



Gleeson Land

**Land North of Whychurch
Farm**
*Geoenvironmental and Geotechnical
Interpretative Report*

Revision 3

August, 2021



Card Geotechnics Limited
Palatine House, Matford Court,
Sigford Road, Exeter, Devon, EX2 8NL
Telephone: 01392 439905
www.cgl-uk.com

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Author	Sam Oakley, Senior Engineer <i>BSc (Hons) FGS</i>		
Checked	Steve Morgan, Associate <i>MSc BSc (Hons) CGeol CMgr FGS MCMI RoGEP Specialist</i>		
Approved	Jo Strange, Technical Director <i>MEng CEng CEnv FICE FWES MEnvSc SiLC ICE Health and Safety Registered (Advanced)</i>		
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EXECUTIVE SUMMARY

Card Geotechnics Limited (CGL) has been commissioned by Gleeson Land to undertake Phase 2 ground investigation, at a site known as Land North of Whychurch Farm (nearest available postcode SN16 9JL). The preliminary development proposals indicate the site is to be developed to comprise low-rise residential properties with private gardens, associated infrastructure and areas of public open space.

A historical review undertaken as part of the desk study found that the site comprised open fields since the earliest available maps in 1885 and remains undeveloped today. Potential infilled areas were identified as part of this review, associated with the presence of historical ponds, noted between 1885 and 1979, where the features are no longer denoted on mapping and assumed to have been backfilled. A historical water tower and associated infrastructure was also noted in the south-east of the site until the early 1990's.

The ground conditions encountered were consistent with the published geology for the area, comprising Topsoil overlying the solid geologies of the Kellaways Sand Member and the Kellaways Clay Member to depth. Localised Made Ground was encountered in the north-west of the site, in an area where a potentially infilled pond was identified, and in the south-east, thought to be associated with the development of the water tower. During the ground investigation, groundwater strikes were not recorded to be present but, during the subsequent monitoring, water was recorded to be present. This is considered to be associated with the boreholes acting as a sump to surface water rather than groundwater.

Assessment of chemical testing results indicate all determinants, with the exception of benzo(a)pyrene in the Made Ground, to be below the applicable human health assessment criteria for a residential use with private gardens. In the locations of Made Ground it is recommended the soils are either capped or excavated and removed. Based on the chemical data gathered, the use of polyethylene water supply pipes in natural ground is considered appropriate at the site, but barrier pipe may be required if placed in Made Ground. Additionally, radon protection measures will not be required at the site as less than 1% of the properties are at risk.

A shallow foundation solution is feasible at the site within the near surface soils. The foundations should be taken through any Topsoil or Made Ground, if present, and formed at a minimum depth of 0.75m into the granular soils with an allowable bearing capacity of 120kN/m² and a minimum depth of 0.9m where cohesive soils are found with an allowable bearing capacity of 70kN/m² considered appropriate. A minimum embedment of 300mm should be achieved into these formations. The concrete should be

designed to a Design Sulfate class DS-2 AC-1s. Following the removal of the Topsoil, a CBR value of 10% should be adopted for the granular soils and a CBR of 2.5% for the cohesive soils.

1. INTRODUCTION

Card Geotechnics Limited (CGL) has been commissioned by Gleeson Land to undertake a geoenvironmental and geotechnical site investigation for the site known as Land North of Whychurch Farm, herein referred to as 'the site'. The objectives of the investigation are to provide details on the ground conditions and groundwater levels to support future development of the site.

This report includes;

-  a summary of the findings of the desk study completed for the site;
-  details of the ground conditions encountered across the site and analysis and interpretation of chemical laboratory testing undertaken on representative soil samples;
-  a source-pathway-receptor risk assessment based on the findings of the ground investigation and results of chemical testing and monitoring;
-  geoenvironmental recommendations with regards to soil contamination and material management; and
-  recommendations for foundations, floor slabs, excavations and pavement design.

The site has been subject to a previous Phase I desk study¹, and pertinent points have been included, however, reference should be made to the original Desk Study report for full details.

This report has been updated to Revision 3 to include the updated proposed development plan for the scheme. This report refers to the investigation of the wider site which lies outside the updated red line boundary which has been kept in for information purposes.

¹ CGL (2021). Land North of Whychurch Farm. Desk Study Report. CG/38164B.

2. SITE CONTEXT

2.1 Site Location

The site is located at Land North of Whychurch Farm, Malmesbury, Wiltshire, (nearest available postcode SN16 9JN), some 300m north-east of Malmesbury Cricket Club. The National Grid reference for the approximate centre of the site is 393700, 188230. A site location plan is included as Figure 1.

2.2 Site Description

The site is irregular in shape and covers an area of approximately 12.6 hectares. The site is bound by the B4014 highway to the north-east, agricultural fields to the east, farms to the south, and to the west by an existing residential development. Whychurch Farm and the A429 are present on the south-eastern boundary of the site, with Whitchurch Farm present on the south-western boundary.

A site walkover of the site was undertaken on 28th July 2020 by a CGL engineer. At the time of the walkover the site comprised three open fields, used for crops and the grazing of livestock. The site and field boundaries mainly consist of mature trees and hedgerows, as well as a drainage ditch located along the north-western boundary aligned north-east to south-west. Public footpaths are noted along the north-west, south, and south-east field boundaries. A large manure stockpile was observed in the western part of the site.

Two sets of overhead lines (OHLs) were also observed during the site walkover; the first transecting the western section of the site running north-west to south-east, and the second running north-east to south-west from the centre of the site, where the cable diverts underground. A water tower and associated infrastructure were also noted off-site adjacent to the south-eastern boundary. Within the field to the south, a stockpile of manure was noted located in the south-west area, assumed awaiting spreading.

The desk study¹ indicated ponds to have historically been present within the southern/western and northern parts of the site. During the walkover, these ponds were not observed. In addition, no evidence of raised/hummocked or otherwise disturbed ground was observed in the areas of the historical ponds.

A photo sheet displaying the general ground conditions of the site at the time of the site walkover is included as Figure 2.

2.3 Topography

The topography of the site is roughly level in the south at elevation at approximately 90m Ordnance Datum (OD) and 92mOD. The levels reduce to the north-west as the site slopes to a topographical low of 83mOD.

2.4 Proposed Development

The proposed development plans for the site indicate it is to be developed with some 71 low-rise residential properties with private gardens, associated infrastructure, and areas of public open space. A proposed development plan is included in Appendix A. The area covered by this Phase II Ground Investigation extends beyond the boundary of the proposed development plan.

A previous ground investigation of Land North of Whychurch Farm was completed by CGL in 2019². Due to access restrictions at the time of the investigation an area in the north-west was not investigated, however for completeness the findings of the investigation have been included in this report even though it falls outside the red line boundary in Appendix A. It is understood that this area is to form the access road leading from the B4014 in the north on to site.

2.5 Desk Study Summary

The historical, geological, hydrogeological, hydrological and environmental context associated with the site have been previously assessed as part of the desk study report completed by CGL in August 2020¹. The key findings are summarised below, however reference should be made to this report for further information.

2.5.1 Historical Development

From the earliest available maps in 1885, the site is shown to comprise undeveloped open fields and three ponds are located across the site; two in the southern part of the site and a single pond in the north. By 1979, these features are no longer denoted and are indicated to have been potentially backfilled. A Water Tower and associated infrastructure are shown in the south-eastern part of the site on the 1979 maps with the location moved off-site to the immediate north by 1992, where the tower currently remains.

The surrounding area comprised open fields associated with farm buildings and local isolated residential properties until 1993, when residential developments were constructed adjacent to and up to 50m from the south-west site boundary. These developments have continued to expand to the west of the site. To the north and east of the site, highways are shown to the north and east from the earliest available maps

² CGL (2019). Filands, Malmesbury. Geotechnical and Geoenvironmental Interpretative Report – Revision 1. Ref.: CG/38164A.

in 1885, later becoming the B4014 and the A429. The roundabout on the A429 to the south-east of the site is shown to have been constructed prior to 1979.

2.5.2 Published Geology

With reference to the British Geological Survey (BGS)³ website the site is directly underlain by two solid geologies:



Oxford Clay Formation – indicated to be present in the southern half of the site, described by the BGS as a *silicate-mudstone, grey, generally smooth to slightly silty, with sporadic beds of argillaceous limestone nodules*;



Kellaways Sand Member – member sits stratigraphically between the overlying Oxford Clay Formation and underling Kellaways Clay Member. Recorded to comprise a *silicate sandstone and silicate siltstone, pale grey, calcareous cemented, with interbeds of sandy and silty mudstone and*



Kellaways Clay Member – indicated to be present across the northern half of the site, described by the BGS to typically comprise *silicate mudstone, grey, commonly smooth in basal part, but more generally silty-silty or silty-sandy, locally with thin beds of siltstone and sandstone, and nodules of argillaceous limestones*.

According to the BGS memoir for the local area⁴, the Oxford Clay Formation in the area is typically less than 10m thick with the Kellaways Clay Member being up to 23m thick. The Kellaways Sand Member is often present between the Oxford Clay Formation and the Kellaways Clay Member; however, this stratum is not mapped on the site.

Proximal to the south-west of the site, the Forest Marble Formation consisting of silicate mudstone, and the Cornbrash Formation comprising fine to medium grained limestone are mapped by the BGS. A fault line is present running along the southern boundary of the site, aligned north-east to south-west, where these two geologies are noted to the south of the Oxford Clay Formation. Recent superficial deposits are not mapped to be present on site or the nearby area.

2.5.3 Unpublished Geology

With reference to the BGS website³, no freely available historical borehole records are located within 250m of the site. In 2019, CGL completed a site investigation and subsequent geoenvironmental and

³ British Geological Survey (BGS), www.bgs.ac.uk (Accessed July 2020).

⁴ BGS memoir: Bulletin of the Geological Survey of Great Britain. No. 54
<http://pubs.bgs.ac.uk/publications.html?pubID=B01649> (Accessed July 2020).

geotechnical report² within the field adjoining the north-western boundary. The investigation comprised five trial pits, three of which were subjected to soakaway testing, and six windowless sample boreholes. The ground conditions were consistent with the published geology for the area comprising Topsoil overlying the Kellaways Clay Member to a maximum depth of 5m bgl. Visual or olfactory evidence of contamination was not recorded during the investigation.

Results from the chemical laboratory analysis on representative samples from both the Topsoil and natural soils did not record contaminant exceedances when compared directly against the applicable assessment criteria.

2.5.4 Hydrology and Hydrogeology

The Oxford Clay Formation and the Kellaways Clay Member are designated by the EA as Unproductive Aquifers. The Cornbrash Formation and the Forest Marble Formation (situated off-site) are designated by the EA as Secondary A Aquifers.

The site is located within a groundwater Source Protection Zone (SPZ) within a Confined Aquifer, defined by the EA as '*where the aquifer is confined and may be impacted by deep drilling activities*'. The nearest active potable abstraction point is located some 1km to the east of the site. No surface water abstraction licenses were identified within 1km of the site. The confined aquifer is understood to relate to the Cornbrash Formation and Forest Limestone Formation which underly the solid geologies of the Oxford Clay Formation and the Kellaways Clay Member which are present on site.

The nearest surface watercourse to the site is an *inland river* located on the north-western boundary, this *inland river* forms part of the Avon Bristol catchment area. The River Avon, aligned west to east, is located some 400m to the south-west of the site.

2.6 Radon

With reference to the UK Radon Map⁵, the site is located within an area where less than 1% of homes are above the Radon Action Level.

2.7 Preliminary Conceptual Site Model

As part of the initial desk study report¹ a preliminary conceptual site model was compiled for the site with respect to the proposed development to identify the potential sources of contamination and the associated potential pollutant linkages.

⁵ UK Maps of Radon. <https://www.ukradon.org/information/ukmaps> (Accessed July 2020).

Preliminary risks to human health, construction workers and future site users from identified sources were assessed as 'low'. Preliminary risks to buildings and services, and plants and vegetation, were assessed as 'very low'.

3. FIELDWORK

A ground investigation was undertaken by CGL between the 26th and 28th August 2020, and comprised the following scope of works:

-  11 mechanically excavated trial pits to depths of between 0.4m and 3.4m (TP01 to TP11);
-  Four mechanically excavated trial pits subject to soakaway test trial pits to depths of between 1.1mbgl and 2.9mbgl (SA01 to SA04); and
-  Five windowless sampling boreholes (WS01 to WS05) to a maximum depth of 5m below ground level (bgl), together with the installation of combined ground gas and groundwater monitoring wells within WS01, WS04 and WS05. In-situ Standard Penetration Tests (SPTs) were undertaken within the boreholes to provide information on the relative strengths and densities of encountered soils.

During the return monitoring visits in October and November 2020, four hand dug inspection (HP01 to HP04) were excavated in the location of the three historical ponds in the north-east, centre and south of the site to a maximum depth of 0.95m bgl.

The rationale for the investigation was to gather information on the geological profile of the site, investigate hydrogeological conditions, undertake in-situ testing and soakaway testing, and collect samples for chemical and geotechnical laboratory testing. The exploratory hole locations were positioned to provide maximum site coverage, whilst also targeting areas of concern highlighted in the desk study including the historical ponds, located in the northern part and central to the southern field of the site, and the historical water tower.

With reference to the proposed development plan in Appendix A, borehole WS01 and hand pits HP01 to HP04 are located outside the red line site boundary, however for the completeness these have been included for information.

Prior to commencing ground penetrating works each exploratory hole location was cleared for buried services using a cable avoidance tool (CAT) and signal generator in accordance with HSG47. The investigation was generally undertaken in accordance with the requirements of BS5930:2015⁶ and BS10175:2017⁷.

⁶ British Standards Institution. (2020). Code of practice for ground investigations. BS5930:2020.

⁷ British Standards Institution (2017). BS10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice.

Exploratory hole locations are presented on Figure 3, a photo sheet depicting the general ground conditions as Figure 4, and exploratory hole records are provided as Appendix B.

3.1 Sampling

Soil samples were recovered for geotechnical and geoenvironmental testing and were logged by a suitably qualified geotechnical engineer from CGL. Groundwater samples were recovered for geoenvironmental testing during the monitoring visit.

Geoenvironmental soil samples comprised representative samples from the Made Ground and natural strata in line with the CGL internal Standard Operating Procedure (SOP), which includes using the appropriate amber glass jars for the collection of samples for hydrocarbon analysis and plastic tubs to collect samples for inorganics analysis. Samples were compacted/filled into the relevant containers to minimise headspace. Samples were stored in cool boxes with ice packs to dispatch to the laboratory and no nonconforming samples were reported by the laboratory.

Geotechnical samples were recovered consisting of bulk and disturbed samples, with in-situ Standard Penetration Tests (SPT's) undertaken within boreholes.

3.2 Installations

As part of the site investigation, three windowless sampler boreholes that were situated either within or in the vicinity of historical ponds were installed with combined ground gas and groundwater monitoring wells to allow for return gas and groundwater monitoring. The details of these installations and their response zones (corresponding strata and depth) are detailed in Table 2 below.

Table 1. Installation Details

Exploratory Hole ID	Response Zone Strata [Response Zone Depth Range (m bgl)]		
	Topsoil	Made Ground	Kellaways Clay Member
WS01	-	[0.5 to 1.0]	-
WS04	-	-	[1.0 to 5.0]
WS05	-	-	[1.0 to 5.0]

3.3 Monitoring

Following completion of the site works, six ground gas and water monitoring visits have been completed between October 2020 and March 2021, with full records presented in Appendix C.

3.4 Laboratory Testing

3.4.1 Chemical

A total of three samples of Made Ground, six samples of Topsoil and three samples of natural soil were scheduled for chemical testing at i2 Analytical Limited (a UKAS and MCERTS accredited laboratory). The

laboratory testing results are provided in Appendix D and the soil analysis included the following determinants:

-  Soil Organic Matter (SOM);
-  Heavy metals including arsenic, barium, beryllium, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium and zinc;
-  Benzene, toluene, ethylbenzene, xylenes (BTEX) compounds;
-  Total Petroleum Hydrocarbons (TPHCWG) and PAHs;
-  Total monohydric phenols;
-  Total cyanide;
-  pH; and
-  Asbestos screening.

3.4.2 Geotechnical

Selected soil samples were submitted for geotechnical laboratory analysis at GSTL (a UKAS accredited laboratory). The laboratory testing results are presented in Appendix E and the analysis included:

-  Moisture content;
-  Atterberg Limits;
-  Particle size distributions;
-  pH;
-  Water soluble sulfate;
-  Acid soluble sulfate; and
-  Total sulfur.

4. GROUND AND GROUNDWATER CONDITIONS

4.1 Summary

The ground conditions encountered during the CGL ground investigation are generally consistent with the published geology for the site, comprising Topsoil (across the entire site) overlying the solid geology of the Kellaways Clay Member across the majority of the site. In the south west of the site, the Kellaways Sand Member was proven overlying the Kellaways Clay Member.

As part of the ground investigation it was not possible to differentiate the Kellaway Clay Member from the Oxford Clay Formation, therefore for simplification the clay has been assessed to be the Kellaway Clay Member.

Localised Made Ground was encountered in the north-western corner of the site (an area where a pond was historically present) and within the area associated with historical development of the water tower and associated infrastructure. The findings of the CGL investigation are summarised in Table 2 with full exploratory hole logs presented in Appendix B.

Table 2. Summary of Ground Conditions

Stratum	Level of Top of Stratum (m bgl)	Total Thickness (m)
Grass over brown clayey silt with varying proportions of sand and gravel. The gravel fraction comprises limestone. (All exploratory hole locations). [TOPSOIL]	Ground Level	0.2 to 0.4
Firm greyish brown and reddish brown silty clay with varying proportions of sand and gravel. The gravel fraction comprises limestone. Rare fragments of decomposed wood (WS01, HP01 and HP04 only) Or Stiff greyish brown, light grey and orangish brown silty clay with varying proportions of sand and gravel. The gravel fraction comprises flint, concrete, brick, bound surfacing and metal fragments. (TP07 only) Or Firm to stiff brownish grey slightly gravelly silty clay. The gravel fraction comprises limestone and rare flint and brick. (WS05, TP03, HP02 and HP03 only) [MADE GROUND]	0.2 to 0.3	0.1* to 0.7
Orangish grey and orangish brown gravel with varying proportions of clay and sand. The gravel fraction comprises flint with rare limestone. Or Orangish brown fine to coarse sand with varying proportions of clay and gravel. The gravel fraction comprises flint and rare limestone. (WS05, SA02 to SA04, TP06, TP08, TP09, TP11 and HP03 only). [KELLAWAYS SAND MEMBER]	0.3 to 0.4	0.2* to 0.9
Firm to stiff orangish brown, brownish grey and bluish grey silty clay with varying proportions of sand. Localised selenite crystals and fossil fragments. (WS01 to WS04, SA01 to SA03, TP01 to TP06 and TP09 to TP11 only). [KELLAWAYS CLAY MEMBER]	0.3 to 1.6	0.3* to 4.7*

*Base not proven

4.2 Water

During the ground investigation, groundwater strikes were not encountered. However, within WS02, a slow seepage was recorded between 4.0m and 5.0mbgl with the samples noted to be damp. A total of six return monitoring visits have been completed between October 2020 and March 2021. Full monitoring records are located in Appendix D and a summary is presented in Table 3.

Table 3. Summary of Water Data.

Exploratory Hole ID	Water Strikes during Investigation (m bgl)	Response zone depth (m bgl)	Water Levels Recorded from Monitoring Visit (m bgl)					
			30/10/20	13/11/20	09/12/20	21/01/21	18/02/21	19/03/21
WS01	Not encountered	0.5 to 1.0	0.3	0.15	0.0	0.0	0.0	0.35
WS04	Not encountered	1.0 to 5.0	1.3	1.24	1.31	1.02	0.22	0.91
WS05	Not encountered	1.0 to 5.0	1.27	1.15	1.09	1.08	0.25	1.01

4.3 Visual and Olfactory Indicators of Contamination

Made Ground was recorded in WS01, WS05, TP03, TP07, HP01 to HP04, recorded to a maximum thickness of 0.7m (within WS01, undertaken within the area of a historical backfilled pond). Within the Made Ground in areas of historical ponds (WS01, HP01 and HP04), rare fragments of decomposed wood

were recorded. Within the area of the historical water tower (TP07), the Made Ground was recorded to include flint, concrete, brick, bound surfacing and metal fragments.

Visual or olfactory evidence of contamination was not encountered within any other exploratory hole locations undertaken during the ground investigation.

4.4 Geotechnical Test Results

Based on the results of the in-situ and laboratory testing, a summary of the geotechnical properties of the soils is presented in Table 4 below. A plot of SPT 'N' values against depth is presented as Figure 5, an undrained shear strength against depth plot as Figure 6, a plasticity index chart as Figure 7, and a particle size distribution chart as Figure 8. Full records of the geotechnical analysis are presented in Appendix E.

Table 4. Geotechnical Testing Results

Atterberg limits							
Strata	Number of Tests	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	% Material <425µm	Modified Plasticity Index	Volume change potential ⁸
Kellaways Clay Member	10	17 to 36	38 to 83	14 to 30	87 to 100	25 to 54	Medium to High
Particle Size Distribution							
Strata	Number of Tests	Clay/Silt (%)	Sand (%)	Gravel (%)	Cobbles (%)	Notes	
Kellaways Sand Member	1	10	28	62	0	Consistent with field description	
SPT 'N' data							
Strata	Number of Tests	SPT 'N' value range		Correlated Strength (kPa) ⁹		Classification	
Kellaways Clay Member	25	7 to 38		31.5 ^a to 171		Low to high strength	

Notes:

a) Considered to be unrepresentative of the actual in-situ strength and is a limitation of the correlation used.

4.5 Sulfate and pH Conditions

Representative samples of Made Ground, Topsoil, Kellaways Clay and Sand Member and the Oxford Clay Formation were scheduled for geotechnical testing of sulfates in accordance with BRE SD1. A summary of the results is included in Table 5 below. Groundwater results will be included after samples have been collected and analysed, following completion of scheduled monitoring visits.

⁸ National House Building Council. (2015). Building near trees. Chapter 4.2.

⁹ Stroud. (1974). The standard penetration test in insensitive clays and soft rock.

Table 3. Sulfate and pH Conditions

Strata	Number of Tests	pH	Water soluble sulfate (2:1) (mg/l)	Acid Soluble Sulfate (SO ₄) (mg/kg)	Total Sulfur (mg/kg)	Total Potential Sulfate (%)	Oxidisable Sulfate (OS) (%)
Made Ground	4	7.3 to 8.1	20 to 220	n/a	n/a	n/a	n/a
Kellaways Sand Member	2	8.2 to 8.4	14 to 36	n/a	n/a	n/a	n/a
Kellaways Clay Member	6	7.3 to 7.8	18 to 44	230 to 3,500	120 to 1,400	0.04 to 0.42	0.01 to 0.09

4.6 Soakaway Testing

Soakaway testing was undertaken at four locations (SA01 to SA04) as indicated on the exploratory hole location plan in Figure 2. The results of the soakaway testing are summarised below in Table 6, with the results presented in Appendix F.

Table 4. Summary of Soakaway Testing Results

Soakaway	Test Number	Trial Pit Depth (m bgl)	Depth Range Tested (m bgl)	Cohesive or Granular	Depth of infiltration (m)	Time (minutes)	Calculated Permeability Rates (m/s) ¹⁰	Test completed to 75%?
SA01	1	2.9	1.64 to 2.9	Cohesive	0.00	180	Not calculated	No
SA02	1	3.0	1.94 to 3.0	Cohesive	0.00	180	Not calculated	No
SA03	1	2.3	1.24 to 2.3	Cohesive	0.01	180	Not calculated	No
SA04	1	1.1	0.45 to 1.1	Granular	0.38	180	2.03 x 10 ⁻⁵ *	No

Notes - * Calculated infiltration rate over depth tested.

4.7 Ground Gas

Six return ground gas monitoring visits were attempted between October 2020 and March 2021. During the visits the boreholes were recorded to be flooded and as such as not suitable for monitoring. The results of this monitoring visits completed are summarised in Table 7 below, with full gas monitoring records available in Appendix C.

Table 5 Summary of Gas Monitoring Data

Location	Number of visits completed	Strata	Water level (m bgl)	Flow rate (max l/hr)	O ₂ (min %)	CO ₂ (steady %)	CH ₄ (max %)
WS01*	0	Made Ground	0.0 to 0.3	-	-	-	-
WS04**	3	Kellaway Clay Member	0.22 to 1.3	<0.1	2.2	1.2	<0.1
WS05***	1	Kellaway Clay Member	0.25 to 1.27	<0.1	19.5	1.0	<0.1

4.8 Ground Model

The ground conditions encountered during the ground investigation were generally consistent with the published geology, comprising Topsoil overlying the solid geology of the Kellaways Clay Member across the majority of the site. It was not possible to differentiate the Kellaway Clay Member from the Oxford Clay Formation, therefore for simplification the clay has been assessed to be the Kellaway Clay Member.

¹⁰ BRE. (2016). *Soakaway design*. BRE 365

The Kellaways Clay Member typically comprise a weathered horizon, which graded from an orange-ish brown mottled bluish grey sandy CLAY to a dark bluish grey occasionally gravelly silty CLAY with inclusions of shell fragments and selenite crystals. Consistency testing of the Kellaways Clay Member recorded the strata to be typically firm (40kPa) becoming stiff (>75kPa) with depth. When the in-situ SPTs are reviewed, the correlated 'N' value at 1.2m typically records undrained shear strengths of between 22kPa to 36kPa ('N' value 5 to 8), these values are not considered to be representative of the actual in-situ strength and is a limitation of the correlation used. Below this depth the SPT 'N' values record an increase in strength with depth which is considered to be typical of the soils.

The Kellaways Sand Member was encountered locally in the south-west of the site only (within HP03, WS05, SA02 to SA04, TP06, TP08, TP09 and TP11). Where encountered, the Kellaways Sand Member was recorded in thin horizons (typically between 0.3m and 0.9m thick and recorded to depths of between 0.6m and 1.2mbgl). In all locations encountered, the Kellaways Sand Member was underlain directly by the Kellaways Clay Member. It is assessed that the Kellaways Sand Member was historically more prevalent across the site, however it has been eroded exposing the underlying Kellaway Clay Member.

Made Ground was recorded to be present locally at the site:

-  In the east of the site, within the area of the former water tower Made Ground was proven in TP07 to a depth of to 0.4m. The trial pit was terminated due to the potential for a buried service. Within the Made Ground, anthropogenic materials including concrete, brick and bound surfacing were recorded to be present.
-  In the north of the site, within the northern most pond detailed on the historical maps, two hand dug pits (HP01 and HP04) were completed, these recorded Made Ground to a depth 0.95m bgl. The soils comprised reworked site won Kellaways Clay Member with rare wood fragments.
-  In the two ponds in the central south of the site, two hand dug pits (HP02 and HP03) were excavated which recorded Made Ground to depths 0.6m and 0.4m respectively. The base of the Made Ground was not proven in HP02. The soils comprised reworked site won Kellaways Clay Member.

During the ground investigation, groundwater was not encountered across the site. A slow seepage was observed within WS02 between 4.0m to 5.0m bgl, and the samples obtained from this depth were recovered as 'damp'. Water was not encountered in any other locations, and the slow seepage was indicative of 'perched water'.

During the return monitoring, water has been recorded to be present within the monitoring standpipe. The water recorded in the wells is considered to be associated with the wells acting as a sump for surface water as opposed to groundwater. It is noted that the water levels in the wells was recorded to rise from October to February before beginning to fall in March. This is assessed to be representative of the seasonal fluctuations in rainfall events.

As part of the desk study, an infilled pond identified in the north-east of the site was assessed to be a potential source of ground gas. A single borehole (WS01) and four hand dug pits (HP01 to HP03 and HP101) were completed within the footprint and recorded the presence of Made Ground to depths of between 0.4m and 1.0m bgl. The ground conditions were recorded to comprise silty clay with variable proportions of gravel. The gravel fraction comprised limestone and flint with rare organic matter including roots and rootlets.

During the return monitoring visits, the response zone of WS01 was recorded to be flooded and as such representative ground gas reading could not be recorded. Where the response zone was not recorded to be flooded, negligible carbon dioxide concentrations of 1.2%, methane of <0.1% and flow rates of >0.1l/hr were recorded from the boreholes monitored. A review of the proposed development plan details the pond in the north to be located within the proposed highways area at the site entrance. On the basis of the limited depth of Made Ground, the absence of significant organic matter, outside rootlets and fragments of wood, and its location within the proposed highways area it is not considered to pose a significant risk to human health, and as such has not been assessed further.

5. CONTAMINATION ASSESSMENT & CONCEPTUAL SITE MODEL

5.1 Introduction

This section evaluates risks to potential receptors at the site from identified chemical contamination. Potential receptors have been identified with reference to the Part 2A regime and associated DEFRA guidance. As with the Part 2A regime, under the planning regime relevant receptors (humans, controlled waters, ecology and buildings) have been considered if there is the potential for them to be adversely affected by exposure to contamination. The Risk Assessment Methodology is presented in Appendix G and detailed information on the assessment criteria adopted is presented in Appendix H.

5.2 Risks to Human Health (Long-term Chronic Risks)

The laboratory test results have been compared against Generic Assessment Criteria (GAC) that have been derived in-house by CGL for the “*Residential with plant uptake*” land use category to assess the risk to human health from contamination in soils.

5.2.1 Risks from Soil Contaminants in Topsoil and Natural Soils

A total of six samples of Topsoil, and three samples of natural soils, were analysed for a suite of contaminants. The results of the analysis are presented in Table H2 and H4 of Appendix H.

When the results of the laboratory testing are compared directly against the appropriate assessment criteria, all determinants for all strata tested are recorded below the GAC for a residential site with plant uptake.

5.2.2 Risks from Soil Contaminants in Made Ground

Made Ground was encountered in four locations (HP01 to HP04, WS01, WS05, TP03 and TP07) in discreet horizons, associated with historical feature, including backfilled ponds and the area of the historical water tower. A borehole drilled within one pond in the north (WS01) identified the rare, decomposed wood fragments, and reworked natural materials. Made Ground was not recorded in any other exploratory hole locations undertaken during the investigation.

A total of three samples of Made Ground were analysed for a suite of contaminants. The results of the analysis are presented in Table H3 of Appendix H.

When the results of the laboratory testing are compared directly against the appropriate assessment criteria, all determinants for all strata tested are recorded below the GAC for a residential site with plant uptake, with the exception of a single sample from TP07 at 0.3m depth, which recorded elevated concentrations of benzo(a)pyrene at 3.6mg/kg compared to the relevant GAC of 2.73mg/kg. With

reference to the exploratory hole record (TP07) it is assessed that the elevated concentration is attributed to the bound surfacing recorded to be present in the Made Ground.

The risks to future site users from Made Ground within the area of the former water tower are considered to be **Moderate / Low**. The risk to construction works is assessed to be **Low** on the basis of the use of PPE and welfare facilities during the works.

5.2.3 Risks from Asbestos in Soils.

Eleven samples of Topsoil, Made Ground and natural soils from varying depths were also submitted for an asbestos screen, with all samples returning a negative result with asbestos not identified.

Therefore, the risks to human health from asbestos within soils on site are considered to be **very low**.

5.2.4 Ground Gas Risk

Basic radon protection measures are not considered necessary in the construction of new buildings as less than 1% of properties are above the action level.

On the basis of the monitoring completed, the risk from ground gas to future site occupants is considered to be **low**.

5.3 Risks to Controlled Waters

The site is within a groundwater source protection zone with a Confined Aquifer, with the nearest surface watercourse being an *inland river*, located on the north-western boundary which feeds in to the River Avon, aligned west to east, is located some 400m to the south-west of the site.

Significant visual and olfactory evidence of contamination was not recorded during the investigation, and evidence of potentially mobile contaminants have not been identified. Concentrations of PAHs were recorded within TP07 (in the area of the historical water tower) above laboratory detection limits, however these concentrations are likely to be associated with fragments of bound surfacing that were encountered during the investigation, and are not considered to represent a significant risk of mobile contamination that may affect controlled waters.

Groundwater was not recorded during the investigation, with only a slow seepage recorded within WS02 at depths of below 4m. Where the Kellaways Sand were encountered, the deposits were typically thin (less than 1m), were not laterally continuous, and in all locations underlain directly by the Kellaways Clay. Given the geology beneath the site predominately comprises very low permeability clays of the Kellaways Clay, it is considered that an aquiclude is present across much of the site and, therefore, a viable migration pathway for vertical migration to deeper groundwater does not exist.

On the basis of the above, the risks to controlled waters are considered to be **very low**.

5.4 Risks to Buildings and Structures

5.4.1 Water Supply Pipes

Based upon the findings of the chemical analysis and with reference to the UK Water Industry Research Guidance¹¹ it is considered that no special precautions are likely to be required based on the contaminant concentrations recorded in the natural soils recorded across much of the site.

For water supply pipes entering the south-eastern part of the site, within the area of the historical water tower (in the area of TP07), Made Ground is present and, as such, special precautions relating to “brownfield land” may be required in accordance with UKWIR. Based on the findings of the investigation (including concentrations of PAHs above laboratory detection limits), barrier pipe may be required in areas in the vicinity of the historical water tower. If, as part of the development, this Made Ground is to be removed during the enabling works, no special precautions are likely to be required.

This report, including the appendices, should be submitted to the local water authority for review. On this basis of the above the risk to buried water supply pipes across the majority of site is considered to be **very low**. If Made Ground is retained around the water tower, and is recorded to depths between 0.75m and 1.35m bgl, then consideration should be given to increase the risk to water supply pipes to **low**.

5.4.2 Buried Concrete

Underground concrete structures may be at risk from aggressive ground conditions from sulfate attack within the natural pyritic Kellaway Clay Member or the Oxford Clay Formation. This can be mitigated through appropriate concrete design.

Chemical analysis has been undertaken on samples of Made Ground, Topsoil, Kellaways Clay Member and the Kellaway Clay Member in accordance with BRE SD1 to determine concrete classification.

Based on the results of chemical testing, a BRE SD1 a Design Sulfate Class of DS-2 AC-1s would apply to buried concrete, assuming static water conditions. Therefore, a **low** risk to buildings and structures is present at the site has been assumed, based on the recorded ground conditions.

¹¹ UK Water Industry Research. 2010. *Guidance for the selection of water supply pipes to be used in brownfield sites*.

5.5 Risks to Plant Growth

Plant growth can be affected by phytotoxic contaminants, such as copper, nickel and zinc. Assessment of phytotoxic metals, see Appendix H, indicates that these do not pose a risk to vegetation.

Nevertheless, plant selection across the site should be considered based on the chemical concentrations and soil conditions recorded during the investigation, therefore, this report including the appendices should be made available to the landscaping designer/horticultural consultant.

5.6 Revised Conceptual Site Model

A semi-quantitative risk assessment, building on that presented in the Desk Study¹, has been undertaken based on the findings of the site investigations and the potential pollutant linkages identified at the site in accordance with the Land Contamination Risk Management¹².

The risks identified are in accordance with DEFRA and LCRM¹³, site prioritisation and categorisation rating system which is summarised in Table 9 below. The Risk Assessment Methodology is presented in Appendix G.

¹² Land The Environmental Agency (2020). Contamination Risk Management (LCRM). *How to assess and manage the risk from land contamination*.

¹³ Environment Agency (2020) Land Contamination Risk Management. Retrieved from <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

Table 6. Revised Qualitative Risk Assessment

Potential Source/Medium	Potential Exposure Route	Potential Receptor	Severity	Probability	Risk Rating
Explosive/asphyxiating gases/vapours from underlying soils (infilled ground and Made Ground within backfilled ponds)	Migration of gases and vapours through the surface via permeable soils and drainage & services	Internal building spaces & future occupiers	Medium	Unlikely	Low
		Off-site internal buildings spaces and residents	Mild	Unlikely	Low
Organic/inorganic contaminants such as hydrocarbons, PAH, metals and asbestos within infilled ground	Direct/indirect ingestion of soil and dust, inhalation of particle vapours and asbestos fibres and dermal contact	Construction workers	Minor ^a	Low likelihood	Very low
		Future site users	Medium	Low likelihood	Moderate / Low
	Direct contact with underground structures and services	Buildings and structures	Mild	Low likelihood	Very low
	Root uptake	Plants and vegetation	Minor	Unlikely	Very Low
PAH within underlying soils within former Water Tower area of site	Direct/indirect ingestion of soil and dust, inhalation of particle vapours and asbestos fibres and dermal contact	Construction workers	Minor ^a	Low likelihood	Very low
		Future site users	Medium	Low likelihood	Moderate / Low
	Direct contact with underground structures and services	Buildings and structures	Mild	Low likelihood	Low
	Root uptake	Plants and vegetation	Minor	Low likelihood	Very low
Naturally occurring sulfates within natural soils	Direct contact	Buildings and infrastructure	Mild	Low likelihood	Low

Notes a) Minor severity rating for construction workers based on C552 description (See Appendix G) 'presence of contamination at concentrations which require the use of personal protective equipment during site work'.

6. GEOENVIRONMENTAL RECOMMENDATIONS

6.1 General

The proposed development of this site is understood to comprise some 71 low-rise residential properties with private gardens, associated infrastructure, and areas of public open space. As such, the recommendations are based on the proposed development of a '*residential with plant up take*' end use. An assessment of material classification has also been undertaken so that an appropriate material management plan can be implemented during groundwork operations. Other receptors, including controlled waters and off-site residents, have also been considered.

6.2 Contamination and Remediation

Across the majority of the site, the concentrations of contaminants from Topsoil and natural soils testing have been recorded below the applicable assessment criteria, the potential risk to identified receptors from soil contamination is considered to be low to very low in these areas. On this basis it is considered that remedial measures are not required for the majority of the site.

However, within the area of the water tower in the south-eastern part of the site, elevated concentrations of benzo(a)pyrene have been recorded above the relevant GAC for the proposed development end use.

Based on the findings of the investigation, it is recommended that as part of the enabling works further investigation is undertaken within the area of the former water tower and historical ponds to delineate the extent of the Made Ground (as required). Once delineated, several options are recommended, dependant on the extent of the Made Ground and the final development proposals;

1. Provision of hardstanding or surfacing over the area of Made Ground (i.e by structure, road, parking area or other hardstanding); or

Within areas of proposed private gardens or public open space/ landscaping;

- 2A. Provision of a capping layer comprising a 600mm thick "clean cover system" as described in Section 6.2.1 below; or

- 2B. Excavation and removal of Made Ground, with inspection undertaken by an appropriately qualified geoenvironmental engineer, together with sampling of the resultant excavation to verify sufficient removal of Made Ground, as described in Section 6.2.2 below.

If, during the development of the site, materials are encountered that are not consistent with the findings of this investigation, further inspection and testing should be undertaken by a suitably qualified geoenvironmental engineer in accordance with section 6.7.

6.2.1 Capping Layers

An effective remediation methodology would be to ‘cap’ the impacted soils, with a suitable layer of site won or imported ‘clean’ material. This capping layer is recommended in areas which are not likely to be covered by hardstanding. Within areas where there is to be proposed hardstanding constructed (e.g. beneath buildings and/or pavements), then the adoption of additional protective measures should not be required.

However, in areas of proposed soft landscaping, a cover system comprising a capping layer is required to prevent contact with underlying Made Ground. Details of the proposed capping layer for areas of private gardens are presented in Table 9 below to comply with NHBC and BS 3882¹⁴.

The extent of the capping layer would be dependent on the extent of the Made Ground, which would require to be confirmed during additional investigation/assessment.

Table 7. Composition of engineered capping layer

Layer	Minimum thickness (mm)
Topsoil	150
Subsoil	450
Geotextile (Terram® 1000 or similar)	Required ^{1,2}

Notes:

1. Terram 1000 is a non-woven geotextile with a pore size of 0.15 mm and a nominal thickness of 0.8 mm.
2. It should be noted if trees/shrubs are planted this may require localised deepening.

6.2.2 Removal of Made Ground

Given the localised and relatively shallow depth of the Made Ground recorded, as an alternative to the use of capping layers, or if the Made Ground cannot be encapsulated beneath areas of hardstanding/structures, excavation and removal of the Made Ground may also be considered.

The extent of Made Ground removal would be dependent on the depth and extent of the Made Ground, which would require to be confirmed during additional investigation.

The Made Ground would require to be excavated to underlying natural soils. All excavated Made Ground shall be segregated from any natural soils and stockpiled appropriately. Following the removal of Made

¹⁴ British Standard. (2015). Specification for Topsoil. BS3882.

Ground, the resultant excavation shall be inspected by a suitably qualified geoenvironmental engineer, to verify removal of the Made Ground. Soil samples should be obtained by the geoenvironmental engineer from both the excavated material, and the soils which are present in the sides and base of the excavation to demonstrate that the full area of contamination has been excavated.

On receipt of chemical test results, the soils may be classified for disposal, or treatment if appropriate for re-use on site in a suitable location, and dealt with accordingly.

If surplus material is excavated, then the natural soils could be offered for re-use via the CL:AIRE register of material, and moved under DOWCOP subject to an appropriate materials management plan(MMP) and 'Qualified Person' declaration being in place for the receiving site. The material will require transporting in accordance with the Environmental Protection (Duty of Care) Regulations, 1990.

6.3 Material Management

In order to minimise the volume of material generated for off-site movement, all waste should be processed prior to disposal in accordance with the waste hierarchy, which is summarised below:



Prevention - using less material in design and manufacture, keeping products for longer, re-use, using less hazardous materials;



Preparing for re-use - checking, segregated storage;



Recycling/recovery - turning waste into a new substance or product, includes composting if it meets quality protocols. Disposal to soil treatment facility; and



Disposal – landfill.

The earthworks contractor will be responsible for appropriate final classification of the soil / waste. Under the Landfill (England and Wales) Regulations 2002 (as amended), there are three types of landfill, which can receive waste: 'inert', 'non-hazardous' and 'hazardous'. Should soil be required to be disposed offsite, the chemical results have been used to classify soils for waste disposal based on guidance contained within WM3¹⁵. The chemical analysis results indicate that the natural soils are deemed as '*not hazardous*' and, if disposed to landfill, uncontaminated natural soils are likely accepted to an inert facility (except Topsoil).

The chemical analysis of the Made Ground indicates that these strata are '*not hazardous*' in accordance with WM3. If required to be disposed off-site Waste Acceptance Criteria (WAC) testing should be

¹⁵ Environment Agency. 2015. *Waste Classification - Guidance on the classification and assessment of waste* (WM3)

undertaken to determine acceptability to an 'inert' landfill incurring a reduced rate of landfill tax. Otherwise, or if not acceptable to an inert facility, disposal to landfill would be to a permitted non-hazardous facility incurring standard rate landfill tax. It will be necessary to segregate the Made Ground from other natural soils at the site, and care should be taken not to mix waste streams, particularly if material is to be re-used or disposed off-site to landfill.

Waste will require pre-treatment, where possible, before it can be disposed to a relevant and licensed landfill. Pre-treatment can be undertaken either at the site of origin or may be carried out at a licensed off-site facility and can include selective segregation of soils which would be conducted on site. However, pre-treatment is not a requirement if waste is sent for recovery instead of disposal. Disposal to a soil treatment/ recovery facility does not incur landfill tax and should be a preferred option where available.

If any surplus material is excavated, then the natural soils could be reused on site or offered for re-use via the CL:AIRE register of material and implementing the 'Definition of Waste : Development Industry Code of Practice (DOWCOP). This may require the production of a Material Management Plan (MMP) and independent review and declaration to the Environment Agency by a Qualified Person (QP). The material will require transporting and disposal in accordance with the Environmental Protection (Duty of Care) Regulations, 1990.

6.4 Buried Services

The local water authority should be consulted and this report, including the appendices, plus the results of any additional investigations and assessment should be submitted for review to determine their site-specific requirements. Further details are provided in Section 5.4.1 of this report.

6.5 Health and Safety

Construction workers have the potential to come into direct contact with dusts and soils during the course of their activities. Based on the findings of the investigation the risk to construction workers is assessed as very low. Notwithstanding this, appropriate health and safety measures should be incorporated during construction. Such precautions should include, but not be limited to:

1. Personal hygiene, washing and changing procedures.
2. Personal protective equipment, including disposable overalls, gloves etc.
3. Measures to avoid surface water ponding and positive collection and disposal of all on-site run-offs.

4. Regular cleaning of all site roads, access roads and the public highway including dust suppression methods (e.g. water spraying), if necessary.

Off-site residents could also be affected by dust generated; however, it is anticipated that appropriate dust suppression will be implemented as part of the works.

6.6 Watching Brief and Discovery Strategy

It is recommended that a watching brief is maintained by the Principal Contractor, particularly during ground works undertaken in areas of historical ponds or historical features (such as the former water tower). Where unexpected gross contamination, such as oily material or material of an unusual colour or odour, is encountered, the following discovery strategy is recommended:

1. Works should cease in the affected area;
2. The main works contractor is to notify a suitably qualified geoenvironmental engineer, who should attend the site and sample the affected material for appropriate analysis and risk assessment.
3. If required by the risk assessment, a geoenvironmental engineer shall supervise the excavation/removal of contaminated material. Contaminated soils should be placed in a bunded area and covered to prevent rainwater infiltration. To facilitate appropriate waste disposal and potential re-use of materials all excavated soils should be segregated and stockpiled depending on their soil classification;
4. Soil samples should be obtained by the geoenvironmental engineer from both the excavated material, and the soils which are present in the sides and base of the excavation to demonstrate that the full area of contamination has been excavated. Where appropriate, in-situ testing should be undertaken on the sides and base of the excavation to assess the presence of residual contamination in the soils;
5. On receipt of chemical test results, the soils may be classified for disposal, or treatment if appropriate, and dealt with accordingly;
6. Detailed records of the stockpile sizes, source and location should be kept and regularly updated to allow materials to be easily tracked from excavation until leaving the site.

Records of excavated areas and the results of chemical testing should be incorporated within a verification report for the site. Similarly if no evidence of contamination or unexpected conditions is found, the contractor should provide a statement to that effect.

7. GEOTECHNICAL RECOMMENDATIONS

7.1 General

The following recommendations are based on the ground and water conditions encountered during the investigation and the results of subsequent geotechnical testing. The in-situ testing and geotechnical laboratory data have been interpreted to provide recommendations for foundations, pavement, excavations and concrete specification.

The proposed development is anticipated to comprise of low-rise buildings and therefore recommendations for foundations are based on this assumption. Should the end use be different it will be necessary to review the findings and recommendations below to ensure that they are appropriate for the development.

It is noted that these recommendations are based on those ground conditions encountered during the site investigation.

7.2 Foundations

Based on the ground conditions encountered and the anticipated Design Actions (loadings) from proposed structures, then it is considered that conventional strip foundations are likely to be appropriate. It is recommended that the foundations designed in accordance with NHBC guidance with the following implemented:

-  A minimum embedment of 300mm into the founding stratum.
-  At a depth of 1.0mbgl, within the cohesive soils, an allowable bearing pressure of 70kN/m² is considered appropriate.
-  At a depth of 0.75mbgl, within the granular soils, an allowable bearing pressure of 120kN/m² is considered appropriate.

It is recommended that prior to pouring concrete, the bases of all excavation should be inspected by a suitability qualified geotechnical engineer or Engineering Geologist to ensure that no loose or soft spots are present (and if present these are removed) prior to concreting. This will also allow variations in ground conditions to be identified. Once inspected, the footings should be immediately blinded to preserve the formation integrity.

Excavations spanning cohesive and granular soils should be locally reinforced to reduce the risk of differential settlement.

7.3 Excavations

Conventional plant is considered appropriate for shallow excavation works at the site. Shallow excavations may remain stable in the short term. However, instability should be anticipated in excavations left open for extended periods of time. No operatives should enter un-shored or otherwise unprotected excavations. This work should be carried out in accordance with the guidelines presented in CIRIA Report 97¹⁶.

Where Made Ground is removed (i.e from backfilled ponds), the resultant excavation shall be backfilled with “clean” granular arisings and compacted in accordance with an appropriate specification.

Based on results of the investigation, isolated perched water may be encountered within the shallow deposits during the excavations works and therefore localised dewatering may be required during excavation, subject to the prevailing groundwater conditions at the time. Perched water, if encountered, is not expected to be laterally prevalent or have considerable recharge once exposed. Water control, if required, would likely be achieved within shallow excavations by adopting a sump pumping system around the perimeter of the excavation.

7.4 Floor Slabs and Heave

On the basis of the ground investigation the following recommendations are made for floor slabs:

 For the granular Kellaway Sand Member a ground bearing floor slab is considered appropriate; and

 For the cohesive Kellaway Clay Member a suspended bearing floor slab is considered appropriate

The foundations and floor slabs will require appropriate heave precautions, and to be designed to withstand the heave forces associated with the medium to high volume change potential Kellaways Clay Member.

7.5 Road / Pavement Design

It is recommended that all Topsoil is removed in areas of proposed road or pavement. CBR values of 2.5% for cohesive soils and 10% for granular soils are considered appropriate. These CBR values are considered appropriate in accordance with CD225¹⁷

¹⁶ CIRIA (1992). *Trenching Practice (Second Edition)*. Construction Industry Research and Information Association Report 97.

¹⁷ Highways England. (2020). Design for new pavement foundations. Ref CD225.

7.6 Buried Concrete

Testing has been undertaken on selected samples of Topsoil, Made Ground and Kellaways Clay Member strata. The results from those strata tested and in accordance with BRE SD1 a Design Sulfate Class of DS-2 AC-1s would apply to buried concrete.

7.7 Drainage

Infiltration testing was completed in the trial pits SA01 to SA04 as part of the ground investigation. All the tests failed in accordance with BRE 365¹⁰. On this basis, soakaway drainage is considered unlikely to be feasible within the underlying natural soils.

7.8 Geotechnical Risk Register

Unforeseen ground conditions and geotechnical and geo-environmental hazards pose one of the largest threats in terms of delay and cost overrun to any development. To be effective in terms of reducing risk and identifying opportunities, geotechnical risk management should be started as soon as possible following project identification.

This register is not intended to be exhaustive at present. There is the provision that additional hazards can be identified as new information and data is brought to light throughout the detailed design and construction process. Therefore, a geotechnical risk register (Table 10) has been produced for the scheme in order to identify potential hazards, the probability of the hazard occurring, impact and risk rating. It is a very simple qualitative risk assessment and should not be viewed as definitive. This Risk Assessment reflects the current level of understanding of the geotechnical and geo-environmental aspects of the scheme and will be subject to revision.

Risk rating is defined by the following relationship:

$$\text{Risk rating (R)} = \text{Probability (P)} \times \text{Impact (I)}$$

Table 8. Definition of Risk Rating

Risk Rating (R) = Probability (P) x Impact (I)						
Probability (P)		Impact (I)		Risk Rating (R)		
Very Likely	5	Very High	5	16-25	Very High	No Action Required
Likely	4	High	4	11-15	High	
Probable	3	Medium	3	6-10	Medium	
Unlikely	2	Low	2	0-5	Low	
Negligible	1	Very Low	1			

10. Geotechnical Risk Register

Hazard	Cause	Consequence	Pre-control			Mitigation
			P	I	R	
Unforeseen ground conditions	Site investigation data designed to provide maximum site coverage, and gaps between exploratory hole locations may give rise to unexpected / unusual ground conditions	- Increased geotechnical risk. - Conservative design approach. - Delay in construction. - Further site investigation required. - Damage to structure. - Additional cost of remediation.	2	3	6	- Appropriate design parameters and design methods given for design. - Thorough review of 3rd party data to assess suitability for design adoption - review of freely available data to cross correlate 3rd party supplied data - allowance for on-site verification during works to confirm suitability of adopted design conditions.
Unforeseen ground conditions	Discovery of Made Ground relating to infilled pond.	- Increased geotechnical risk. - Delay in construction. - Further site investigation - Additional cost of remediation	2	3	6	- Additional investigation to delineate extents of infilled ponds should be undertaken as part of the enabling works for the development. - if additional ponds are encountered (not shown on historical maps), watching brief and discovery strategy procedure to be followed.
Heave	High volume change potential soils	- Damage to structure - Injury to personnel due to trip hazards	4	3	12	- Appropriate founding depths and ensure that all foundations are built in accordance with NHBC guidance.
Potential soft spots	Unusual ground conditions / lateral variation in the near surface weathered Kellaways Clay Member	- Increased geotechnical risk - Further site investigation and foundation design required. - Delay in construction.	2	4	8	- Appropriate design parameters and design methods given for design. - Assessing ground conditions are consistent with what is expected before laying foundations.
Un-trafficable construction site	Soft ground / drainage problems	- Delay in construction.	2	3	6	- Formations laid to correct falls.
	Heavy Rain	- Buildability constraints.	3	2	6	- Adequate construction drainage. - Dedicated haul roads
Seepages and perched water	Seepages may occur within sand horizons, particularly during wet and inclement weather	- Increased geotechnical risk - Buildability constraints	3	2	6	- Appropriate control of seepages by pumping of water, if required

FIGURES

PHOTO SHEET



Photograph 1 – Showing an access gate to the north of the site, off the B4014.



Photograph 2 – Looking south, from the access gate to the north of the site, showing open fields.



Photograph 3 – Looking south-east, looking at the access gate between fields.



Photograph 4 – Looking south-west, showing the overhead lines present within the open fields on-site.

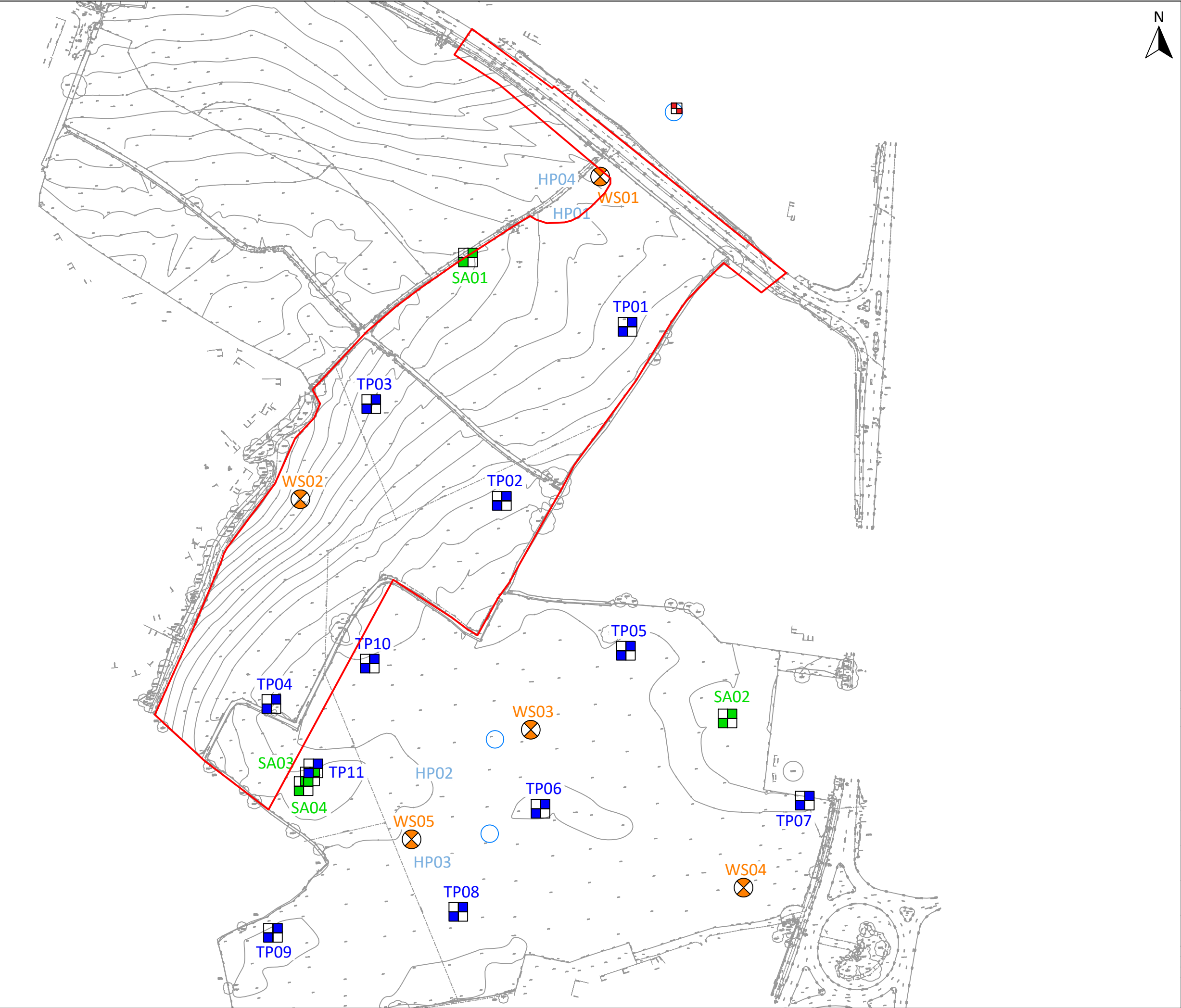


Photograph 5 – Looking east, showing open fields with the water tower and infrastructure situated to the east.



Photograph 6 – Looking south-west, showing open fields, currently sectioned to allow for grazing cattle in the south-west of the site.

Client	Project	Job No
Gleeson Land	Land North of Whychurch Farm	CG/38164B
	Title	Figure 2
	Photo Sheet – Site Walkover	



KEY

Approximate Site boundary

Machine excavated trial pit
(CGL August 2020)

Soakaway trial pit
(CGL August 2020)

Window Sample Borehole
(CGL August 2020)

Hand-Dug Inspection Pit
(CGL October 2020)

Estimated locations of historical ponds
(and hand-pit locations)

- Notes
1.

Exploratory hole locations are for indicative purposes only.
2.

Do not scale from this drawing.
3.

Topographical survey taken from Digital Terrain Surveys LLP 'DTS080920-1M6C' (originally from August 2011 but revised in September 2020).

1	26/08/2021	ZAH Updated Site Boundary
0	21/04/21	
Rev	Date	Comments

Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW
T: 01483 310600

Project		Land North of Whychurch Farm	
Client		Gleeson Land	
Drawing title		Exploratory Hole Location Plan	
Scale(s)		Job No.	
NTS		CG/38164B	
Drawn	TSB	14/09/20	Dwg No. Figure 3
Checked	ARA	05/10/20	
Approved	SJM	21/04/21	
			Rev. 1

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PHOTO SHEET



1. Made Ground at WS01.



2. WS01 Kellaways Clay Member.



3. WS01 Kellaways Clay Member.



4. WS02 Kellaways Clay Member.



5. WS02 Kellaways Clay Member.



6. Kellaways Clay Member.

Client	Project	Job No
Gleeson Land	Land North of Whychurch Farm	CG/38164B
	Title	Figure 4
	Ground Investigation Photosheet	

PHOTO SHEET

								
7. TP01 Kellaways Clay Member.			8. Strata horizon at TP01 of the Kellaways Clay Member.			9. TP01 excavation.		
								
10. TP02 Kellaways Clay Member arisings.			11. TP02 Kellaways Clay Member arisings.			12. TP02 excavation.		
Client Gleeson Land			Project Land North of Whychurch Farm			Job No CG/38164B		
			Title Ground Investigation Photosheet			Figure 4		



13. Kellaways Sand Member at TP08.



14. TP08 Kellaway Clay Member arisings.



15. TP08 Excavation.



16. Topsoil at SA03.

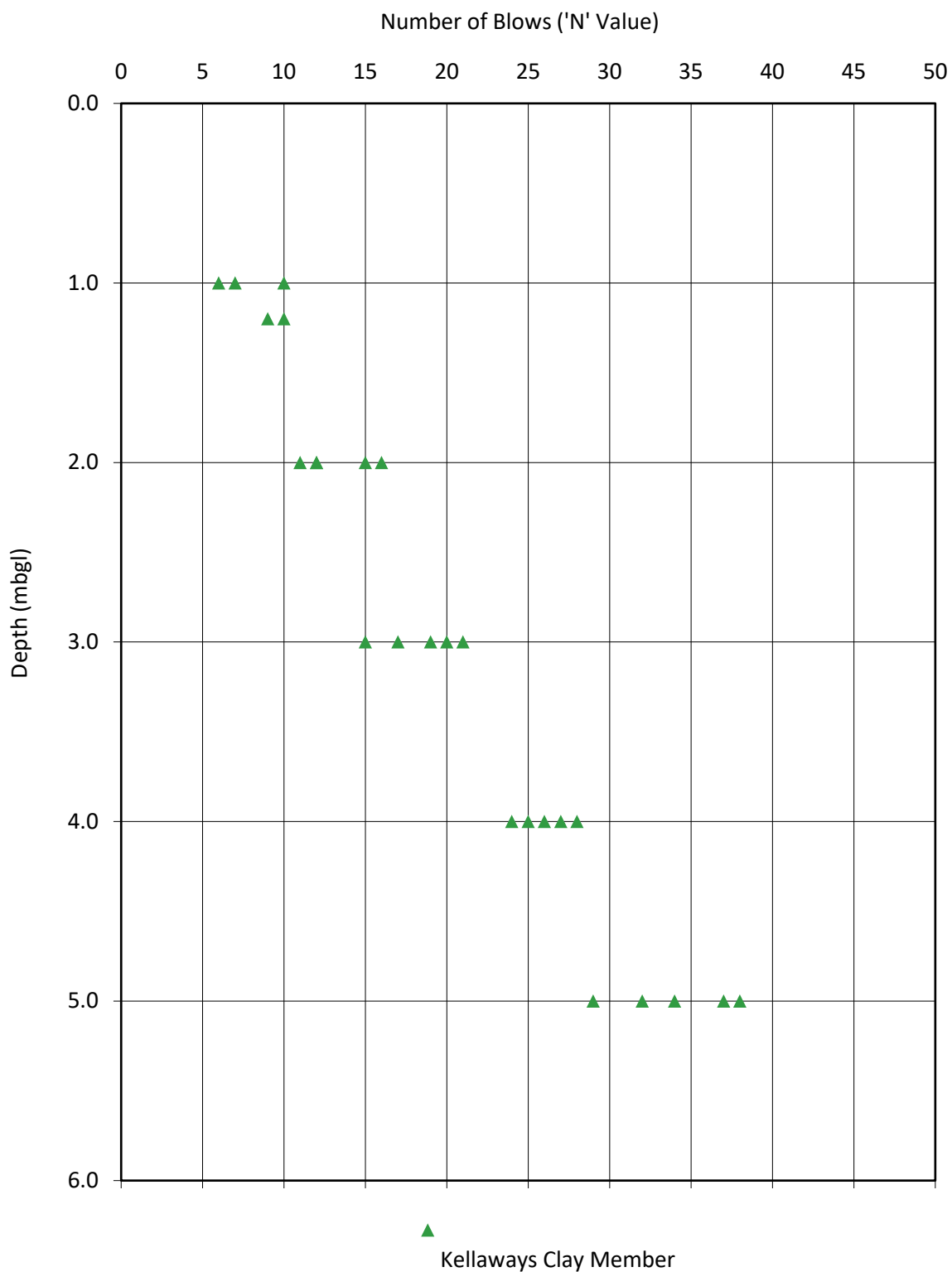


17. Kellaways Sand Member (left) and Kellaway Clay Member (right) arisings.



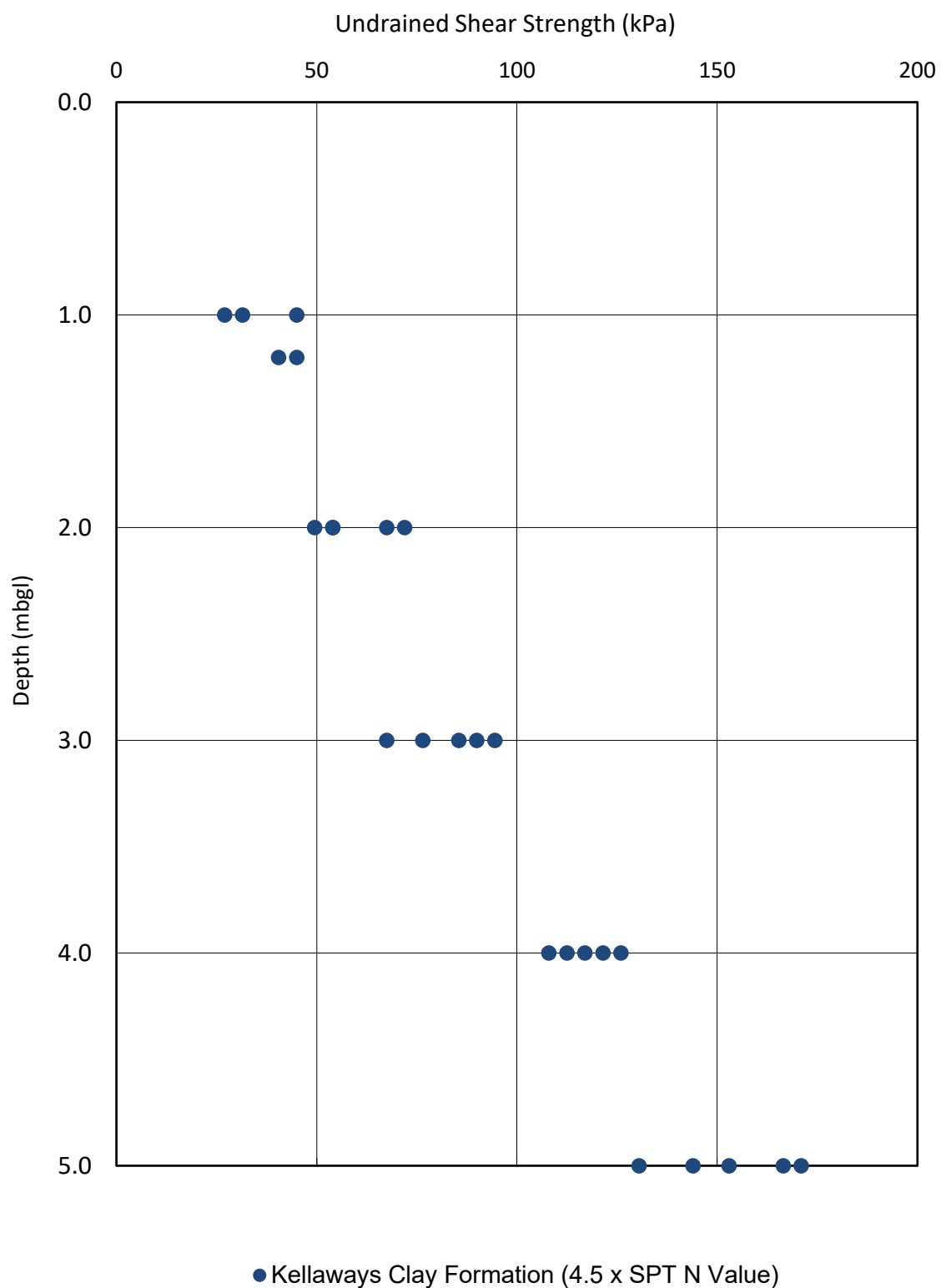
18. Strata horizon at SA03 of the Kellaways Sand Member and Kellaway Clay Member.

Client	Project		Job No
Gleeson Land	Land North of Whychurch Farm		CG/38164B
	Title		Figure 4
	Ground Investigation Photosheet		



Notes: SPT 'N' values are uncorrected

Client	Project	Job No.
Gleeson Land	Land North of Whychurch Farm	CG/38164B
	Title	
	SPT 'N' value against depth plot	Figure 5



Client	Project	Job No.
Gleeson Land	Land North of Whychurch Farm	CG/38164B
	Title	
	Undrained shear strength against depth plot	Figure 6

Key:

C Clay M Silt

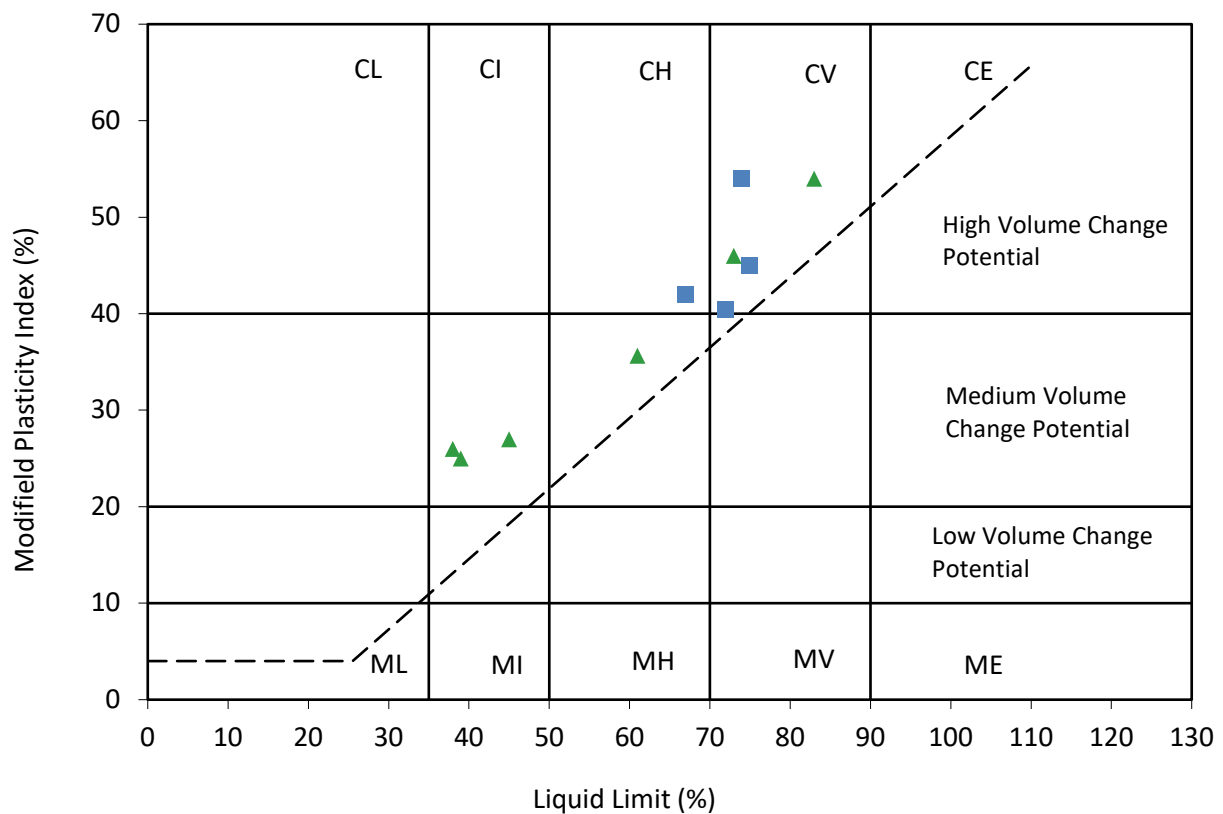
L Low plasticity

I Intermediate plasticity

H High plasticity

V Very high plasticity

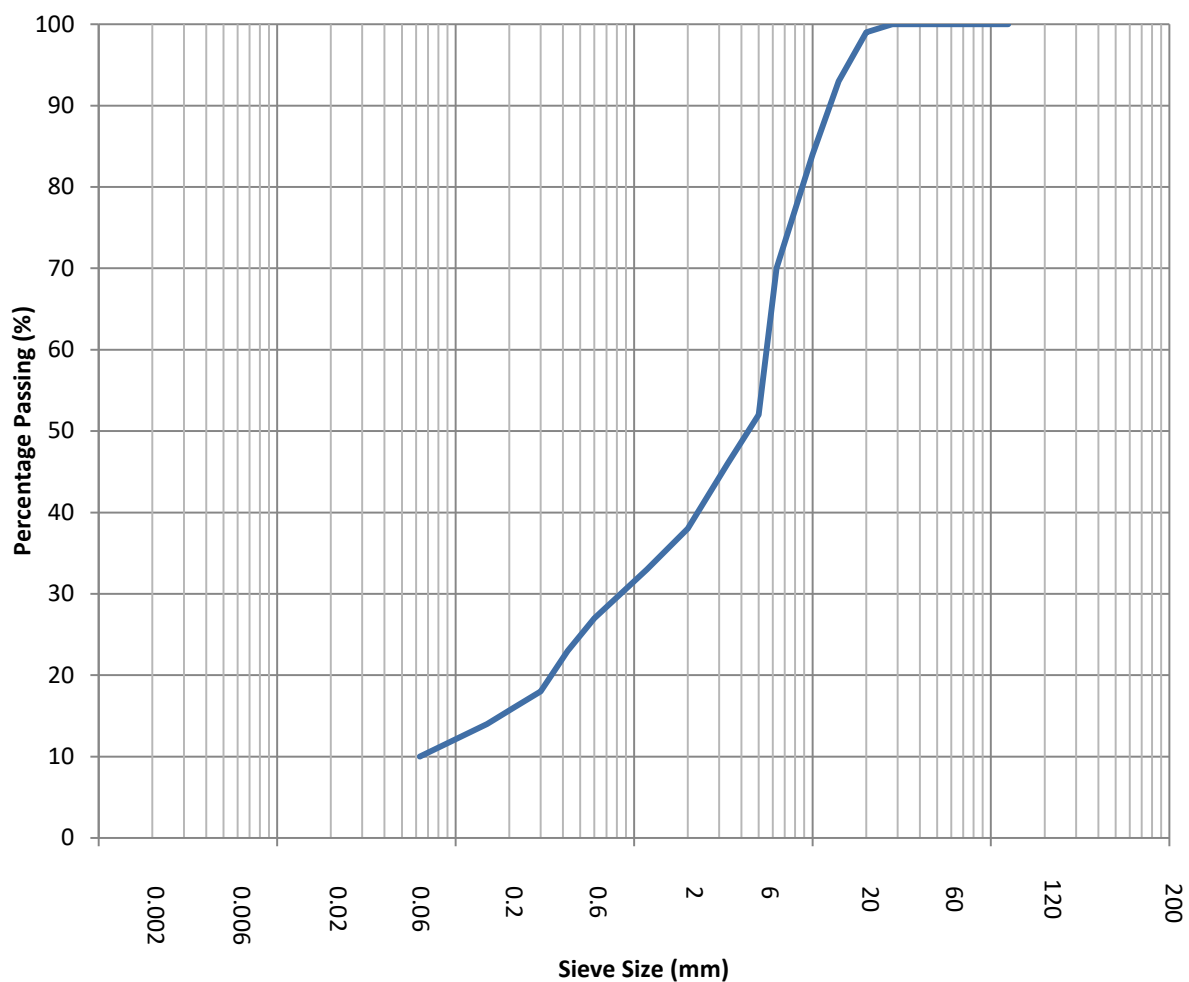
E Extremely high plasticity



■ Oxford Clay Formation ▲ Kellaways Clay Formation — — — A Line

Notes. Volume change potential based on NHBC 4.2 : 2016 : Building near trees. Plasticity of the soils is based on BS 5930 : 2015 : Code of practice for site investigations. British Standards Institution, London.

Client	Project	Job No.
Gleeson Land	Land North of Whychurch Farm	CG/38164B
	Title	Figure 7
	Plasticity Index Chart	



CLAY	Fine	Medi	Coarse	Fine	Med	Coarse	Fine	Med	Coarse	COBBLES
	SILT			SAND			GRAVEL			

— SA04 (0.60)

Notes: Test undertaken on sample of Kellaways Sand Member from Trial Pit SA04

Client Gleeson Land	Project Land North of Whychurch Farm	Job No. CG/38164B
	Title Particle Size Distribution Chart (wet-sieve)	Figure 8

APPENDIX A

Proposed Development Plans



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- APPLICATION SITE BOUNDARY (6.04HA)
- AFFORDABLE HOUSING

LAND BUDGET

SITE AREA:	6.04HA
DEVELOPABLE AREA:	2.14HA
NO. DWELLINGS:	71 UNITS
DENSITY:	33 DPH
ACCESS ARRANGEMENTS:	0.53HA
ROAD INFRASTRUCTURE:	0.31HA
ALLOTMENTS	0.03HA
AMENITY GREEN SPACE:	1.26HA
NATURAL GREEN SPACE	1.20HA
LANDSCAPE BUFFER	0.08HA
PLAY SPACE (CHILDREN)	0.01HA
PLAY SPACE (YOUTH)	0.04HA
SUDS	0.44HA

ACCOMMODATION SCHEDULE

TYPE	NO.	%
1 BED FLAT	10	(15%)
2 BED FLAT	8	(11%)
2 BED HOUSE	8	(11%)
3 BED HOUSE	34	(50%)
4 BED HOUSE	11	(13%)

TOTAL	71 UNITS
AFFORDABLE (40%)	28 UNITS
MARKET (60%)	43 UNITS

A	UPDATED RED LINE BOUNDARY	19.08.21
Rev	Description	Date
Purpose of Issue		
PLANNING		
Bradley Murphy Design Ltd 6 The Courtyard Hatton Technology Park Dark Lane Hatton Warwickshire CV35 8XB		
t: 01926 676496 e: info@bradleymurphydesign.co.uk www.bradleymurphydesign.co.uk		
Client		
gleeson		
Project		
LAND NORTH OF WHYCHURCH FARM, MALMESBURY		
Drawing Title		
ILLUSTRATIVE MASTERPLAN		
Drawn	Checked	Approved
SR	JJ	RM
Job No.	Scale	Sheet Size
20.035	NTS	A1
Drawing Number		Revision
BMD.20.035.DR.005		A

APPENDIX B

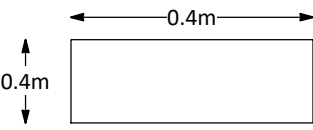
Exploratory Hole Records

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No HP01
Job No CG/38164B	Date 16-10-20	Ground Level (m) 87.30	Co-Ordinates (m) E 393,757.0 N 188,486.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
				87.05	(0.25)	Grass over soft brown slightly sandy clayey silt. Frequent rootlets. [TOPSOIL]
				87.00		Soft brownish yellow and grey mottled red slightly sandy silty clay. Occasional rootlets. [MADE GROUND]
				86.80	(0.20)	Soft brownish yellow and grey mottled red slightly gravelly silty clay. Gravel is angular medium to coarse limestone. Occasional rootlets. [MADE GROUND]
				86.75		0.45 Single angular limestone cobble.
				86.65	(0.10)	Firm brownish yellow and grey mottled red slightly gravelly silty clay. Gravel is angular medium to coarse limestone. Rare rootlets. [MADE GROUND]
					0.65	Firm to stiff brownish yellow and grey mottled red slightly gravelly silty clay. Gravel is angular medium to coarse limestone. [MADE GROUND]
						(Pit terminated at 0.65m)

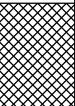
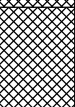
Plan  Stability: Stable	General Remarks METHOD: Excavated using hand tools to depth. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Terminated at 0.65m due to density of strata.
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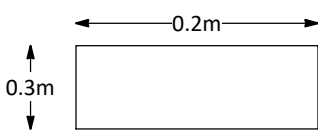
Method/ Plant Used	Field Crew	Logged By	Checked By
Hand Pit	CGL	YPM	SJM

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No HP02
Job No CG/38164B	Date 30-10-20	Ground Level (m) 90.70	Co-Ordinates (m) E 393,644.0 N 188,107.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
				90.50		(0.20) Grass over firm brown slightly gravelly sandy silt. Gravel is subangular to subrounded fine to coarse silicate sandstone limestone and concrete. Occasional rootlets. [TOPSOIL]
				90.10		(0.40) Firm greyish brown slightly sandy gravelly silty clay with a low cobble content. Gravel is subangular to subrounded fine to coarse silicate sandstone and limestone. Cobbles are of limestone. [MADE GROUND] 0.40 Single fragment of brick.
				90.10		0.60 Animal bone encountered (up to 40mm diameter). (Pit terminated at 0.6m)

Plan  Stability: Stable	General Remarks METHOD: Excavated using hand tools to depth. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Terminated at 0.6m bgl due to presence of animal bone.
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Method/ Plant Used	Hand excavated	Field Crew	CGL	Logged By	ALD	Checked By	SJM
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TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No HP03
Job No CG/38164B	Date 30-10-20	Ground Level (m) 91.50	Co-Ordinates (m) E 393,657.0 N 188,024.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
				91.30		Grass over firm brown slightly ravelly slightly sandy silt. Gravel is angular to subrounded fine to medium silicate sandstone. Occasional rootlets. [TOPSOIL]
				91.10		Firm greyish brown and orangish brown slightly sandy slightly gravelly clayey silt. Gravel is subangular to subrounded fine to coarse silicate sandstone. Rare rootlets. [MADE GROUND]
				90.90		Orangish brown slightly clayey slightly sandy angular to rounded fine to coarse breccia and silicate sandstone GRAVEL. [KELLAWAYS SAND MEMBER]
(Pit terminated at 0.6m)						

Plan Stability: Stable	General Remarks METHOD: Excavated using hand tools to depth. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Terminated at 0.6m bgl within natural strata.
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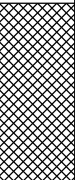
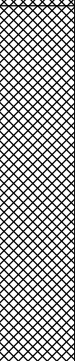
Method/ Plant Used	Hand excavated	Field Crew	CGL	Logged By	ALD	Checked By	SJM
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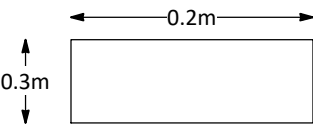
Report ID: CGL_TP_LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 GLB || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No HP04
Job No CG/38164B	Date 30-10-20	Ground Level (m) 87.30	Co-Ordinates (m) E 393,757.0 N 188,486.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
				87.00		Grass over firm brown and orangish brown slightly sandy clayey silt. Frequent rootlets. [TOPSOIL] (0.30) 0.30
				86.40		Soft to firm mottled purplish brown orangish brown bluish grey sandy clayey silt. Occasional rootlets, Rare wood fragments. [MADE GROUND] (0.60) 0.60 - 0.70 Slightly gravelly. Gravel is subangular coarse flint. 0.70 - 0.90 Minor seepage.
				86.35		Stiff mottled orangish brown and bluish grey slightly sandy silty CLAY. [KELLAWAYS CLAY MEMBER] (Pit terminated at 0.95m) 0.90 0.95

Plan  Stability: Stable	General Remarks METHOD: Excavated using hand tools to depth. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Minor seepage was recorded between 0.7m and 0.9m bgl. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Terminated at 0.95m bgl within natural strata.
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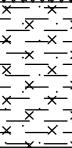
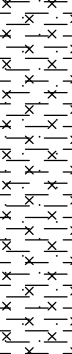
Method/ Plant Used	Hand excavated	Field Crew	CGL	Logged By	ALD	Checked By	SJM
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Report ID: CGL_TP_LOG || Project: CG_38164B FILANDS PHASE 3.GPJ || Library: CGL_AGS4_R3.GLB || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No SA01
Job No CG/38164B	Date 28-08-20	Ground Level (m) 86.00	Co-Ordinates (m) E 393,685.0 N 188,436.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (m) (Thickness)	DESCRIPTION
0.80	HSV	98		85.70		(0.30) 0.30	Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
				85.10		(0.60) 0.90	Firm locally stiff fissured orangish brown mottled bluish grey slightly sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]
83.60		(1.50) 2.40					Firm fissured orangish brown locally mottled bluish grey sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]
				1.70	HSV	81	1.60 - 2.40 Relict rootlets.
							83.10
				(Pit terminated at 2.9m)			

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 2.9m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Trial pit terminated at 2.9m in order to complete soakaway testing.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL_TP_LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No SA02
Job No CG/38164B	Date 28-08-20	Ground Level (m) 90.20	Co-Ordinates (m) E 393,846.0 N 188,150.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.80	HSV	119		89.90		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
				89.70		Orangish grey clayey sandy subangular to rounded fine to medium limestone and silicate sandstone GRAVEL. [KELLAWAYS SAND MEMBER]
				88.60		Firm to stiff fissured bluish grey locally mottled orangish brown silty CLAY. Rare rootlets and relict rootlets. [KELLAWAY CLAY MEMBER]
1.80	HSV	70		87.20		Stiff fissured dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter) and rare selenite crystals (up to 20mm diameter). [KELLAWAY CLAY MEMBER]
(Pit terminated at 3m)						

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.0m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Trial pit terminated at 3.0m in order to complete soakaway testing.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No SA03
Job No CG/38164B	Date 28-08-20	Ground Level (m) 90.40	Co-Ordinates (m) E 393,587.0 N 188,114.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
				90.10		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
				89.20		Light yellowish brown sandy subrounded to rounded fine to medium silicate sandstone GRAVEL. [KELLAWAYS SAND MEMBER]
				89.00		Firm purplish brown and orangish brown slightly gravelly silty CLAY. Gravel is subrounded to rounded fine to medium silicate sandstone. [KELLAWAY CLAY MEMBER]
				88.10		Firm to stiff purplish grey and orangish brown silty CLAY. Rare shell fragments (up to 50mm diameter). [KELLAWAY CLAY MEMBER]
						(Pit terminated at 2.3m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 2.3m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Trial pit terminated at 2.3m in order to complete soakaway testing.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No SA04
Job No CG/38164B	Date 28-08-20	Ground Level (m) 90.40	Co-Ordinates (m) E 393,583.0 N 188,108.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
				90.10		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
				89.30		Light yellowish brown clay very sandy subrounded to rounded fine to medium silicate sandstone GRAVEL. [KELLAWAYS SAND MEMBER]
						(Pit terminated at 1.1m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 1.1m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Trial pit terminated at 1.1m in order to complete soakaway testing.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL_TP_LOG || Project: CG_38164B FILANDS PHASE 3.GPJ || Library: CGL_AGS4_R3.GLB || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP01
Job No CG/38164B	Date 27-08-20	Ground Level (m) 88.25	Co-Ordinates (m) E 393,784.0 N 188,393.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.20	ES			87.95		(0.30) 0.30 Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL] 0.20 - 0.30 100mm band of subangular to subrounded medium to coarse limestone.
0.80	ES			86.85		(1.10) 1.10 Firm fissured orangish brown mottled bluish grey slightly sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER] 0.90 Becoming firm.
				85.25		(1.60) 1.60 Firm to stiff fissured bluish grey mottled orangish brown sandy silty CLAY. [KELLAWAYS CLAY MEMBER] 1.40 - 1.60 Rare rootlets. 1.60 - 3.00 Rare relict rootlets.
						(Pit terminated at 3m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.0m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP02
Job No CG/38164B	Date 27-08-20	Ground Level (m) 89.50	Co-Ordinates (m) E 393,706.0 N 188,285.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.20	ES	100		89.20		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
0.50	HSV			88.70		Firm fissured orangish brown mottled bluish grey silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]
				87.90		Firm orangish brown mottled bluish grey sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]
2.00	HSV	52		87.20		Firm fissured bluish grey mottled orangish brown slightly sandy silty CLAY. Rare relict rootlets. [KELLAWAYS CLAY MEMBER]
2.50	HSV	54		86.30		Firm becoming stiff thinly laminated dark bluish grey silty CLAY. Rare selenite crystals (up to 20mm diameter). [KELLAWAYS CLAY MEMBER]
						(Pit terminated at 3.2m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.2m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.
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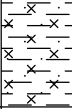
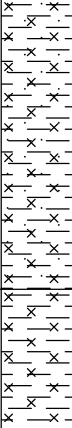
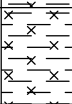
Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP03
Job No CG/38164B	Date 27-08-20	Ground Level (m) 86.00	Co-Ordinates (m) E 393,625.0 N 188,345.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (m) (Thick-ness)	DESCRIPTION
0.20	ES			85.80		0.20	Firm brown slightly gravelly slighty sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets.
				85.70		0.30	[TOPSOIL]
				85.20		(0.50)	Brown and brownish grey slightly sandy gravelly silt. Gravel is angular to subrounded medium to coarse brick, sandstone and limestone. [MADE GROUND]
						0.80	Firm fissured orangish brown mottled bluish grey slightly sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]
2.10	HSV	61		84.00		(1.20)	Firm orangish brown mottled bluish grey sandy silty CLAY. Rare relict rootlets. [KELLAWAYS CLAY MEMBER]
						2.00	
						(0.60)	Firm fissured dark blush grey silty CLAY. [KELLAWAYS CLAY MEMBER]
2.80	HSV	69		83.40		2.60	
				(0.40)		Stiff fissured dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter) and rare selenite crystals (up to 20mm diameter). [KELLAWAYS CLAY MEMBER]	
				83.00		3.00	(Pit terminated at 3m)

Plan	General Remarks
Stability: Stable	METHOD: Trial pit machine excavated 0.0m to 3.0m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.

Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP04
Job No CG/38164B	Date 27-08-20	Ground Level (m) 90.50	Co-Ordinates (m) E 393,563.0 N 188,159.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.20	ES	105		90.20		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
0.70 0.80	HSV ES					Firm becoming stiff fissured orangish brown mottled yellowish grey silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]
1.40	HSV	79				1.60 - 1.70 Low subrounded claystone cobble content. 1.70 - 2.80 Slightly sandy.
2.00	HSV	87				
				87.70		2.80
				87.50		3.00
						Very stiff fissured light bluish grey locally mottled orangish brown sandy silty CLAY. Rare relict rootlets. [KELLAWAYS CLAY MEMBER]
						(Pit terminated at 3m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.0m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP05
Job No CG/38164B	Date 27-08-20	Ground Level (m) 91.10	Co-Ordinates (m) E 393,783.0 N 188,192.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.20	ES			90.80		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
						Firm fissured orangish brown mottled bluish grey silty CLAY. Rare rootlets and relict rootlets. [KELLAWAYS CLAY MEMBER]
				89.60		1.30 - 1.50 100mm pockets of orangish brown clayey fine to coarse sand.
						Stiff fissured bluish grey locally mottled orangish brown slightly sandy silty CLAY. Rare relict rootlets. [KELLAWAYS CLAY MEMBER]
				88.30		1.90 Becoming purplish grey locally stained orangish brown.
				88.00		Stiff fissured dark bluish grey silty CLAY. Rare selenite crystals (up to 20mm diameter). [KELLAWAYS CLAY MEMBER]
						(Pit terminated at 3.1m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.1m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP06
Job No CG/38164B	Date 27-08-20	Ground Level (m) 91.50	Co-Ordinates (m) E 393,730.0 N 188,094.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.60	ES			91.20		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
						Orangish brown slightly clayey slightly gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse silicate sandstone and limestone. [KELLAWAYS SAND MEMBER]
1.60	HSV	64		90.70		Stiff fissured bluish grey locally mottled orangish brown slightly sandy silty CLAY. Rare relict rootlets. [KELLAWAY CLAY MEMBER]
2.60	HSV	101		89.10		Stiff fissured dark bluish grey silty CLAY. Rare selenite crystals (up to 20mm diameter). [KELLAWAY CLAY MEMBER]
				88.10		
						(Pit terminated at 3.4m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.4m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021



Project Land North of Whychurch Farm				TRIAL PIT No TP07
Job No CG/38164B	Date 27-08-20	Ground Level (m) 90.50	Co-Ordinates (m) E 393,894.0 N 188,099.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (m) (Thick-ness)	DESCRIPTION
0.30	ES			90.40		0.10	Firm brown slightly gravelly slighty sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets.
						(0.30)	
				90.10		0.40	Stiff greyish brown, light grey and orangish brown gravelly silty clay. Gravel is angular to subrounded fine to coarse silicate sandstone, concrete, brick, bound surfacing and metal fragments.
							[TOPSOIL]
							[MADE GROUND]
							(Pit terminated at 0.4m)

Plan  Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 0.4m. CONTAMINATION: Made Ground was encountered from 0.1m to 0.4m, potentially associated with a nearby service. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Trial pit terminated at 0.4m due to potential to be excavating above a service.
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Method/ Plant Used	JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP08
Job No CG/38164B	Date 27-08-20	Ground Level (m) 91.20	Co-Ordinates (m) E 393,679.0 N 188,030.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.20	ES			90.90		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
				90.60		Orangish brown slightly clayey slightly gravelly fine to coarse SAND. Gravel is angular to rounded fine to coarse silicate sandstone and limestone. [KELLAWAYS SAND MEMBER]
0.80	HSV	73				Firm becoming stiff fissured bluish grey locally mottled orangish brown slightly sandy silty CLAY. Rare relict rootlets. [KELLAWAY CLAY MEMBER]
						(1.40)
1.70	HSV	61		89.20		
						Stiff fissured dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter) and rare selenite crystals (up to 20mm diameter). [KELLAWAY CLAY MEMBER]
						(1.20)
				88.00		
						3.20
						(Pit terminated at 3.2m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.2m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP09
Job No CG/38164B	Date 27-08-20	Ground Level (m) 91.50	Co-Ordinates (m) E 393,564.0 N 188,017.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.20	ES	41		91.10		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
0.60	ES			90.70		Orangish brown and yellowish brown slightly clayey sandy subrounded to rounded fine to medium silicate sandstone GRAVEL. [KELLAWAYS SAND MEMBER]
0.90	HSV			89.60		Firm becoming stiff fissured bluish grey locally mottled orangish brown slightly sandy silty CLAY. Rare relict rootlets. [KELLAWAY CLAY MEMBER]
						1.60 Becoming purplish grey locally mottled yellowish grey. 1.70 - 1.90 Rare selenite crystals (up to 20mm diameter).
						Stiff fissured dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter) and rare selenite crystals (up to 20mm diameter). [KELLAWAY CLAY MEMBER]
3.00	HSV	91		88.40		3.10
(Pit terminated at 3.1m)						

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.1m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL_TP_LOG || Project: CG_38164B FILANDS PHASE 3.GPJ || Library: CGL_AGS4_R3.GLB || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP10
Job No CG/38164B	Date 27-08-20	Ground Level (m) 91.10	Co-Ordinates (m) E 393,624.0 N 188,184.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
0.70	HSV	123		90.70		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
						Firm fissured bluish grey locally mottled orangish brown slightly sandy silty CLAY. Rare pockets (up to 300mm diameter) of orangish brown slightly clayey gravelly fine to coarse sand. Rare relict rootlets. [KELLAWAYS CLAY MEMBER]
				90.10		
						Firm fissured orangish brown and bluish grey sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]
				88.30		
						Stiff fissured dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter) and rare selenite crystals (up to 20mm diameter). [KELLAWAYS CLAY MEMBER]
				88.00		
						3.00 - 3.10 Abundant fossil fragments (up to 50mm diameter). (Pit terminated at 3.1m)

Plan Stability: Stable	General Remarks METHOD: Trial pit machine excavated 0.0m to 3.1m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order.
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Method/ Plant Used JCB 3CX	Field Crew Channel Plant Hire	Logged By ALD	Checked By SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

TRIAL PIT LOG



Project Land North of Whychurch Farm				TRIAL PIT No TP11
Job No CG/38164B	Date 28-08-20	Ground Level (m) 90.40	Co-Ordinates (m) E 393,589.0 N 188,119.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	DESCRIPTION
				90.10		Firm brown slightly gravelly slightly sandy silt. Gravel is subangular to subrounded fine to coarse limestone. Frequent rootlets. [TOPSOIL]
				89.70		Light yellowish brown sandy subrounded to rounded fine to medium silicate sandstone GRAVEL. [KELLAWAYS SAND MEMBER]
				89.40		Firm to stiff purplish grey and orangish brown silty CLAY. Rare shell fragments (up to 50mm diameter). [KELLAWAY CLAY MEMBER]
						(Pit terminated at 1m)

Plan	General Remarks
Stability: Stable	METHOD: Trial pit machine excavated 0.0m to 1.0m. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, trial pit was backfilled with lightly compacted arisings in reverse order. REMARKS: Trial pit terminated at 1.0m in order to progress SA03 and SA04 to target soakaway testing in granular material.

Method/ Plant Used	JCB 3CX	Field Crew	Channel Plant Hire	Logged By	ALD	Checked By	SJM
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Report ID: CGL TP LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 G.L.B || Date: 30 March 2021

WINDOW SAMPLE LOG



Project Land North of Whychurch Farm				HOLE No WS01
Job No CG/38164B	Date 26-08-20	Ground Level (m) 87.30	Co-Ordinates (m) E 393,767.0 N 188,494.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (m) (Thickness)	DESCRIPTION	
0.50	ES			87.00		(0.30) 0.30	Grass over firm brown slightly gravelly clayey silt. Gravel is subangular to subrounded fine to medium limestone. Frequent rootlets. [TOPSOIL]	
				86.30		(0.70) 1.00	Firm greyish brown and reddish brown slightly gravelly silty clay. Gravel is subangular to subrounded fine to coarse limestone. Rare fragments of partially decomposed wood (up to 5mm diameter). Rare rootlets. [MADE GROUND]	
1.10-1.20 1.20	D SPT	N7				(1.60)	Firm fissured orangish brown mottled brownish grey slightly sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]	
2.00	SPT	N11					1.80 Becoming yellowish brown and orangish brown. 2.20 Becoming bluish grey and orangish brown.	
2.60-2.70	D			84.70		2.60	Stiff dark bluish grey slightly sandy silty CLAY. [KELLAWAYS CLAY MEMBER]	
3.00	SPT	N15				(0.60)		
3.80-3.90 4.00	D SPT	N22		84.10		3.20	Stiff thinly laminated dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter). [KELLAWAYS CLAY MEMBER]	
5.00	SPT	N22		82.30		5.00	(Window sample terminated at 5m)	

Boring Progress and Water Observations						General Remarks	
Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth	METHOD: Dynamic sampling 0.0m to 5.0m. CASING: None used. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, borehole backfilled with arisings 5.0m to 1.0m. A slotted standpipe (50mm) was installed to 1.0m, response zone 1.0m to 0.5m, bentonite seal 0.5m to 0.2m, stopcock and cover 0.2m to 0.0m.	
Method/ Plant Used			Dando Terrier 2002			Field Crew 360 Drilling	Logged By ALD Checked By SJM

Report ID: CGL WS LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 GLB || Date: 30 March 2021

WINDOW SAMPLE LOG



Project Land North of Whychurch Farm				HOLE No WS02
Job No CG/38164B	Date 26-08-20	Ground Level (m) 85.20	Co-Ordinates (m) E 393,581.0 N 188,286.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (m) (Thickness)	DESCRIPTION	
0.50-0.60	D	N7		84.90		(0.30) 0.30	Grass over soft brown slightly sandy slightly gravelly clayey silt. Gravel is subrounded fine to medium limestone. Frequent rootlets. [TOPSOIL]	
				84.40		(0.50) 0.80	Firm to stiff orangish grey slightly sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]	
1.00	SPT	N7					Firm fissured orangish brown mottled brownish grey slightly sandy silty CLAY. [KELLAWAYS CLAY MEMBER] 0.80 - 1.20 Rare rootlets.	
1.50-1.60	D					(1.70)	1.50 - 1.90 Rare selenite crystals (up to 15mm diameter).	
2.00	SPT	N12						
2.60-2.70	D			82.70		2.50	Firm to stiff dark bluish grey slightly sandy silty CLAY. [KELLAWAYS CLAY MEMBER]	
3.00	SPT	N11				(1.20)		
3.70-3.80	D			81.50		3.70	Stiff thinly laminated dark bluish grey silty CLAY. Rare fossil fragments. [KELLAWAYS CLAY MEMBER]	
4.00	SPT	N20				(1.30)		
5.00	SPT	N26		80.20		5.00	(Window sample terminated at 5m)	

Boring Progress and Water Observations						General Remarks
Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth	
						METHOD: Dynamic sampling 0.0m to 5.0m. CASING: None used. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Slow seepage encountered at 4.0m (sample recovered as damp). BACKFILL: On completion, borehole backfilled with arisings 5.0m to 0.0m.

Method/ Plant Used	Dando Terrier 2002	Field Crew	360 Drilling	Logged By	ALD	Checked By	SJM
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Report ID: CGL_WS_LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3_GLB || Date: 30 March 2021

WINDOW SAMPLE LOG



Project Land North of Whychurch Farm				HOLE No WS03
Job No CG/38164B	Date 26-08-20	Ground Level (m) 91.40	Co-Ordinates (m) E 393,724.0 N 188,143.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill		
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (m) (Thickness)	DESCRIPTION			
0.60-0.70	D	N5		91.10		(0.30) 0.30	Grass over soft brown slightly sandy slightly gravelly clayey silt. Gravel is subrounded fine to medium limestone. Frequent rootlets. [TOPSOIL]			
				90.70		(0.40) 0.70	Firm orangish grey slightly sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]			
1.00	SPT	N5		90.00		(0.70) 1.40	Firm fissured orangish brown mottled brownish grey slightly sandy silty CLAY. Rare rootlets. [KELLAWAYS CLAY MEMBER]			
1.50-1.60	D	N9		89.20		(0.80) 2.20	Firm locally soft light grey, light bluish grey and orangish brown silty CLAY. Frequent selenite crystals (up to 2mm diameter). [KELLAWAYS CLAY MEMBER]			
2.00	SPT			88.40		(0.80) 3.00	Firm to stiff thinly laminated dark grey and brownish grey silty CLAY. Rare selenite crystals (up to 20mm diameter). [KELLAWAYS CLAY MEMBER]			
2.50-2.60	D	N13		86.40		(2.00) 5.00	Stiff thinly laminated dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter). [KELLAWAYS CLAY MEMBER]			
3.00	SPT									
3.50-3.60	D	N19		86.40		(2.00) 5.00	Stiff thinly laminated dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter). [KELLAWAYS CLAY MEMBER]			
4.00	SPT									
4.70-4.80	D	N30		86.40		(2.00) 5.00	Stiff thinly laminated dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter). [KELLAWAYS CLAY MEMBER]			
5.00	SPT									
(Window sample terminated at 5m)										

Boring Progress and Water Observations						General Remarks	
Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth	METHOD: Dynamic sampling 0.0m to 5.0m. CASING: None used. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, borehole backfilled with arisings 5.0m to 0.0m.	

Method/ Plant Used	Dando Terrier 2002	Field Crew	360 Drilling	Logged By	ALD	Checked By	SJM
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Report ID: CGL WS LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3_GLB || Date: 30 March 2021

WINDOW SAMPLE LOG



Project Land North of Whychurch Farm				HOLE No WS04
Job No CG/38164B	Date 26-08-20	Ground Level (m) 91.30	Co-Ordinates (m) E 393,856.0 N 188,045.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (m) (Thickness)	DESCRIPTION	
0.70-0.80	D			90.90		(0.40) 0.40	Grass over soft brown slightly sandy clayey silt. Frequent rootlets. [TOPSOIL]	
				90.20		(0.70) 1.10	Firm to stiff orangish brown and light grey slightly sandy silty CLAY. Rare rootlets. [KELLAWAY CLAY MEMBER]	
1.20	SPT	N8		89.70		(0.50) 1.60	Firm purplish grey and orangish brown silty CLAY. [KELLAWAY CLAY MEMBER] 1.10 - 1.40 Rare rootlets.	
1.50-1.60	D			88.80		(0.90) 2.50	Firm locally stiff thinly laminated purplish grey, orangish brown and yellowish grey silty CLAY. Rare selenite crystals (up to 10mm diameter) [KELLAWAY CLAY MEMBER]	
2.60-2.70	D			86.30		(2.50) 5.00	Stiff thinly laminated dark grey and brownish grey silty CLAY. [KELLAWAY CLAY MEMBER] 2.50 - 3.20 Rare selenite crystals (up to 20mm diameter).	
3.00	SPT	N16						
3.60-3.80	D							
4.00	SPT	N19						
5.00	SPT	N25					(Window sample terminated at 5m)	

Boring Progress and Water Observations						General Remarks
Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth	
						METHOD: Dynamic sampling 0.0m to 5.0m. CASING: None used. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, a slotted standpipe (50mm) was installed to 5.0m, response zone 5.0m to 1.0m, bentonite seal 1.0m to 0.2m, stopcock and cover 0.2m to 0.0m.

Method/ Plant Used	Dando Terrier 2002	Field Crew	360 Drilling	Logged By	ALD	Checked By	SJM
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Report ID: CGL WS LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 GLB || Date: 30 March 2021

WINDOW SAMPLE LOG



Project Land North of Whychurch Farm				HOLE No WS05
Job No CG/38164B	Date 26-08-20	Ground Level (m) 91.20	Co-Ordinates (m) E 393,650.0 N 188,078.0	
Client Gleeson Land				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth (m)	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (m) (Thickness)	DESCRIPTION	
				90.90		(0.30) 0.30	Grass over soft brown slightly sandy clayey silt. Frequent rootlets. [TOPSOIL]	
0.50	ES			90.60		(0.30) 0.60	Firm to stiff brownish grey slightly gravelly silty clay. Gravel is subangular to subrounded fine to medium silicate sandstone and limestone. Rare rootlets. [MADE GROUND]	
0.80-0.90	D					(0.90)	Soft to firm locally stiff light bluish grey and orangish brown silty CLAY. Rare rootlets. [KELLAWAY CLAY MEMBER]	
1.00	SPT	N5		89.70		1.50	1.00 - 1.50 Firm.	
1.60-1.70	D					(0.70)	Firm thinly laminated purplish grey locally orangish brown silty CLAY. [KELLAWAY CLAY MEMBER]	
2.00	SPT	N8		89.00		2.20		
2.50-2.60	D					(2.80)	Stiff thinly laminated dark bluish grey silty CLAY. Rare fossil fragments (up to 50mm diameter). [KELLAWAY CLAY MEMBER]	
3.00	SPT	N16					2.20 - 2.60 Rare selenite crystals (up to 10mm diameter).	
3.50-3.70	D						3.60 - 3.80 Frequent fossil fragments (up to 50mm diameter).	
4.00	SPT	N20						
5.00	SPT	N29		86.20		5.00	4.90 - 5.00 Frequent fossil fragments (up to 50mm diameter). (Window sample terminated at 5m)	

Boring Progress and Water Observations						General Remarks
Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth	
						METHOD: Dynamic sampling 0.0m to 5.0m. CASING: None used. CONTAMINATION: Visual or olfactory evidence of contamination was not encountered. GROUNDWATER: Groundwater was not encountered. BACKFILL: On completion, a slotted standpipe (50mm) was installed to 5.0m, response zone 5.0m to 1.0m, bentonite seal 1.0m to 0.2m, stopcock and cover 0.2m to 0.0m.

Method/ Plant Used	Dando Terrier 2002	Field Crew	360 Drilling	Logged By	ALD	Checked By	SJM
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Report ID: CGL WS LOG || Project: CG_38164B FILANDS PHASE 3 GPU || Library: CGL_AGS4_R3 GLB || Date: 30 March 2021

APPENDIX C

Gas and Groundwater Monitoring Records

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	Land North of Whychurch Farm	Job No:	CG/38164B
Date:	30/10/2020	Engineer:	ALD
Time:	10:00	Client:	Gleeson Land

METEOROLOGICAL & SITE INFORMATION									
State of ground:	Dry		Moist		Wet	<input checked="" type="text"/>			
Wind:	Calm		Light		Moderate	<input checked="" type="text"/>	Strong		
Cloud cover:	None		Slight		Cloudy		Overcast	<input checked="" type="text"/>	
Precipitation:	None		Slight	<input checked="" type="text"/>	Moderate		Heavy		
Barometric pressure (mb):	1005		Local pressure system*:	Steady		Air temperature (°C):	13		

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O ₂ (% vol. in air)	CO ₂ (% vol. in air)	CH ₄ (% vol. in air)	PID (ppm)	Depth to Groundwater (mbgl)	Depth to base (mbgl)
WS01	0			Response zone flooded				0.30	1.03
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								
WS04	0	<0.1		21.0	<0.1	<0.1	0.1	1.30	4.78
	15	<0.1		12.7	1.2	<0.1			
	30	<0.1		3.8	1.2	<0.1			
	45	<0.1		3.0	1.2	<0.1			
	60	<0.1		2.9	1.2	<0.1			
	90			2.7	1.2	<0.1			
	120			2.7	1.2	<0.1			
	150			2.7	1.2	<0.1			
	180			2.7	1.2	<0.1			
	240			2.7	1.2	<0.1			
	300			2.7	1.2	<0.1			
WS05	0	<0.1		21.0	<0.1	<0.1	0.2	1.27	4.88
	15	<0.1		20.0	1.0	<0.1			
	30	<0.1		19.5	0.9	<0.1			
	45	<0.1		19.9	0.7	<0.1			
	60	<0.1		20.3	0.5	<0.1			
	90			20.5	0.4	<0.1			
	120			20.7	0.3	<0.1			
	150			20.7	0.3	<0.1			
	180			20.8	0.2	<0.1			
	240			20.8	<0.1	<0.1			
	300			20.9	<0.1	<0.1			

Notes:
 The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.
 * With reference to the Weather Underground rolling weather archive for Cambridge weather station.
 NR= Not recorded

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	Land North of Whychurch Farm	Job No:	CG/38164B
Date:	13/11/2020	Engineer:	ALD
Time:	09:00	Client:	Gleeson Land

METEOROLOGICAL & SITE INFORMATION									
State of ground:	Dry		Moist		Wet	<input checked="" type="text"/>			
Wind:	Calm		Light	<input checked="" type="text"/>	Moderate		Strong		
Cloud cover:	None	<input checked="" type="text"/>	Slight		Cloudy		Overcast		
Precipitation:	None	<input checked="" type="text"/>	Slight		Moderate		Heavy		
Barometric pressure (mb):	1000		Local pressure system*:	Steady		Air temperature (°C):	10		

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O ₂ (% vol. in air)	CO ₂ (% vol. in air)	CH ₄ (% vol. in air)	PID (ppm)	Depth to Groundwater (mbgl)	Depth to base (mbgl)
WS01	0			Response zone flooded				<0.15 (flooded)	1.02
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								
WS04	0	<0.1		2.1	0.1	<0.1	0.0	1.24	4.80
	15	<0.1		13.7	1.1	<0.1			
	30	<0.1		3.6	1.2	<0.1			
	45	<0.1		2.9	1.2	<0.1			
	60	<0.1		2.7	1.2	<0.1			
	90			2.4	1.2	<0.1			
	120			2.3	1.2	<0.1			
	150			2.2	1.2	<0.1			
	180			2.2	1.2	<0.1			
	240			2.2	1.2	<0.1			
	300								
WS05	0			Response zone flooded				1.15	4.90
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								

Notes:

Area around WS01 was noted to be wet and boggy. Water within the well was purged to 0.90m bgl following first round of monitoring, then re-monitored 51 minutes later. Prior to re-monitoring, well was dipped, with water at 0.74m bgl.

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

** With reference to the Weather Underground rolling weather archive for Cambridge weather station.*

NR= Not recorded

GAS MONITORING RECORD SHEET

GAS MONITORING RECORD SHEET

Date			
Site:	Land North of Whychurch Farm	Job No:	CG/38164D
Date:	21/01/2021	Engineer:	YPM
Time:	13:00	Client:	Gleeson Land

METEOROLOGICAL & SITE INFORMATION							
State of ground:	Dry	☐	Moist	☐	Wet	☒	
Wind:	Calm	☐	Light	☒	Moderate	☐	Strong
Cloud cover:	None	☐	Slight	☐	Cloudy	☐	Overcast
Precipitation:	None	☐	Slight	☒	Moderate	☐	Heavy
Barometric pressure (mb):		1009		Local pressure system*:		Falling	
				Air temperature (°C):		4	

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O ₂ (% vol. in air)	CO ₂ (% vol. in air)	CH ₄ (% vol. in air)	PID (ppm)	Depth to Groundwater (mbgl)	Depth to base (mbgl)
WS01	0			Response zone flooded				0.00	1.03
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								
	360								
WS04	0			Response zone flooded				1.02	4.81
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								
WS05	0			Response zone flooded				1.08	4.96
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

* With reference to the Weather Underground rolling weather archive for Cambridge weather station.

NR= Not recorded

GAS MONITORING RECORD SHEET

Date			
Site:	Land North of Whychurch Farm	Job No:	CG/38164D
Date:	18/02/2021	Engineer:	YPM
Time:	12:00	Client:	Gleeson Land

METEOROLOGICAL & SITE INFORMATION							
State of ground:	Dry		Moist		Wet	<input checked="" type="text"/>	
Wind:	Calm		Light	<input checked="" type="text"/>	Moderate	<input checked="" type="text"/>	Strong
Cloud cover:	None		Slight	<input checked="" type="text"/>	Cloudy		Overcast
Precipitation:	None	<input checked="" type="text"/>	Slight		Moderate		Heavy
Barometric pressure (mb):		993	Local pressure system*:		rising	Air temperature (°C):	
						7	

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O ₂ (% vol. in air)	CO ₂ (% vol. in air)	CH ₄ (% vol. in air)	PID (ppm)	Depth to Groundwater (mbgl)	Depth to base (mbgl)
WS01	0			Response zone flooded			-	0.00	1.02
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								
	360								
WS04	0			Response zone flooded			0.1	0.22	4.83
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								
WS05	0			Response zone flooded			0.0	0.25	4.92
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

* With reference to the Weather Underground rolling weather archive for Cambridge weather station.

NR= Not recorded

GAS MONITORING RECORD SHEET

Date			
Site:	Land North of Whychurch Farm	Job No:	CG/38164D
Date:	19/03/2021	Engineer:	YPM
Time:	10:00	Client:	Gleeson Land

METEOROLOGICAL & SITE INFORMATION							
State of ground:	Dry	☒	Moist	☐	Wet	☐	
Wind:	Calm	☒	Light	☐	Moderate	☐	Strong ☐
Cloud cover:	None	☐	Slight	☐	Cloudy	☒	Overcast ☐
Precipitation:	None	☐	Slight	☒	Moderate	☐	Heavy ☐
Barometric pressure (mb):		1020		Local pressure system*:		rising	
				Air temperature (°C):		10	

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O ₂ (% vol. in air)	CO ₂ (% vol. in air)	CH ₄ (% vol. in air)	PID (ppm)	Depth to Groundwater (mbgl)	Depth to base (mbgl)
WS01	0			Response zone flooded			-	0.35	1.02
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								
	360								
WS04	0			Response zone flooded				0.91	4.83
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								
WS05	0			Response zone flooded				1.01	4.92
	15								
	30								
	45								
	60								
	90								
	120								
	150								
	180								
	240								
	300								

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

* With reference to the Weather Underground rolling weather archive for Cambridge weather station.

NR= Not recorded

APPENDIX D

Chemical Laboratory Results



Sam Oakley
Card Geotechnics Ltd
Palatine House
Unit 2
Sigford Road
Exeter
EX2 8NL

t: 01392 439905

e: Samo@cgl-uk.com

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

t: 01923 225404

f: 01923 237404

e: reception@i2analytical.com

Analytical Report Number : 20-27607

Replaces Analytical Report Number: 20-27607, issue no. 1

Client sampling date amended.

Project / Site name:	Filands Phase 3, Malmesbury	Samples received on:	28/08/2020
Your job number:	CG-38164B	Samples instructed on/ Analysis started on:	02/09/2020
Your order number:	POP005361	Analysis completed by:	10/09/2020
Report Issue Number:	2	Report issued on:	23/09/2020
Samples Analysed:	14 soil samples		

Signed: 

Agnieszka Czerwińska
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

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



Analytical Report Number: 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Your Order No: POP005361

Lab Sample Number				1608333	1608334	1608335	1608336
Sample Reference				WS01	TP01	TP01	TP02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.20	0.80	0.20
Date Sampled				26/08/2020	27/08/2020	27/08/2020	27/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	19	18	13	19
Total mass of sample received	kg	0.001	NONE	0.5	0.48	1.2	0.5

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1	6.8	7.3	6.8
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	400	700	310	910
Water Soluble Sulphate (Soil Equivalent)	g/kg	0.0025	MCERTS	0.039	-	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	39	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.02	-	0.044	-
Total Sulphur	mg/kg	50	MCERTS	-	-	120	-
Organic Matter	%	0.1	MCERTS	2.8	7.2	0.5	7.3

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Total WAC-17 PAHs	mg/kg	0.85	NONE	< 0.85	< 0.85	< 0.85	< 0.85
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	1	1.1	1.4	< 1.0
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.8	8.7	6.3	12
Barium (aqua regia extractable)	mg/kg	1	MCERTS	47	47	28	54
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.1	0.84	1.2	0.92
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	0.7	< 0.2	1.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	0.2	< 0.2	0.3
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	30	25	29	31
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	30	26	29	31



Analytical Report Number: 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Your Order No: POP005361

Lab Sample Number				1608333	1608334	1608335	1608336
Sample Reference				WS01	TP01	TP01	TP02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50	0.20	0.80	0.20
Date Sampled				26/08/2020	27/08/2020	27/08/2020	27/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	12	11	13	13
Lead (aqua regia extractable)	mg/kg	1	MCERTS	28	30	17	38
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	14	26	15
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	42	39	41	44
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	93	72	81	80

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10

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



Analytical Report Number: 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Your Order No: POP005361

Lab Sample Number	1608337	1608338	1608339	1608340
Sample Reference	TP03	TP04	TP04	TP05
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.20	0.20	0.80	0.20
Date Sampled	27/08/2020	27/08/2020	27/08/2020	27/08/2020
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	14	16	15	25
Total mass of sample received	kg	0.001	NONE	0.5	0.5	1.2	0.47

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	-	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.3	7.6	7.8	7.1
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	530	390	230	1500
Water Soluble Sulphate (Soil Equivalent)	g/kg	0.0025	MCERTS	0.025	-	-	-
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	25	-	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.013	-	0.018	-
Total Sulphur	mg/kg	50	MCERTS	-	-	150	-
Organic Matter	%	0.1	MCERTS	2.8	2.3	-	8.7

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.22
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.43
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.34
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.27
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	0.3
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	-	< 0.05
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	-	< 0.05

Total PAH

Total WAC-17 PAHs	mg/kg	0.85	NONE	< 0.85	< 0.85	-	1.56
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	1.2	< 1.0	-	1.3
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	9.2	9.4	-	12
Barium (aqua regia extractable)	mg/kg	1	MCERTS	41	45	-	78
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.89	0.9	-	1.1
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	0.4	-	2.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-	0.4
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	-	< 1.2
Chromium (III)	mg/kg	1	NONE	26	29	-	34
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	26	29	-	34



Analytical Report Number: 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Your Order No: POP005361

Lab Sample Number				1608337	1608338	1608339	1608340
Sample Reference				TP03	TP04	TP04	TP05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.20	0.20	0.80	0.20
Date Sampled				27/08/2020	27/08/2020	27/08/2020	27/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	7.4	7.6	-	28
Lead (aqua regia extractable)	mg/kg	1	MCERTS	110	22	-	52
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15	15	-	18
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	40	41	-	45
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	56	55	-	95

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	-	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	-	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	-	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	< 10	-	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	-	< 10

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



Analytical Report Number: 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Your Order No: POP005361

Lab Sample Number	1608341	1608342	1608344	1608345
Sample Reference	TP06	TP07	TP09	TP09
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	0.60	0.30	0.20	0.60
Date Sampled	27/08/2020	27/08/2020	27/08/2020	27/08/2020
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	7.2	13	19	9.8
Total mass of sample received	kg	0.001	NONE	0.5	1.3	0.51	1.5

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.2	8.1	7.3	8.4
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	760	2700	1400	590
Water Soluble Sulphate (Soil Equivalent)	g/kg	0.0025	MCERTS	0.071	0.24	-	0.029
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	71	240	-	29
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.036	0.12	-	0.014
Total Sulphur	mg/kg	50	MCERTS	-	-	-	-
Organic Matter	%	0.1	MCERTS	0.9	3.2	7.6	0.5

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.1	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	1.3	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	1.4	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.95	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.7	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.96	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	3.6	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	1.3	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	3.3	< 0.05	< 0.05
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Total WAC-17 PAHs	mg/kg	0.85	NONE	< 0.85	15.6	< 0.85	< 0.85
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	< 1.0	1.2	1.8	< 1.0
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	19	13	20	18
Barium (aqua regia extractable)	mg/kg	1	MCERTS	47	150	54	18
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.4	1	1.4	0.74
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	0.3	1	0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	0.3	0.4	0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (III)	mg/kg	1	NONE	31	30	37	19
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	31	30	37	19



Analytical Report Number: 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Your Order No: POP005361

Lab Sample Number				1608341	1608342	1608344	1608345
Sample Reference				TP06	TP07	TP09	TP09
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.60	0.30	0.20	0.60
Date Sampled				27/08/2020	27/08/2020	27/08/2020	27/08/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	13	19	22	9.4
Lead (aqua regia extractable)	mg/kg	1	MCERTS	12	26	34	12
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	39	28	28	21
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	56	33	62	39
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	71	100	110	48

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	10	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	33	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	220	< 8.0	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	260	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	84	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	92	< 10	< 10

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



Analytical Report Number: 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Your Order No: POP005361

Lab Sample Number	1608512			
Sample Reference	WS05			
Sample Number	None Supplied			
Depth (m)	0.50			
Date Sampled	26/08/2020			
Time Taken	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	

Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	N/A	NONE	15
Total mass of sample received	kg	0.001	NONE	0.5

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	970
Water Soluble Sulphate (Soil Equivalent)	g/kg	0.0025	MCERTS	0.44
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	440
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.22
Total Sulphur	mg/kg	50	MCERTS	-
Organic Matter	%	0.1	MCERTS	2.2

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05
Coronene	mg/kg	0.05	NONE	< 0.05

Total PAH

Total WAC-17 PAHs	mg/kg	0.85	NONE	< 0.85
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	1.9
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	21
Barium (aqua regia extractable)	mg/kg	1	MCERTS	110
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.7
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2
Chromium (III)	mg/kg	1	NONE	40
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	40



Analytical Report Number: 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Your Order No: POP005361

Lab Sample Number				1608512
Sample Reference				WS05
Sample Number				None Supplied
Depth (m)				0.50
Date Sampled				26/08/2020
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Copper (aqua regia extractable)	mg/kg	1	MCERTS	19
Lead (aqua regia extractable)	mg/kg	1	MCERTS	29
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	45
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	2.8
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	72
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	99

Monoaromatics & Oxygenates

Benzene	µg/kg	1	MCERTS	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10

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



Analytical Report Number : 20-27607

Project / Site name: Filands Phase 3, Malmesbury

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1608333	WS01	None Supplied	0.5	Brown clay and loam with gravel and vegetation.
1608334	TP01	None Supplied	0.2	Brown loam and clay with gravel and vegetation.
1608335	TP01	None Supplied	0.8	Light brown clay with vegetation.
1608336	TP02	None Supplied	0.2	Brown sandy clay with vegetation.
1608337	TP03	None Supplied	0.2	Brown sandy clay with vegetation.
1608338	TP04	None Supplied	0.2	Brown sandy clay with vegetation.
1608339	TP04	None Supplied	0.8	Brown clay with vegetation.
1608340	TP05	None Supplied	0.2	Brown sandy clay with vegetation.
1608341	TP06	None Supplied	0.6	Brown sandy clay with vegetation.
1608342	TP07	None Supplied	0.3	Brown gravelly clay with vegetation.
1608344	TP09	None Supplied	0.2	Brown sandy clay with vegetation.
1608345	TP09	None Supplied	0.6	Brown gravelly clay with vegetation.
1608512	WS05	None Supplied	0.5	Light grey gravelly clay with vegetation.



Analytical Report Number : 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS



Analytical Report Number : 20-27607

Project / Site name: Filands Phase 3, Malmesbury

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX E

Geotechnical Laboratory Results



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 50070

Client Ref: **38164B**

Report Date: **28-09-2020**

Client PO: **POP005362**

Client **Card Geotechnics Limited**
Palatine House, Sigford Rd, Exeter
EX2 8NL

Contract Title: **Filands Phase 3**
For the attention of: **Sam Oakley**

Date Received: **04-09-2020**
Date Completed: **28-09-2020**

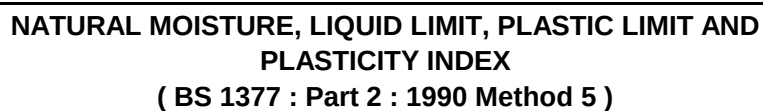
Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	10
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	10
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	1
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Office Manager/Director) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
Sean Penn (Administrative/Accounts Assistant) - Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)



Contract Number	50070	
Site Name	Filands Phase 3	
Date Tested	22/09/2020	
	DESCRIPTIONS	

[illegible]

Operators	Checked	23/09/2020	Wayne Honey (Administrative/Quality Assistant)
Daniel Bassett	Approved	23/09/2020	Paul Evans (Quality/Technical Manager)





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **50070**

Borehole/Pit No. **SA04**

Site Name **Filands Phase 3**

Sample No.

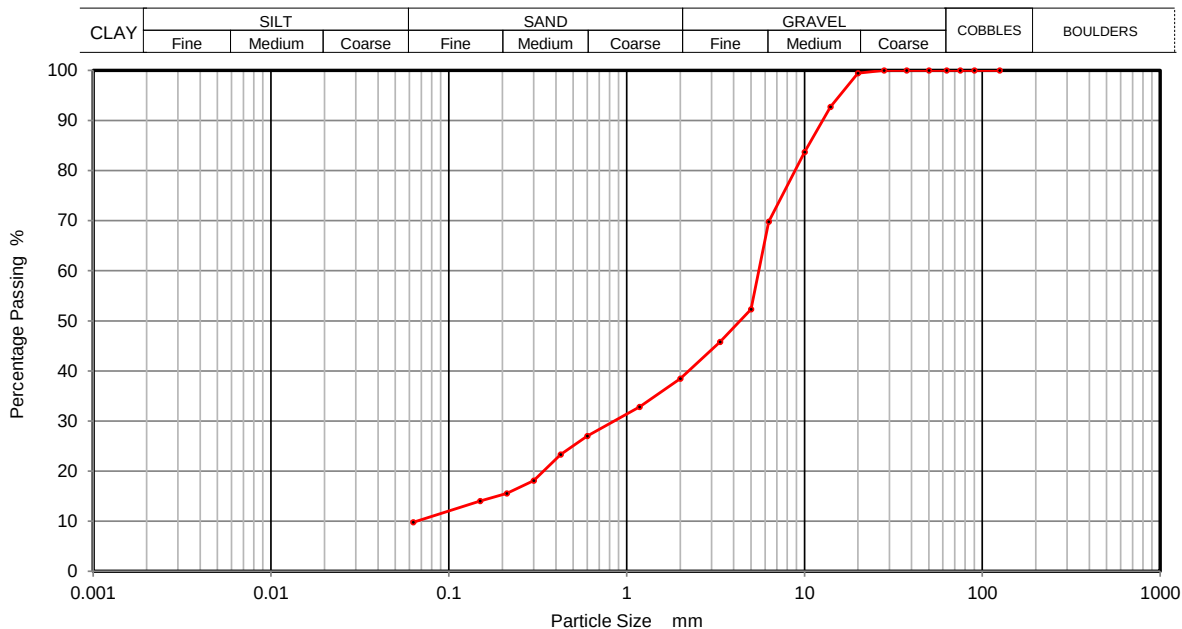
Soil Description **Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL**

Depth Top **0.60**

Depth Base **0.80**

Date Tested **28/09/2020**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	99		
14	93		
10	84		
6.3	70		
5	52		
3.35	46		
2	38		
1.18	33		
0.6	27		
0.425	23		
0.3	18		
0.212	16		
0.15	14		
0.063	10		

Sample Proportions	% dry mass
Cobbles	0
Gravel	62
Sand	28
Silt and Clay	10

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	27/09/2020	Wayne Honey	<i>W. Honey</i>
RO/MH	Approved	28/09/2020	Paul Evans	<i>DP Evans</i>





Laboratory Report



Contract Number: 50773

Client Ref:

Report Date: **26-10-2020**

Client PO:

Client **Card Geotechnics Limited**
Windsor House
Cornwall Road,
Harrogate
HG1 2PW

Contract Title: **Filands Phase 3, Malmesbury**
For the attention of: **Sam Oakley**

Date Received: **14-10-2020**Date Completed: **26-10-2020**

Test Description	Qty
BRE Suite B Greenfield Site (pyrite present) includes pH, water & acid soluble sulphate and total sulphur BRE - BR279 - @ Non Accredited Test	4
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Emma Sharp (Office Manager/Director) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)

Sean Penn (Administrative/Accounts Assistant) - Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

APPENDIX F

Soakaway Test Results

Test Location: SA01

Test No: 1

Date: 28/08/2020

Water Level during Test

Time (mins)	Depth (m bgl)
0	1.64
0.25	1.64
0.5	1.64
0.75	1.64
1	1.64
2	1.64
3	1.64
4	1.64
5	1.64
10	1.64
15	1.64
20	1.64
25	1.64
30	1.64
35	1.64
40	1.64
60	1.64
120	1.64
150	1.64
180	1.64
Test terminated	

Trial Pit Dimensions

Depth	2.9 m bgl
Length	2.8 m
Width	0.6 m

$$f = \frac{V_p}{a_p \times t_p}$$

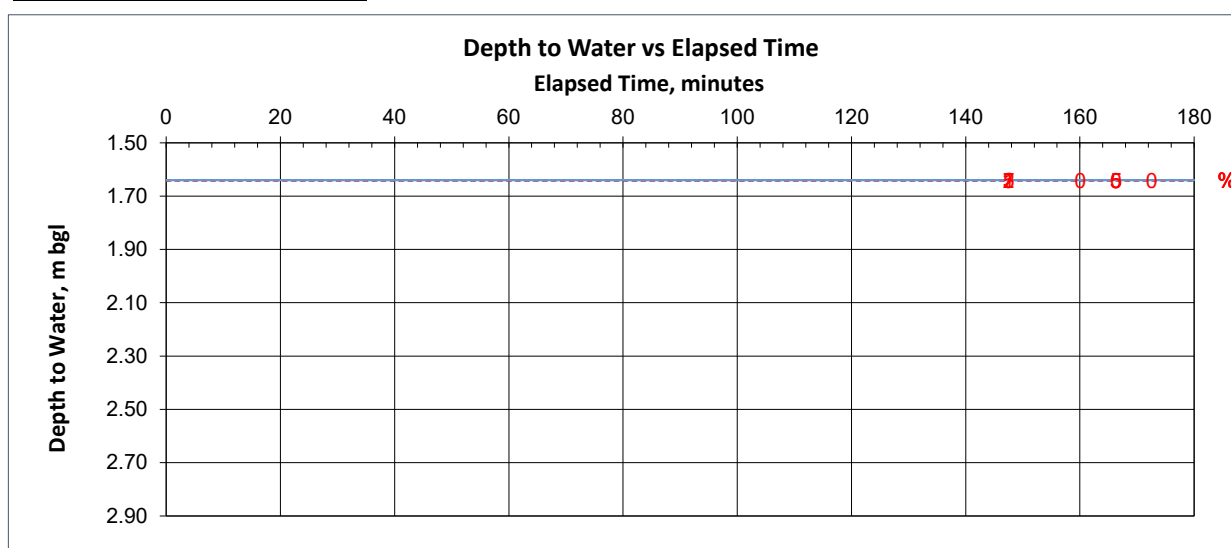
 f = soil infiltration rate V_p = volume of water from 75% to 25% effective depth a_p = Internal surface area at 50% effective depth t_p = time for the water level to fall from 75% to 25% effective depth

time at 75% effective depth (mins)

time at 25% effective depth (mins)

(from graph)

Calculated Soil Infiltration Rate = Test failed



Notes: BRE Digest 365. (2016). Soakaway design. Test failed to achieve a 75% reduction in the effective height in accordance with BRE 365

Client Gleeson Land	Project Land North of Whychurch Farm	Job No. CG/38164B
	Title Soil Infiltration Test	Created SWO Checked SJM Approved

Test Location: SA02

Test No: 1

Date: 28/08/2020

Water Level during Test

Time (mins)	Depth (m bgl)
0	1.94
0.25	1.94
0.5	1.94
0.75	1.94
1	1.94
2	1.94
3	1.94
4	1.94
5	1.94
10	1.94
15	1.94
20	1.94
25	1.94
30	1.94
35	1.94
40	1.94
60	1.94
120	1.94
150	1.94
180	1.94
Test terminated	

Trial Pit Dimensions

Depth	3.0 m bgl
Length	2.7 m
Width	0.6 m

$$f = \frac{V_p}{a_p \times t_p}$$

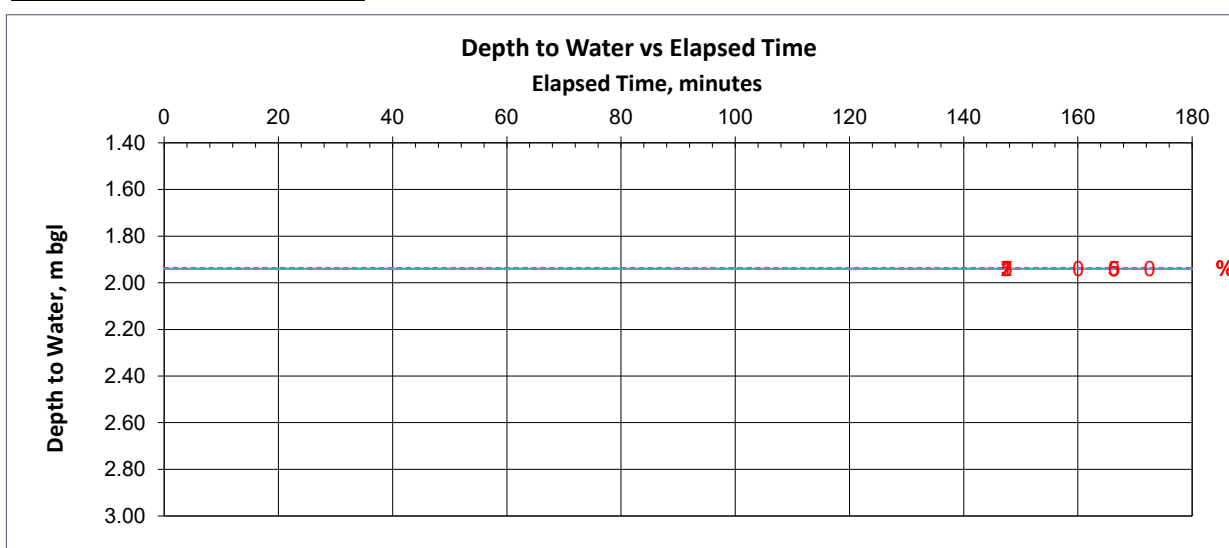
 f = soil infiltration rate V_p = volume of water from 75% to 25% effective depth a_p = Internal surface area at 50% effective depth t_p = time for the water level to fall from 75% to 25% effective depth

time at 75% effective depth (mins)

time at 25% effective depth (mins)

(from graph)

Calculated Soil Infiltration Rate = Test failed



Notes: BRE Digest 365. (2016). Soakaway design. Test failed to achieve a 75% reduction in the effective height in accordance with BRE 365

Client	Project	Job No.
Gleeson Land	Land North of Whychurch Farm	CG/38164B
	Title	Created SWO Checked SJM Approved
	Soil Infiltration Test	

Test Location: SA03

Test No: 1

Date: 28/08/2020

Water Level during Test

Time (mins)	Depth (m bgl)
0	1.24
0.25	1.24
0.5	1.24
0.75	1.24
1	1.24
2	1.24
3	1.24
4	1.24
5	1.24
10	1.24
15	1.24
20	1.24
25	1.24
30	1.24
35	1.24
40	1.24
60	1.24
120	1.25
150	1.25
180	1.25
Test terminated	

Trial Pit Dimensions

Depth	2.3 m bgl
Length	2.4 m
Width	0.6 m

$$f = \frac{V_p}{a_p \times t_p}$$

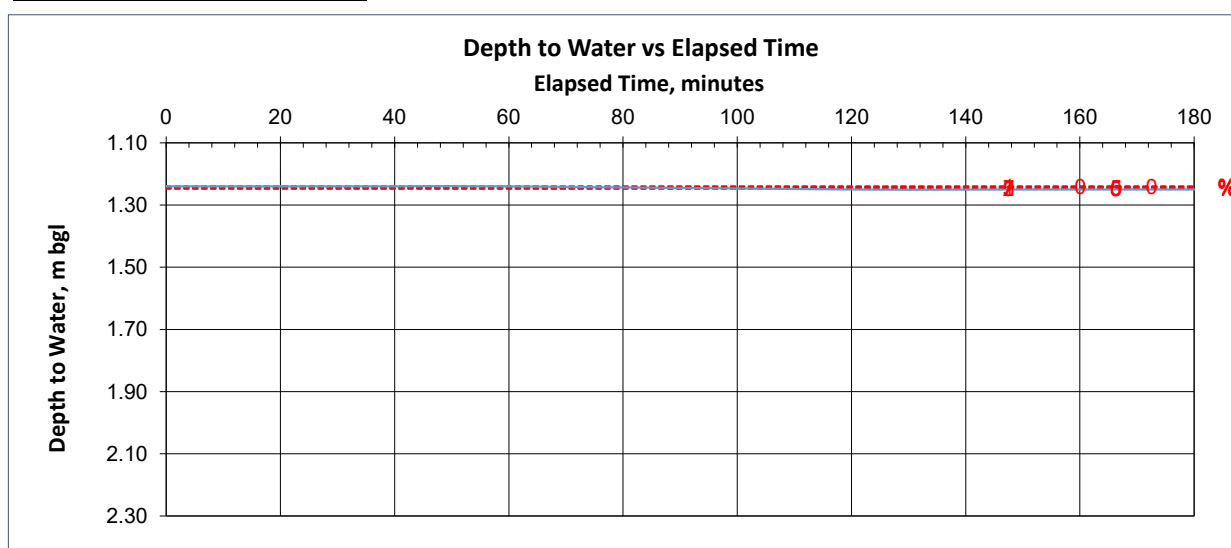
 f = soil infiltration rate V_p = volume of water from 75% to 25% effective depth a_p = Internal surface area at 50% effective depth t_p = time for the water level to fall from 75% to 25% effective depth

time at 75% effective depth (mins)

time at 25% effective depth (mins)

(from graph)

Calculated Soil Infiltration Rate = Test failed



Notes: BRE Digest 365. (2016). Soakaway design. Test failed to achieve a 75% reduction in the effective height in accordance with BRE 365

Client	Project	Job No.
Gleeson Land	Land North of Whychurch Farm	CG/38164B
	Title	Created SWO Checked SJM Approved
	Soil Infiltration Test	

Test Location: SA04

Test No: 1

Date: 28/08/2020

Water Level during Test

Time (mins)	Depth (m bgl)
0	0.45
0.25	0.45
0.5	0.46
0.75	0.47
1	0.48
2	0.49
3	0.50
4	0.51
5	0.52
10	0.55
15	0.58
20	0.60
25	0.61
30	0.63
35	0.65
40	0.67
60	0.71
120	0.75
150	0.79
180	0.83
Test terminated	

Trial Pit Dimensions

Depth	1.1 m bgl
Length	1.6 m
Width	0.6 m

$$f = \frac{V_p}{\alpha_p \times t_p}$$

 f = soil infiltration rate V_p = volume of water from 75% to 25% effective depth α_p = Internal surface area at 50% effective depth t_p = time for the water level to fall from 75% to 25% effective depth

time at 75% effective depth (mins)

12

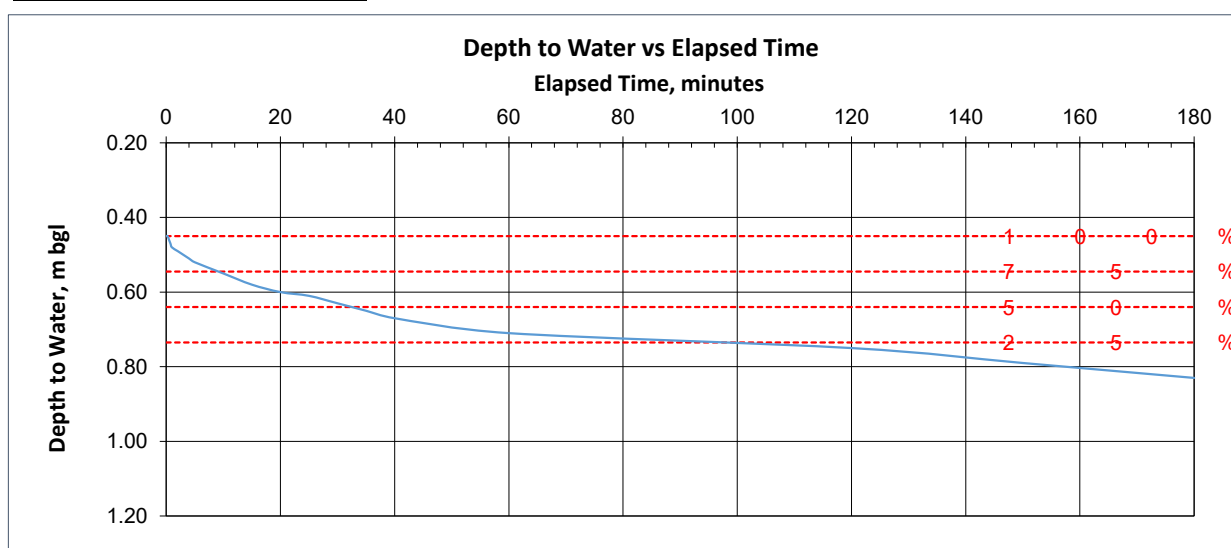
time at 25% effective depth (mins)

95

(from graph)

Calculated Soil Infiltration Rate = **2.039E-05** m/s

Calculation corrected to calculate infiltration rate over depth tested.



Notes: BRE Digest 365. (2016). Soakaway design. Test failed to achieve a 75% reduction in the effective height in accordance with BRE 365

Client	Project	Job No.
Gleeson Land	Land North of Whychurch Farm	CG/38164B
	Title	Created SWO Checked SJM Approved
	Soil Infiltration Test	

APPENDIX G

Risk Assessment Methodology

CGL Risk Assessment Methodology

The following risk Assessment methodology is based on CIRIA C552 (2001) Contaminated Land Risk Assessment – A Guide to Good Practice¹, in order to quantify potential risk via risk estimation and risk evaluation, which can be adopted at the Phase I stage. This will then determine an overall risk category which can be used to identify likely actions. This methodology uses qualitative descriptors and therefore is a qualitative approach and is undertaken for each potential pollution linkage (source-pathway-receptor) identified for the site in accordance with Contaminated Land Reports 6² and 11³.

The methodology requires the classification of:

- The magnitude of the consequence (severity) of a risk occurring, and
- The magnitude of the probability (likelihood) of a risk occurring.

The potential consequences of contamination risks occurring at this site are classified in accordance with Table 1 below, which is adapted from the CIRIA guidance¹.

Table 1. Classifications of Consequence ratings

Classification	Definition of Consequence	Examples
Severe	Short-term (acute) risks to human health. Short-term (acute) risk of pollution of sensitive water resource or ecosystem. Catastrophic damage to crops/buildings/property/infrastructure, including off-site soils.	High concentration of cyanide on the surface of an informal recreation area Major spillage of contaminants from site into controlled waters Explosion causing building collapse
Medium	Long-term (chronic) risks to human health Long-term (chronic) pollution of sensitive water resource Significant change in an ecosystem/contamination of off-site soils	Concentrations of a contaminant from site exceeding the generic or site specific assessment criteria Leaching of contaminants from a site into a major or minor aquifer Death of a species within a designated nature reserve
Mild	Pollution of non-sensitive water resource Significant damage to crops/ buildings/property/infrastructure Damage to an ecosystem or sensitive buildings/structures/services	Pollution of a non-classified groundwater Damage to a building rendering it unsafe to occupy (e.g. foundation damage resulting in instability)
Minor	Easily preventable non-permanent health effects Harm, although not necessarily significant harm, which may result in financial loss or expenditure to resolve Easily repairable effects of damage to buildings/structures/services	Presence of contamination at concentrations which require the use of personal protective equipment during site work Loss of plants in a landscaping scheme/discolouration of concrete

¹ CIRIA, (2001). *Contaminated Land Risk Assessment. A Guide to Good Practice*. CIRIA C552.

² M.J. Carter Associates, (1995). *Prioritisation and Categorisation Procedure for Sites Which May Be Contaminated*. Contaminated Land Report 6. Department of the Environment. C

³ Environment Agency, (2004). *Model Procedures for the Management of Land Contamination*. Contaminated Land Report 11.

The potential probability of the risks being realised are classified in accordance with the ratings set out in Table 2 which are adapted from the CIRIA guidance¹. It should be noted that where a pollutant linkage has not been identified the likelihood is considered to be zero.

Table 2. Classifications of probability ratings

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable in the long term, or there is evidence at the receptor that an event has occurred
Likely	There is a pollution linkage and all the elements are present and in the right place which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the short term.
Unlikely	There is a pollutant linkage but circumstances are such that it is improbable that an event would occur even in the very long term

In accordance with C552 the risk classification for each pollution linkage are classified in accordance with the matrix for consequence and probability set out in Table 3. The definitions for the risk classifications are presented in Table 4.

Table 3. Risk classification matrix

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very High	High	Moderate	Moderate / Low
	Likely	High	Moderate	Moderate / Low	Low
	Low likelihood	Moderate	Moderate / Low	Low	Very Low
	Unlikely	Moderate / Low	Low	Very Low	Very Low

Table 4. Risk classification definitions

Classification	Definition
Very High	There is a high probability that severe harm could arise to a designated receptor from the identified hazard or there is evidence that severe harm is currently happening. This risk, if realised, is likely to result in substantial liability. Urgent investigation (if not already undertaken) and remediation are likely to be required.
High	Harm is likely to arise to a designated receptor from the identified hazard. Realisation of the risk is likely to result in substantial liability. Urgent investigation (if not already undertaken) and remediation are likely to be required.
Moderate	It is possible that harm could arise to a designated receptor from the identified hazard. However, it is either relatively unlikely that such harm would be severe or if any harm were to occur it is more likely that the harm would be relatively mild. Urgent investigation (if not already undertaken) is normally required to clarify the potential risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low	It is possible that harm could arise to a designated receptor from the identified hazard, but it is considered likely that this harm, if realised, would at worst normally be mild.
Very Low	There is a low possibility that harm could arise to a designated receptor from the identified hazard. In the event of such harm being realised it is not likely to be severe.

APPENDIX H

Chemical Assessment Tables

ASSESSMENT CRITERIA

Table H1 below sets out CGL's rationale for generic assessment criteria (GAC) adoption in order to evaluate risks posed to potential receptors from identified chemical contamination. Potential receptors have been identified with reference to the Part IIA regime and associated DEFRA guidance. As with the Part IIA regime, under the planning regime all receptors (humans, controlled waters, ecology, crops/livestock and buildings) have been considered if there is the potential for them to be adversely affected by exposure to contamination. The results of the assessment are then presented in Tables H2 to H5 of this appendix.

Table H1. Rationale for Assessment Criteria Adoption

Source / Media	CGL's Approach & Rationale
<i>Risks to Human Health (long-term chronic risks)</i>	
Soil contaminants	- Laboratory test results have been compared against Generic Assessment Criteria (GACs) derived in-house by CGL using the Contaminated Land Exposure Assessment (CLEA) model and version 1.071 of the CLEA software. Where Soil Guideline Values (SGVs) have been published previously by the Environment Agency, the CGL GACs have updated these based on current exposure parameters (e.g. updated inhalation rates). - The GACs have been generated assuming a sandy loam soil type and a Soil Organic Material of 1% for the Made Ground (measured range 0.5 - 4.2%) and 1% for the natural soils (measured 0.1 – 1.2%). - In the event impacts are identified on a site above the GAC level for arsenic, cadmium, chromium VI, benzene or benzo(a)pyrene, the results have been compared to the applicable Category 4 Screening Level (C4SL) published by DEFRA to further assess risks. - The exception to the above relates to lead. The SGV for lead has been withdrawn and the C4SL for lead is used by CGL directly as a first tier of assessment. - The CGL GACs represent conservative screening criteria (set at acceptable or minimal risk) and have generally been calculated using the default parameters for the standard land use scenarios set out in the CLEA technical report and toxicological inputs in line with the requirements of Science Report SC050021/SR2 and, in the case of petroleum hydrocarbons, Science Report P5-080/TR3. - Where a CGL GAC has not been derived alternative assessment criteria will be sourced from current commercially-available sources (including international standards where no suitable UK assessment criteria exists). - Concentrations of cyanide above the laboratory reporting limit are assessed against a Soil Screening Value (SSV) developed by Atkins. Atkins have based this assessment criteria on acute exposure to a 0 to 6 year old child. - Where the dataset is of appropriate size, assessment against the applicable GAC or C4SL is carried out at the 95th percentile of the sample mean (designated US₉₅), which is considered to represent a reasonable worst-case scenario. An assessment of the normality of the data has been undertaken. Where datasets are normally distributed the one sample t-test has been applied to calculate the US₉₅. In the case of non-parametric datasets, the Chebychev Theorem has been applied. The Grubbs Test has also been used to identify potential outliers within datasets. - It is noted that the British Geological Survey has published background levels for a number of organic and inorganic constituents. In the event that the C4SL or a GAC is found to be exceeded, the risk may still be considered to be low, unlikely to meet the definition of contaminated land under Part IIA and potentially suitable for use from a development perspective, if the contaminant concentrations are below local background levels, assuming no other contributing factors. - At this time an authoritative GAC is not available for asbestos fibres in soil. A positive identification of asbestos fibres in a soil sample by the laboratory is considered sufficient to warrant additional assessment of risks. Laboratory identification and quantification by microscopy may be required subject to source of material.
Ground gas	Concentrations and flow rates of carbon dioxide and methane in ground gas are converted to Gas Screening Values (GSVs) in accordance with CIRIA (2007). Potential risks associated with gas chemistry are evaluated in accordance with guidance presented in CIRIA (2007), NHBC (2007), BSI (2007).
Radon	Risks from the radon content of soil gas are evaluated in accordance with BRE (2011).
<i>Risks to Buildings & Structures</i>	
Water supply pipes	The evaluation of water supply pipe requirements at the site has been undertaken in general accordance with guidance and criteria produced by the UK Water Industry (2011).

Source / Media	CGL's Approach & Rationale
Sulfate & pH conditions	• The evaluation of risks to buried concrete has followed the guidance and criteria produced by BRE (2005).
<i>Risks to Vegetation & Plants</i>	
Soil contaminants	• Risks to plant growth (i.e. phytotoxicity) have been assessed for specific contaminants where the limits for phytotoxic effect proposed (e.g. by BS 3882) are significantly lower than the health GAC.

Land Use Category:		Residential with homegrown produce consumption					SOM:	2.50%
Stratum:		[TOPSOIL]					No. Samples	6
Determinand	GAC mg/kg	SSL mg/kg (See Note A)	Min recorded (mg/kg)	Max recorded (mg/kg)	No. Samples exceeding GAC	No. Samples exceeding SSL	US ₉₅ (mg/kg)	US ₉₅ > GAC
Arsenic	28	-	8.7	20	0	0	-	-
Beryllium	1.72	-	0.84	1.4	0	0	-	-
Boron	290	-	0.4	2.9	0	0	-	-
Cadmium	11	-	< 0.2	0.4	0	0	-	-
Chromium (III)	886	-	25	37	0	0	-	-
Chromium (VI)	2.93	-	< 1.2	< 1.2	0	0	-	-
Copper	4220	-	7.4	28	0	0	-	-
Lead (note E)	200	-	22	110	0	0	-	-
Mercury	43.3	-	< 0.3	< 0.3	0	0	-	-
Nickel	182	-	14	28	0	0	-	-
Selenium	350	-	< 1	< 1	0	0	-	-
Vanadium	320	-	39	62	0	0	-	-
Zinc	4590	-	55	110	0	0	-	-
Benzene	0.18	-	< 0.001	< 0.001	0	0	-	-
Toluene	294	-	< 0.001	< 0.001	0	0	-	-
Ethyl benzene	183	-	< 0.001	< 0.001	0	0	-	-
m-Xylene	149	-	< 0.001	< 0.001	0	0	-	-
o-Xylene	151	-	< 0.001	< 0.001	0	0	-	-
p-Xylene	142	-	< 0.001	< 0.001	0	0	-	-
Total Phenols (note C)	508	-	< 1	< 1	0	0	-	-
Total Cyanide (note D)	34	-	< 1	< 1	0	0	-	-
Aliphatic EC5-6	66.2	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC6-8	178	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC8-10	44.7	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC10-12	230	125	< 1	< 1	0	0	-	-
Aliphatic EC12-16	1780	55.3	< 2	< 2	0	0	-	-
Aliphatic EC16-35	128000	-	< 16	< 16	0	0	-	-
Aromatic EC5-7	0.107	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC7-8	294	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC8-10	61.1	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC10-12	163	-	< 1	< 1	0	0	-	-
Aromatic EC12-16	317	-	< 2	< 2	0	0	-	-
Aromatic EC16-21	592	-	< 10	< 10	0	0	-	-
Aromatic EC21-35	1490	-	< 10	< 10	0	0	-	-
Naphthalene	5.56	-	< 0.05	< 0.05	0	0	-	-
Acenaphthylene	405	-	< 0.05	< 0.05	0	0	-	-
Acenaphthene	492	-	< 0.05	< 0.05	0	0	-	-
Fluorene	392	-	< 0.05	< 0.05	0	0	-	-
Phenanthrene	219	-	< 0.05	0.22	0	0	-	-
Anthracene	5310	-	< 0.05	< 0.05	0	0	-	-
Fluoranthene	556	-	< 0.05	0.43	0	0	-	-
Pyrene	1240	-	< 0.05	0.34	0	0	-	-
Benzo(a)Anthracene	11.3	-	< 0.05	0.27	0	0	-	-
Chrysene	22	-	< 0.05	0.3	0	0	-	-
Benzo(b)fluoranthene	3.31	-	< 0.05	< 0.05	0	0	-	-
Benzo(k)fluoranthene	92.7	-	< 0.05	< 0.05	0	0	-	-
Benzo(a)Pyrene	2.73	-	< 0.05	< 0.05	0	0	-	-
Indeno(1,2,3,cd)pyrene	36.1	-	< 0.05	< 0.05	0	0	-	-
Dibenzo(a,h)anthracene	0.297	-	< 0.05	< 0.05	0	0	-	-
Benzo(g,h,i)perylene	339	-	< 0.05	< 0.05	0	0	-	-
Asbestos in Soils	(Number of samples in which Asbestos detected)				0	0	-	-

Notes:

A. SSL (Soil Saturation Limit) presented for contaminants where GAC exceeds the calculated saturation limit using CLEA. Where the SSL is exceeded, there is the potential for free product.

B. Concentrations for total xylenes should be compared against m-xylene for fresh spills and o-xylene for all other cases.

C. GAC relates to phenol (C6H5OH) only.

D. Cyanide GAC based on acute exposure of 0-6 year old child (Atkins value).

E. Published C4SL.

Land Use Category:		Residential with homegrown produce consumption					SOM:	2.50%
Stratum:		[MADE GROUND]					No. Samples	3
Determinand	GAC mg/kg	SSL mg/kg (See Note A)	Min recorded (mg/kg)	Max recorded (mg/kg)	No. Samples exceeding GAC	No. Samples exceeding SSL	US ₉₅ (mg/kg)	US ₉₅ > GAC
Arsenic	28	-	9.8	21	0	0	-	-
Beryllium	1.72	-	1	1.7	0	0	-	-
Boron	290	-	0.3	0.5	0	0	-	-
Cadmium	11	-	0.3	0.4	0	0	-	-
Chromium (III)	886	-	30	40	0	0	-	-
Chromium (VI)	2.93	-	< 1.2	< 1.2	0	0	-	-
Copper	4220	-	12	19	0	0	-	-
Lead (note E)	200	-	26	29	0	0	-	-
Mercury	43.3	-	< 0.3	< 0.3	0	0	-	-
Nickel	182	-	21	45	0	0	-	-
Selenium	350	-	< 1	2.8	0	0	-	-
Vanadium	320	-	33	72	0	0	-	-
Zinc	4590	-	93	100	0	0	-	-
Benzene	0.18	-	< 0.001	< 0.001	0	0	-	-
Toluene	294	-	< 0.001	< 0.001	0	0	-	-
Ethyl benzene	183	-	< 0.001	< 0.001	0	0	-	-
m-Xylene	149	-	< 0.001	< 0.001	0	0	-	-
o-Xylene	151	-	< 0.001	< 0.001	0	0	-	-
p-Xylene	142	-	< 0.001	< 0.001	0	0	-	-
Total Phenols (note C)	508	-	< 1	< 1	0	0	-	-
Total Cyanide (note D)	34	-	< 1	< 1	0	0	-	-
Aliphatic EC5-6	66.2	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC6-8	178	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC8-10	44.7	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC10-12	230	125	< 1	< 1	0	0	-	-
Aliphatic EC12-16	1780	55.3	< 2	10	0	0	-	-
Aliphatic EC16-35	128000	-	< 32	473	0	0	-	-
Aromatic EC5-7	0.107	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC7-8	294	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC8-10	61.1	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC10-12	163	-	< 1	< 1	0	0	-	-
Aromatic EC12-16	317	-	< 2	< 2	0	0	-	-
Aromatic EC16-21	592	-	< 10	< 10	0	0	-	-
Aromatic EC21-35	1490	-	< 10	84	0	0	-	-
Naphthalene	5.56	-	< 0.05	< 0.05	0	0	-	-
Acenaphthylene	405	-	< 0.05	< 0.05	0	0	-	-
Acenaphthene	492	-	< 0.05	< 0.05	0	0	-	-
Fluorene	392	-	< 0.05	< 0.05	0	0	-	-
Phenanthrene	219	-	< 0.05	< 0.05	0	0	-	-
Anthracene	5310	-	< 0.05	< 0.05	0	0	-	-
Fluoranthene	556	-	< 0.05	1.1	0	0	-	-
Pyrene	1240	-	< 0.05	1.3	0	0	-	-
Benzo(a)Anthracene	11.3	-	< 0.05	1.4	0	0	-	-
Chrysene	22	-	< 0.05	0.95	0	0	-	-
Benzo(b)fluoranthene	3.31	-	< 0.05	1.7	0	0	-	-
Benzo(k)fluoranthene	92.7	-	< 0.05	0.96	0	0	-	-
Benzo(a)Pyrene	2.73	-	< 0.05	3.6	1	0	-	-
Indeno(1,2,3,cd)pyrene	36.1	-	< 0.05	1.3	0	0	-	-
Dibenzo(a,h)anthracene	0.297	-	< 0.05	< 0.05	0	0	-	-
Benzo(g,h,i)perylene	339	-	< 0.05	3.3	0	0	-	-
Asbestos in Soils	(Number of samples in which Asbestos detected)				0	0	-	-

Notes:

A. SSL (Soil Saturation Limit) presented for contaminants where GAC exceeds the calculated saturation limit using CLEA. Where the SSL is exceeded, there is the potential for free product.

B. Concentrations for total xylenes should be compared against m-xylene for fresh spills and o-xylene for all other cases.

C. GAC relates to phenol (C6H5OH) only.

D. Cyanide GAC based on acute exposure of 0-6 year old child (Atkins value).

E. Published C4SL.

Land Use Category:		Residential with homegrown produce consumption					SOM:	1.00%
Stratum:		Natural Soils					No. Samples	3
Determinand	GAC mg/kg	SSL mg/kg (See Note A)	Min recorded (mg/kg)	Max recorded (mg/kg)	No. Samples exceeding GAC	No. Samples exceeding SSL	US ₉₅ (mg/kg)	US ₉₅ > GAC
Arsenic	28	-	6.3	19	0	0	-	-
Beryllium	1.72	-	0.74	1.4	0	0	-	-
Boron	290	-	< 0.2	0.5	0	0	-	-
Cadmium	11	-	< 0.2	0.2	0	0	-	-
Chromium (III)	886	-	19	31	0	0	-	-
Chromium (VI)	2.93	-	< 1.2	< 1.2	0	0	-	-
Copper	4220	-	9.4	13	0	0	-	-
Lead (note E)	200	-	12	17	0	0	-	-
Mercury	43.3	-	< 0.3	< 0.3	0	0	-	-
Nickel	182	-	21	39	0	0	-	-
Selenium	350	-	< 1	< 1	0	0	-	-
Vanadium	320	-	39	56	0	0	-	-
Zinc	4590	-	48	81	0	0	-	-
Benzene	0.09	-	< 0.001	< 0.001	0	0	-	-
Toluene	129	-	< 0.001	< 0.001	0	0	-	-
Ethyl benzene	77	-	< 0.001	< 0.001	0	0	-	-
m-Xylene	63.1	-	< 0.001	< 0.001	0	0	-	-
o-Xylene	64.3	-	< 0.001	< 0.001	0	0	-	-
p-Xylene	60.3	-	< 0.001	< 0.001	0	0	-	-
Total Phenols (note C)	257	-	< 1	< 1	0	0	-	-
Total Cyanide (note D)	34	-	< 1	< 1	0	0	-	-
Aliphatic EC5-6	39.6	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC6-8	84.9	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC8-10	18.7	-	< 0.001	< 0.001	0	0	-	-
Aliphatic EC10-12	93.2	50.2	< 1	< 1	0	0	-	-
Aliphatic EC12-16	795	22.2	< 2	< 2	0	0	-	-
Aliphatic EC16-35	128000	-	< 64	< 64	0	0	-	-
Aromatic EC5-7	0.0528	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC7-8	129	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC8-10	25.1	-	< 0.001	< 0.001	0	0	-	-
Aromatic EC10-12	68.3	-	< 1	< 1	0	0	-	-
Aromatic EC12-16	137	-	< 2	< 2	0	0	-	-
Aromatic EC16-21	291	-	< 10	< 10	0	0	-	-
Aromatic EC21-35	1120	-	< 10	< 10	0	0	-	-
Naphthalene	2.32	-	< 0.05	< 0.05	0	0	-	-
Acenaphthylene	169	-	< 0.05	< 0.05	0	0	-	-
Acenaphthene	206	-	< 0.05	< 0.05	0	0	-	-
Fluorene	165	-	< 0.05	< 0.05	0	0	-	-
Phenanthrene	95.8	-	< 0.05	< 0.05	0	0	-	-
Anthracene	2330	-	< 0.05	< 0.05	0	0	-	-
Fluoranthene	283	-	< 0.05	< 0.05	0	0	-	-
Pyrene	616	-	< 0.05	< 0.05	0	0	-	-
Benzo(a)Anthracene	7.79	-	< 0.05	< 0.05	0	0	-	-
Chrysene	14.9	-	< 0.05	< 0.05	0	0	-	-
Benzo(b)fluoranthene	2.6	-	< 0.05	< 0.05	0	0	-	-
Benzo(k)fluoranthene	77.4	-	< 0.05	< 0.05	0	0	-	-
Benzo(a)Pyrene	2.23	-	< 0.05	< 0.05	0	0	-	-
Indeno(1,2,3,cd)pyrene	27.4	-	< 0.05	< 0.05	0	0	-	-
Dibenzo(a,h)anthracene	0.254	-	< 0.05	< 0.05	0	0	-	-
Benzo(g,h,i)perylene	316	-	< 0.05	< 0.05	0	0	-	-
Asbestos in Soils	(Number of samples in which Asbestos detected)				0	0	-	-

Notes:

A. SSL (Soil Saturation Limit) presented for contaminants where GAC exceeds the calculated saturation limit using CLEA. Where the SSL is exceeded, there is the potential for free product.

B. Concentrations for total xylenes should be compared against m-xylene for fresh spills and o-xylene for all other cases.

C. GAC relates to phenol (C6H5OH) only.

D. Cyanide GAC based on acute exposure of 0-6 year old child (Atkins value).

Table H5. Data assessment summary – potential soil risk to vegetation and plants (Made Ground).

Determinant	Assessment Criteria (mg/kg)	Measured range	Measured Range > Assessment Criteria? (Y/N)
		(mg/kg)	
Copper ¹	135	12 to 19	N
Zinc ¹	200	93 to 100	N
Nickel ¹	75	21 to 45	N
Boron (water soluble) ²	5	0.3 to 0.5	N

Table H6. Data assessment summary – potential soil risk to vegetation and plants (topsoil and natural soils)

Determinant	Assessment Criteria (mg/kg)	Measured Value	Measured Values > Assessment Criteria? (Y/N)
		(mg/kg)	
Copper ¹	135	7.4 to 28	N
Zinc ¹	200	48 to 110	N
Nickel ¹	75	14 to 28	N
Boron (water soluble) ²	5	<0.2 to 2.9	N

¹ BSI, (2015). *Specification for topsoil and requirements for use. BS 3882:2015*. Values taken for pH 6-7

² Limit for phytotoxic effect. Nable, Banuelos and Paul, (1997). *Boron Toxicity*. Plant and Soil, Volume 193, pp 181-198