazard Statements hit:

Carc. 1B; H350 "May cause cancer [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.23%)

HP 11: Mutagenic "waste which may cause a mutation, that is a permanent change in the amount or structure of the genetic material in a cell"

Hazard Statements hit:

Muta. 1B; H340 "May cause genetic defects [state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard]."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.23%)

Hazard properties (substances considered hazardous until shown otherwise)

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

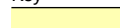
TPH (C6 to C40) petroleum group: (conc.: 0.23%)

Determinands

Moisture content: 22% Dry Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number							
1	●	TPH (C6 to C40) petroleum group				2800 mg/kg		2295.082 mg/kg	0.23 %	✓	
				TPH							
Total:									0.23 %		

Key

- | | |
|---|---|
|  | User supplied data |
|  | Hazardous result |
|  | Determinand defined or amended by HazWasteOnline (see Appendix A) |

Classification of sample: WS06[1]

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS06[1]	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
0.40 m		
Moisture content:		
13%		
(dry weight correction)		

Hazard properties

None identified

Determinands

Moisture content: 13% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
1	arsenic { arsenic trioxide }				<10 mg/kg	1.32	<13.203 mg/kg	<0.00132 %		<LOD
	033-003-00-0	215-481-4	1327-53-3							
2	cadmium { cadmium sulfide }			1	<0.2 mg/kg	1.285	<0.257 mg/kg	<0.00002 %		<LOD
	048-010-00-4	215-147-8	1306-23-6							
3	chromium { chromium(III) oxide }				2.7 mg/kg	1.462	3.492 mg/kg	0.000349 %	✓	
		215-160-9	1308-38-9							
4	copper { dicopper oxide; copper (I) oxide }				8 mg/kg	1.126	7.971 mg/kg	0.000797 %	✓	
	029-002-00-X	215-270-7	1317-39-1							
5	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	6.5 mg/kg		5.752 mg/kg	0.000575 %	✓	
	082-001-00-6									
6	mercury { mercury dichloride }				<2.5 mg/kg	1.353	<3.384 mg/kg	<0.000338 %		<LOD
	080-010-00-X	231-299-8	7487-94-7							
7	nickel { nickel dihydroxide }				5.1 mg/kg	1.579	7.129 mg/kg	0.000713 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]							
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8 mg/kg	2.554	<20.429 mg/kg	<0.00204 %		<LOD
	034-002-00-8									
9	zinc { zinc sulphate }				28 mg/kg	2.469	61.186 mg/kg	0.00612 %	✓	
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]							
10	phenol				<1 mg/kg		<1 mg/kg	<0.0001 %		<LOD
	604-001-00-2	203-632-7	108-95-2							
11	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }				<1 mg/kg	1.884	<1.884 mg/kg	<0.000188 %		<LOD
	006-007-00-5									
12	pH				8.4 pH		8.4 pH	8.4 pH		
			PH							

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
13	acenaphthene	201-469-6	83-32-9		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
14	acenaphthylene	205-917-1	208-96-8		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
15	anthracene	204-371-1	120-12-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
16	benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
17	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
18	benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
19	benzo[ghi]perylene	205-883-8	191-24-2		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
20	benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
21	chrysene	601-048-00-0	205-923-4	218-01-9	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
22	dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
23	fluoranthene	205-912-4	206-44-0		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
24	fluorene	201-695-5	86-73-7		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
26	naphthalene	601-052-00-2	202-049-5	91-20-3	<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
27	phenanthrene	201-581-5	85-01-8		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
28	pyrene	204-927-3	129-00-0		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %			<LOD
Total:									0.0126 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
●	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS06[2]

✔ **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:	
WS06[2]	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
1.00 m		

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	● pH				7.3 pH		7.3	pH	7.3 pH		
Total:										0%	

Key

- User supplied data
- Determinand defined or amended by HazWasteOnline (see Appendix A)

Classification of sample: WS07

 **Hazardous Waste**
Classified as **17 05 03 ***
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS07	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.30 m	Entry:
Moisture content:	17 05 03 * (Soil and stones containing hazardous substances)
14%	
(dry weight correction)	

Hazard properties

HP 8: Corrosive "waste which on application can cause skin corrosion"

pH; pH "Assumed to be irritant/corrosive because of pH value"

Because of determinand:

pH: (conc.: 12.2 pH)

Determinands

Moisture content: 14% Dry Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				29	mg/kg	1.32	33.587	mg/kg	0.00336 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium sulfide }			1	1	mg/kg	1.285	1.127	mg/kg	0.0000877 %	✓	
	048-010-00-4	215-147-8	1306-23-6									
3	chromium { chromium(III) oxide }				28	mg/kg	1.462	35.898	mg/kg	0.00359 %	✓	
		215-160-9	1308-38-9									
4	copper { dicopper oxide; copper (I) oxide }				12	mg/kg	1.126	11.851	mg/kg	0.00119 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
5	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	11	mg/kg		9.649	mg/kg	0.000965 %	✓	
	082-001-00-6											
6	mercury { mercury dichloride }				<2.5	mg/kg	1.353	<3.384	mg/kg	<0.000338 %		<LOD
	080-010-00-X	231-299-8	7487-94-7									
7	nickel { nickel dihydroxide }				22	mg/kg	1.579	30.482	mg/kg	0.00305 %	✓	
	028-008-00-X	235-008-5 [1] 234-348-1 [2]	12054-48-7 [1] 11113-74-9 [2]									
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				<8	mg/kg	2.554	<20.429	mg/kg	<0.00204 %		<LOD
	034-002-00-8											
9	zinc { zinc sulphate }				70	mg/kg	2.469	151.623	mg/kg	0.0152 %	✓	
	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]									
10	phenol				<1	mg/kg		<1	mg/kg	<0.0001 %		<LOD
	604-001-00-2	203-632-7	108-95-2									
11	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides,				<1	mg/kg	1.884	<1.884	mg/kg	<0.000188 %		<LOD

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
	ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }									
	006-007-00-5									
12	pH				12.2 pH		12.2 pH	12.2 pH		
			PH							
13	acenaphthene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		201-469-6	83-32-9							
14	acenaphthylene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		205-917-1	208-96-8							
15	anthracene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		204-371-1	120-12-7							
16	benzo[a]anthracene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	601-033-00-9	200-280-6	56-55-3							
17	benzo[a]pyrene; benzo[def]chrysene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	601-032-00-3	200-028-5	50-32-8							
18	benzo[b]fluoranthene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	601-034-00-4	205-911-9	205-99-2							
19	benzo[ghi]perylene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		205-883-8	191-24-2							
20	benzo[k]fluoranthene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	601-036-00-5	205-916-6	207-08-9							
21	chrysene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	601-048-00-0	205-923-4	218-01-9							
22	dibenz[a,h]anthracene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	601-041-00-2	200-181-8	53-70-3							
23	fluoranthene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		205-912-4	206-44-0							
24	fluorene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		201-695-5	86-73-7							
25	indeno[123-cd]pyrene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		205-893-2	193-39-5							
26	naphthalene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
	601-052-00-2	202-049-5	91-20-3							
27	phenanthrene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		201-581-5	85-01-8							
28	pyrene				<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
		204-927-3	129-00-0							
Total:								0.0304 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Hazardous result
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non CLP determinands

■ chromium(III) oxide (EC Number: 215-160-9, CAS Number: 1308-38-9)

Conversion factor: 1.462

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Repr. 1B H360FD , Skin Sens. 1 H317 , Resp. Sens. 1 H334 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302 , Acute Tox. 4 H332

■ lead compounds with the exception of those specified elsewhere in this Annex (worst case)

CLP index number: 082-001-00-6

Description/Comments: Worst Case: IARC considers lead compounds Group 1; Carcinogenic to humans; Lead REACH Consortium considers some lead compounds Carcinogenic category 1A

Data source: Regulation 1272/2008/EC - Classification, labelling and packaging of substances and mixtures. (CLP)

Additional Hazard Statement(s): Carc. 1A H350

Reason for additional Hazards Statement(s)/Risk Phrase(s):

03 Jun 2015 - Carc. 1A H350 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium www.reach-lead.eu/substanceinformation.html (worst case lead compounds). Review date 29/09/2015

■ salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex

CLP index number: 006-007-00-5

Description/Comments: Conversion factor based on a worst case compound: sodium cyanide

Data source: Commission Regulation (EC) No 790/2009 - 1st Adaptation to Technical Progress for Regulation (EC) No 1272/2008. (ATP1)

Additional Hazard Statement(s): EUH032 >= 0.2 %

Reason for additional Hazards Statement(s)/Risk Phrase(s):

14 Dec 2015 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

■ pH (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: None.

■ acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Aquatic Chronic 2 H411 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

■ acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 1 H310 , Acute Tox. 1 H330 , Acute Tox. 4 H302

■ anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

■ benzo[ghi]perylene (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 23 Jul 2015

Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

▪ **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Acute Tox. 4 H302

▪ **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

▪ **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2 H351

▪ **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 06 Aug 2015
Hazard Statements: Skin Irrit. 2 H315 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Carc. 2 H351 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302

▪ **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 21 Aug 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Skin Irrit. 2 H315

▪ **TPH (C6 to C40) petroleum group** (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Aquatic Chronic 2 H411 , Repr. 2 H361d , Carc. 1B H350 , Muta. 1B H340 , STOT RE 2 H373 , Asp. Tox. 1 H304 , Flam. Liq. 3 H226

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Worst case species based on risk phrases

cadmium {cadmium sulfide}

Worst case species based on risk phrases

chromium {chromium(III) oxide}

No hexavalent chromium present

copper {dicopper oxide; copper (I) oxide}

Most likely common species

lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}

No hexavalent chromium present

mercury {mercury dichloride}

Worst case species based on risk phrases

nickel {nickel dihydroxide}

Worst case species based on risk phrases

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Worst case species based on risk phrases

zinc {zinc sulphate}

No hexavalent chromium present

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Worst case species

Appendix C: Version

HazWasteOnline Classification Engine: **WM3 1st Edition v1.1, May 2018**

HazWasteOnline Classification Engine Version: 2018.348.3739.7650 (15 Dec 2018)

HazWasteOnline Database: 2018.348.3739.7650 (15 Dec 2018)

This classification utilises the following guidance and legislation:

WM3 v1.1 - Waste Classification - 1st Edition v1.1 - May 2018

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004

1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010

2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010



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- DO NOT SCALE
- NOTES:
- Approximate Development Area.
 - - - Potential extent of tree influence zone.
 - █ Approximate location of underground tanks.
 - - - Possible extent of Peat deposits over 1.5 m begl.
 - █ Approximate area for additional investigation.
- N.B. All positions approximate only

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CLIENT:

Partner Construction Ltd

PROJECT:

Crease Drove, Crowland

TITLE:

Phase II Hazard Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN by :	DATE:
LB	January, 2019
PROJECT No:	DRAWING No:
P8723	5



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Note:

This proposed foundation location plan is illustrative only and must not be used for construction design.

**ACCOMMODATION SCHEDULE**

DWELLING TYPE	GIFA	HEIGHT (STOREYS)	AMOUNT	%
1A 1B2P FLAT	45.00m ² / 53.20m ²	-	06	12
F133 2B4P HOUSE	72.54m ²	2	26	52
F113 3B5P HOUSE	84.30m ²	2	04	36
F131 3B5P HOUSE	83.66m ²	2	14	
TOTAL			50	100

DO NOT SCALE

NOTES:

- Approximate Site Boundary.
- Piled foundations anticipated.
- Deepened/tree impacted traditional foundations
- Traditional foundations to 1m depth.

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CLIENT:

Partner Construction Ltd

PROJECT:

Crease Drove, Crowland

TITLE:

Proposed Foundation Plan

SCALE@SIZE :

NTS

ISSUE:

FINAL

DESIGN/DRAWN by :

LB

DATE:

January, 2019

PROJECT No:

P8723

DRAWING No:

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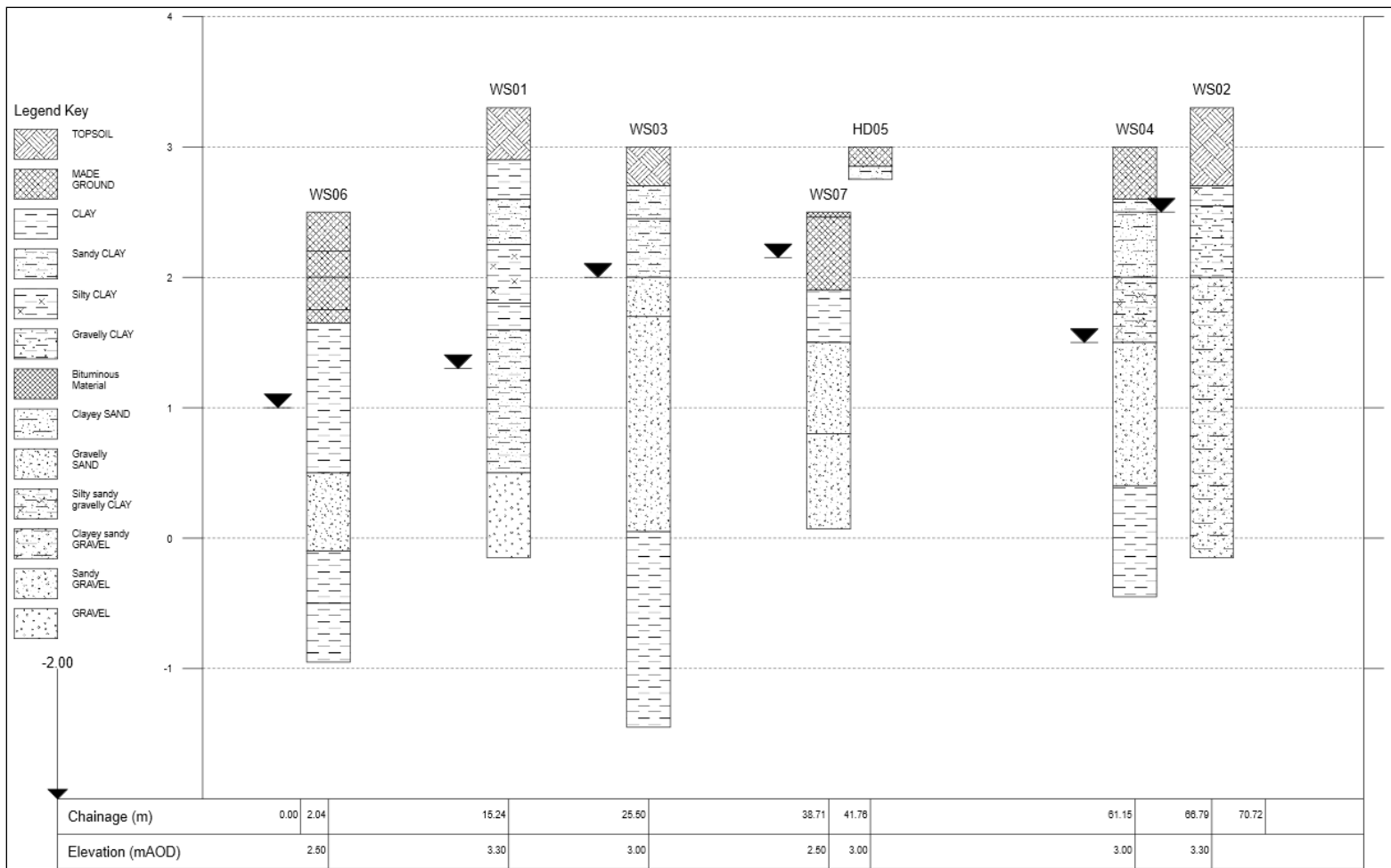
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DO NOT SCALE
NOTES:



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CLIENT:

Partner Construction Ltd

PROJECT:

Crease Drove, Crowland

TITLE:

Ground Water Section Model

SCALE@SIZE :

NTS

ISSUE:

FINAL

DESIGN/DRAWN by :

LB

DATE:

January, 2019

PROJECT No:

P8723

DRAWING No:

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